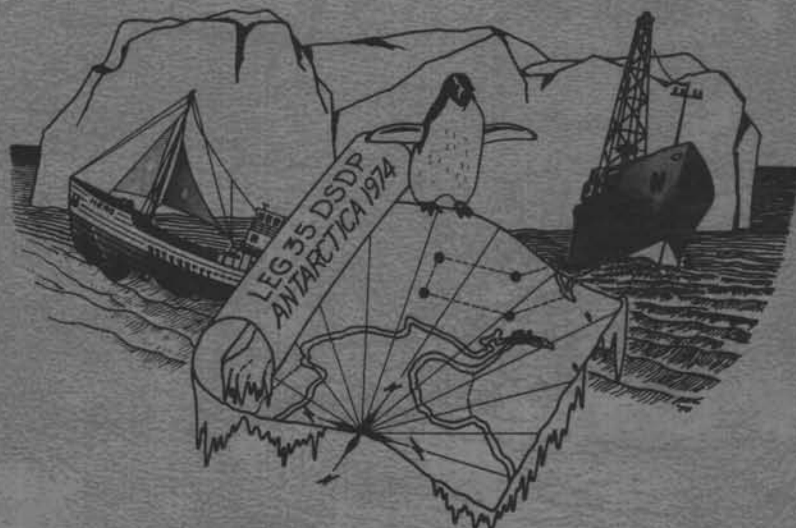
OLIVAS

DEEP SEA DRILLING PROJECT

TECHNICAL REPORT No.8

OPERATIONS RESUMES - Part IV



Contract NSF C-482 Leg 34 through Leg 44A

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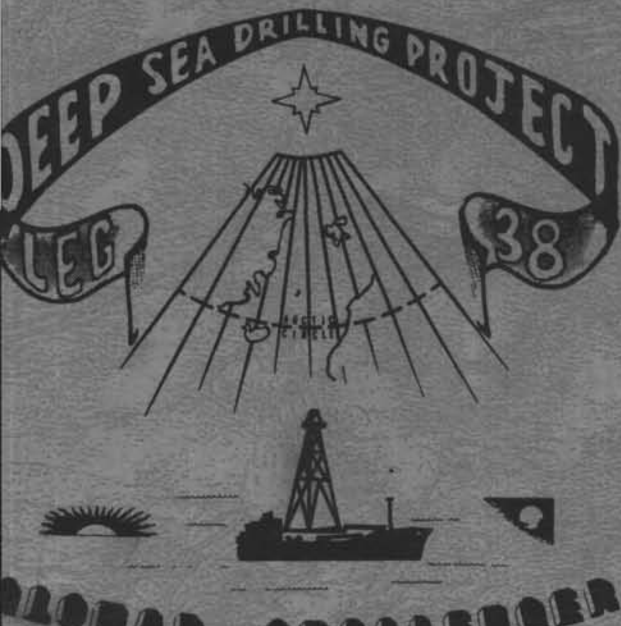

BLACK SEA · 1975

SCRIPPS INSTITUTION OF OCEANOGRAPHY
University of California at San Diego

OPERATIONS RESUMES

LEG 34 through LEG 44A

Prepared for

NATIONAL SCIENCE FOUNDATION

Under Provisions of Contract NSF C-482

By

DEEP SEA DRILLING PROJECT

Scripps Institution of Oceanography

University of California at San Diego

March 1976

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INTRODUCTION

Deep Sea Drilling Project Technical Report Number 8 is the fourth edition of Operation Resumes published since the Project became operational on August 11, 1968.

The book tells about operational and engineering procedures used aboard D/V GLOMAR CHALLENGER from Leg 34 through Leg 44A. Other DSDP Technical Reports dealing with Operation Resumes were TR No. 1, published in October of 1971, TR No. 5, published in October of 1972, and TR No. 7, which came off the presses in April of 1974.

We have followed the same successful and widely-read format established on the first three DSDP Technical Reports citing Operation Resumes. This Technical Report gives performance achievements, drilling and coring results, drill bit performance and improvements, coring equipment modifications, tests of new procedures and equipment, improvement of coring procedures, plus problems encountered and anticipated and the steps taken or proposed to eliminate the trouble.

ACKNOWLEDGEMENTS

The success and the resulting contribution to the basic earth science research has, to a great extent, been due to the achievements by the technical staff of the Deep Sea Drilling Project.

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

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

The outstanding talent and dedication of these people is acknowledged and the Project extends its most sincere thanks.

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Principal Engineer
Deputy Project Manager
Deep Sea Drilling Project

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Principal Investigator
Project Manager
Deep Sea Drilling Project

OPERATIONS RESUMES

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Leg 38 - Dublin, Ireland to Amsterdam, Netherlands
August 2, 1974 to September 25, 1974
Cruise Co-Chief Scientists:
Dr. Manik Talwani, Lamont-Doherty Geological Observatory
Dr. Gleb Udintsev, USSR Academy of Sciences
Cruise Operations Manager:
Mr. M. D. Pennock, British Petroleum Company, Ltd.

Leg 39 - Amsterdam, Netherlands to Cape Town, S. A.
October 6, 1974 to December 17, 1974
Cruise Co-Chief Scientists:
Dr. Katharina Perch-Nielsen, Eidg. Technische Hochschule Zurich
Dr. Peter R. Supko, Deep Sea Drilling Project
Cruise Operations Manager:
Mr. David L. Edmiston, Atlantic-Richfield Company

Leg 40 - Cape Town, S.A. to Abidjan, Ivory Coast
December 20, 1974 to February 15, 1975
Cruise Co-Chief Scientists:
Dr. Hans M. Bolli, Eidg. Technische Hochschule Zurich
Dr. William B. F. Ryan, Lamont-Doherty Geological Observatory
Cruise Operations Manager:
Mr. Glen Foss, Deep Sea Drilling Project

Leg 41 - Abidjan, Ivory Coast to Malaga, Spain
February 15, 1975 to April 10, 1975
Cruise Co-Chief Scientists:
Dr. Yves Lancelot, Lamont-Doherty Geological Observatory
Dr. Eugen Seibold, Institut und Museum der Universitat Kiel
Cruise Operations Manager:
Mr. Robert Knapp, Deep Sea Drilling Project

Leg 42 - Malaga, Spain to Istanbul, Turkey
April 14, 1975 to June 12, 1975
Cruise Co-Chief Scientists: Leg 42A
Dr. Ken J. Hsu, Eidg. Technisches Hochschule Surich
Dr. Lucien Montadert, Institut Francais du Petrole
Cruise Co-Chief Scientists: Leg 42B
Dr. David Ross, Woods Hole Oceanographic Institution
Dr. Yuri Neprochnov, USSR Academy of Sciences
Cruise Operations Manager:
Mr. M. D. Pennock, British Petroleum Company, Ltd.

Leg 43 - Istanbul, Turkey to Norfolk, Virginia
June 13, 1975 to August 12, 1975
Cruise Co-Chief Scientists:
Dr. Brian Tucholke, Lamont-Doherty Geological Observatory of Columbia University
Dr. Peter Vogt, U. S. Naval Oceanographic Office
Cruise Operations Manager:
Mr. Glen Foss

Leg 44 - Norfolk, Virginia to Norfolk, Virginia
August 15, 1975 to October 1, 1975
Cruise Co-Chief Scientists:
Dr. William E. Benson, National Science Foundation
Dr. Robert E. Sheridan, University of Delaware
Cruise Operations Manager:
Mr. Robert Knapp, Deep Sea Drilling Project

Leg 44A - Norfolk, Virginia to San Juan, Puerto Rico
November 8, 1975 to November 27, 1975
Cruise Chief Scientist:
Dr. William E. Benson, National Science Foundation
Cruise Operations Manager;
Mr. Glen Foss

DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 34

SUMMARY

The primary objectives of Leg 34 were a deep penetration into basement and the investigation of metaliferous clays in the sediment sections. Three sites were drilled; one each in the Bauer Deep, the Nazca Plate, and the Eastern Nazca Plate.

Re-entry was accomplished on two sites in water depths as great as 4487 meters. Unfortunately, the deepest penetration into the basalt was only 59 meters before hole conditions required abandonment of the site. On the second re-entry site, only 10.5 meters of basalt was penetrated before the same hole conditions prevailed. This leg brought to light that basalt drilling is not the same the world over and that certain types and ages of basalt drill differently. Some of the freshest and hardest basalts recovered by the Project were found on this leg. New and/or different drilling techniques will have to be tried in order to find ones capable of overcoming the hole problems encountered.

The sediment recovery was relatively good and the scientific findings should prove significant.

The voyage began at Papeete, Tahiti on December 17, 1973 and ended in Callao, Peru, February 2, 1974.

Even though the leg was faced with many problems, it was a technical success and a required forward step to deep basement penetration.

PORT CALL

Leg 34 began at 0630 hours, December 17, 1973, when the Glomar Challenger arrived at Papeete, Tahiti. The priority items for this port call were "topping-off" with fuel (200,000 + gallons), loading groceries, loading GMI and DSDP supplies, installation of guide arms on the heave compensator and assembly of a re-entry cone with a new mud cross. Also of importance was the brief schooling of the on-coming crews on the operation of the heave compensator. Neville Mott (GMI) and Jim Lockman (GMI) supervised the guide arm installation and briefing of the crews, respectively. All of the major items were taken care of during the three day port call, even though some of the heave compensator and re-entry cone work had to be completed later while underway.

All DSDP shipments arrived as scheduled but GMI did not receive many of their expected shipments. Fortunately, none of the missing shipments were critical enough to hamper continuous operation. The port call ended at 0800 hours, December 20, 1973, when the Glomar Challenger headed for Site 319.

UNDERWAY

Enroute to the first site and between sites, profiling was done at maximum speeds attainable except for the short trip from Site 321 to Callao, Peru, when extra time was available and the cruising speed was held to less than the maximum available. Survey speeds averaging about 6 knots over a total period of 8.7 hours were used to pinpoint the three sites. Approximately 4.6 hours of extra surveying was performed after the termination of Site 321 because of the available time. The following table illustrates the underway time, distance, and speeds.

UNDERWAY STATISTICS

From	To	Total Dist. Naut. Miles	Steaming Time (Days)	Avg. Steaming Speed, Knots	Survey Time, Etc.	Average Weather			
						Wind	Current	Sea	Swell
Tahiti	Site 319	2849.4	14.9	7.73	0.2	20-25	1.0	2-4	5-7
Site 319	Site 320	1107.7	5.1	8.84	0.1	10-15	.8	1-3	2-4
Site 320	Site 321	261.1	0.9	9.73	0.3	5-10	.8	1-2	1-3
Site 321	Callao	285.0	1.6	7.59	0.0	0-5	.8	Calm	
Voyage Total		4503.2	22.5	8.14	0.6				

The above table reflects relative slow speeds from Tahiti to Site 319, from Site 319 to Site 320 and from Site 321 to Callao. During these times, the Challenger maintained an almost due east heading bucking east to southeasterly prevailing winds, currents and seas. From Site 320 to Site 321, the speed increased when the weather subsided. From Site 321 to Callao, Peru, the speed was reduced for profiling and to match established ETA.

The above information suggests that the efficiency of the Glomar Challenger can be greatly improved if advantage is taken of the prevailing and seasonal weather conditions in different parts of the world. When considered in the light that approximately

50 percent of the Glomar Challenger's time is spent cruising and that the overall Project cost is approximately $1,000 per hour, cruising speed becomes a major factor in determining on-site-time available and the overall cost of each site investigated. The prevailing and seasonal weather conditions are prime considerations in the drilling industry when vessels are mobilized from one area to another. Cruising time savings from 15 to 25 percent have and can be made from such preplanning. There are complications of holding to a rigid time and direction schedule but, all in all, it is an important and potentially time savings factor.

At present, the Challenger's hull has relatively heavy marine growth which is estimated to have reduced the speed up to one knot. The output of the vessel's propulsion system, while underway, was calculated to be approximately 1800 horsepower per shaft by the D.C. motor outputs. The motor readings were varying but holding around 600 amps and 715 volts each. The motor readings varied between motors either due to individual motor characteristics or inaccurate meters. The shafts were turning 200 rpm. These readings were taken between Tahiti and Site 319 when we were heading into the prevailing weather. The screws would vibrate as if cavitation was occuring during vessel movement even though the stern was ballasted down. At this time, increased shaft speed did not appear to increase cruising speed and the varying loads on the screws was affecting the engine turbocharger heat. A more complete checkout of engine/generator/motor output, with accurate meters, should be made to confirm that full horsepower is available to the screws and to confirm where cavitation actually begins. Consideration should be given to some type of available nozzle design which would reduce cavitation and increase thrust during restraining weather conditions. In calm weather conditions, the ship made 10 knots with greatly reduced loads on the propulsion system.

SITE SUMMARIES

Hole 319 - The objective of Hole 319 was to determine the metaliferous clay content of the sediments by continuously coring (approximately 110 meters) to basalt and to determine a reasonable setting depth of the 13-3/8" casing for the re-entry hole. The mud line was referenced to drill pipe measurement with Core No. 1 as being 4294 meters. The mud line may have been slightly shallower because the core barrel was nearly full of metaliferous ooze. Coring was continued to the top of basalt at 4406 meters on Core No. 12. The top of the basalt drilled very rough with high, erratic torque. Light bit weight (10,000 to 15,000 pounds) and slow as practical rotary and pump were used in an attempt to recover the sediment-basalt contact. However, of the 5.5 meters of sediment and 1.5 meters of basalt cored, only 3.5 meters of sediment were recovered. To confirm that we were in basalt, Core No. 13 cored 3.0 meters of basalt using 20,000 pounds of bit weight, 40 rpm rotary and 5-6 spm pump (100 psi). Drilling was rough with continued high torque as on Core No. 12. Recovery was only 0.8 meters of basalt. An oriented core was attempted on Core No. 14, which is discussed in a later section of this report.

The heave compensator was used in the passive mode on all cores on this site except Core No. 3, when an oil leak had to be repaired. The standard bottomhole assembly was used with three (3) bumper subs and a non-magnetic drill collar for the oriented core. The ship's heave, as seen on the heave compensator, was from 2' to 5'.

The sediment core recovery was relatively good but, according to the scientists, there was no improvement in core disturbance using the heave compensator. In soft formations, the heave compensator will apparently not change core disturbance without a change in the core barrel design.

A summary of coring results on Hole 319 is as follows:

Total Sediments Cored	110.0 meters
Total Sediments Recovered	83.9 meters
Percent Recovery	76.3 percent
Total Basalt Cored	6.5 meters
Total Basalt Recovered	.9 meters
Percent Recovery	13.8 percent

Hole 319A - This was the re-entry hole. The re-entry cone and mud cross were keel-hauled with no trouble at all. The 13-3/8" casing was run down to the top of the mud cross. Considerable trouble was encountered in stabbing the 13-3/8" shoe into the top of the 20" mud cross mouth with the chain tie-down assembly. It was necessary to send a diver down to confirm that the 13-3/8" casing was in the top of the 20" mud cross. The divers reported that the 13-3/8" casing was in the top 4" of the mud cross at a slight angle and would not go into the 20" far enough to shear the cross bar pins holding the chain hooks. There was slightly more than 1" clearance between the hook sides and the O.D. of the 13-3/8" casing shoe. Then, with the 13-3/8" casing in the very mouth of the 20" mud cross, a joint of drill pipe was spudded through the 13-3/8" casing with an air hoist. The chain tie-down assembly was released. The remainder of the 13-3/8" casing was run. Even though the threads on the casing were cleaned prior to running, the majority of the joints were difficult to stab and get started. The very upper portion of the 13-3/8" buttress threads (run out portion) is beginning to rust away from exposure.

After the casing was run, the bottomhole assembly was picked up and latched to the casing hanger with the release sub. The release sub had been tested in the casing hanger earlier. An important point is that the casing bushing hanger must be left out of the bottomhole assembly at this point when running a mud cross, as it will not pass the 13-3/8" casing portion of the mud cross when the bit is pulled. Another important operating procedure used was stripping over the 13-3/8" casing portion of the mud cross when the top stand of drill collars above the release sub was pulled on the preceeding trip out of the hole. It was set back with the rest of the drill collars.

At this point the top stand of collars with the 13-3/8" casing and squnch joint in place was made up. The assembly was then lowered to just above the casing latch in the cone. It was not lowered further to avoid putting too much weight on the slings, while the squnch joint was stabbed. The Squnch joint was lowered a few times in an attempt to latch onto the top of the mud cross. At this point, the port stern sling holding the re-entry cone went slack. The cone assembly was hanging on one sling with the 13-3/8" through the cone throat. The doubled port sling was retrieved and was still intact which meant that the sling bar on the cone had been pulled off the cone. After several different methods of trying to straighten the cone had failed, a keelhaul line was run over the bow of the ship and walked back to the cone. One end was tied off on the starboard side and the other end snatch blocked to the crane. The cone was pulled straight and the keelhaul line tied off. A double hook sling was dropped through the holes in the moon pool cover and the rim of the cone was snagged with one of the hooks. The cone was straightened. Then the casing hanger was latched. The cone assembly was then pulled up against the underside of the hull. Many attempts were made to latch the squnch joint but to no avail. The mud cross was tied off under the hull using a diver to string the slings. There are only two possibilities as to why the Squnch joint did not latch; one, that the male portion of the joint with the latch ring was damaged or; two, that the latch ring was installed upside down on the pin end. This was the one piece of equipment that had not been tested. It was considered a proven piece of oil field equipment and trouble free. The latch ring was shipped installed but may have been turned over when the pin was cleaned.

The cone was lowered and washed in from 4296 meters to 4362 meters in 4-1/2 hours with no trouble. Two wireline runs were required to release the casing and retrieve the Baker shifting tool. On the first run, the shifting tool hung up and the shear pin in the Otis retrieving tool sheared. The difficulty in releasing the casing may have been due to binding caused by not having a casing hanger bushing for alignment purposes.

Once released, sediment was drilled to the top of the basalt at 4394 meters. Note that the top of the basalt was found 12 meters shallower on this hole than on Site 319 at the same beacon position. In drilling the basalt, the same high torque conditions were encountered as on Site 319. In fact, the drill string became stuck for awhile on the second core. During the cutting of the third core, one of the slings holding the mud cross wore through. To prevent the mud cross from dropping down the drill string and onto the cone, the drill string was pulled clear of the cone after the core was retrieved. The ship was moved 500' off location. The remaining sling was cut and the mud cross dropped. The drill pipe was pulled. All six rollers were missing from the casing running tool dogs along with one snap spring. It appeared that the snap rings holding the rollers had failed; possibly, the rollers themselves had shattered.

For re-entry, three more drill collars were added to the bottomhole assembly and the bottom bumper sub was removed. This added weight was considered necessary as the basalt on this location was the freshest and hardest ever found by the Project.

The bit was then run to within 13 meters of the top of the cone. Mud was pumped down the drill string to clean out the pipe dope and scale. The EDO tool was checked and ran to a depth of 600 meters when the voltage regulator failed. Later, it was found that some screws had backed out causing a short circuit. The second EDO tool was then checked out and ran to bottom without circulation. The EDO tool was run at 4500 ft/hr and up to 6,000 feet per hour without overrunning the line. The cone was located but the transducer was torquing and occasionally stopped rotating. The tool was raised and lowered intermittently to maintain transducer rotation. The video finally went out and the EDO tool pulled. The transducer protector sheath had slid up and the bottom tip of the transducer had been damaged, probably from hitting the flapper on the float valve. The Schlumberger cable was then cut and a line wiper installed along with a circulating head on top of the drill pipe to allow pump circulation while running the EDO tool. The protective sheath was removed from a new transducer to give more clearance between the core bit throat and the O.D. of the transducer. After additional EDO tool and electrical cable problems, the EDO tool was finally run to the bit. Pumping while running the EDO helped but because of the lack of experience, the tool was run at about 5000 feet per hour. The pump was left on until the EDO tool had seated and was put back on every time the tool was to be raised to keep from hitting the flapper in the float. This procedure worked well and when the EDO tool was finally retrieved, there were no signs of marks or damage to the transducer. The 8 degree transceiver worked well but the 45 degree transceiver was almost non-existent. Several hours (approximately 17 hours) were spent in trying to position over the cone. The primary reason for this delay was the malfunctioning of the multiplex signals to turn on the 45 degree transceiver and cleared up only after many hours of despair. The bit was then lowered to the top of the cone and approximately four hours were spent allowing the bit to pass directly over the cone three times and stabbing the cone on the fourth pass. This was considered necessary in order to build up the confidence of the technicians. The transducer still had to be raised and lowered intermittently to reduce torquing problems.

During re-entry, the pipe was lowered rapidly without taking weight and rotated freely on the following two stands indicating that re-entry had been made in the casing. The top of the basalt was re-entered with only a slight indication (10,000 pounds) on the weight indicator. The pump was used to wash (precautionary) while going to bottom from 4398 to 4413 meters. Reaming was required from 4413 to 4422.5 (T.D.). Core No. 4 was cut and retrieved. Only two meters were cut on this core to allow full core barrels and right spacing on subsequent cores. Torque conditions were still dominate. During Core No. 5, the Bowen power sub failed causing a 5-1/4 hour delay. Then Cores Nos. 6 and 7 were cut with considerable torque and working of stuck pipe. At this point, GMI received orders from their La Jolla office to remove the heave compensator until the material found in the hydraulic system could be identified. After the heave compensator was set back the Bowen power sub locked up again while working the bit back to bottom to cut Core No. 8. The drill string stuck and was worked above the basalt. After inspecting the Bowen sub gear box and putting it back into operation, a center bit was used to clean up the hole. Approximately three hours were spent trying to clean up the basalt section (59 meters) but with no success. Approximately 4-1/2 hours were spent working stuck drill pipe. The site was abandoned as prospects for clearing up the hole problems were poor.

A summary of coring results on Hole 319A is as follows:

Total Sediments Cored	0 meters
Total Basalt Cored	59.0 meters
Total Basalt Recovered	14.5 meters
Percent Recovery	24.6 percent

Hole 320 - This was the second re-entry site, located on the Nazca Plate with about 135 meters of sediment. The main objective, again, was deep basalt penetration. As the basalt was older, the scientists were hoping that this site would drill better. Only three cores were taken on this hole, one at 4493 meters, one at the casing point, and one at 100 meters penetration. All went well and according to plan with the following results:

Total Sediments Cored	28.5 meters
Total Sediments Recovered	19.4 meters
Percent Recovery	68.0 percent

Hole 320A - Because of q questionable mud line, an additional mud line core was taken and the mud line adjusted to DPM of 4487 meters. All went well.

Total Sediments Cored	9.0 meters
Total Sediments Recovered	8.8 meters
Percent Recovery	98.0 percent

Hole 320B - The keelhaul lines had previously been hung. On this site, because of the narrowing time factor and potential problems, the mud cross was not run. However, two inch slots approximately 18 inches long were cut and staggered in the middle portion of the cone to possibly help any cuttings to fall through the cone. The keel-hauling procedure went well and an important point is that it was done at night. The same amount of casing was run (65 meters) as on Site 319A. The casing was run in 2-1/2 hours; each joint was Baker locked and tack welded. The bottomhole assembly was picked up and the latch tool tested in the rotary table. The bushing was run this time as the mud cross had been left out. The casing was washed in from 4487 to 4450 meters in 1/2 hour. The sediments were very soft and easy to wash with very slow pump. The casing was released two meters above the drill pipe measurement mud line just in case the casing would settle due to the soft formation. The Baker release tool worked well and the casing was released by putting in a little left hand torque, then right hand torque and picking up slightly.

The sediment was washed to 4623 meters and then continuously cored to top basalt at 4642 meters. The basalt was cored to 4670 meters. Again, the same type torque and stuck pipe conditions, as at Site 319, prevailed. High viscosity mud pills (150 seconds plus) were tried without success to try to clean out the hole. While attempting to work the bit to bottom for Core No. 6, the Bowen sub locked up again. This time it was the gear box and not the hydraulic motor as before. In order to break the connection between the power sub and the swivel, the drill string had to be pulled. After discussion with scientists, a decision was made to pick up the Kelly and attempt to re-enter the hole. The Kelly conversion required a total of 14-1/2 hours plus round trip time.

The standard bottomhole assembly was used and ran to 4472 meters. The electronic technicians had "hard wired" the EDO tool for 45 degree scanning. It was run the same as on Hole 319A. However, three hours were lost when the Allison torque converter failed on the Schlumberger unit. Attempts to use the auxiliary electric drive resulted in a shaft failure and the EDO tool was lowered at idle speed through the torque converter as the unit was still usable in certain gears. The EDO tool performed fairly well but still had torquing and to a certain extent, video problems. Approximately eight hours scanning and ship positioning was required before the re-entry was attempted. The EDO tool was beginning to act as if the video was going out and the cone was stabbed on the second pass over the cone. The same technique of lowering the pipe was used to determine if re-entry had been made.

As on Site 319A, the top of the basalt was re-entered with no problem but the hole had to be reamed from 4648-4670 meters with the drill pipe sticking continually. A center bit was used in an attempt to clean up the hole prior to coring. The pipe stuck on the last attempt for 3-1/2 hours when a final decision was made to abandon the hole and take sediment cores.

Just prior to this, the ship took an 800 foot excursion. The weather had picked up and the thrusters reacted to high gain settings used during re-entry and caused failure of an engine turbocharger. A propulsion engine was then assigned to the thruster until repairs could be made.

To enable sediment cores, two wireline runs were made to retrieve the center bit but without success. The drill string had to be pulled. When the bit was broken out, the center bit was found wedged in the throat of the bit where a portion of the core forming guide of the bit was found to be off center. Most likely it was a manufacturing defect. The site was abandoned.

Total Sediments Cored	19.0 meters
Total Sediments Recovered	16.9 meters
Percent Recovery	88.9 percent

Total Basalt Cored	28.0 meters
Total Basalt Recovered	1.2 meters
Percent Recovery	4.3 percent

Site 321 - This site was located on the eastern edge of the Nazca Plate south of the Mendawa fracture zone. The mud line was located at 4827 meters with 124 meters of sediment. All went well on this site while coring sediment. A standard bottomhole assembly was used with a non-magnetic drill collar for possible oriented cores. The top of the basalt was found at 4951 meters. As on the previous sites, the basalt drilled with high torque which is characteristic of broken or fractured formation and with sticking of the drill string. Only 10.5 meters of basalt was penetrated on this site. However, in general, this basalt drilled better than at the previous sites as the basalt seemed to be a bit more massive and consolidated. The fractured pieces drilled and acted as if they were larger. When the bit was being worked to bottom for Core No. 15 and the Kelly drive bushing engaged, the rotary required 750 amps (approximately 17,000 ft. lbs.) of torque to rotate but then acted normal. The driller was instructed not to pick up off bottom unless absolutely necessary for fear of having to ream and work the pipe to bottom. The torque dropped to 150 amps and the pump pressure lost 200 psi. Finally, it was decided that we must have lost part of the bottomhole assembly. The weight indicator showed a 25,000 pound loss but when the pipe was pulled, the complete bottomhole assembly had been lost at the second joint above the joint of 5-1/2" drill pipe and had parted in the 5" O.D. body three feet above the pin end. The failure appeared to be due to fatigue and corrosion and not torsion. One side of the pipe appeared to be thinner than the other, but field caliper measurements were poor due to the oxidation scale in the pipe. The section has been returned for laboratory analysis. The site was abandoned and the area surveyed prior to departure to Callao, Peru.

Total Sediment Cored	114.5 meters
Total Sediments Recovered	81.1 meters
Percent Recovery	70.8 percent

Total Basalt Cored	10.5 meters
Total Basalt Recovered	4.7 meters
Percent Recovery	44.8 percent

DRILLING AND CORING

Sediment drilling and coring: The methods and equipment for sediment coring appear to be very adequate. Undisturbed sediment cores, particularly in soft ooze, will be almost impossible to obtain with the present coring system even with the heave compensator. As the sediment becomes firmer, the degree of disturbance is less when little or no pump is used. There were a few cases of collapsed plastic liners that were creased longitudinally.

BASALT DRILLING AND CORING

On Holes 319 and 319A, the spring tensioned core catcher bodies cracked in the welds where the tapers for the dog catchers had been welded together. In addition, in the fractured or pillow type basalt drilling, chunks of broken or fractured basalt seemed to jam this type catcher more easily. This may be due to fouling of the sleeve and spring assembly. Somewhat better recovery was obtained with the shorter dog type catcher together with two short finger catchers. However, when drilling the finely glassed and fractured basalt on Site 319A, the small pieces jammed in the tapered slots on two core runs preventing the dogs from sliding up the taper for full bore opening. In reality, not enough basalt was cored or recovered to justify a good comparison. When coring fractured basalt, chances of recovery are very slim.

Site 319 had the freshest and hardest basalt found by the Project. The basalt was evidently heavily fractured with only small chunks recovered. The exception was one massive flow unit in which 7.3 meters of basalt was recovered. Often when working the bit to bottom, no weight could be applied without the Bowen sub torquing to maximum and the pipe becoming stuck. High viscosity mud pills and high annular velocities did not appear to be of any help. On this location, the fractured or broken basalt was so fine that it would apparently heave in and pack off around the bit like sand causing excessive pump pressures. However, the pipe could be "snaked" up the hole without pump and then pump circulation would be regained.

On Hole 320B, the same characteristics existed except that the basalt pieces seemed to be much larger. Pump pressure did not increase due to packing off, but the larger chunks would wedge the bit or drill collars resulting in stuck pipe. Attempts to reduce the pumping rate to keep the basalt pieces under the bit in order to grind them up only appeared to help at times. The problem in every case was that no bit weight could be applied to grind up the chunks because the drill string would torque to maximum. Dry drilling was not attempted for fear of burning up the bit bearings.

Site 321 was not drilled into the basalt enough to determine the drilling characteristics, however, what little was drilled appeared similar to the other sites.

Attached are copies of the TOTCO Recorder rotary torque readings. In reviewing these recordings only Core No. 13 on Hole 319A had almost consistent low torque drilling with good basalt recovery (7.3 meters). This was a massive basalt flow unit. Similarly, low torque drilling sections were observed on Core No. 2 on Hole 319A but the core catcher was probably already jammed when this section was drilled. Core No. 5 on Hole 319A also shows a relatively good section just prior to the Bowen sub failure but, again, the core catcher may have already been jammed. There were no low torque drilling sections on Hole 320B. There were no recordings on Site 321 as the electric rotary drive is not connected to the recorder.

The scientists feel that the better chance of cemented and consolidated basalt are in the older basalts and where there is more sediment overburden. This theory should be investigated for future site selection. In addition, a test hole should be drilled far enough into the basalt to determine its stability prior to committing a re-entry cone.

After the basalt study for this leg is complete, a general drilling plan covering different techniques may be worthwhile. Possibly, different type bits, mud and/or cement along with different weight and speed techniques could be tried and evaluated. This type of basalt drilling is very difficult and will require time for experimentation for development of drilling techniques.

ORIENTED CORING

Oriented coring was scheduled on this leg to further prove the technique. A Sperry Sun Well Company representative was on board to supervise this particular operation.

Hole 319 (the continuous coring run to basalt) was selected using the gammaloy drill collar rather than Hole 319A to help eliminate any creation of problems with re-entry. Only three meters of basalt was cored on Core No. 13 with 0.8 meters recovery. The special gammaloy inner core barrel with a 3 point scriber segment spring loaded core catcher was dropped and two meters of basalt was cored in one hour forty-five minutes. Pipe rotation, mud pumps, etc. were shut down at half meter intervals for two minutes to allow for the camera to take reasonably still pictures.

When the core barrel was retrieving, there was only one large chunk of irregular shaped basalt jammed (wedged) at the entrance of the core catcher. In addition, there were cracks on the sides of the core catcher body where the tapers for the segment catcher were welded into the catcher body. The result was no cores for the scribers to mark.

The pictures taken were good. See attached field data sheet. However, the data obtained shows that the magnetic lug (scriber) made a turn of 364 degrees during the coring interval as follows:

Eight degrees in first 30 minutes, 167 degrees in next 27 minutes, 166 degrees in next 24 minutes and 23 degrees in final 18 minutes. It is assumed that a chunk of basalt put abnormal pressure on the inner core barrel bearing assembly which caused the inner core barrel to turn. At any rate, the magnetic lug did make a right turn of approximately 264 degrees. If a core of basalt had been cut and up in the core barrel, this rotation may have been prevented.

The recording instrument ran for full term of test and the alignment of the instrument with the magnetic lug and scribed core catcher dog remained true throughout the test.

HEAT PROBE

The heat probe instrument was run in a special inner core barrel with a three foot sub just above the lower inner barrel sub. A baffle plate was made up at this connection. A 2.5" O.D. pipe was used for a spacer so that the heat probe would extend through the finger type core catchers with the instrument body against the top set of finger core catchers. The heat probe was run on Site 319 in the sediments at 4343.5 meters and 4372 meters. In each case approximately 5,000 pounds of weight was put on the bit. The weight would fall off due to soft sediment and an attempt was made to maintain bit weight. This movement apparently caused friction and heat on the probe and gave unstable measurements. The first test was acceptable but the second one was not. The drill string should be left stationary at whatever weight the formation can support when run with a heave compensator.

POSITIONING

There were no major problems with the ship's positioning system. The hydrophones were kept ten feet below the hull with minimal acoustical interference. On Hole 320B, the ship took a sudden 800 foot excursion indirectly due to a high gain setting left on the computer after the re-entry procedure. The weather had picked up and the thrusters overreacted. A turbocharger on a thruster engine went out. This situation was remedied with little loss of time.

The weather was good on all sites with normal excursions within 100 feet at all times. Interesting is the fact that more excursions occur in calm weather than in slightly rough weather as the computers were continuously "hunting" a resistance to work against.

The ten foot offset capability installed in Honolulu was used on re-entry Holes 319A and 320B. This capability did not appear to help in pinpointing the cone but did help when trying to maneuver the bit across the top of the cone. Large offsets (200 feet +) should be used from the start to more accurately locate the position of the cone. There were also problems with the EDO tools that aggrevated the situation as described in other sections of this report.

Before the end of the leg, each of the two stern thrusters were leaking oil at the rate of about one gallon per 24 hours.

Ocean Research equipment beacons performed well. (See attached beacon performance summary). On Site 319, the 16 kHz long life beacon functioned perfrectly for 11 days and 22 hours. All beacons were "soaked" prior to dropping. One beacon acted erratically on the deck and was not used.

EQUIPMENT

HEAVE COMPENSATOR

Unfortunately, the heave compensator had only limited use and then only in the passive mode. However, during its use, the crews became familar with its operation. The compensator was used in sea conditions with a ship's heave of up to seven feet with only 5,000 $\pm$ pound bit weight variation in the passive mode. The guide arm attachments are presently being modified to ease the removal and installation required when picking up or setting back the unit. Fiberous material found in the hydraulic oil caused concern that this oil was attacking the hydraulic hoses. Orders were received from GMI to stop using the unit until the source of this material was located. Also, hydraulic fluid began leaking past the compensator piston. The top teflon seal was replaced as the original one was damaged and cut as if it had slipped. GMI is to investigate the possibility of using an alternative hydraulic oil as the present "Pydraul 29-E-LT" attacks anything rubber including shoes. Although the operation of this particular unit appears complex, crew confidence will build with experience. For certain, more experience will be required before the full capability of the unit is realized.

BOWEN SUB

Two hydraulic motor failures and finally the gear box seizure resulted in many hours of lost time and in the use of the back-up Kelly-Rotary Table system. Without really knowing the actual cause of these failures, it appears that there had been minimal maintenance on the unit. Some type of program is needed where the hydraulic oil is periodically analyzed, the power unit checked, and the power sub, itself, checked after so many hours of operation. This check out should be done by competent Bowen and GMI personnel at convenient port calls. The Bowen sub or equivalent is an essential tool for this Project because of its inherent advantages when reaming and working in bad hole conditions.

KELLY DRIVE

A 41 foot hex Kelly was used after the Bowen sub failed. This method is acceptable as a backup but has certain weak points. The Kelly drive bushing fits into the Ideco elevator bushing fine and does not appear to need a lock down device. However, the fit between the Ideco elevator bushing and the rotary table looks a little "spooky". When the vessel rolls or the pipe moves, the bottom of this bushing lifts off of the rotary table on one side. Either the pin drive is too loose of a fit or the drive pins are too short or both. This whole arrangement should be looked at for safety purposes.

In addition, with problem holes and only a 41 foot Kelly, the Kelly drive bushing cannot be engaged until the bit is near bottom after a connection has been made. This means there is no way of rotating the pipe if the hole has filled in without laying out the joint that was just picked up. A longer Kelly is needed. The guide arm support for the swivel needs to be redesigned so as not to require pulling the bottom seal assembly on the swivel. The present design can easily damage seals and takes time.

SCHLUMBERGER UNIT

The Allison torque converter was damaged and the emergency electric drive shaft into the right angle drive was sheared during use on Site 320B. There were no spare coils to replace bad ones on the emergency electric drive. This unit is old and appears to be in need of a complete "shop" overhaul. Since this unit is not used often, routine maintenance is difficult. Maybe enforced maintenance is the only answer where the unit is run to 6,000 feet or so on each leg and checked out on a specially prepared check out form. In addition, a minimum spare parts inventory should be established and maintained.

DRILL PIPE

The drill pipe failure is the second failure during the existence of the Project. However, after the joint has been analyzed and the cause of failure determined, corrective action to "weed out" any additional weak joints in the drill string should be taken as soon as practical. Consideration should be given to salvaging tool joints from retired joints. Considerable savings can be realized by having the tool joints reconditioned and flash welded to new tubes. Most drilling contractors are doing this today. Because of the corrosive sea water, internal coating would seem a reasonable investment even with the large number of wireline runs required.

DRILL COLLAR HANDLING

Even though the bottomhole assembly consists of only three stands, they are very difficult to handle in the derrick. A different "mule" device, arm or double drum winch would be much better than the sliding, single line tugger now used.

TOTCO RECORDER

This is an excellent tool to evaluate the drilling operations and drilling conditions. This unit is in need of repair and calibration. A diaphragm is leaking and many of the recording functions are not operating properly.

WEIGHT INDICATOR

Just to be on the safe side, this unit should be checked out. It appeared to be inconsistent on its read out and acted a little "spooky" even though it is relatively new.

MUD PUMPS

In need of a good hydraulic valve seat puller.

GUIDE RAILS

The guide rails are bent and appear to need attention. They should be extended closer to the derrick floor to give more working room.

ELEVATORS

Taper appears to be deep into elevator throat but they may be to specifications. A formal periodic maintenance program should be established.

EDO TOOL

Consideration should be given to having electronic components "potted" so as to prevent mechanical failures. Spare "potted" sections could be carried aboard for repairs. This will require that a standard and final design be reached soon with a stronger rotor motor and smaller O.D transducer.

DSDP TOOLS

Greater standarization on all parts and threaded connections is needed including the number of each to maintain on the rig. A more rugged bit breaker is needed for use on rig. A new one received broke on its first use and had to be modified.

Better quality control is needed on the Smith core bits. The bits onboard were gauged from 10" O.D. to 10-1/4" O.D. In addition, the offset in the one bit described above was probably due to poor quality control during manufacturing.

The Baker shifting tool needs a better method of making up fishing necks. The present allen lock screws are positioned such that threads do not make all the way up when screw holes are aligned. The present tool was made up and tack welded.

If the mud cross is to be run with the re-entry cone, the upper portion of the 20" O.D. mud cross section should be extended approximately 25 feet, then when keelhauled with the cone, this 20" section would be above the water line and visible for stabbing the casing or bit and for latching the upper Squnch joint. Sheaves would have to be put on the bails and the pick up line deadlined on the derrick floor in order to provide adequate pick up line length.

COMMUNICATIONS

Nearly all incoming and outgoing traffic was handled directly through WWD with very little difficulty. The slight time differences involved on this leg did not hamper the reporting schedule to any large extent. The ionospheric conditions were such that communications with WWD could be carried on in the mornings and late afternoons during WWD's working hours. Amateur radio (HAM) communications were good through operators in California. Personal calls to keep in touch with families and friends were made via these HAM operators.

A few commercial radio-telephone calls were made through the Miami marine operator with relatively clear voice communications.

The weather radio facsimile maps were received primarily from Long Island with fair results.

The satellite weather pictures were good.

A possible answer to improved communications would be through communication satellites. The cost of such a system will be high.

PERSONNEL

Global Marine's personnel did an exceptional job in handling the two re-entry sites. One tool pusher individually prevented the loss of the cone on Site 319A. The crews worked safely and tirelessly in view of the many equipment and hole problems encountered on this leg. All are to be commended for their personal contribution to the technical success of this leg.

The scientific party and DSDP personnel, in particular the electronics tedhnician, did a great job. The understanding and concern showed by the Co-Chief Scientists made the difficult times a little easier, even though the deep basalt penetration anticipated was not achieved.

Erick Jansson
Cruise Operations Manager
Deep Sea Drilling Project

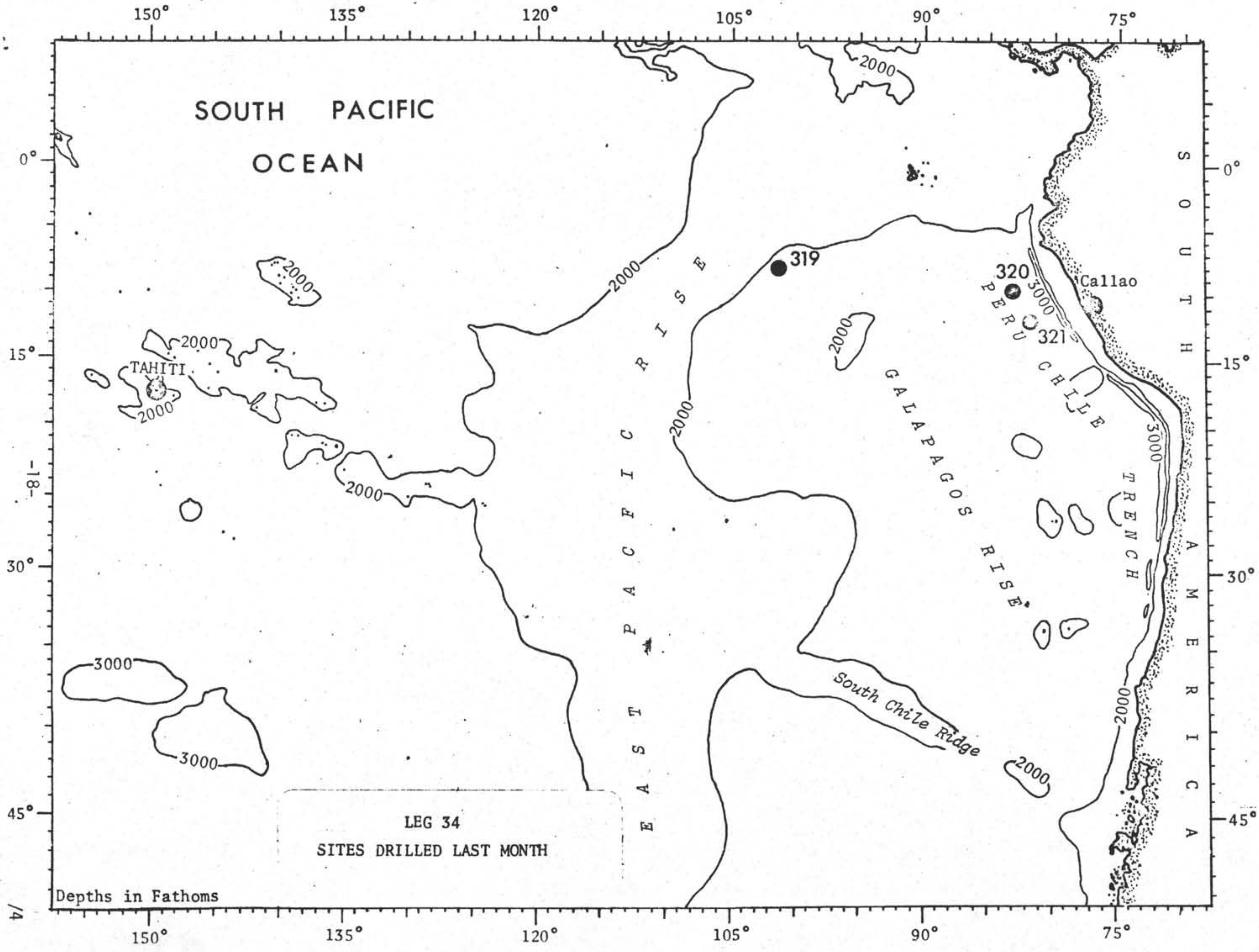
February 1974

DEEP SEA DRILLING PROJECT
SUMMARY OF OPERATIONS
LEG 34

Total Days Leg 34	46.9
Total Days In Port	3.1
Total Days Cruising (Including Site Survey)	23.1
Total Days On Site	20.7

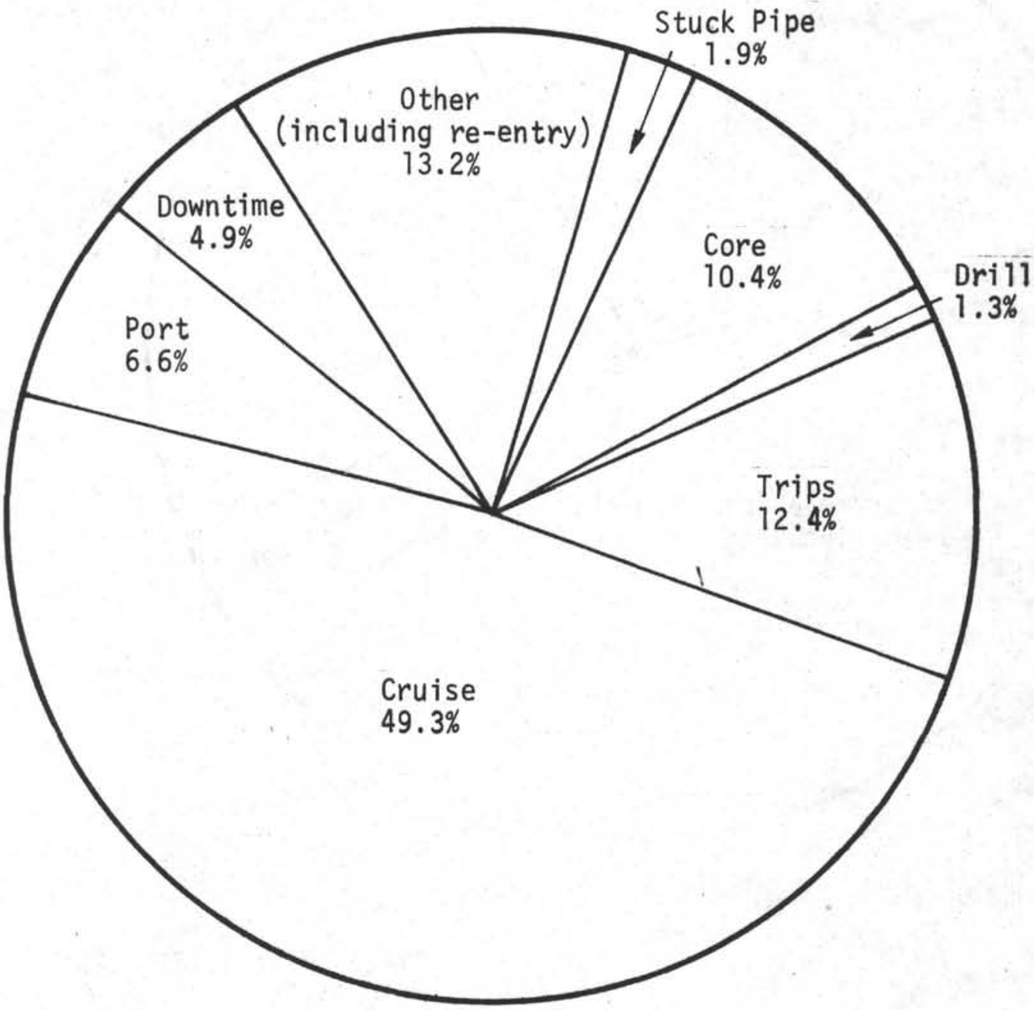
Trip Time	5.8
Drilling Time	0.6
Coring Time	4.9
Lost Time (Mechanical Downtime)	2.3
Stuck Pipe	0.9
Other (Re-entry, Reaming, Etc)	6.2

Total Distance Traveled (Nautical Miles)	4503.2
Average Speed (Knots)	8.14
Sites Investigated	3
Holes Drilled	6
Number of Cores Attempted	45
Number of Cores With Recovery	45
Percent of Cores With Recovery	100
Total Meters Cored	385.0
Total Meters Recovered	231.5
Percent of Cored Interval Recovered	60.1
Total Meters Drilled	320.5
Total Penetration	705.5
Percent of Penetration Cored	54.6
Maximum Penetration at Single Hole	183.0
Maximum Water Depth	4927.0
Minimum Water Depth	4296.0
Average Water Depth	4570.0



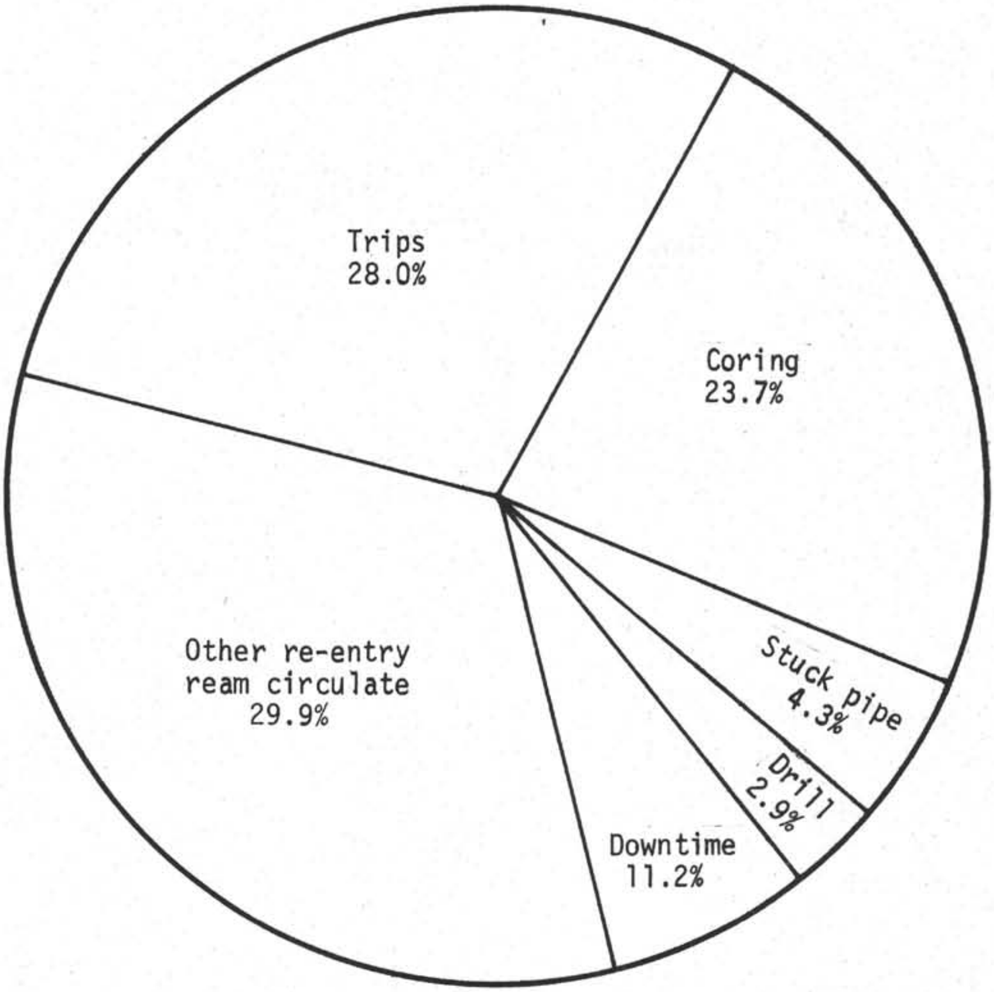
LEG 34
SITES DRILLED LAST MONTH

FIGURE I
DEEP SEA DRILLING PROJECT
TOTAL TIME DISTRIBUTION
LEG 34



START LEG: December 17, 1973
FINISH LEG: February 2, 1974
TOTAL TIME: 46.9 Days

FIGURE II
DEEP SEA DRILLING PROJECT
ON-SITE TIME DISTRIBUTION
LEG 34



TOTAL TIME ON SITE:	20.7 Days
TOTAL SITES:	3
TOTAL HOLES:	6

DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 34

Site No.	Make	Freq. kHz	Serial Number	Site Time Hours	
319	ORE	13.5	271	0	Erratic behavior on deck. Double life. Returned to DSDP.
319 319A	ORE	16.0	184	286.0	Strong. Pulse width 3.9m sec. Double life.
320 320A 320B	ORE	13.5	281	156.8	Pulse width 4.0m sec. Double life.
321	ORE	16.0	268	52.5	Pulse width 4.0m sec. Short life.

DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 34

Hours	Mfg.	Size	Type	Serial Number	Meters Cored	Meters Drilled	Meters Total Penet.	Hours On	Condition	
319	Smith (RR)	10-1/8"	F94C	RC204	116.5	0	116.5	6.5	T-5,B-6,BT	Rerun Site 314. Only rotation and weight coring 6.5 meters of basalt.
319A Bit No. 1	Smith	10-1/8"	F99CK	RC878	28.5	98.0	126.5	14.0	T-4,B-4,BT	1/8" OG. Only 2 broken inserts. Bit in good condition otherwise. Had 12.5 hours drilling and 1.5 hours reaming. Worked stuck pipe.
319A Bit No. 2	Smith	10-1/8"	F99CK	RC879	30.5	0	30.5	12.0	T-3,B-4	Bit in good condition. Cone tip inserts missing on 3 cones. Had 6.75 hours drilling, 3 hours reaming with core barrel and 2.5 hours washing and reaming with center bit. Cones still fairly tight. Worked stuck pipe.
320	Smith (RR)	10-1/8"	F99CK	RC878	19.4	77.0	96.4	1.15	T-4,B-4,BT	Rerun Site 319A. Bit hardly rotated. All sediment drilling.
320A	Smith (RR)	10-1/8"	F99CK	RC878	9.0	0	9.0	0.10	T-4,B-4,BT	Used same bit as above for mud line determination.
320B Bit No. 1	Smith	10-1/8"	F94CK	RC899	47.0		136.0	12.3	T-3,B-4,BT	Bit in condition with 2 broken inserts. Heavily scared on sides due to broken basalt and working stuck pipe.
320B Bit No. 2	Smith	10-1/8"	F94CK	RC910	0	0	0	15.5	T-2,B-3	Bit in good condition. Scared on sides due to broken basalt and working stuck pipe. All 15.5 hours used for reaming and working pipe. No coring or drilling. Piece of basalt jammed in core forming guide.
321	Smith	10-1/8"	F94CK	PC161	125.0	9.0	134.5	4.0	Lost in hole.	Drill pipe parted above mud line loosing complete bottomhole assembly.

DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 34

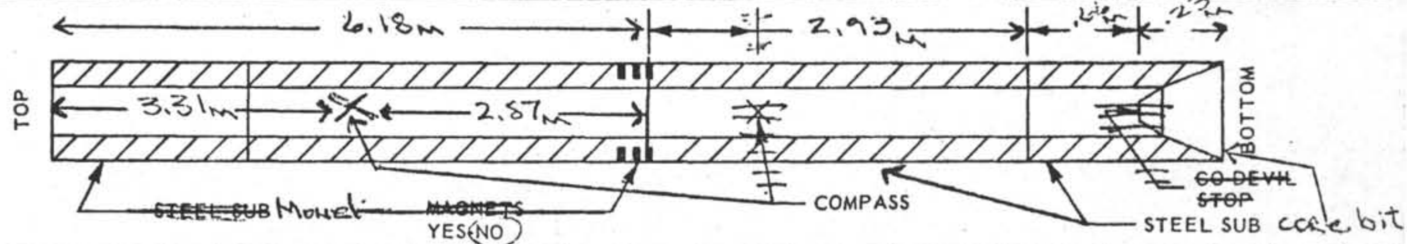
Hole	Latitude	Longitude	Water Depth Meters	Number Of Cored	Cored With Recovery	Percent With Recovery	Meters Cored	Meters Recovered	Percent Recovered	Meters Drilled	Total Penet. Meters	Avg Rate Penet. M/Hr.	Time On Hole	Time On Site
Bauer Deep														
319	13°01.04'S	101°31.46'W	4296	14	14	100	116.5	84.8	73	0	116.5	18.6	65.0	
319A	13°01.04'S	101°31.46'W	4296	7	7	100	59.0	14.5	25	98	157.0	6.3	221.0	
	Site Totals			21	21	100	175.5	99.3	56.6	98	273.5	8.8		286.0
Nazca Plate														
320	09°00.40'S	83°31.80'W	4487	3	3	100	28.5	19.5	68	77	105.5	91.7	16.0	
320A	09°00.40'S	83°31.80'W	4487	1	1	100	9.0	8.8	98	0	9.0	90.0	9.8	
320B	09°00.40'S	83°31.80'W	4487	6	6	100	47.0	18.1	38.5	136	183.0	31.0	131.0	
	Site Totals			10	10	100	84.5	46.4	54.9	213	297.5	41.6		156.8
Eastern Nazca Plate														
321	12°01.29'S	81°54.24'W	4927	14	14	100	125.0	85.8	68.6	9.5	134.5	33.4	52.5	52.5
	Site Totals			14	14	100	125.0	85.8	68.6	9.5	134.5	33.4		52.5
	Leg Totals		4570	45	45	100	385.0	231.5	60.1	320.5	705.5	16.7		495.3

SPERRY-SUN WELL SURVEYING COMPANY
MAGNETIC MULTISHOT FIELD DATA AND TIME SHEET NO. 1

CORE ~~JOB~~ NO. 14

COMPANY Scripps Institution of Oceanography DATE 1-6-'74
STATE S. Pacific Ocean COUNTY/PARISH FIELD DSDP
LEASE Leg 34 Site ~~WELL~~ NO. 319 SURVEYED FROM 4410.5 m TO 4412.5 ~~FEET~~ m.

CLOCK NO. E 319 FRAME NO. 39 SD MAGAZINE NO. 388 COMPASS NO. 134820° CENTRALIZER F.G.
COMPASS SPACING 9.42' FROM BOTTOM/~~TOP~~ LENGTH OF COLLAR 20.28' TYPE COLLAR NMDC
FILM LENGTH CALC. 69.3" MEASURED 69.3" FIRST FLASH 00-00 LAST FLASH 231-00
REMARKS: Magnetic Declination = 9°02' East, "AA" Battery tube, 10⅛" Hole
OPERATOR Penrod



IN RUN SURFACE TIME	MEASURED DEPTH in m	~~OUT RUN SURFACE TIME~~	IN RUN SURFACE TIME	~~MEASURED DEPTH~~	~~OUT RUN SURFACE TIME~~	IN RUN SURFACE TIME	MEASURED DEPTH	OUT RUN SURFACE TIME
				Making up				
40-50 43-20	4410.5			Dropped 08:15				
71-35 73-05	4411.0			Pumping Down				
99-15 100-45	4411.5			Shut down pump 28:15				
123-30 125-10	4412.0			Pumps on 35:30				
141-45 143-20	4412.5			Going to Bottom				
						Slips set 146:30		
						Set back 1 joint		
						Picked up and lower pipe 155:00		
						Going after Tool		
						Picking Tool 187:15		
						Coming Out		
						On Surface 210:35		

Comment: Instrumentation ran full term with perfect time gradient. Scribe alignment held true throughout test.

SP-437

SPERRY-SUN WELL SURVEYING COMPANY

Date JANUARY 6, 1974

CORE ORIENTING LOG

Core ~~JOB~~ NO. 14

CORRECTIONS

Declination 9 Degrees EAST ~~WEST~~

WELL INFORMATION

Company Scripps Institution of Oceanography
Contractor Global Marine Inc.
Well Name Leg 34 Site 319
County So. Pacific Ocean State
Hole Size 10 1/8
Formation Name Basalt
Formation Description —

PERFORMANCE

Interval Cored 4412.5 Finish
4410.0 Start
Footage Cored 2.0 m attempted;
Actually no core recovered inside core barrel. Large slug of Basalt jammed in entrance.

Azimuth Correction for Declination
East Declination ☒ Add to Azimuth
West Declination ☐ Subtract from Azimuth

Reference Groove Correction:
From Above, Groove is 0 Degrees R L of Orientation Lug
Right Add to Lug Az. Left Subtract F/ Az.

DRIFT			STATION				ORIENTATION						
Incl.	Magnetic Direction	True Direction	Station No.	Time	Picture No.	Depth	Magnetic Lug Direction	Magnetic Lug Az.	Declination Correction	True Lug Azimuth	Reference Groove Corr.	Reference Groove, True	Direction Ref. Groove
3 1/2	S30E Before Coring	S21E	1	43-00	129	4410.5	N74W	286	+9	295	0	295	N65W
3 1/2	N51W	N42W	2	73-00	219	4411.0	N71W	294	+9	303	0	303	N57W
3 3/4	N14W	N05W	3	100-00	300	4411.5	S79E	101	+9	110	0	110	S70E
3 1/2	N12E	N21E	4	124-00	372	4412.0	S87W	267	+9	276	0	276	N84W
3 3/4	N57W	N48W	5	142-00	426	4412.5	N70W	290	+9	299	0	299	N61W
			6										
			7										
			8										
			9										
			10										
			11										
			12										
			13										
			14										
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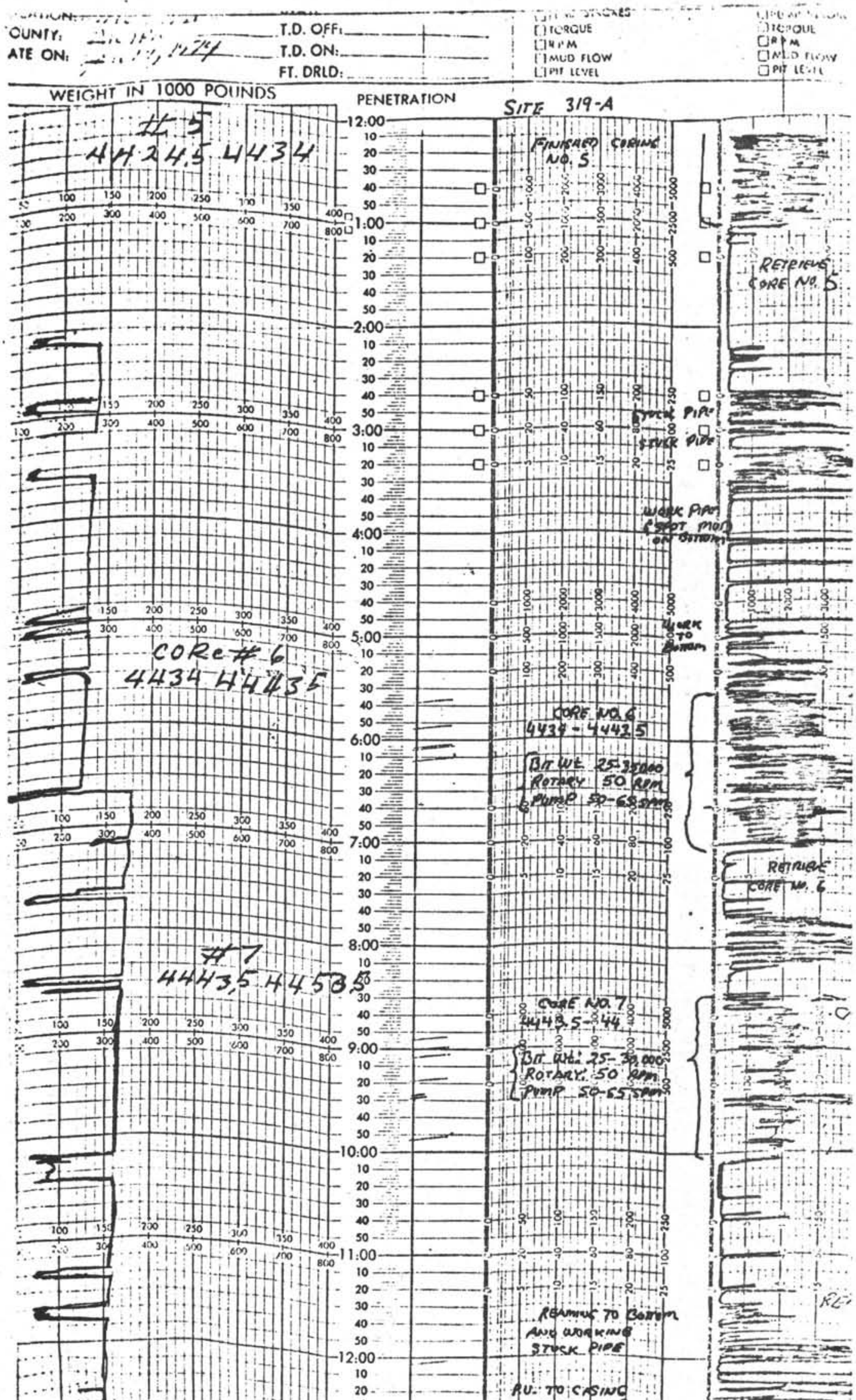
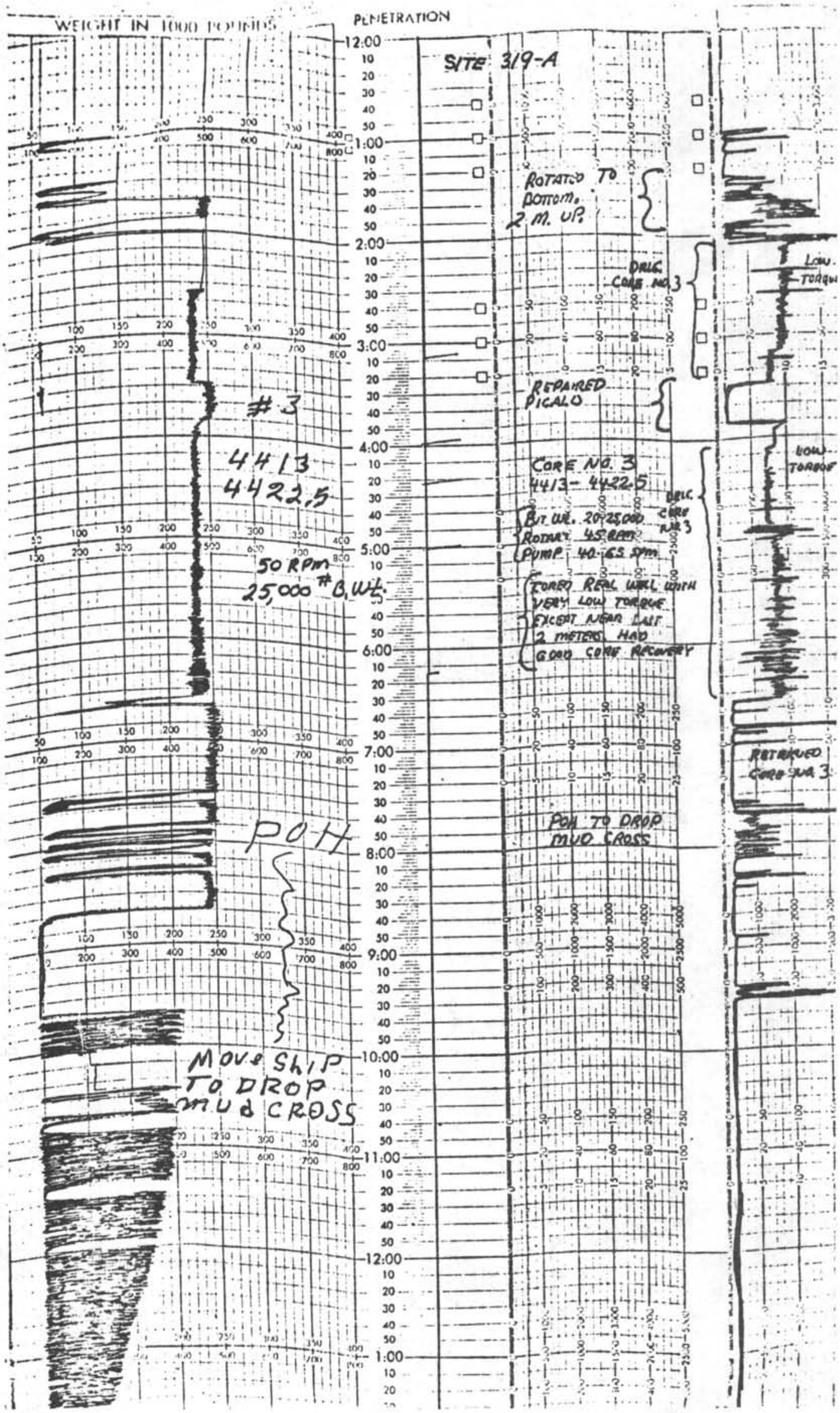
			16										
			17										
			18										
			19										
			20										

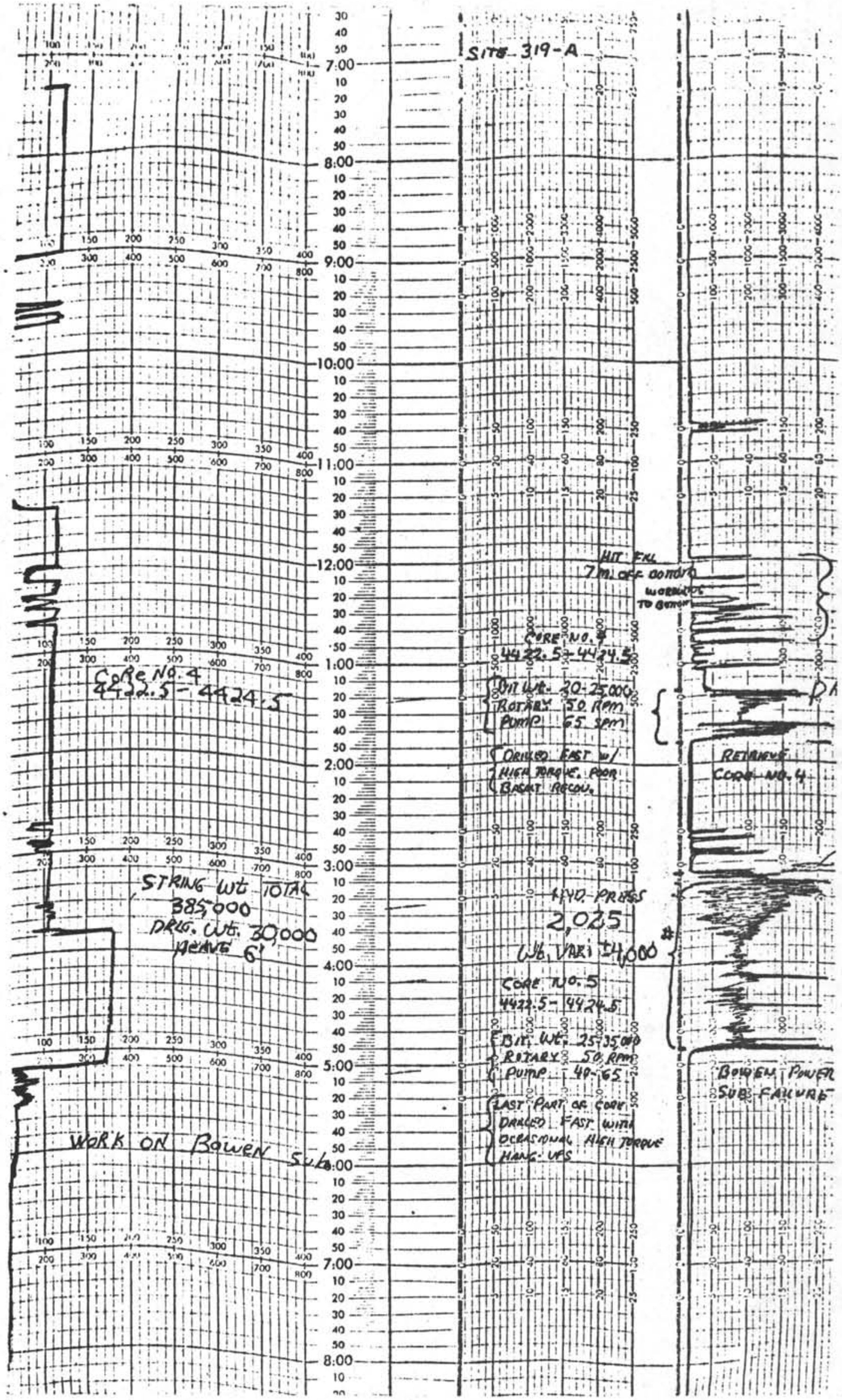


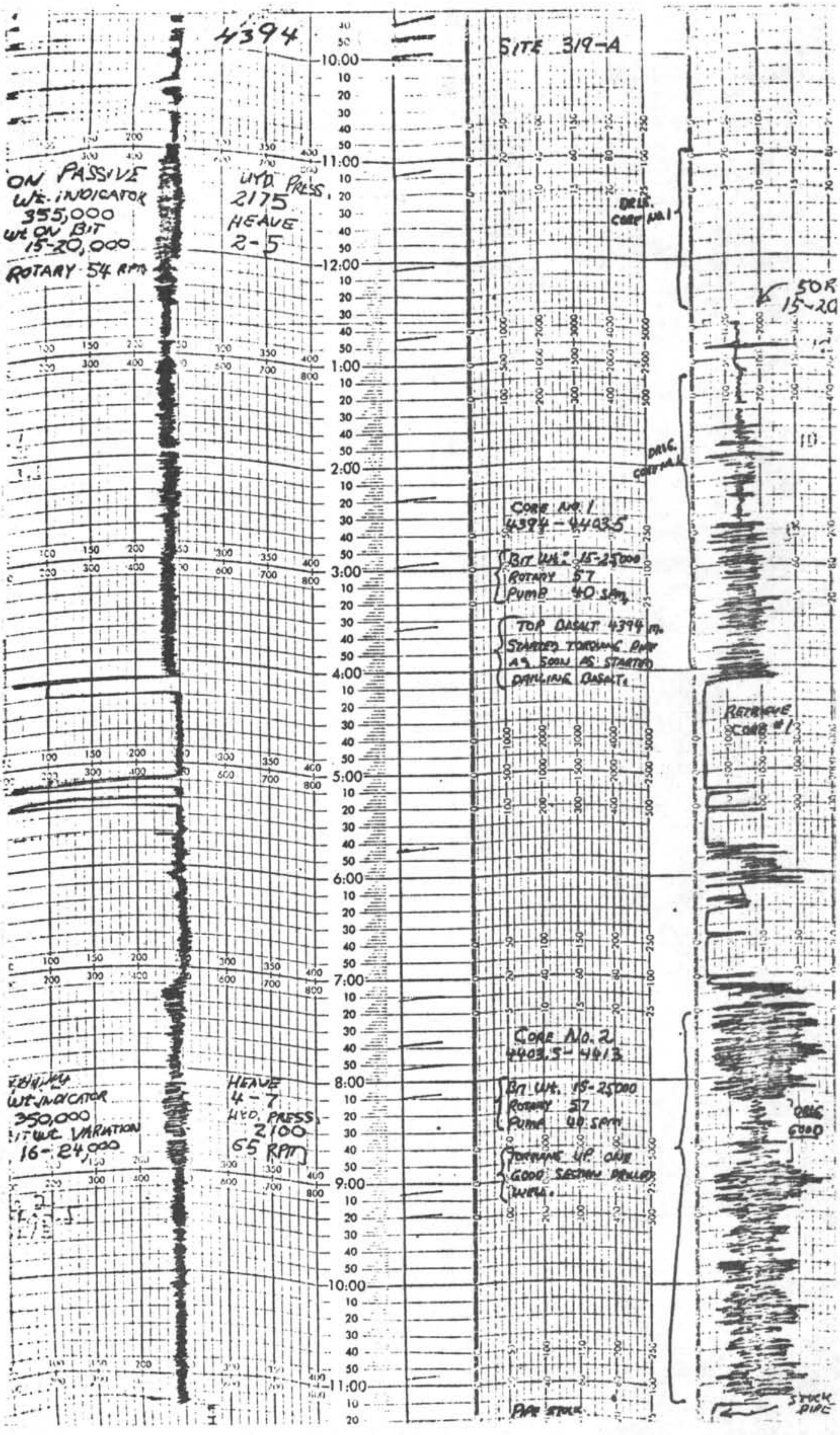
WEIGHT
0 (1000's of lbs) 800

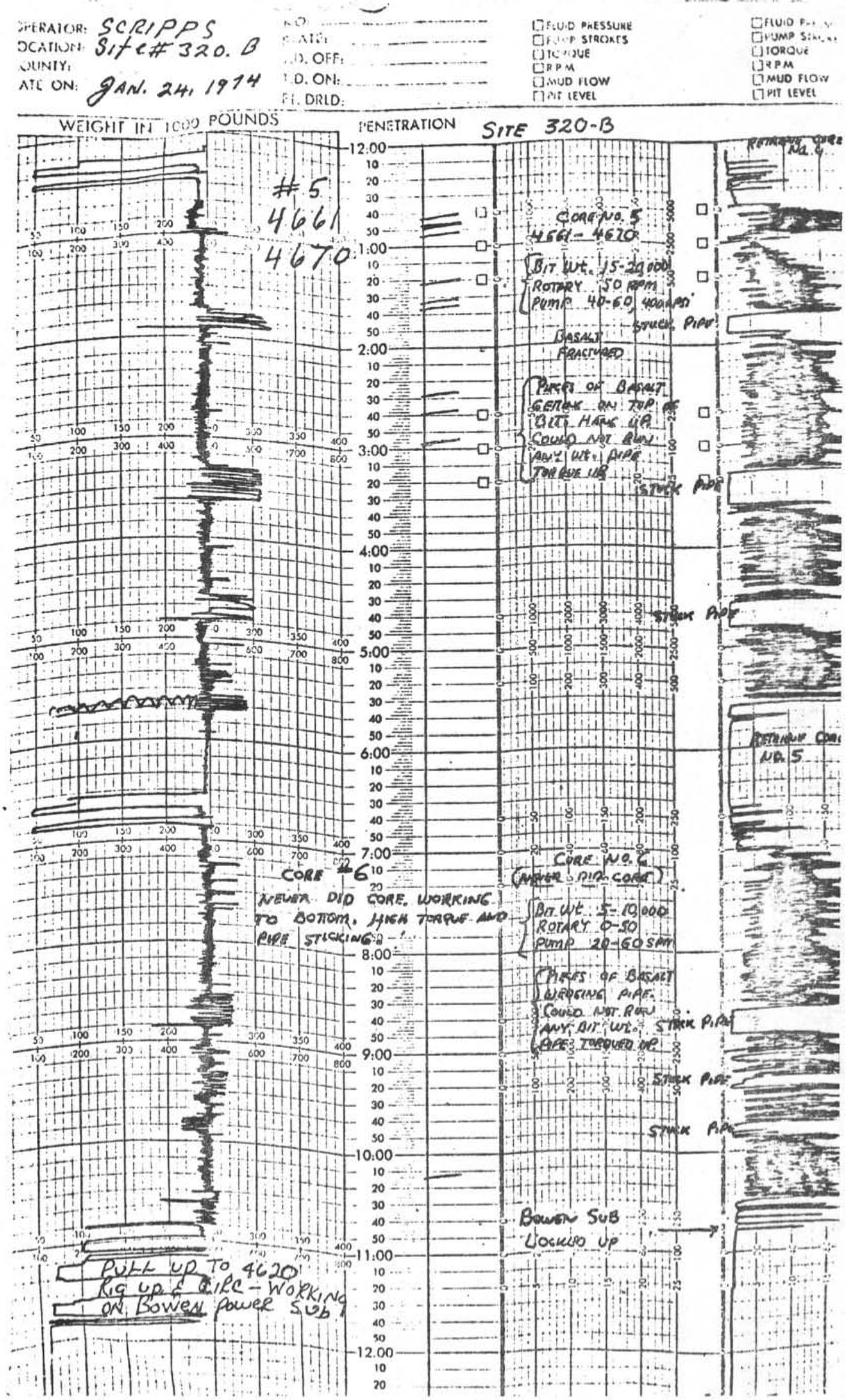
TORQUE
0 (1000's of) 25
ft- lbs

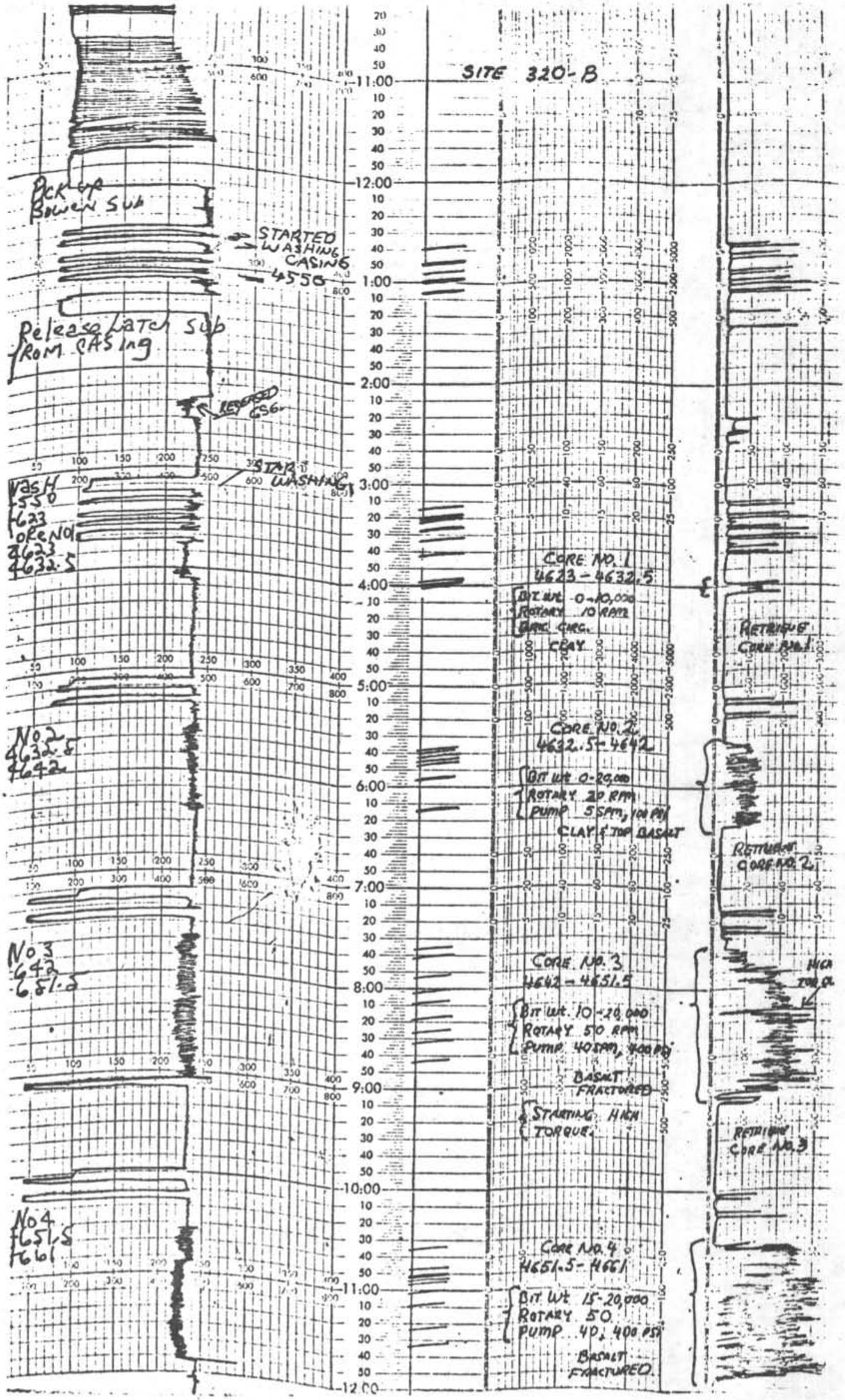


WEIGHT IN 1000 POUNDS
PENETRATION
SITE 319-A
ROTATED TO BOTTOM, 2 M. UP.
DRLG. CORE NO. 3
REPAIRED PIGALO
#3
4413
4422.5
CORE NO. 3
4413 - 4422.5
BIT WT. 20-25,000
ROTARY 45 RPM
PUMP 40-65 SPM
DRLG. CORE NO. 3
50 RPM
25,000 # B.WT.
CORED REAL WELL WITH VERY LOW TORQUE EXCEPT NEAR LAST 2 METERS. HAD GOOD CORE RECOVERY
LOW TORQUE
RETRIEVED CORE NO. 3
POH
POH TO DROP MUD CROSS
MOVE SHIP TO DROP MUD CROSS


SITE 319-A
HIT FILL
7m OFF BOTTOM
WORKING TO BOTTOM
CORE NO. 4
4422.5-4424.5
BIT WT. 20-25,000
ROTARY 50 RPM
PUMP 65 SPM
DRILLED FAST w/
HIGH TORQUE. POOR
BASALT RECOV.
RETRIEVE
CORE NO. 4
STRING WT TOTAL
385,000
DRLG. WT. 30,000
HEAVE 6'
H2O PRESS
2,025
Wt. VARI ±4,000#
CORE NO. 5
4422.5-4424.5
BIT. WT. 25-35,000
ROTARY 50 RPM
PUMP 40-65
LAST PART OF CORE
DRILLED FAST WITH
OCCASIONAL HIGH TORQUE
HANG-UPS
BOWEN POWER
SUB FAILURE
WORK ON BOWEN Sub


4394
SITE 319-A
ON PASSIVE
Wt. INDICATOR
355,000
Wt ON BIT
15-20,000
ROTARY 54 RPM
HYD. PRESS. 2175
HEAVE
2-5
CORE NO. 1
4394-4403.5
BIT Wt. 15-25000
ROTARY 57
PUMP 40 SPM
TOP BASALT 4394 m.
STARTED TORQUING PIPE
AS SOON AS STARTED
DRILLING BASALT.
RETRIEVE CORE #1
CORE NO. 2
4403.5-4413
BIT Wt. 15-25000
ROTARY 57
PUMP 40 SPM
TORQUING UP ONE
GOOD SECTION DRILLED
WELL.
HEAVE
4-7
HYD. PRESS.
2100
65 RPM
Wt. INDICATOR
350,000
BIT Wt. VARIATION
16-24,000
PIPE STUCK
STUCK PIPE


OPERATOR: SCRIPPS
LOCATION: Site# 320. B
COUNTY:
DATE ON: JAN. 24, 1974
FLUID PRESSURE
PUMP STROKES
TORQUE
RPM
MUD FLOW
PIT LEVEL
WEIGHT IN 1000 POUNDS
PENETRATION
SITE 320-B
#5
4661
4670
CORE NO. 5
4661-4670
BIT WT. 15-20,000
ROTARY 50 RPM
PUMP 40-60, 400 PSI
STUCK PIPE
BASALT FRACTURED
PIECES OF BASALT GETTING ON TOP OF BIT. HANG UP. COULD NOT RUN ANY WT. PIPE TORQUE UP
STUCK PIPE
STUCK PIPE
RETRIEVE CORE NO. 5
CORE #6
NEVER DID CORE. WORKING TO BOTTOM. HIGH TORQUE AND PIPE STICKING
CORE NO. 6 (NEVER DID CORE)
BIT WT. 5-10,000
ROTARY 0-50
PUMP 20-60 SPM
PIECES OF BASALT WEDGING PIPE. COULD NOT RUN ANY BIT WT. PIPE TORQUED UP
STUCK PIPE
STUCK PIPE
STUCK PIPE
BOWEN SUB LOCKED UP
PULL UP TO 4620
RIG UP & CIRC - WORKING ON BOWEN POWER SUB


SITE 320-B
Pick up Bowen Sub
STARTED WASHING CASING 4550
Release Latch Sub FROM CASing
REVERSED CSG
START WASHING
Wash 4550 4623
Core No 1 4623 4632.5
CORE NO. 1 4623-4632.5
BIT WT. 0-10,000
ROTARY 10 RPM
REV. CIRC.
CLAY
RETRIEVE CORE NO. 1
No 2 4632.5 4642
CORE NO. 2 4632.5-4642
BIT WT 0-20,000
ROTARY 20 RPM
PUMP 5 SPM, 100 PSI
CLAY & TOP BASALT
RETRIEVE CORE NO. 2
No 3 4642 4651.5
CORE NO. 3 4642-4651.5
BIT WT. 10-20,000
ROTARY 50 RPM
PUMP 40 SPM, 400 PSI
BASALT FRACTURED
STARTING HIGH TORQUE.
HIGH TORQUE
RETRIEVE CORE NO. 3
No 4 4651.5 4661
CORE NO. 4 4651.5-4661
BIT WT 15-20,000
ROTARY 50
PUMP 40, 400 PSI
BASALT FRACTURED.

DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 35

SUMMARY

Leg 35 was the second voyage of the Glomar Challenger to investigate the Antarctic waters. The objectives were to drill a series of holes in the Pacific Antarctic Basin and to continue the scientific program that had been initiated on Leg 28. In obtaining the desired scientific information, the ship's positioning capabilities were used to their limits, especially in the area of the Drake Passage.

The voyage commenced in Callao, Peru, on February 13, 1974, after a 10.9 day port call of which 2.4 days were spent in dry dock. The ship stopped for 16 hours in Valparaiso, Chile to change out personnel and to take on emergency supplies. Leg 35 ended in Ushuaia, Argentina, on March 30, 1974. A total of 55 cores were attempted and 52 were recovered. A total of 515 meters were cored and 192.5 meters recovered. 1696.5 meters were drilled and resulted in a total penetration of 2212 meters.

Total length of the leg (including the Callao port call) was 56.3 days of which 16.5 days were spent on site and 28.2 days cruising. While on site the ship lost 2.2 days because of mechanical breakdowns and another 0.8 days because of bad weather.

DRILLING AND CORING ASSEMBLIES

A standard bottomhole assembly was used on two (2) of the four (4) sites. This assembly consisted of a bit, bit sub (with float valve), core barrel, three 8-1/4" drill collars, two 5' stroke bumper subs, three 8-1/4" drill collars, two 5' stroke bumper subs, two 8-1/4" drill collars, one 7-1/4" drill collar and a joint of heavy wall drill pipe. On Sites 323 and 324, the bottomhole assembly was modified to accommodate the heave compensator. One of the lower bumper subs was removed from the string. Four sites were drilled on this leg and all were below 60°S. The previous deep Antarctic voyage, Leg 28, drilled eight sites below 60°S. During the four months required to drill these combined 12 sites, no drilling tools were lost.

A cracked joint of drill pipe was located and removed from the drill string at Site 325. The drill string had been suspended from the ship while riding out a gale. When the weather improved to the point that operations were again safe, the drill string was pulled and the bottomhole assembly inspected. The bottomhole assembly was not damaged but a circumferential crack about one inch long, approximately 24" below the tool joint, was discovered.

CORING AND DRILLING EQUIPMENT

The standard non-rotating inner core barrel was used on all sites. Recovery was not up to expectation and was attributed to several factors. First, very little coring was attempted in the soft clays and oozes near the mudline where recovery is usually high. Secondly, at three of the four sites, the silt and sand streaks encountered required more circulation than is normally used when coring soft formations. When less circulation was used at these sites the bit would plug and the drill string had a tendency to stick. Thirdly, glacial debris hampered the coring of the soft sediments in that pebbles would lodge in the core catcher and prevent the entry of sediment into the core barrel.

Only 18% of the total penetration was cored due to the limited time that was available for drilling. The on-site time was adequate for drilling four sites, however, the extended port call in Callao reduced the on-site time by 16 days, hence time was not available for continuous coring at more than two sites.

Site 324 was abandoned because of unstable hole conditions at 218 meters below the mudline. On the last coring attempt, there was no recovery. Approximately 10 meters of fill had been washed out. The drill string was torquing and the bit was plugging. After recovery of the drill string, it was discovered that the hinge section of the flapper valve had broken and was lying across the top of the bit. This is probably the reason why no core was recovered, however, the bad hole condition was the main cause for the termination of the drilling.

POSITIONING

On Site 322, the computer gave intermittent commands for 100 rpm ahead and 200 rpm astern signals. The crew was unable to isolate the problem and the ship was positioned in semi-automatic for the remainder of the time on-site. The problem was traced to the No. 1 hydrophone receiver timing signal but disappeared while the crew was troubleshooting the problem. The ship remained positioned over the beacon in automatic for 45 minutes. The malfunction could have been due to a loose verification generator card or bad contacts.

At Site 324, positioning in the Y axis became erratic as the wind increased and seas became choppy. A gyro was changed out and this seemed to improve positioning. After the site was completed the thrusters were tested for maximum thrust in both semi-automatic and manual. The maximum thrust was erratic. The bow thrusters would turn up to 480 rpm and the stern had an intermittent maximum thrust of 280 rpm to 380 rpm. This problem was caused by excessive drive current to the stern thrusters static exciters. The low rpm on the stern thruster was felt to be the probable cause of poor positioning on the first two sites.

At Site 325, positioning again became erratic and some loss of acoustics was experienced. The winds were 60 mph and the sea swells were 16-18 feet. Insufficient drive voltage to the thruster static exciters caused the stern thrusters to turn only 300 rpm. The digital analog converter, which drives the exciters, became overloaded. The filter network in the propulsion console was checked and the static exciter drives were adjusted. This correction gave acceptable positioning in both manual and automatic, however, the ship had drifted nine miles from the beacon while riding out a gale and while making repairs to the positioning system.

A second beacon was dropped and the ship positioned satisfactorily until the wind shifted and began coming from the same direction as the current. It became evident that the ship could not thrust against the wind and current to maintain heading into the swell with only one stern thruster. The crew attempted to assign generator No. 1 to No. 1 stern thruster and tripped the control relay. No further attempts were made to use the No. 1 thruster for the remainder of the leg. The exciters were switched in the engine room and reference and feedback currents were readjusted to proper settings. Positioning was good for the remainder of the site. When Site 325 was abandoned, we were positioning in automatic with winds up to 60 mph. Twenty-two foot swells caused the ship to pitch ten degrees.

While in port at Ushuaia, the digital analog control problem and the static exciter were reviewed to determine exactly what caused the intermittent thruster failures. No obvious solution was reached.

UNDERWAY

Enroute to the first Site (322), the ship cruised at full speed (210 turns) when weather would permit. Winds up to 75 mph did require a reduction of speed to prevent the ship from taking severe rolls. In some cases the ship experienced rolls up to 35 degrees.

On March 1, 1974 the National Science Foundation's R/V Hero rendezvoused with the Challenger at 60°S and 79°W on Site 322. Badly needed supplies were transferred. The Hero accompanied the Challenger during the remainder of the leg. The Hero would cruise approximately 5 to 15 miles ahead of the Challenger to scout for ice. At night or in times of poor visibility and heavy snow squalls speed was reduced to 5 knots. Some damage was sustained by the Hero while transferring material to the Glomar Challenger at Site 323. It appeared to be minor. First ice was encountered on March 15 at 67°S and 96°W. This was a bergy bit which was not visible on the ship's radar and was first reported by the bow lookout. Later the same day a medium sized ice berg was spotted four miles on the starboard side. This was the last ice observed and for reasons of safety the ship's speed was reduced to 5 knots at night or during heavy snow squalls until we moved north to 60°S, safely out of ice infested waters. The R/V Hero was released on the evening of March 28, 1974.

On March 19 the No. 6 propulsion motor became inoperative due to the bearing on the commutator end of the motor locking. The motor was decoupled from the starboard shaft. During the remainder of the voyage, the ship cruised with two motors on the starboard shaft and three motors on the port shaft. This reduced the maximum ship's speed by 10%, however, approximately 80% of the time cruising was not operating at top cruise speed because of sea conditions and visibility.

On March 13, 1974, a burned out bearing caused the loss of generator No. 7. This loss did not affect the ship's speed because it is normally assigned to No. 1 stern thruster while positioning. Generator No. 7 was repaired at 04:30 hours on March 29th while enroute to Ushuaia. Repairs of any kind were extremely difficult as the ship was constantly rolling 10° to 20° or pitching 5° to 10°. In any case, while enroute to Ushuaia, Argentina, repairs were continued in the engine room and trouble-shooting was continued on the positioning system.

While going around Cape Horn winds would gust from 50 to 70 mph. Swells were 10' to 20' high and seemed to come from all directions. After entering the Beagle Channel the ship was delayed while waiting for the Argentine Pilot.

HEAVE COMPENSATOR

The heave compensator was used successfully on the second site. Recordings of the performance were taken for reasons of acceptance. The system was not used on Site 322 (first site) because a suction hose on the hydraulic pumps burst causing the loss of approximately 390 gallons of pydraul. Insufficient hydraulic fluid was left to operate the system.

The Hero delivered 300 gallons of pydraul to the ship and the heave compensator was utilized on Site 323.

The system had to be vented several times to remove air from the system. In 5003 meters of water, the drill string weight was approximately 375,000 pounds. Accumulator air pressure and compensator fluid pressure was constant at 2500 psi. The system operated in both active and passive modes; full air bank and part air bank was tested; the system was operated with one hydraulic pump as well as with two hydraulic pumps; weight variations were hardly detectable; the average weight on the bit was 18,000 pounds. Instrumented recordings of the performance were made during this 22 hour test and the indications were that the system was operating within the designed specifications. During this test, it was necessary to vent the hydraulic system at least once every eight hours. The hydraulic pressure would fluctuate apparently due to pydraul becoming aerated. In the soft sediments the heave compensator apparently is not improving core recovery or providing a less disturbed core. In the firm or hard formations, the bit life has been extended noticeably and core recovery has improved. Deeper penetrations into basalt will be possible by extending bit life that will reduce the number of re-entries while drilling to a given depth.

Minor modifications will be made to the system during the upcoming port calls. The piston stroke indicator has been unreliable but this is not a major concern. This instrument does not affect the performance of the system. It provides the driller with a convenient monitoring device for the piston.

CALLAO, PERU PORT OF CALL

The Challenger docked at Callao City dock at 09:00 hours on February 2, 1974. Approximately 4900 sacks of gel, baraite and cement were loaded. A mistake in the cement order resulted in an excess of 1100 sacks. The excess cement was donated by the National Science Foundation to the Peruvian Navy. The Bowen power sub, which experienced a motor failure, was repaired in a local machine shop. The torque-o-matic right angle drive and transmission was replaced on the logging winch. GMI and DSDP supplies were loaded along with 170 joints of new 5" S135 drill pipe. Modifications and inspection of the heave compensator system were completed. This included:

a. Modify heave compensator stabilizer arm.
b. Install goose neck vents on 6" stand pipes.
c. Install new hydraulic fluid storage tank and transfer system.
d. Inspect and service anti-sling shot valve.
e. Complete bi-monthly and semi-annual inspection of the heave compensator. Unable to inspect the accumulator because the inspection cap was stuck to the accumulator. Plan to complete this inspection at the end of Leg 37.
f. Replace one damaged 4" hydraulic high pressure hose. Inspect the remaining high pressure hoses.
g. Clean and flush main hydraulic system.

Antarctic modifications were 80% completed while in Callao. Three inch Amot valves were installed on all twelve D398 Caterpillars to control sea water temperatures to the engines. Tanner gas injection was installed on all external air lines. Four new rig floor heaters were installed. A new Mark XIV gyro was installed on the ship's bridge. An emergency generator crank case heater and an evaporator pre-heater were installed. All exposed air and water lines were covered with insulation material.

Through the cooperation and courtesy of the Peruvian Navy the Challenger entered one of the Navy dry drocks at 22:00 hours on February 9, 1974 to repair her thrusters. She departed at 08:30 hours on February 12, 1974. In addition the ship's hull was inspected, cleaned and painted and the zinc anodes replaced. The stern gland packing was replaced; all sea valves except for three were inspected; all hydrophones were inspected and the teflon bushings were found to be loose and were corrected by having retainers fabricated and installed. An ABS Survey Certificate was obtained for the work accomplished.

PERSONNEL

Minor injuries, mostly on the hands and fingers, were experienced. All personnel on the ship were safety conscious and contributed to the success of the Antarctic voyage.

The contractor's personnel are to be highly commended for their seamanship and professional drilling operation while working under adverse conditions caused by high winds and rough seas.

At all times the scientific group was cooperative and understanding, particularly when technical problems or marginal weather conditions caused termination of a site before fulfillment of the scientific objectives.

Lamar P Hayes

Lamar P. Hayes
Cruise Operations Manager
Deep Sea Drilling Project

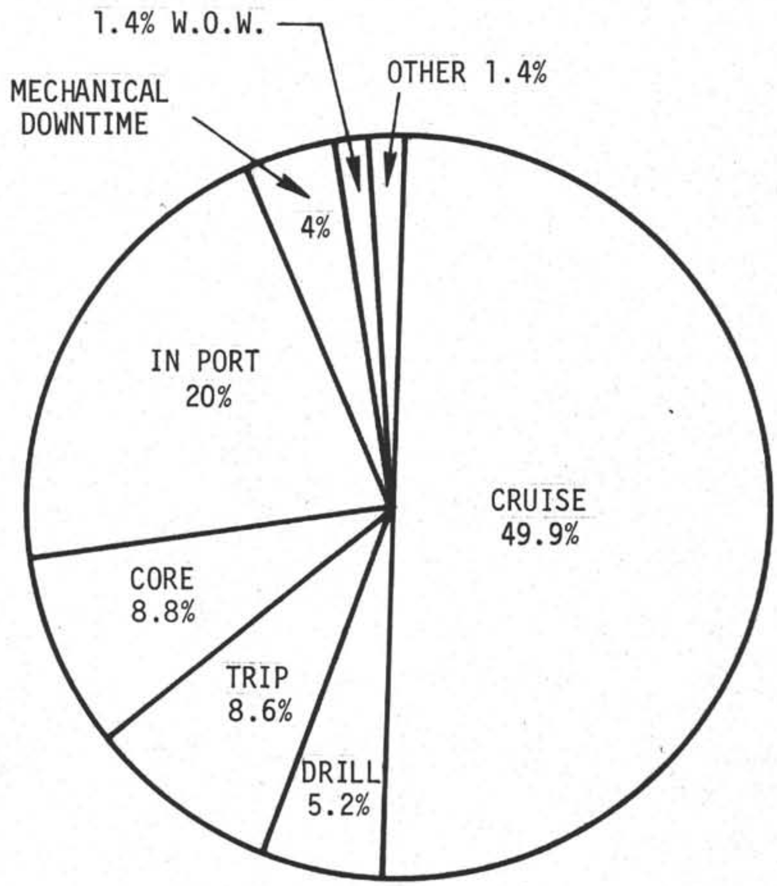
DEEP SEA DRILLING PROJECT

SUMMARY OF OPERATIONS

LEG 35

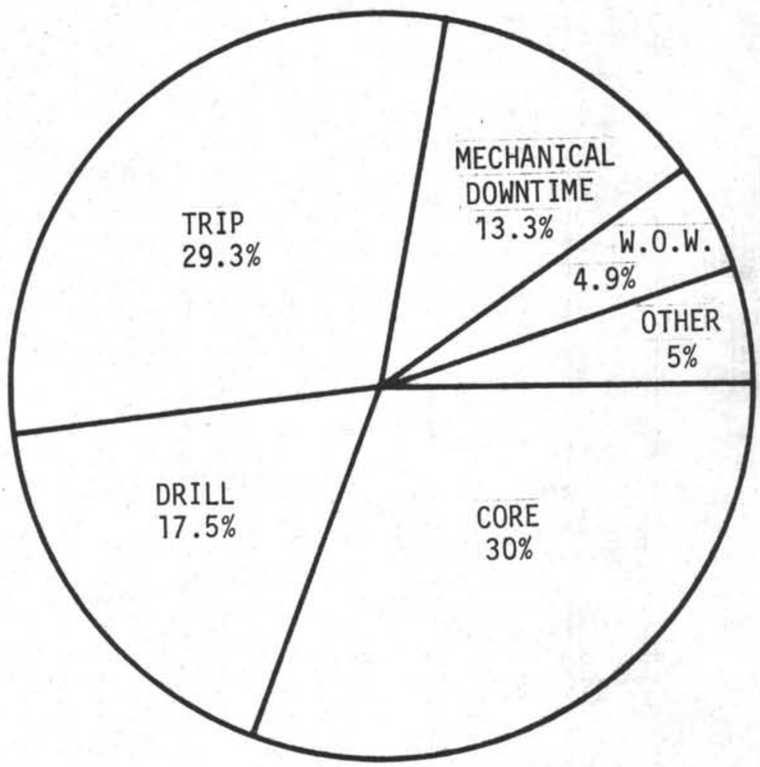
Total days Leg 35	56.3
Total days in Port	11.6
Total days Cruising (Survey time included)	28.2
Total days on Site	16.5
Trip time	4.8
Drilling time	2.9
Coring time	4.9
Mechanical Downtime	2.2
Waiting on weather	.8
Other (includes running logging unit)	.9
Total distance traveled (nautical miles)	5239
Average speed (Knots)	7.7
Sites Investigated	4
Holes drilled	4
Number of cores attempted	55
Number of cores with recovery	52
Percent of cores with recovery	94
Total meters cored	515
Total meters recovered	192.5
Percent of core interval recovery	37.3
Total meters drilled	1696.5
Total meters of penetration	2212
Percent of penetration cored	23
Maximum penetration - meters	731
Minimum penetration - meters	219
Maximum water depth - meters	5036
Minimum water depth - meters	3755

LEG 35
TOTAL TIME DISTRIBUTION
Percentages



OTHERS: Run severing tool
Cut drilling line

LEG 35
ON SITE TIME DISTRIBUTION
Percentages



OTHERS: Run severing tool
Cut drilling line

DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 35

Hole	Latitude	Longitude	Water Depth Meters	Number Of Cores	Cores With Recovery	Percent Recovered	Meters Cored	Meters Recovered	Percent Recovered	Meters Drilled	Total Penet. Meters	Avg. Rate Penet.	Time On Hole	Time On Site
322	60° 01.45' S N.Bellingshausen Abbysal Plain	79° 25.49' W	5036	14	13	92	125.5	34.4	27.4	418.5	544.0	60	83.5	83.5
323	63° 40.84' S Bellingshausen Abbysal Plain	97° 59.69' W	5003	21	20	95	199.5	75.5	37.9	531.5	731.0	28	112	112
324	69° 03.21' S Amudson Sea	98° 47.20' W	4459	10	9	90	95	48.1	50.6	123	219.0	99	51	51
325	65° 02.79' S Continental Rise off Palmer Peninsula	73° 40.40' W	3755	10	10	100	95	34.3	36.1	623	718	48	151	151
		Totals		55	52	94.5	515	192.5	37.4	1696.5	2212	42	397.5	397.5

DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 35

Hole	Mfg.	Size	Type	Serial Number	Meters Cored	Meters Drilled	Meters Total Penet.	Hours On Bit	Condition	Remarks
322	Smith	10-1/8	F94C	PC202	125.5	418.5	544	8.0	B4 - T2	Drilled some hard sand
323	Smith	10-1/8	F94CK	PC896	199.5	531.5	731.0	26.1	B4 - T1	Drilled 30 meters of basalt
324	Smith	10-1/8	F93C	KN149	95	123.5	219.0	3.2	B1 - T1	Abandon because of sand
325	Smith	10-1/8	F94CK	RC893	95	623.0	718.0	14.9	B2 - T2	Abandoned Site because of weather

DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 35

Site No.	Make	Freq. kHz	Serial Number	Site Time Hours	Remarks
322	ORE	13.5	273	83.5	Dropped at 4 Kts. Signal O.K.
323	ORE	16	232	112	Dropped at 4 Kts. Good Signal
324	ORE	13.5	195	51	Dropped at 4 Kts. Good Signal
325	ORE	16	241	20	Dropped at 4 Kts. Good signal
325	ORE	16	214	131	Dropped still in water. Good signal

DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 36

Leg 36 of the Deep Sea Drilling Project started on March 30, 1974 at Ushuaia, Argentina and ended 52.61 days later at Rio de Janeiro, Brazil, on May 22, 1974. The Challenger traveled 4653.4 nautical miles and drilled a total of ten holes at six sites in the Drake Passage, Falkland Plateau, Falkland (Malvinas) Outer Basin and Argentine Basin. Water depths varied between 1531.5 meters (5025') and 5103 meters (16,743'). Maximum penetration reached below the ocean floor was 575.5 meters (1,888') while the longest drill string worked during the leg was 5574 meters (18,288').

Time distribution for the 52.61 days total leg time was 24.93 days cruising, 20.65 days on site, 4.52 days port time, and 2.51 days other time (Figure 1). Total site time of 20.65 days was divided into 6.09 days coring, 1.79 days drilling. 5.52 days trips, 5.55 days wait on weather, 1.04 days lost to dynamic positioning problems, 0.66 days other time (includes mechanical downtime, routine maintenance, etc.). (Figure 2).

A total of 2480 meters of ocean sediments were penetrated, of which 40.6% were cored. A total of 107 cores were attempted during the leg with 95.3% of the cores attempted having usable recovery. Average recovery on all cores cut during the leg was 57.5%. This recovery percentage, on all cores cut, is in line with the Project average to date of approximately 55%.

Scientifically, most of the success stories derived from Leg 36 will be the result of the drilling program conducted in the Falkland Plateau area and the two relatively successful holes drilled and cored in the Falkland (Malvinas) Outer Basin area. Very little scientific information is likely to be derived from the other holes spudded due to their lack of penetration. Outside of the two mentioned areas, the deepest penetration reached on any of the other holes was 53 meters with core recovery on only the first core taken at the ocean floor.

The elements, in general, played havoc with operations during Leg 36. The Challenger was in three hurricane force storms plus being subjected to hundreds of icebergs while on site as well as while underway. Due to the influence of the elements, six of the ten holes spudded during Leg 36 had to be abandoned before reaching all of the scientific objectives. All scientific objectives were reached on only two of the holes. It might be noted that none of the holes were abandoned due to poor or unstable hole conditions. An interesting statistic, that will not appear as such in the text of this report, is the total time lost either directly or indirectly to the elements during Leg 36. A very close estimate of this lost time will amount to a total of 13.88 days or 26.4% of the total leg time. The human element of decision making on site, etc., is involved in some of this lost time and therefore, one might rightfully contest the validity of this statistic.

The elements, indeed, dealt harshly with drilling operations throughout the leg, but the thing that was to finally turn the lights out on Leg 36 was the Challenger's dynamic positioning system. While positioning over the final drill site on the Rio Grande Rise, the power supply to the vertical reference gyro failed and all efforts to restore the power to the gyro were unsuccessful, thus ending operations for Leg 36.

The Deep Sea Drilling Project is managed by the Scripps Institution of Oceanography (University of California, San Diego) under a contract with the National Science Foundation. The Glomar Challenger is owned and operated by Global Marine Inc. who perform the coring operations under a subcontract with the University of California. Planning for the voyages is coordinated with the scientific community through the Joint Oceanographic Institutions Deep Earth Sampling (JOIDES) organization.

VOYAGE SUMMARY

The first site on Leg 36 was in the Drake Passage area at latitude 56° 35'S and longitude 65° 18.2'W. Soon after departing the sheltered waters of the Beagle Channel, approximately eight hours out of Ushuaia, Argentina, the sea conditions began to build. By midnight of April 4, 1974, the Challenger was experiencing rolls of 20-25 degrees with pitches of 5-8 degrees on a due south course. As we approached Site 326, weather conditions were deemed too bad to drop a site beacon, so the ship continued on by the proposed site at reduced speed to do additional survey work while the weather conditions improved. By 1500 hours, April 5, 1974, the sea conditions had improved; winds northwest 30 mph, seas northwest 4-6 feet, swells northwest 14-16'. The beacon was dropped while weather conditions continued to improved. By 2200 hours April 5, 1974, the weather had improved, winds north northwest 20 mph, swells northwest 10', roll 3°, pitch 3°. The worst, however, was yet to come for Site 326. As the bit neared the ocean floor, the winds and seas were on the increase again. The hole was spudded to obtain the first punch core, but it then became necessary to pull the bit above the ocean floor to await better positioning of the vessel. While positioning back over the beacon, the drill string parted resulting in the loss of the complete drill string plus the bottomhole assembly. (For comments concerning this failure, refer to Attachment I.)

Having secured the rig floor equipment, the Challenger departed Site 326 on the night of April 6, 1974 enroute to sheltered waters to pick up a new drill string and bottomhole assembly. As the nearest sheltered area was the Beagle Channel, radio contact was made with the Argentine Navy to gain permission to anchor. The Argentines directed the Challenger to Bahia Aguirre area which required no pilotage. The drill ship went on anchor at 1700 hours, April 7, 1974 and started making up a replacement drill string. Just after midnight an officer of the Argentine Coast Guard boarded the Challenger to investigate the circumstances causing the drill ship to seek anchorage again in Argentine waters. The officer departed the Challenger and later, by radio, informed us that the drill ship was to remain at anchor until given clearance to leave the area by the Argentine Coast Guard. The Challenger was detained for a total of 35 hours by the Argentine Officials but since the crews were continuing to pick up drill pipe, the actual lost time due to the detainment was 15-1/2 hours. The Challenger was released to get underway at 2130 hours, April 9, 1974.

Site 327, our second site, was planned at latitude 50° 52.3'S, longitude 45° 47'W, in the Falkland Plateau area. The time lost as a result of the drill string failure, that is additional cruising time, time at anchorage in Bahia Aguirre, and Argentine detainment, will be included in time assigned to Site 327. Weather again played an active part in operations during site time on Site 327. Hole 327 was abandoned due to bad weather after obtaining only the initial punch core at the ocean floor. Hole 327A met with much more success. After reaching a significant penetration of 469.5 meters, it too had to be abandoned due to the bad weather. Excessive rolling of the ship (rolls greater than 9°) caused the abandonment.

Having been rolled out of the 327A Hole, so to speak, by nine degree rolls, the drill ship departed Site 327 at 1800 hours, April 17, 1974 on a course of 130° heading southeasterly with good intentions of drilling the Proposed Site 36-4 in the Central Scotia Sea (north) at latitude 56° 20'S, longitude 39° 47'W. Again, the elements had a few surprises in store for us. On the morning of April 19, 1974 at 0845 hours, our first iceberg was sighted at latitude 55° 37.3'S, longitude 41' 21.9'W. Since noon of the 18th of April, the barometric pressure had been steadily falling. The lowest recorded pressure was noted to be 28.12 inches mercury at 1535 hours, April 19, 1974. The profile gear was pulled in and all equipment secured for the expected storm. At 1600 hours, winds were recorded gusting to 70 mph as the seas and swells increased. By 2200 hours, the winds were gusting to 80 mph from the southwest. The ship's course at the time was 165° and speed 150 turns while experiencing rolls to 25° and pitches to 11°. By 0600 April 20, the ship was unable to hold heading into the wind and seas with the aid of the thrusters at full power. At this time the winds were southwest 60 mph, swells southwest 25-30 feet, rolls 10-20 degrees, pitches 5-10 degrees. At 0615 hours, the ship was forced to reverse course and run with the elements to the northeast. At 1400 hours April 20, while on a course of 060° and experiencing 50 mph winds and swells of 25-35 feet, the ship's captain was forced to continue northeasterly to better weather and abandon all efforts to drill Proposed Site 36-4. At 1220 hours April 21, numerous icebergs were sighted while running on the 060° course, position latitude 54° 49.6'S, longitude 33° 15'W. Winds were down to 30-40 mph and swells running 20 feet. At 1700 hours April 21, a decision was made mutually by the ship's Captain, Cruise Operations Manager, and the Co-Chief Scientists to abandon all efforts to drill the Proposed 36-6 location

(Outer Wall of South Sandwich Trench). Many icebergs could be seen now in the area of the ship. As darkness approached, the ship's speed was reduced for travel through the night in this hazardous environment. Hundreds of icebergs continued to be sited along our course to Proposed Site 36-9C, which would now be Drill Site 328. The Challenger arrived at Site 328, Falkland (Malvinas) Outer Basin, at 0400 hours on April 24, 1974 and still in iceberg country. Site location was latitude 49° 48.7'S, longitude 36° 39.5'W. Approximately 4-1/2 days cruising time had been lost. Three holes were spudded on Site 328, two of the three being affected by the elements before reaching all scientific objectives. Increasing winds and swells caused the abandonment of Hole 328. An iceberg passing within four-tenths of a mile of our site location caused loss of Hole 328B. Thoughts of drilling a 328C Hole were envisioned but the extended forecast of inclement weather for the area soon cancelled this. It must be noted here that the human element was involved to some degree in the ultimate loss of Hole 328B and the resultant damage to the drill string. (For added detail regarding the loss of Hole 328B, refer to Attachment II.)

As the Challenger departed Site 328 at 1715 hours April 30, 1974, on a course 261° back to the Falkland Plateau area and Site 329, the icebergs, once again, were out in force and were to play havoc with our planned course of travel. At 2043 hours, it became necessary to make our first course deviation to avoid icebergs in the area. The ship's course was changed to 295° and speed reduced due to hazardous conditions. Not long after the last iceberg for Leg 36 had been sighted at latitude 49° 02'S, longitude 39° 10W, the bad weather that had been forecasted for the area arrived to confront the Challenger with hurricane force winds and maximum swells estimated at 40-50 feet on the morning of May 2, 1974. The ship's speed had to be reduced at times to 150 turns due to heavy vibration caused by the cavitation of the propellers. Site 329, latitude 50° 39.31'S, longitude 46° 5.73'W, was reached at 2220 hours, May 3, 1974, with good weather conditions prevailing.

The cruise between Sites 328 and 329 had required an additional 31 hours to negotiate. Again, the lost time was attributable to the elements.

The crews aboard the Challenger basked in good weather during the drilling of Sites 329 and 330. Site 330 was nearby at latitude 50° 55.2'S, longitude 46° 53'W. Weather did deteriorate somewhat as Hole 330A was abandoned and the Challenger got underway for the Argentine Basin site.

After an unusually uneventful cruise, the Challenger arrived at Site 331, latitude 37° 53'S, longitude 38° 7'W, on May 12, 1974, only to face yet another storm with winds of hurricane force. The weather forecast issued for space period May 13-14 indicated good weather, wind light and variable. The ship's weatherman issued a revised forecast during the morning of the 13th indicating stronger winds and swells, wind northerly 20-30 mph, swells northerly 4-7 feet. Based on the apparently good weather forecasted, the crews started running pipe and the hole was spudded at noon, May 13, 1974. By 1830 hours, however, the drill pipe was started out of the hole due to increasing winds and seas. The pipe was pulled very slowly with the assurance that by morning it could be returned to bottom with the weather improved. By the morning of the 14th, however, weather conditions continued to deteriorate to the point of being too hazardous to finish pulling drill pipe out of the hole. The storm raged as 2187 meters of drill string was left hanging below the drill ship, suspended from the elevators. Winds were recorded at 90 mph maximum, swells increased to 30-40 feet. The drill ship had been blown off site by some 5-6 miles by the time the storm had subsided. As marginal weather conditions continued to prevail and due to the remaining leg time growing ever so short, the decision was made to abandon Site 331 and trek north during the marginal weather anticipating using the remaining leg time to drill a site proposed on the Rio Grande Rise.

The Challenger got underway at 1745 hours, May 16, 1974, on a northerly course. Seas were down to a smooth cruising condition by the following day and the crews enjoyed the uneventful trip north as the temperatures warmed somewhat. Having dropped the beacon at 0200 hours, May 20, 1974, there was just one disappointment left for the crews aboard the Challenger on the Rio Grande Rise. While positioning over the beacon and having just gone into automatic mode of positioning, the power supply to the vertical reference gyro in the computer room failed. All efforts to restore the power to the gyro were unsuccessful and the ship could not be positioned on site. Drilling and coring operations were abruptly concluded for Leg 36.

All that remained for Leg 36 was for the Glomar Challenger to negotiate some four hundred miles of the South Atlantic Ocean into Rio de Janeiro; she did so in grand style arriving at 0915 hours on May 22, 1974.

DRILLING AND CORING - SITE SUMMARIES

The accepted standard bottomhole assembly was used during all coring and drilling operations on Leg 36. The assembly consisted of the following: Smith 10-1/8" bit Type F-94CK (4-cutter journal bearing insert type), float sub, 8-1/4" core barrel, three 8-1/4" drill collars, two Baash-Ross bumper subs, three 8-1/4" drill collars, two Baash-Ross bumper subs, two 8-1/4" drill collars, one 7-1/4" drill collar, and a range-3 joint of 5-1/2" drill pipe. One of the lower most bumper subs was inadvertently bent during coring operations of Site 327 and was removed from the assembly. The remaining sites were drilled with three bumper subs quite satisfactorily. The bottomhole assembly has an effective weight of 30,000 lbs in sea water. The drill string used is 5-inch O.D. with 5-1/2" F.H. connections. The inner core barrel is a non-rotating 3-1/2" O.D. by 9-1/2 meters barrel containing an inner plastic liner in which the 2-3/8" O.D. core is captured during coring operations. All components of the drilling assembly has a minimum I.D. of four inches through which the inner barrel is retrieved.

On all sites during the leg the double soft formation finger type catchers were used in the inner core barrel initially with the plastic sock run with the top catcher. This arrangement, as past records indicate, performed quite well with recovery in the softer formations normally high. There were three unexplained exceptions to this rule; the initial core on Hole 326, and the second core taken on Holes 328A and 331. Four other occurrences of zero recovery were explained by the fact that the core barrel was bridged with basement rock above the Baker float, not letting the inner barrel reach its seat. As the sediments became firmer, the plastic sock was removed from service and the double soft formation catchers were run until such time harder sediments warranted going to one (upper) soft formation catcher and one (lower) finger type hard formation catcher.

Once again, as past leg records indicate, the program of continuous coring offered the better percentage of recovery. On Hole 328, continuous coring through soft to firm clays offered an excellent 94% recovery. On Site 329, the continuous coring program through the first 179.5 meters of penetration offered an excellent 93% recovery, while intermittent coring in the deeper and firmer sediments offered a disappointing 36% recovery.

Site 326 - Drake Passage

As the drill string approached bottom on this site, weather conditions were beginning to deteriorate. The hole was spudded in a water depth of 3822 meters and a punch core of 9.5 meters was taken in soft sediments. Only 0.5 meters of usable core was recovered. With the bit positioned above the ocean floor, while improving our position over the beacon, the drill string parted near the bottom of the drill ship losing a total of 389 joints of 5" drill pipe and a complete bottomhole assembly. The site was abandoned at this point. The age of the sandy silt recovered was Quaternary.

Site 327 - Falkland Plateau

Two holes were spudded at Site 327. The original hole was abandoned due to weather and poor ship positioning after taking only a punch core in a water depth of 2411 meters by DPM. After a period of waiting on weather, Hole 327A was spudded.

Hole 327A

Hole 327A was continuously cored to a penetration of 118 meters, then intermittently cored to a total penetration of 469.5 meters. The hole was considered a scientific success even though all objectives were not reached before weather conditions deterioated and maximum operating limits of roll forced abandonment of the hole. Hole 327A reached Barremian Age claystone sediments.

Site 328 - Falkland (Malvinas) Outer Basin

Three holes were spudded on Site 328 in a water depth of 5103 meters. Hole 328 and 328B reached significant depths before both were abandoned due to the elements. Hole 328A was abandoned after experiencing poor recovery on the second core. As the Co-Chief Scientist wanted better recovery over the upper interval, Hole 328B was spudded. Hole 328 was intermittently cored to a depth of 5500 meters with a total penetration of 397 meters. The hole was bottomed in grey zeolitic claystone of Upper Cretaceous Age. The hole was ultimately abandoned when the elements increased to a point beyond the positioning capabilities of the ship. The position over the beacon was still being maintained adequately but it was requiring nearly all available power to position the ship.

Hole 328B

Hole 328B was spudded in order to get better recovery in interval missed by poor core recovery on Hole 328A and to penetrate sediments not reached in Hole 328. This hole was washed in to 5110 meters and then cored continuously to 5167.5 meters. The center bit was then dropped and pumped to its seat in the core barrel and then the hole was drilled to 5538 meters through interval previously penetrated by Hole 328. One additional core was cut from 5538-5547.5 meters, however while drilling at 5574 meters, operations were suspended due to an iceberg heading toward the Challenger. The bit was pulled to within a safe distance of the mudline (147 meters below the ocean floor) to wait out the movement of the iceberg. The hole was subsequently lost and abandoned at the depth of 5574 meters with a maximum penetration of 471 meters. The sediments reached were brown zeolitic clays of Upper Cretaceous Age.

Site 329 - Falkland Plateau

This site was selected so as to penetrate younger sediments in Falkland Plateau area that had been missing in the previously drilled 327A Hole. The site was spudded in a water depth of 1531.5 meters and routinely cored and drilled to the objective subbottom depth of 464.5 meters. Upon reaching limestone sediments of Upper Paleocene Age, that overlapped sediments occurring in 327A, the site was abandoned.

Site 330 - Falkland Plateau

The site was selected to complete the story on the Falkland Plateau, that is to penetrate sediments older than those reached in Hole 327A and to date basement. The water depth on Site 330 was 2636 meters by PDR. Since the top sediments had been penetrated in Hole 327A, the bottomhole assembly was quickly "drilled in" to a penetration of 129 meters, then the hole was cored and drilled intermittently to basement. A total penetration of 575.5 meters was reached with 19 meters of basement being cored. Basement in this case was granite. The oldest sediments were sandstone, siltstone, and lignite of Middle-Upper Jurassic Age. All scientific objectives were reached on Hole 330.

Hole 330A

With some time remaining for the site, the scientists wanted to take another look at the 129 meters of top sediments drilled in Hole 330. The first core attempt recovered only 4.0 meters of usable core with a piece or basement rock noted to be in this recovery. The second core attempt failed to recover any usable core. A bridge in either the core barrel or bit was suspected. The center bit was dropped in an effort to clear the core barrel without success. Three additional attempts to core were made to a total penetration of 53 meters with no usable recovery. The hole was abandoned and the bit pulled. The bridge of basement rock was found above the Baker float valve. The bridge consisted of three pieces of cores, the largest being six inches long.

Site 331 - Argentine Basin

This site was spudded in a water depth of 5073.5 meters of DPM. The first core taken had a 100% recovery of 8.5 meters of grey ooze. The second core failed to recover any usable core. The heave compensator had been picked up on this site and after the second core, was placed in operation. The heave compensator made approximately 8-12 strokes with a hook load of nearly 400,000 lbs when the main piston shaft seal started leaking hydraulic fluid badly. The compensator was set back at this point as winds and seas increased. No scientific information of any consequence was gained from the site. The age of the sediment recovered was Quaternary. The Challenger subsequently experienced a severe storm of hurricane force and was blown off the site beacon by approximately 5-6 miles. A second beacon was dropped but continued bad weather forced a decision to be made to move north in hope of better weather. Due to a subsequent failure of the ship's dynamic positioning system, Site 331 was the last site spudded for Leg 36.

SHIP'S DYNAMIC POSITIONING SYSTEM

Performance of the dynamic positioning system during Leg 36 was inconsistent. On some sites the elements simply overran the capabilities of the system but on others, the system failed to perform satisfactorily in generally good weather. The elements certainly had a detrimental effect on operations during the leg but the thing that was to abruptly terminate operations on Leg 36 was the ship's dynamic positioning system. While positioning over the beacon on the final site for Leg 36 on the Rio Grande Rise, the power supply unit furnishing power to the vertical reference gyro failed and subsequent efforts to make repairs failed and operations on Leg 36 were terminated. All that was left was the cruise into Rio de Janeiro. Hopefully, all of the positioning problems can be corrected during port call in Rio. Listed below are comments on the dynamic positioning concerning positioning performance at each site:

Site 326

Positioning was somewhat poor on the site due to marginal weather conditions. A strong current estimated at 3-4 knots apparently was effecting positioning quite a bit, in fact, apparently much more than was first realized. The scope on the bridge positioning equipment was found to also be a factor in positioning. The ship's position would not repeat when switching from one scale to another. This problem was corrected by changing out the scope. The drill string parted approximately one hour after the scope was changed out while attempting to re-position over the beacon.

Site 327

Initially, the computer seemed to be slow in building up a memory to the existing environmental conditions at the time the ship was positioned over the beacon. In most instances the computer would over react to a signal, that is, it would over thrust the position. Part of the positioning problem was due to intermittent loss of acoustics caused by the unfavorable sea conditions and heavy roll and current sweeping thruster wash under the hydrophones. The hydrophones had been lowered to their lower most position upon arrival and improvements were not possible. In addition, the ship experienced an erratic behavior of the main shaft. This problem was resolved finally by changing a DX-15 card in the D-A converter for starboard shaft and reducing maximum thrust gain setting to 85%. The acoustics problem improved as sea conditions improved by switching from hydrophone 1, 2 and 3 to hydrophones 1, 3 and 4 (No. 2 seemed more susceptible to noise). After these problems were resolved with the improved sea conditions, positioning was excellent in Automatic Mode for the remainder of site time, approximately 3-1/2 days. It seems, however, that the ship's positioning capabilities can be overcome quite readily by adverse sea conditions particularly where there seems to be an appreciable current present.

Site 328

Upon dropping the beacon on site at 0400 hours, April 24, 1974, the ship came back to the beacon and positioned over same and went into Automatic Mode of positioning at 0500 hours. After six hours (at 1100 hours), the ship started experiencing positioning problems due to erratic behavior of the mainshafts at high rpm's. The computer would call for slow rpm's ahead and the shafts would go full ahead at 200 rpm's. These excessively high rpm's would cause the ship to overshoot the beacon. The shafts were then called on to go astern hard. Thirty hours of troubleshooting were required to overcome these problems. During this time some rig time was lost, however, the hole was spudded while positioning in Semi-Automatic Mode. During the troubleshooting, the K4 and K5 relays in the propulsion console were changed. Reference and feedback control voltages to the generators were set in the engine room and y-gains and maximum thrust were adjusted at the computer. The positioning was returned to Automatic Mode at 1700 hours, April 25, 1974. At 0830 hours, April 26, 1974, weather conditions required more power to the main shafts to maintain station, requiring 160 rpm's on both shafts. The excessive power demand by the positioning left insufficient power for drilling safely at a depth of 5500 meters. Drilling operations were suspended due to inadequate power to the rig floor. The ship was still being positioned in Automatic Mode and the ship continued to position in Automatic until 2100 hours on April 29, 1974. At this time, acoustics became intermittent due to disintegration of the beacon signal and adverse weather conditions. The ship was, at this time, returned to Manual Mode and a second beacon was dropped at 0055 hours, April 30. The computer program was reloaded to wipe out the computer's memory and freshly restore anew all of the computer's instructions. Indications were that the main shafts were being over driven. Positioning was somewhat improved but wash from the thrusters still caused intermittent acoustic losses during high winds and seas when thrusting neared the limits of thrusters. Position was maintained in Automatic Mode until departing site. There seems to be yet another problem, that of the beacon's image on the bridges positioning scope moving around the scope erratically at times. This movement occurs for no apparent reason indicating ship's movement at a speed that is just not possible. Apparently the image does return to its correct position, for in all cases, no ill effects were noted in our drilling operation, such as excess torque, drag, etc.

Site 329

The ship's dynamic positioning system functioned better on Site 329 than on any other site thus far on Leg 36. Weather conditions were generally excellent during site time. The ship was placed in Automatic Mode of operation on arrival over the beacon and remained in Automatic Mode throughout site time. A few movements of the beacon image with relation to the scope screen occurred at times up to 120 feet excursions but this was, again, believed to be erratic movement and not necessarily true movement of the ship.

Site 330

The ship's dynamic positioning system functioned well on Site 330. Weather conditions were generally good, however, the weather was rapidly deteriorating as Site 330 was completed. The barometer had been steadily falling.

Site 331

The ship's positioning system continued to perform erratically. Initially, on Site 331, the ship would not position in Automatic Mode. The thrusters, as well as the main shafts, would over react to a signal. That is, the computer would call for too many rpm's and run past the position calling for main shafts to go astern at 200 rpm's. The beacon signal continued to move too abruptly at times on the positioning scope, taking apparent excursions of 120 feet or more. The ship was finally placed in Automatic Mode successfully by going to Manual Mode and bringing the ship over the beacon and then going to Automatic Mode rather than going to Semi-Automatic and then to Automatic Mode as is the normal sequence of operations.

On Site 331, the elements completely overcame the positioning capabilities of the ship as the ship was blown off location some five or six miles during the severe storm experienced while on site. Winds of 90 mph with swells estimated at 50 feet were recorded in the bridge's log during the storm.

Proposed Site 36-11A

The final site for Leg 36 was to be Site 332 on the Rio Grande Rise. The drill ship arrived at site and dropped the beacon at 0200 hours, April 20, 1974. While positioning over the beacon at approximately 0315 hours, the gyro indicator light on the bridge's positioning panel went to red indicating the loss of the gyro. Upon investigating, the gyro's power supply unit was found to be out of order. Efforts to correct the problem were unsuccessful, thereby bringing an abrupt halt to operations so far as Leg 36 was concerned. The proposed site was not given a site number. The rig time involved will be shown in leg statistics as other time.

LOST TIME - THE ELEMENTS

The elements were involved in cruising time and/or site time on all sites investigated during Leg 36 with only one exception, that being Site 330. A total of 133.25 hours of on-site time were lost to the elements. In several instances, trips caused directly by the elements were also recorded in Leg 36 statistics as weather time. On more than one occasion, cruising times were lengthened significantly by the elements. Lost time, while underway, was not broken out as weather time but will be included in the cruising times even though a good estimate of lost time cruising is mentioned within this report.

Sites that were directly affected by the elements are listed as follows:

Site 326

Lost 4-1/2 hours after spudding due to high winds and seas. The drill string parted just below the drill ship resulting in the loss of 389 joints of drill pipe plus a complete bottomhole assembly.

Site 327

Lost 8-1/2 hours. Had to pull bit due to reaching operational limits of 7° roll.

Site 327A

Lost 33-1/2 hours before spudding due to excessive rolling of ship.

Site 328

Lost 14-1/2 hours due to increasing winds and swells requiring more power to adequately position ship. Elements forced trip. Assigned trip time to wait on weather.

Hole 328B

Lost 18-1/4 hours. Iceberg in area of ship forced trip as safety precaution and subsequent loss of hole.

NOTE: Due to elements, forced to abandon the drilling of Proposed Sites 36-4 and 36-6. The Challenger required 4-1/2 days longer in finally arriving at Site 328. This additional cruising time will not be shown as wait on weather.

Site 329

No time lost on site due to weather.

NOTE: Estimated cruising time lost between Sites 328 and 329 due to icebergs and rough seas is 1/3 days which will appear in statistics as cruising time to Site 329.

Site 331

Lost 54 hours after taking punch core. Storm hit preventing any additional drilling on site.

Included herein are summary sheets of the ship's positioning illustrating the average conditions faced by the Challenger while positioning on each site.

COMMUNICATIONS

During Leg 36, communications certainly were not outstanding but it is believed that all parties concerned were kept adequately informed of the Challenger's daily progress and/or setbacks. The Challenger was in daily contact with Station WWD, San Diego, and could receive its traffic normally without problems, but occasionally WWD could not receive our traffic. Thus, some of the ship's traffic had to be sent via commercial means through VPC (Falkland Islands Radio) and later as the Challenger moved northward via PPR (Rio de Janeiro Radio. A diligent effort was made, however, to handle as much traffic as possible with WWD.

Several radiotelephone calls to GMI's and DSDP's offices were made via commercial telephone high seas stations, WOM in Miami and KMI Oakland. Several personal calls were also made through these stations.

On April 23, the ship's TMC (main high power transmitter) went out and could not be repaired. As a result of this failure the RCA CW transmitter was placed into service. Of course, this transmitter has less power than the TMC. During Leg 36, communications with the Navy were non-existent.

Amateur radio (HAM) communications were somewhat spotty during Leg 36 but most everybody expressing a desire to call the States got through at least once.

PERSONNEL

Global Marine's personnel performed well and are to be commended for their untiring efforts during some very difficult working conditions experienced during Leg 36.

The scientific party and SIO technician staff were all a fine group of people to be associated with; all expressed an enthusiasm in their work. The scientific party took the many operational problems experienced in stride and exhibited an understanding attitude.

Otis M. Moore
Cruise Operations Manager
Deep Sea Drilling Project

June 1974

DEEP SEA DRILLING PROJECT
SUMMARY OF OPERATIONS
LEG 36

Total Days On Leg (March 30 - May 22, 1974)		52.61
Total Days In Port		4.52
Total Days Cruising		24.93
Total Days On Site		20.65
Total Days Other Time (Time at Anchorage Bahia Aguirre) (Time Attempting Position Rio Grande Rise)		2.51
Coring Time	6.09	
Drilling Time	1.79	
Trip Time	5.52	
Waiting On Weather	5.55	
Dynamic Positioning Problems	1.04	
Mechanical Downtime & Other (On Site)	0.66	

Total Distance Traveled (Nautical Miles)	4653.4
Average Speed (Nautical Miles)	7.78
Sites Investigated	6
Holes Drilled	10
Number of Cores Attempted	107
Number of Cores With Recovery	102
Percent of Cores With Recovery	95.3
Total Meters Drilled	1474.0
Total Meters Cored	1006.0
Total Meters Recovered	578.7
Percent of Core Recovered	57.5
Total Meters Penetration	2480
Maximum Penetration at Single Hole (Meters)	575.5
Maximum Water Depth (Meters)	5103

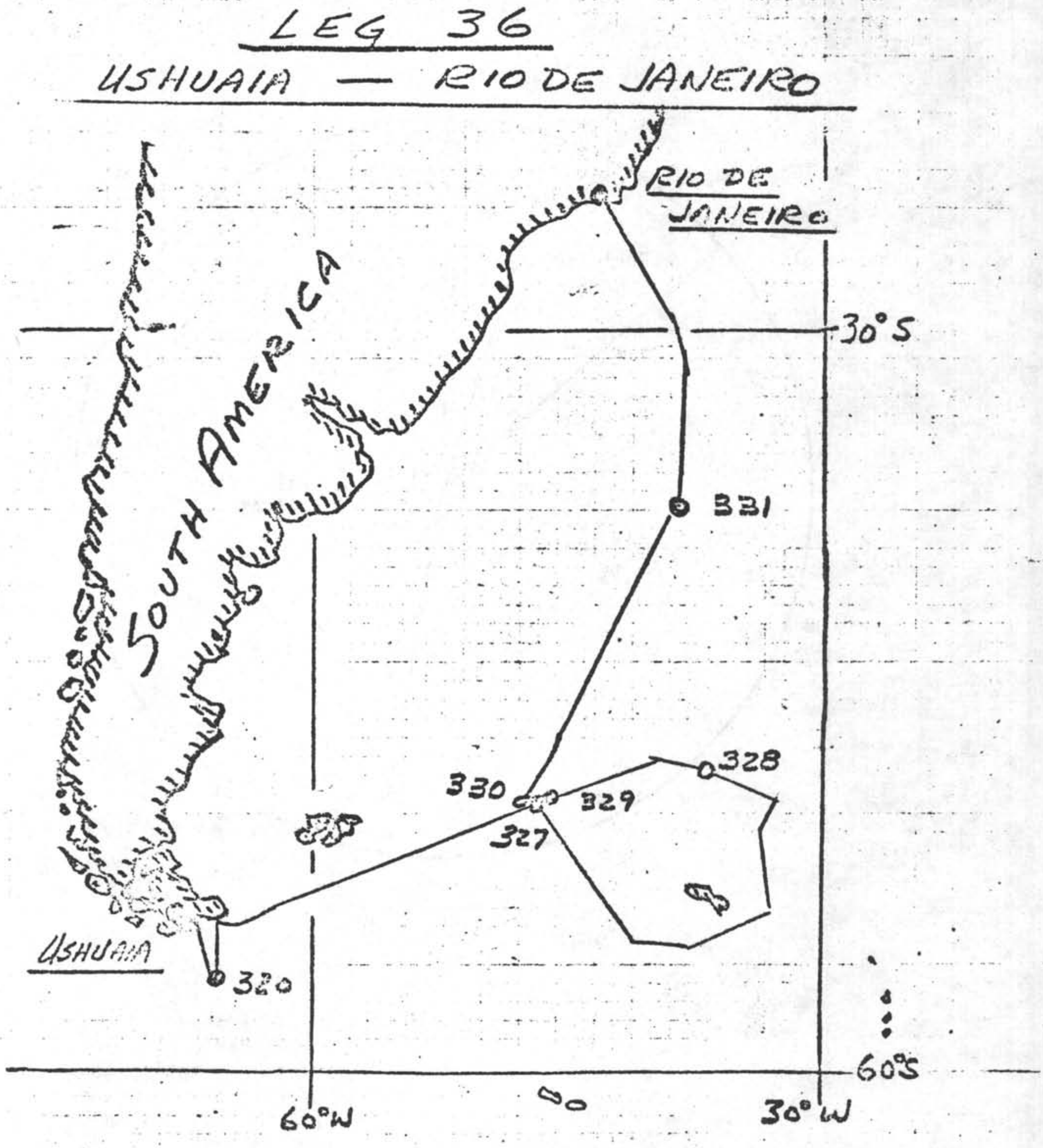
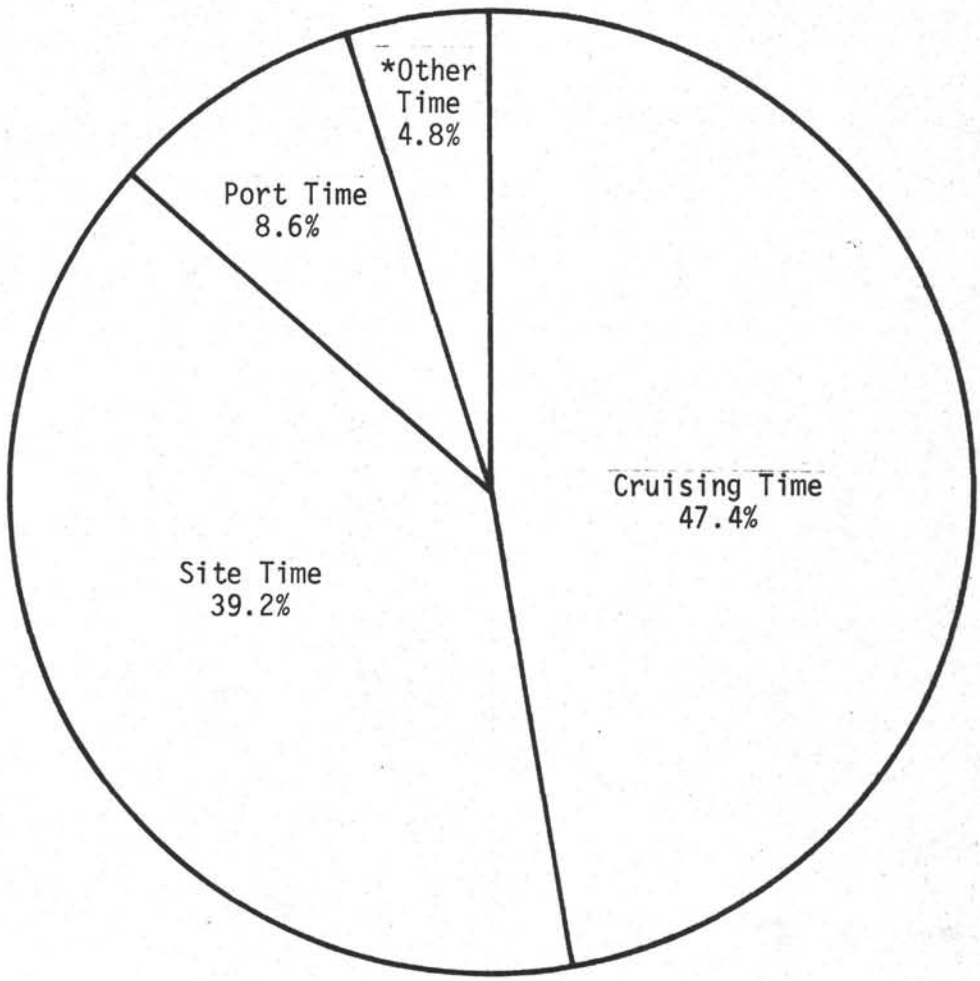

LEG 36
USHUAIA — RIO DE JANEIRO
RIO DE JANEIRO
SOUTH AMERICA
30°S
331
328
330
329
327
USHUAIA
320
60°S
60°W
30°W

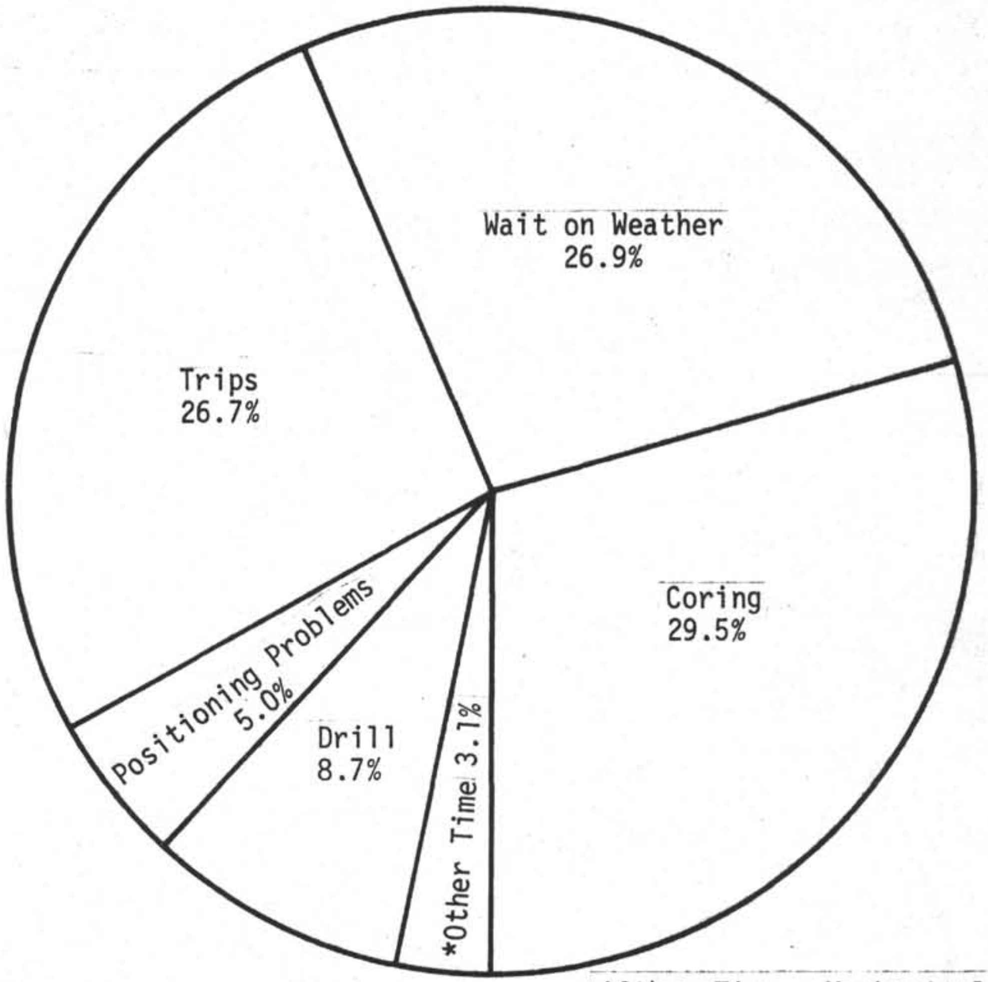
Figure I
Deep Sea Drilling Project
Total Time Distribution
LEG - XXXVI



Start Leg: March 30, 1974
Finish Leg: May 22, 1974
Total Leg Time: 52.61 Days

*Other Time Includes:
- Anchorage Bahia Aguirre -
- Time lost attempting to position on Rio Grande Rise (no site given location) -

Figure II
Deep Sea Drilling Project
Site Time Distribution
LEG - XXXVI



*Other Time - Mechanical Downtime
- Routine Maintenance
Total Time on Site: 20.65 Days
Total Sites: 6
Total Holes: 10

LEG 36 - Site 326
DYNAMIC POSITIONING SUMMARY

LEGEND

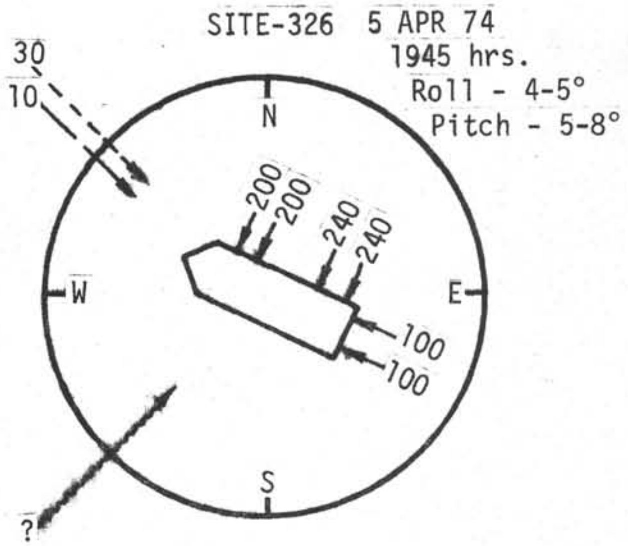
CHALLENGER HEADING-AVERAGE

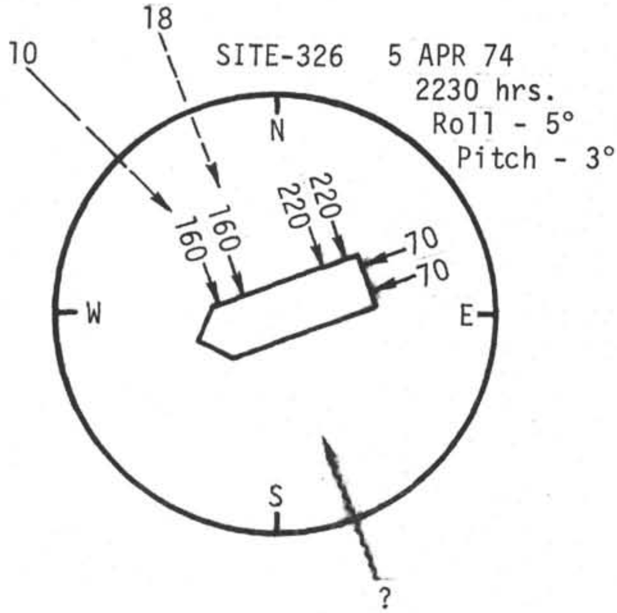
15 WIND: DIRECTION AND SPEED (MPH)-AVERAGE

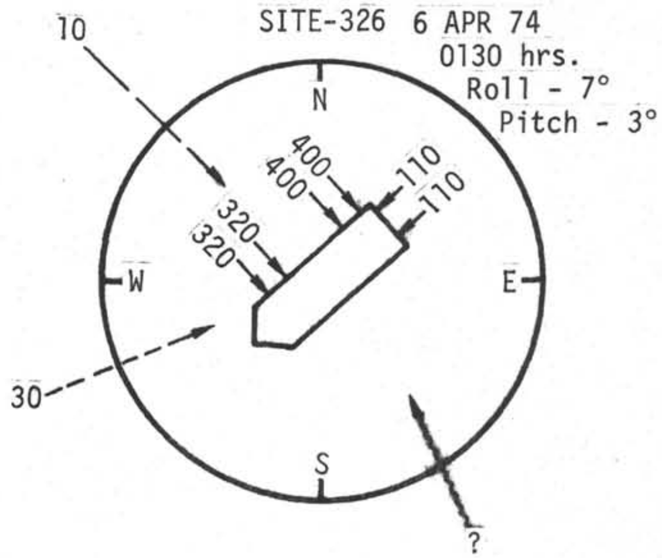
4 SWELL: DIRECTION AND HEIGHT (FEET)-AVERAGE

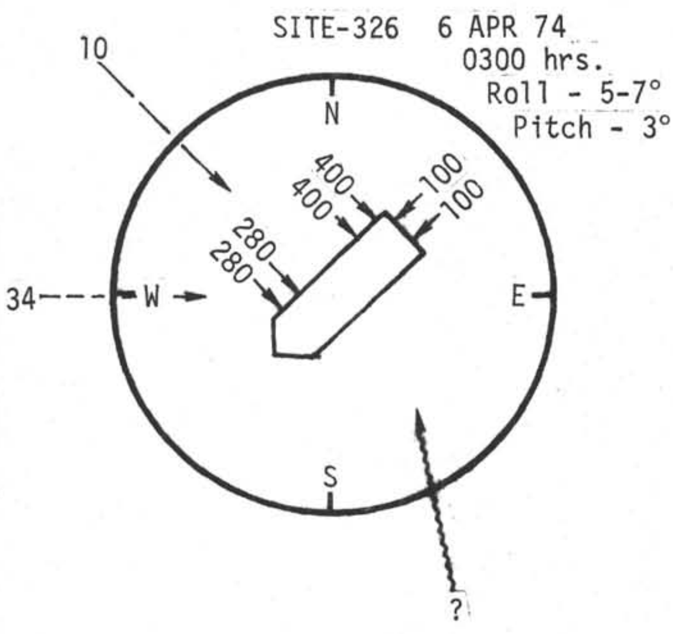
2 CURRENT: DIRECTION AND SPEED (KTS.)

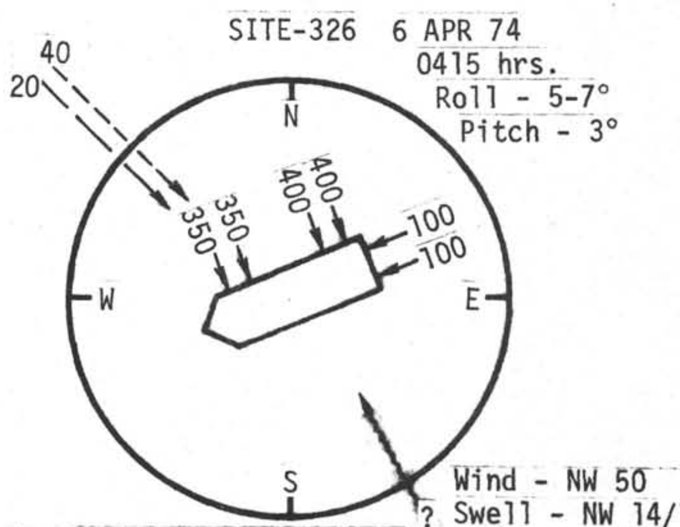
THRUSTER AND MAIN PROPULSION ARROWS INDICATE AVERAGE RPM.











Wind - NW 50
Swell - NW 14/1
Sea - NW 4/8
Roll - 8-10°
Pitch - 8°

Forced into Semi-Automatic mode at 0500 hrs. 6 APR 74. Drill pipe parted at 1850 hrs.

LEG 36 - Site 327
DYNAMIC POSITIONING SUMMARY

LEGEND

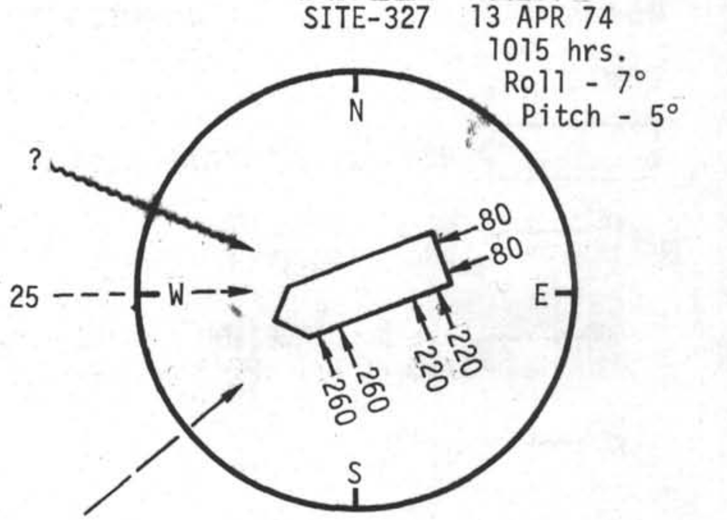
CHALLENGER HEADING-AVERAGE

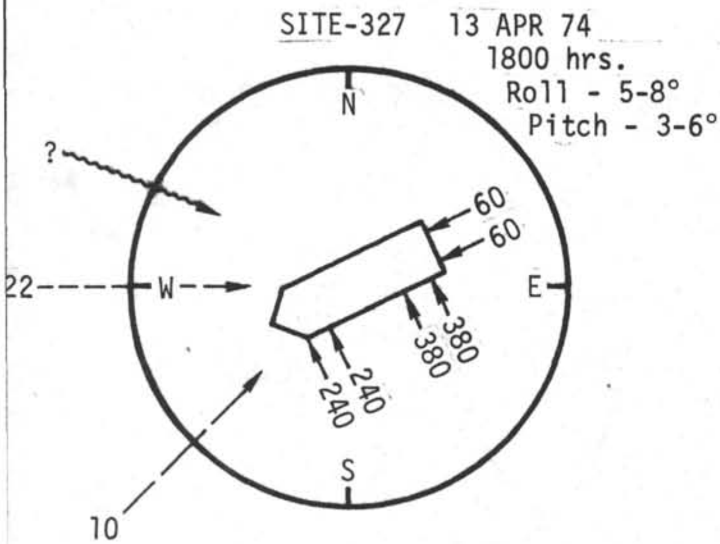
15 AND SPEED (MPH)-AVERAGE
WIND: DIRECTION

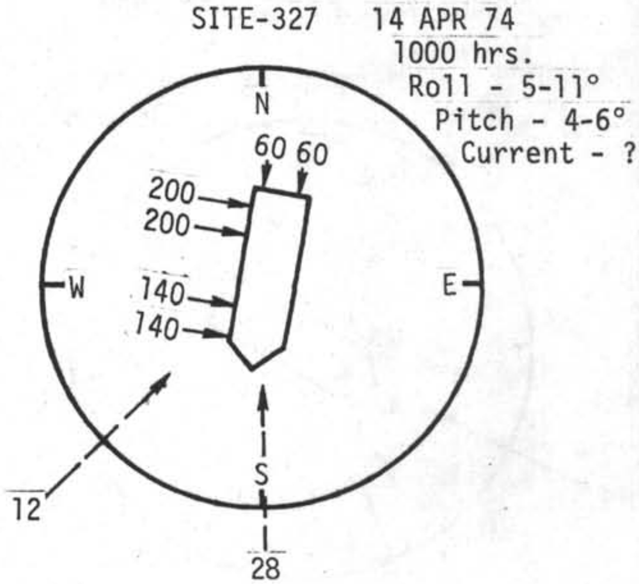
4 SWELL: DIRECTION
AND HEIGHT (FEET)-AVERAGE

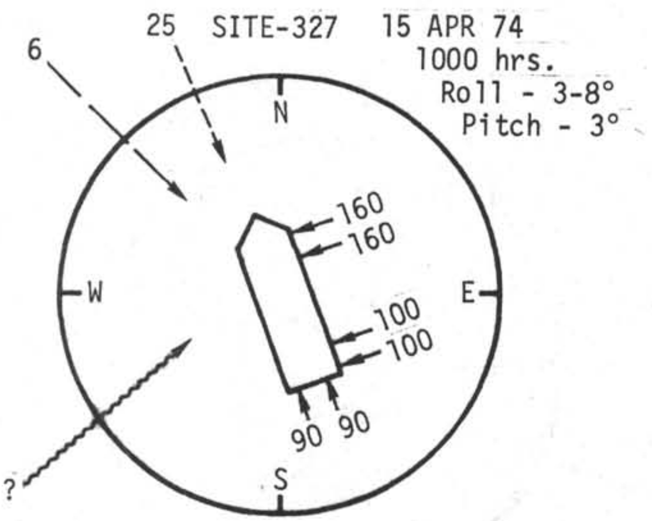
2 CURRENT: DIRECTION
AND SPEED (KTS.)

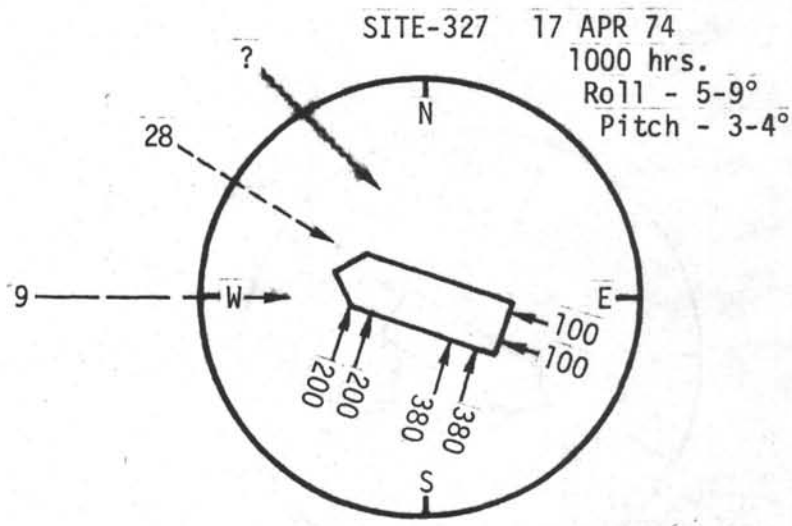
THRUSTER AND MAIN PROPULSION
ARROWS INDICATE AVERAGE RPM.











LEG 36 - Site 328
DYNAMIC POSITIONING SUMMARY

LEGEND

CHALLENGER HEADING-AVERAGE

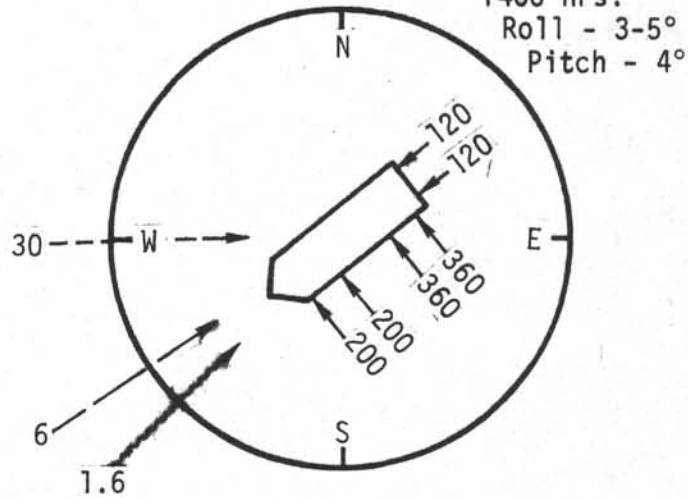
15 WIND: DIRECTION AND SPEED (MPH)-AVERAGE

4 SWELL: DIRECTION AND HEIGHT (FEET)-AVERAGE

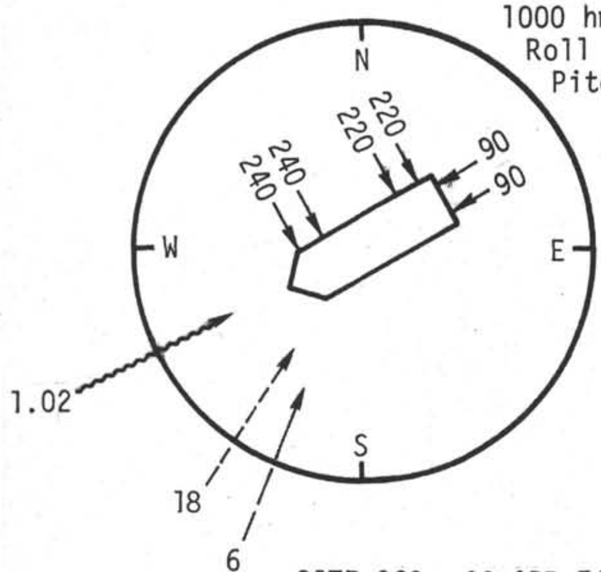
2 CURRENT: DIRECTION AND SPEED (KTS.)

THRUSTER AND MAIN PROPULSION ARROWS INDICATE AVERAGE RPM.

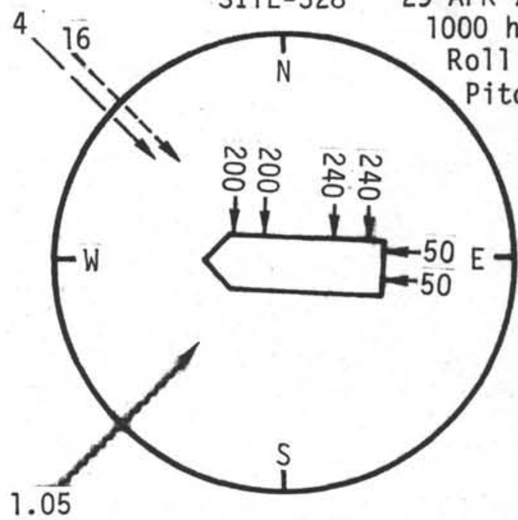
SITE-328 27 APR 74
1400 hrs.
Roll - 3-5°
Pitch - 4°



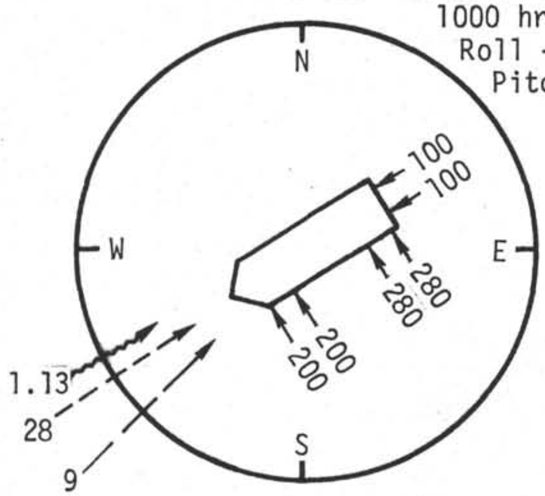
SITE-328 28 APR 74
1000 hrs.
Roll - 6°
Pitch - 3°



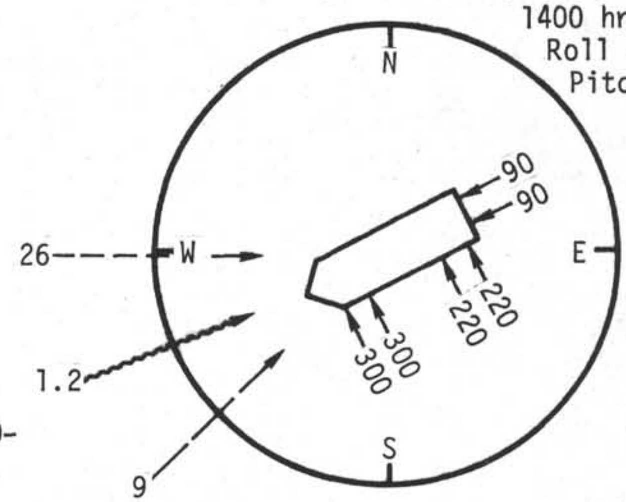
SITE-328 29 APR 74
1000 hrs.
Roll - 5°
Pitch - 2°



SITE-328 30 APR 74
1000 hrs.
Roll - 5°
Pitch - 2-5°



SITE 328 30 APR 74
1400 hrs.
Roll - 5°
Pitch - 4°



LEG 36 - Site 329
DYNAMIC POSITINING SUMMARY

LEGEND

CHALLENGER HEADING-AVERAGE

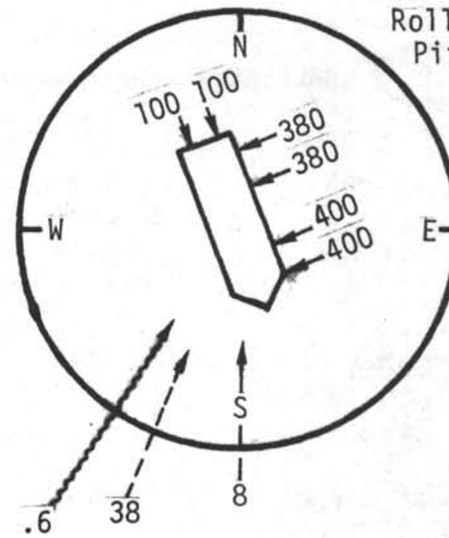
15- - - → WIND: DIRECTION AND SPEED (MPH)-AVERAGE

4—— → SWELL: DIRECTION AND HEIGHT (FEET)-AVERAGE

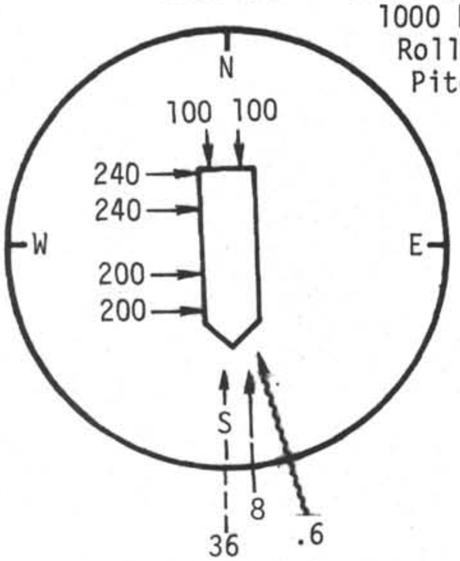
2~~~→ CURRENT: DIRECTION AND SPEED (KTS.)

THRUSTER AND MAIN PROPULSION ARROWS INDICATE AVERAGE RPM.

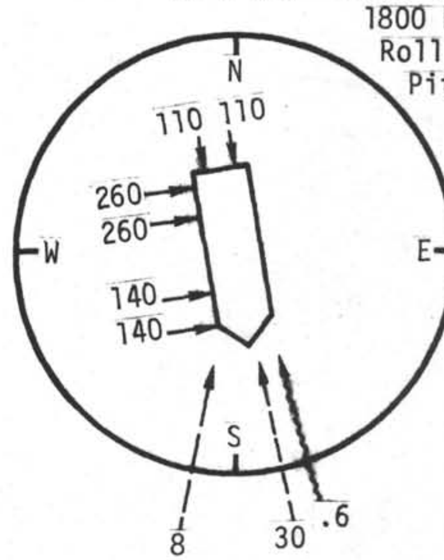
SITE-329 4 MAY 74
0600 hrs.
Roll - 5°
Pitch - 3°



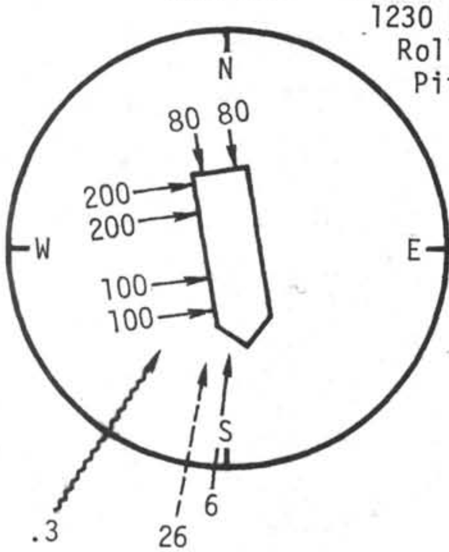
SITE 329 4 MAY 74
1000 hrs.
Roll - 5-7°
Pitch - 4°



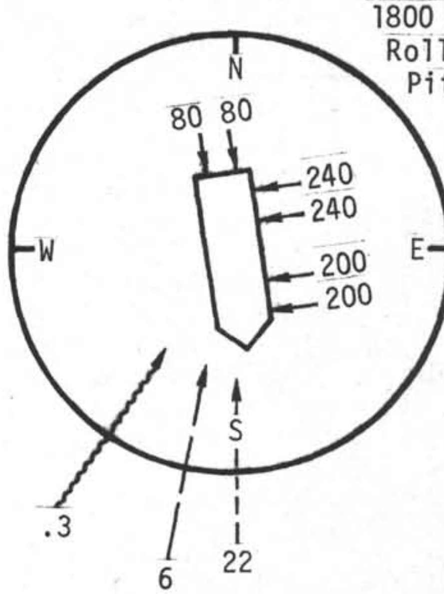
SITE-329 4 MAY 74
1800 hrs.
Roll - 5-7°
Pitch - 4°



SITE-329 5 MAY 74
1230 hrs.
Roll - 3°
Pitch - 3°



SITE-329 5 MAY 74
1800 hrs.
Roll - 3°
Pitch - 2°



LEG 36 - Site 330
DYNAMIC POSITIONING SUMMARY

LEGEND

CHALLENGER HEADING-AVERAGE

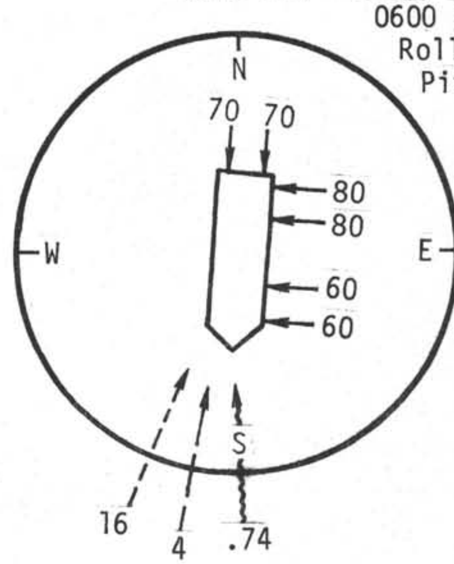
15 WIND: DIRECTION AND SPEED (MPH)-AVERAGE

4 SWELL: DIRECTION AND HEIGHT (FEET)-AVERAGE

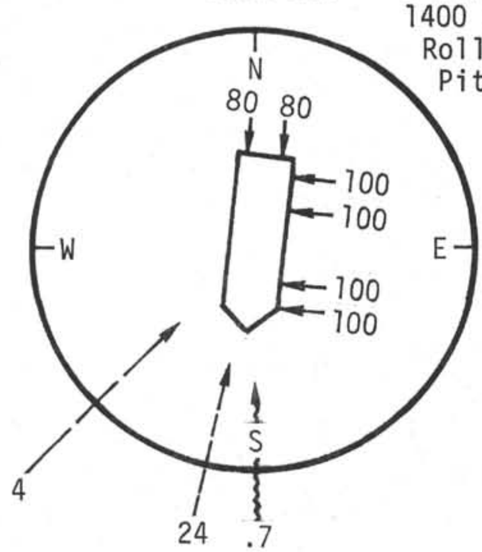
2 CURRENT: DIRECTION AND SPEED (KTS.)

THURSTER AND MAIN PROPULSION ARROWS INDICATE AVERAGE RPM.

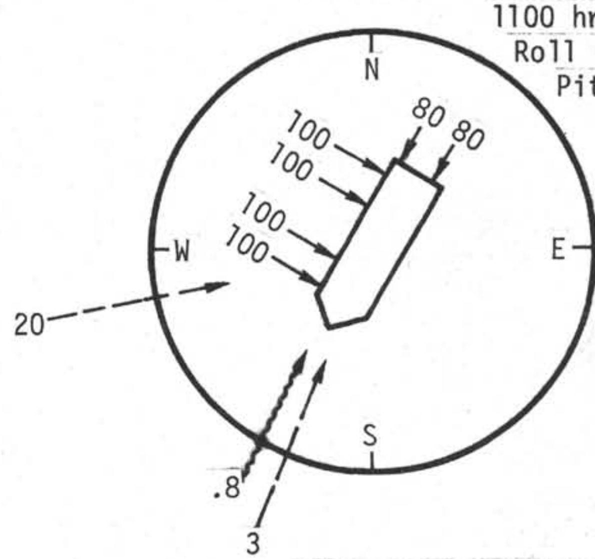
SITE-330 6 MAY 74
0600 hrs.
Roll - 2°
Pitch - 2°



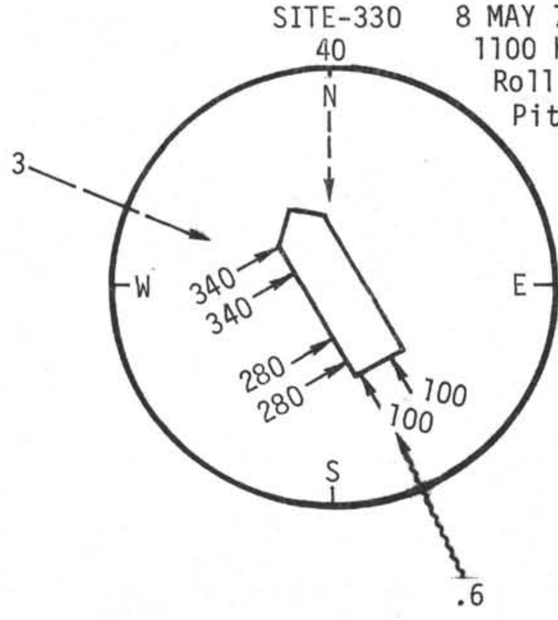
SITE-330 6 MAY 74
1400 hrs.
Roll - 2°
Pitch - 2°



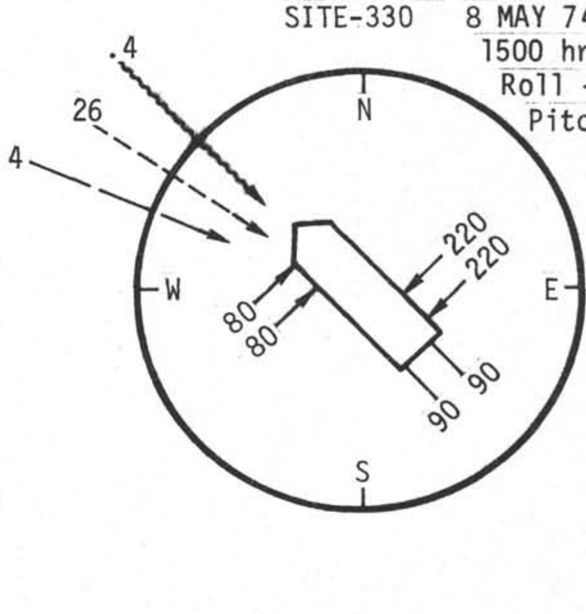
SITE-330 7 MAY 74
1100 hrs.
Roll - 4°
Pitch - 3°



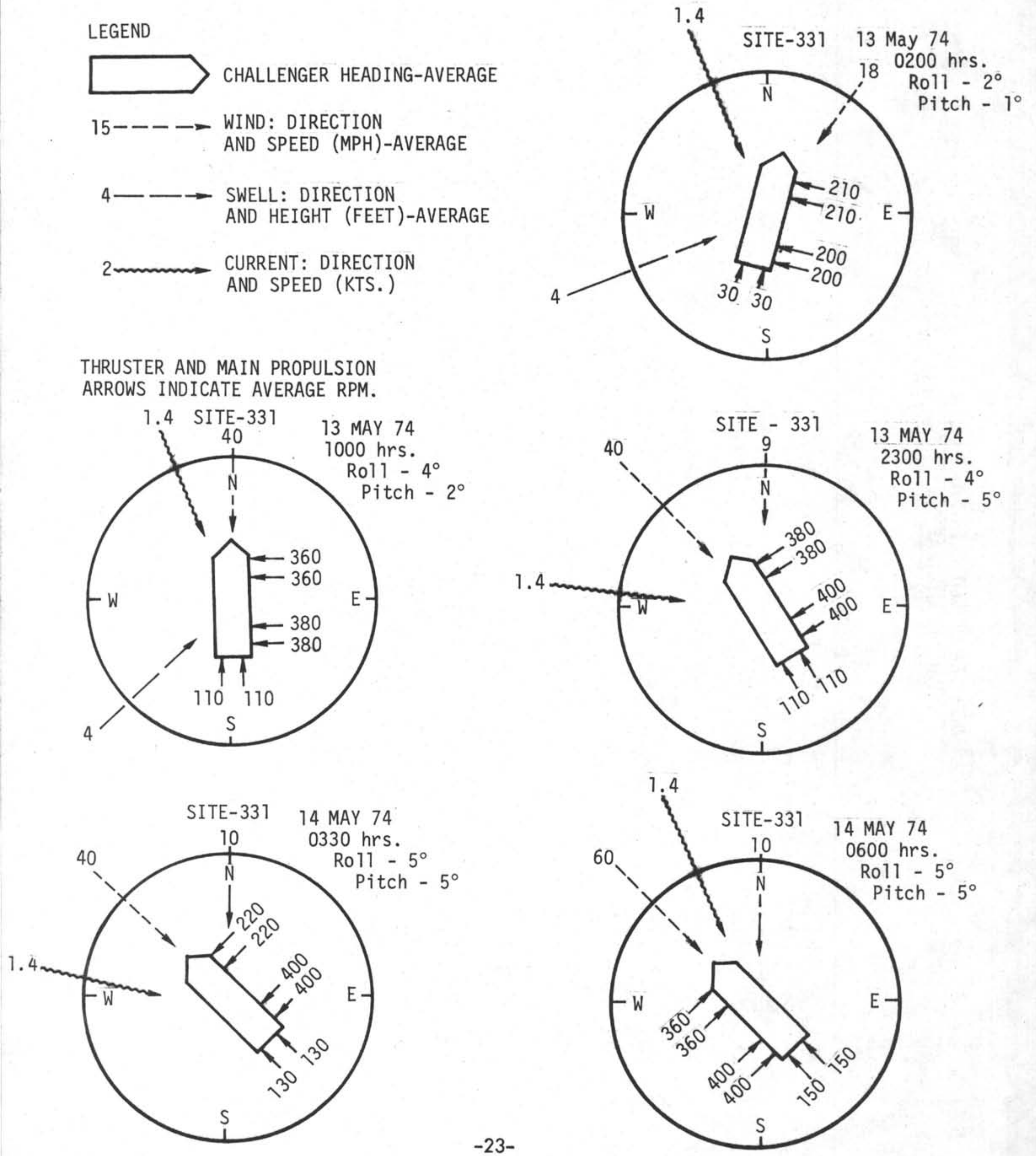
SITE-330 8 MAY 74
1100 hrs.
Roll - 3°
Pitch - 4°



SITE-330 8 MAY 74
1500 hrs.
Roll - 3°
Pitch - 4°



LEG 36 - Site 331
DYNAMIC POSITIONING SUMMARY



Note: Forced into Semi-Automatic mode at 0615 hrs. 14 MAY 74. Storm

DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 36

Site No.	Make	Freq. kHz	Serial Number	Site Time Hours	Remarks
326	ORE	13.5	215	30.25	Dropped at 2.5 knots. Good signal.
327	ORE	16.0	243	107.00	Dropped at 6.0 knots. Good signal.
328	ORE	13.5	282	141.00	Dropped at 4.5 knots. Good signal. Weakened signal after
328	ORE	16.0	246	16.25	5.87 days. Dropped second beacon on sixth day.
329	ORE	13.5	225	46.50	Dropped at 5 knots. Good signal.
330	ORE	16.0	247	63.25	Dropped at 5 knots. Good signal.
331	ORE	13.5	278	66.25	Dropped at 5 knots. Good signal. Lost beacon due to
331	ORE	16.0	250	25.00	storm. Dropped second beacon.
	ORE	13.5	208	7.50	Dropped at 5 knots. Good signal. Hole not spudded due to positioning failure. No site number assigned.

DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 36

Hole	Mfg.	Size	Type	Serial Number	Meters Cored	Meters Drilled	Meters Total Penet.	Hours On Bit	Condition	Remarks
Drake Passage										
326	Smith	10-1/8"	F94C	PC159	9.5	0	9.5	0.5		Lost bit when drill string parted.
Falkland Plateau										
327	Smith	10-1/8"	F94CK	RC895	5.0	0	5.0	0.5	As New	Pulled above ocean floor and wait on weather.
327A	Smith	10-1/8"	F94CK	RC895	256.5	213.0	469.5	13.95	T1, B1	Suitable for rerun.
					271.5	213.0	474.5	14.45		
Falkland (Malvinas) Outer Basin										
328	Smith	10-1/8"	F94CK	PC901	112.0	285.0	397	6.73	T1, B1	Suitable for rerun.
328A	Smith	10-1/8"	F94C	RC890	17.0	0.0	17	0.17		
328B	Smith	10-1/8"	F94C	RC890	66.5	404.5	471	12.28	T1, B1	Suitable for rerun.
					83.5	404.5	488	12.45		
Falkland Plateau										
329	Smith (RR)	10-1/8	F94CK	RC901	312.5	152.0	464.5	9.93		
330	Smith (RR)	10-1/8"	F94CK	RC901	161.5	414.0	575.5	21.83		
330A	Smith (RR)	10-1/8"	F94CK	RC901	47.5	5.5	53.0	0.92	T2, B2, 1BT	Seals effective.
					663.5	856.5	1490.0	39.41	(totals include initial run on Hole 328 above)	
Argentine Basin										
331	Smith (RR)	10-1/8"	F94CK	RC890	18.0	0	18.0	0.17	T1, B1	Suitable for rerun.

DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 36

Hole	Latitude	Longitude	Water Depth	Number Of Cores	Cores With Recovery	Percent With Recovery	Meters Cored	Meters Recovered	Percent Recovered	Meters Drilled	Total Penet. Meters	Avg. Rate Penet.	Time On Hole	Time On Site
Drake Passage														
326	56° 35'S	65° 18.2'W	3822	1	1	100	9.5	0.5	5.3	0	9.5		30.25	30.25
Falkland Plateau														
327	50° 52.3'S	46° 47.02'W	2411	1	1	100	5.0	5.0	100.0	0	5.0		24.50	
327A	50° 52.3'S	46° 47.02'W	2411	27	27	100	256.5	128.1	50.0	213.0	469.5	33.6	82.50	107.00
Falkland (Malvinas) Outer Basin														
328	49° 48.7'S	36° 39.5'W	5103	12	12	100	112.0	62.1	55.4	285.0	397.0	59.0	68.00	
328A	49° 48.7'S	36° 39.5'W	5103	2	2	100	17	7.4	43.5	0	17.0	100.0	24.00	
328B	49° 48.7'S	36° 39.5'W	5103	7	7	100	66.5	62.6	94.0	404.5	471.0	38.3	65.25	157.25
Falkland Plateau														
329	50° 39.3'S	46° 05.7'W	1531.5	33	33	100	312.5	215.0	68.8	152.0	464.5	46.8	46.50	46.5
330	50° 55.2'S	46° 53.0'W	2636	17	17	100	161.5	85.5	53.0	414.0	575.5	26.4	49.50	
330A	50° 55.2'S	46° 53.0'W	2636	5	1	20	47.5	4.0	8.4	5.5	53.0	57.6	13.75	63.25
Argentine Basin														
331	37° 53.0'S	38° 6.92'W	5073.5	2	1	50	18.0	8.5	47.2	0	18.0	108.0	91.25	91.25
		Totals		107	102	95.3	1006.0	578.7	57.5	1474.0	2480.0		495.5	495.5

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG 36

Date	Site Number	Cruise	Trips	Drill	Core	Stuck Pipe	Wait On Weather	Position Ship	Mechanical Downtime	In Port Time	Other	Total Time	Remarks
Mar 30–Apr 4	Ushuaia									108.50		108.50	Depart 0800 April 4, 1974.
Apr 4–6	326	31.25	16.00		7.25		4.50	7.50				61.50	Lost drill string.
Apr 6–14	327	101.50	11.00		1.50		8.50	2.00	1.50		53.00	179.00	Pick up new drill string.
Apr 14–17	327A		6.75	7.25	34.50		33.50		0.50			82.50	Bent bumper sub. Abandoned due to weather.
April 17–26	328	154.00	13.00	7.25	23.00		14.50	10.25				222.00	Abandoned due to weather.
April 26–27	328A		14.25		3.25				3.00		3.50	24.00	Ran Schlumberger unit. Poor core recovery.
April 27–30	328B		19.50	11.75	12.50		18.25		3.25			65.25	Lost hole due to icebergs.
Apr 30–May 5	329	77.00	11.25	3.25	32.00							123.50	Reached objectives
May 5–8	330	6.00	9.00	13.00	27.00				0.50			55.50	Reached objectives.
May 8	330A		6.75	0.50	6.50							13.75	Bridged core barrel.
May 8–16	331	100.50	25.00		3.75		54.00	5.25	0.75		2.50	191.75	Abandoned due to weather.
May 16	To Rio	128.00									7.50	135.50	Computer failed on May 20, 1974. Headed for Rio.
		598.25	132.50	43.00	146.25		133.25	25.00	9.50	108.50	66.50	1262.75	

NOTE: 26.9% On-Site Time = WOW
5% On-Site Time = Lost Position Problems
Site Time 495.5 hrs = 20.65 Days

DRILL STRING FAILURE - SITE 326
APRIL 6, 1974 - DRAKE PASSAGE

As the Challenger approached the proposed drill Site 326, the weather conditions appeared marginal for dropping the positioning beacon. Upon mutual agreement between the Drilling Superintendent, Ship's Captain, and Operations Manager, it was agreed that no beacon would be dropped, instead the ship would steam on by the site while continuing to tow the profile gear. The vessel steamed approximately 18-1/2 miles past the site location, made its turn and again, as the drill ship approached the site, it was deceided that the weather had improved sufficiently to permit dropping the positioning beacon. The beacon was dropped on site with the understanding that the drill string would not be run until it was determined that the ship could be positioned over the beacon satisfactorily. By the time the bit was run to near bottom of the ocean, ship positioning began to deteriorate. Again, it was agreed that the initial core could be safely obtained. This initial core would be a punch core taken without circulating or rotating the drill string. Having successfully taken the punch core, the ship's positioning continued to be poor. Due to poor positioning, it was agreed that the bit would be pulled above the ocean floor and coring operations suspended until the ship was satisfactorily positioned over the site beacon.

At approximately 1800 hours, April 6, 1974, the scope on the bridge positioning equipment was determined not to be operating properly. The ship's position would not repeat when switching from one scale to another. The scope was changed and the drill ship was being positioned back over the beacon while the drill string was hanging above the ocean floor. It was estimated, at this time, that the drill ship was approximately 3000 feet off the beacon. At 1850 hours, the drill string parted near the bottom of the drill ship. The heave compensator was not being used at this time. The weather conditions at the time the drill string failed were recorded as: winds NW 50 mph, sea NW 6-8 feet, swell NW 17 feet average, roll 8-10°, pitch 8-19°. The current at the time was unknown but apparently the ship was experiencing the effects of a strong current. Later this current was estimated to be as much as 3-4 knots. Based on the consensus of opinions of the experience on board ship, the drill ship had drilled successfully in similar sea conditions. It was agreed, however, that this may have been the strongest current ever experienced during any of the Challenger's drilling operations.

The pipe failure, as best can be determined at this time, occurred in a new joint of 5" O.D. drill pipe. There was some degree of internal corrosion and pitting evidenced in the failed joint. Pictures were taken of the failure for additional study. One may better determine the condition of the pipe by additional inspection of the recovered half of the parted joint, that is by a complete Tuboscope inspection, etc. It is believed that the failure occurred due to the additional stress set up by the vessel movement, pitch and roll, plus the current that was existing at the time of failure. It is believed that the current was setting up stresses in the pipe that were not anticipated due mainly to the fact that the speed of the current was underestimated. There is the possibility that a bottom current in this Drake Passage area could have been effecting the length of the drill string. The corrosion and pitting, as evidenced internally, could have also been a factor in the failure.

On future sites, while experiencing similar conditions, one should endeavor to make every effort to be more mindful of all the forces effecting the drill string. One should not hang the drill string off bottom in any severe seas at all while attempting to position the ship. When experiencing a positioning problem, one should immediately start pulling out of the hole. Once positioning is again satisfactory, the pipe can be run back in the hole. Do not permit the pipe to hang off bottom for any appreciable length of time and allow stresses to concentrate at a point in the drill string; that point being near the bottom of the drill ship.

Due to this drill pipe failure and the excessively long delivery time on 5" O.D. drill pipe, it was deemed necessary by the Deep Sea Drilling Project to set up some operational limits under which to work the drill string in the future. These operational limits are stated as: "The maximum limit under which the drill pipe is to be worked is a vessel roll and/or pitch of 7°. In no case are operations to continue where occasional vessel rolls and/or pitch exceed 9°." During the drilling of the remaining sites of Leg 36, these limits were found to be quite reasonable.

ANALYSIS OF FACTORS RESULTING IN THE LOSS OF HOLE 328B

Hole 328B had penetrated to 5574 meters at the time operations had to be shutdown for an iceberg approaching the ship. All sediments penetrated had been clay type sediments which are soft but normally offer good hole conditions. Fifty barrels of get mud was pumped in the hole before bit was pulled off bottom. The bit was pulled to 5250 meters to wait out the movement of the iceberg. Sediments at 5250 meters (ocean floor at 5103 meters) were soft clays. Reference is made to the drilling recorder chart. The bit hung at 5250 meters for approximately one hour and forty minutes with the ship's positioning system and the heave of the ship causing bit to move and/or reciprocate about the well bore. One might conclude that this motion caused the bit to sidetrack on the low side of the hole and/or cause a bridge to be formed in the hole at this point. When operations were resumed it is believed that upon lowering the bit past 5250 meters, the bit started to sidetrack (refer closely to string weight on drilling recorder chart). The driller noticed after running four doubles back in the hole, that something did not appear to be proper, that is, he was losing some string weight off the total hook load on the indicator. The pump was kicked on, swivel was in string at the time, and the pipe was reciprocated and pumped for approximately 20 minutes. The string weight returned to normal. It is now believed that the pump jetted out soft clay ahead of the bit and actually made hole while regaining the string weight. The pipe may or may not have already been bent at this time. At this point (refer to chart), the pipe was continued to be run in the hole in doubles but a close look at the recorder chart indicates that string weight was started to be lost on first double run in the hole without pump on until approximately 30,000 to 50,000 lbs were lost from the total hook load and then as the remaining doubles were run back to bottom, very little if any weight could be detected as being lost from the total string weight. However, now one can be almost certain that the last ten doubles run were laid on the ocean floor. It was determined after returning to near bottom, that the string weight lost was approximately 30,000 to 50,000 lbs and the string could not be rotated. The pump pressure was determined to be normal but all other factors indicated the bottomhole assembly had been broken off. The pipe was started out of the hole upon pulling to 5400 meters (assuming string still all in tack) and the total string weight was immediately regained. Upon regaining the normal total string weight, it became apparent what had actually happened to the bit on the way in the hole. The string continued to be pulled out of the hole. At four stands above the bottomhole assembly, two joints of drill pipe were found to be badly bent as a result of laying over the drill pipe. One other joint was found bent at 39 joints above the top of the bottomhole assembly, however, this may or may not have been bent due to laying the drill pipe over.

In an effort to eliminate the recurrence of this problem, it is recommended that the following be considered:

1. The bit be reciprocated frequently the maximum distance possible while handling off waiting during similar circumstances.

2. Proceed back to bottom very cautiously watching the weight indicator closely being sure the correct string weight is maintained at all times on the indicator.

3. If in doubt at all as to whether the bit is taking weight, pick up swivel and circulate and ream the bit back to bottom while maintaining full string weight on the indicator. This may tend to sidetrack the hole but more important this procedure will prevent damaging and/or losing drill pipe and/or bottomhole assembly.

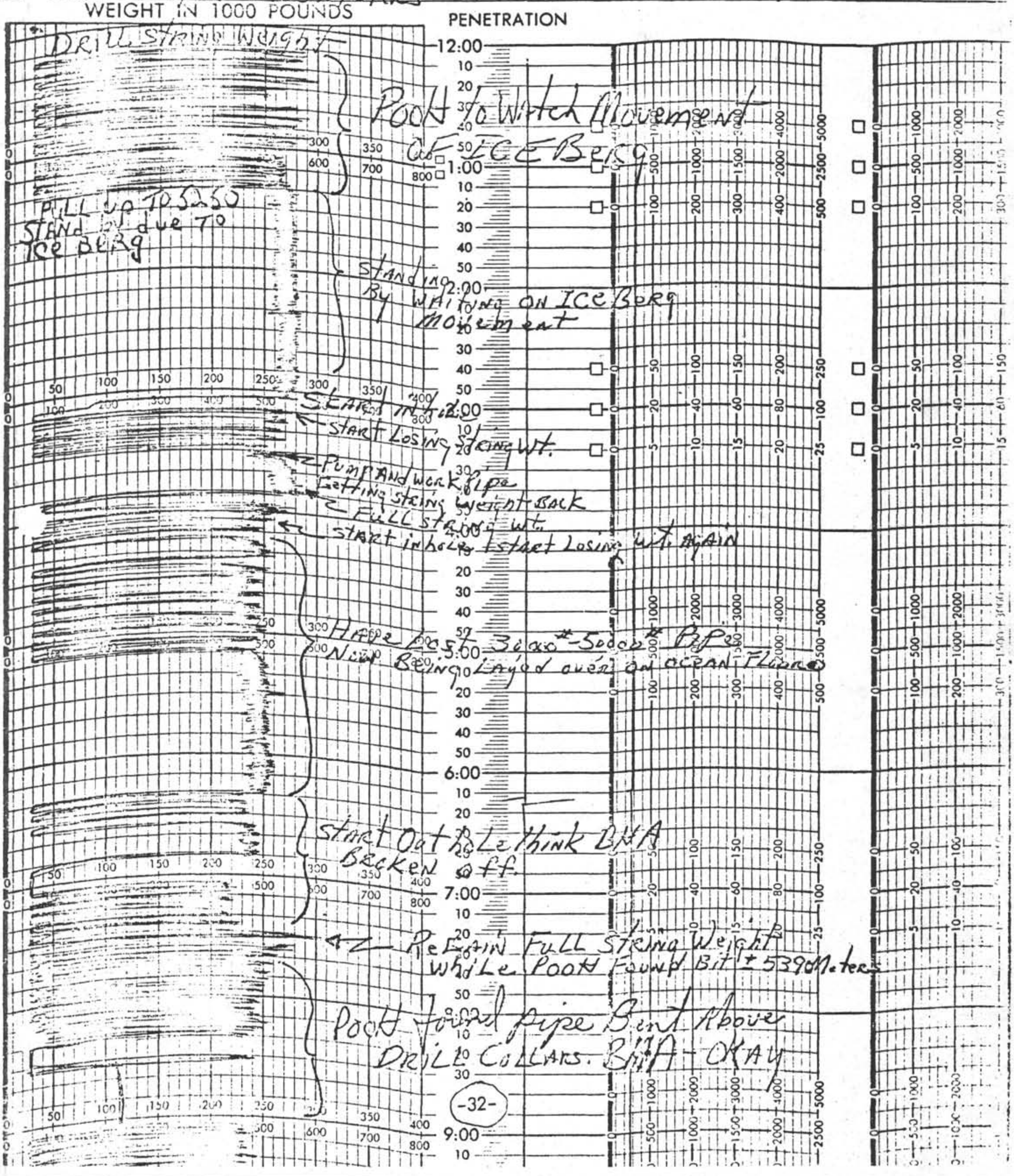
OPERATOR: Scripps NO: Site 328B

LOCATION: So Atlantic STATE:

COUNTY: T.D. OFF:

DATE ON: 4/29/74 T.D. ON:

Water Depth - 5103 Meters



DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 37

Leg 37 began May 22, 1974 at Rio de Janeiro, Brazil and ended 67.7 days later at Dublin, Ireland on July 29, 1974. This leg was planned as a deep penetration of the igneous section of the oceanic crust. Previous legs had penetrated a maximum of 80 meters of basalt with a single bit but deep penetration would require repeated re-entries. The other legs attempting re-entry had succeeded in only one re-entry per hole but their experiences resulted in many modifications of the re-entry equipment, especially the scanning sonar tool which is the re-entry seeing eye.

The Challenger traveled 5987 miles and drilled nine holes on four sites. Total penetration was 3191.5 meters consisting of 1455.5 meters of basalt and 1735.5 meters of sediment. All of the basalt was cored, recovering 242.6 meters for a recovery of 16.7 percent. The maximum and minimum basalt penetration per hole was 582.5 and 110 meters. Only 321 meters of sediment were cored with 50.8 percent recovery.

A total of ten re-entries were made and nine of these were on one hole, 332B. Only three of the nine succeeded in extending the depth of the hole. Parted casing accounted for most of the extra re-entries.

Time distribution for the leg was 6.63 days in port, 26.24 days cruising, and 34.8 days on site. The on site time consisted of 6.96 days on trips, 1.46 days drilling, 15.35 days coring, 1.52 days with stuck pipe, 0.56 days positioning ship, 0.96 days mechanical downtime, 2.06 days for re-entry, and 5.93 days miscellaneous time.

This leg was an operational success but it also had some failures which future legs can use to advantage. The most prominent failures were parted casing, destruction of the mud cross and stuck drill pipe resulting in loss of part of the bottomhole assembly.

The major accomplishment for the leg was proving reliable re-entry capabilities.

PORT CALL - RIO de JANEIRO, BRAZIL

The Challenger docked at Rio at 0915 hours on May 22, 1974. Leg 36 had experienced problems with the positioning system and the heave compensator. Rough seas had also effected some structural damage to the ship. These repairs and drill pipe inspection had been scheduled for the port call.

The following personnel had been assembled in Rio for the repairs:

R. Rakestraw	Manager, Glomar Challenger
J. Barber	Port Engineer, GMI
J. Lockman	Heave Compensator, Project Engineer, GMI
B. Henderson	Electronic Engineer, GMI
G. Brown	Brown Bros.
D. Liddle	Brown Bros.
K. Reid	AMF-Tuboscope
B. Segui	General Electric
Larson	Larson & Powers
Ivie	Larson & Powers

Work items proposed and completed were as follows:

1. D. C. Propulsion Board - Clean, check and diagram circuitry.

2. Computer-Exciter Interface Unit - Check and diagram circuitry. Identify source of thruster lock-up problems at full power.

3. G. E. Bridge Console - Trace and rewire circuits.

4. Guide Arm Roller Assemblies - General inspection and repair.

5. Heave Compensator - Modify piston sleeve to accept a chevron seal, calibrate instrumentation and check 4" hydraulic hose deterioration. (Found inner liner separated in one hose. Repaired large crack in setback cradle).

6. Continuing ABS Survey.

7. Drill Pipe Inspection - Internal Sonoscope (inspected 635 joints and downgraded 5 joints to 2A).

8. Inspect For Structural Damage (found and repaired cracks in moon pool area).

9. Stabilizer System - Check and adjust (structural defects in original design will require extensive repairs in shipyard after Leg 38.)

10. Painting - Hull above loadline.

All repairs were completed in port except those related to dynamic positioning and the heave compensator. These repairs were completed enroute to Recife, Brazil.

UNDERWAY

Engineers and technicians expert in repairing and adjusting the dynamic positioning system and the heave compensator accompanied us to Recife where we were to rendezvous with the scientific group.

The cruise to Recife was interrupted for 28 hours at a test site (20° 48.89'S, 34° 37.39'W). The drill string was run to 940 meters (9 meters above the mudline) to check out the scanning sonar, positioning system and heave compensator. All systems checked out OK except the thrusters at full power. The problem was finally traced to a filter circuit in the bridge console and repairs were made while underway. Two more stops enroute for a total of 5.3 hours were required for testing repairs.

Our arrival at Recife was delayed because of darkness. The Harbor Pilot preferred daylight because of the very narrow port entrance and the unique construction of the Challenger. While waiting for daylight, speed tests were conducted to gather data on ship's speed, thruster RPM, horsepower, etc.

Transferring personnel and loading supplies consumed 3.6 hours and we departed at 1130 hours, June 5, 1974 and arrived at Site 332 at 1100 hours, June 17, 1974. We had traveled 4144 miles since leaving Rio de Janeiro.

We were a very optimistic group approaching the first site. All equipment critical to the success of the leg was in excellent repair and, as a further advantage, operations had been scheduled during the most favorable weather season. Subsequent operations confirmed that the optimism was well founded because we left the last site after drilling five record holes.

The Challenger departed the last site, 335 at 1600 hours on July 21, 1974 and arrived at Dublin, Ireland at 0524 hours on July 29, 1974 ending Leg 37.

DRILLING AND CORING

Hole problems in the basalt were expected and plans to combat them included mud flushes and cementing. Mud flushes appeared to be successful in clearing the hole of cuttings. Apparently large volumes of the light weight (9 lb/gal, 75 vis) are required and a minimum volume may be one annular volume. Hole 333A was flushed with smaller than annular volumes with little improvement in hole conditions and a large weighted slug was being prepared for this hole when the pipe stuck. The intent was to flush the hole with 1-1/2 annular volumes of 15 lb/gal mud which should have carried the cuttings through the enlarged hole sections. The pipe stuck in cuttings and was eventually severed at the lower bumper sub. Cementing to stabilize sloughing basalt was not used, but it would have been a final alternate to maintain Hole 333A.

Stabilizers had been provided to stabilize the bottomhole assembly if high bit weights were required, but coring rates were satisfactory in all holes and the stabilizers were not used. Penetration rate plots are in the Appendix, which also shows bit weight, annular velocity, RPM, and torque.

DRILLING AND CORING ASSEMBLIES

The bottomhole assembly used in all operations consisted of the following: 10-1/8" bit, Monel core barrel, three 8-1/4" drill collars, one bumper sub, three 8-1/4" drill collars, two bumper subs, two 8-1/4" drill collars, one 7-1/4" drill collar, one joint of 5-1/2" HWDP.

Monel inner barrels were used during coring operations in 332A and 332B but were set aside after coring 200 meters in 333A because of connection wear and flaring. Steel inner barrels were used in the remaining holes.

Hard formation finger-type core catchers were used in the rubble zones of the Upper Basalt section and performed very effectively, but spring and finger loss was much higher than expected and the supply was very low at the end of the leg.

The spring loaded slip-type catchers jammed when used in the rubble zones but core recovery in the more continuous basalt was satisfactory. Weaknesses in design started showing up in Hole 334 when cracks were found in the thread of the core catcher sub near the rolled pin which locks the nose threads. For safety, the nose was spot welded to the sub. Continued use on Hole 334 exposed other cracks on the core catcher sub body near the upper end of the slip dog guide. The core apparently forces the slip dog to the top of the guide and exerts an expanding force on the sub causing swelling and cracking. Swelling of the core catcher sub could prevent pulling the inner barrel and these catchers were set aside. The slip-type catcher seems to be the best catcher for basalt if these design problems can be overcome.

CORE BITS

The most efficient coring bits were the Smith F94CK with chisel shaped inserts. Two bits with spherical shaped inserts cored basalt at essentially the same rate as the chisels but the sediment layers in the basalt cored slower.

One Christensen type MC23 diamond bit was used. The proper place for it was in the lowest section of 332B and it was picked up but re-entry into the parted casing was not possible. It was used to spud Holes 333 and 333A but stopped coring when firm sediment was encountered. The diamonds had been completely removed from the face and the matrix was worn smoothly down below the water courses.

The best indicator of bit condition was core size. The scientists calipered the core diameter and these values were plotted versus depth. Dull bit condition and the core diameter clearly correlate and it was found that a core diameter of 5.5 cm is a good limit for loose bearings. Complete dependence on this method was difficult initially but confidence increased with each bit run. All core diameter plots are included in the Appendix to this report.

POSITIONING

With a few exceptions, positioning was extremely good with a mean error of $\pm$ 40 feet. The maximum vessel excursion for the entire leg was 400 feet with an operating time loss of only 80 minutes.

The weather was good for the entire leg and this is reflected in the operating speeds of the thrusters and main propulsion system. The thrusters with 486 RPM at maximum thrust were operated as follows:

	Time Operated %	
	Bow Thrusters	Stern Thrusters
100-200 RPM	67%	55%
200-300 RPM	27%	35%
Over 300 RPM	6%	10%

The main propulsion system with 225 RPM at maximum thrust was operated as follows:

0- 75 RPM	66% of time
75-100 RPM	22.5% of time
Over 100 RPM	11.5% of time

On June 19, a squall with wind gusts to 50 mph blew the ship 400 feet off location requiring semi-automatic mode for repositioning and interrupted operations for 50 minutes.

On June 29, the drill pipe was pulled to replace a tach generator on one of the stern thrusters. Positioning was threatened in all modes because the No. 1 thruster was intermittently dropping off-line. Transferring control to the other thruster was prevented because of the bad tach generator.

The ship's gyro compass failed on July 12 causing the ship to slew 360° and drift 400 feet off site. The ship was operated in manual mode for 30 minutes during switch over to the secondary gyro compass.

The main propulsion shafts went full astern on July 12 and the problem was traced to an unstable vertical reference gyro. Semi-automatic mode was used for five minutes while switching to the back up gyro.

A total of ten beacons were used. Eight were dropped on site with two failures. Two other beacons were failures during the soaking operation. (Soaking is a shallow water beacon signal test with the beacon suspended by the crane).

Beacon No. 287 failed two days after launch on Site 332 and double life beacon No. 259 was dropped and used for the duration of the site. A quad life beacon No. 316 was dropped nine days later as a standby but was never used for positioning.

On Site 334, two beacons which had exceeded their battery shelf life were soaked and both failed.

On Site 335, the first beacon's signal started fluctuating after 43 hours and another beacon was dropped and used for positioning. The first beacon regained power and continued to produce a steady signal. Maximum vessel excursion during these beacon problems was 150 feet.

SITE 332

Sediment was found only in the valleys of the very hilly ocean floor and since our minimum sediment requirement was 100 meters, the site selection and beacon drop required accuracy. A 13.5 kHz double life beacon was dropped on the third pass over the site streaming profiling equipment.

This first hole on the site was designed to accurately determine by drill pipe measurement the mudline and casing setting depth for the re-entry hole. The standard bottomhole assembly was used and the mudline depth of 1851 meters was determined with punch cores. The sediment was firm and could not be penetrated without pumping. Jetting down continued with 440 GPM to 1924 meters for a casing setting depth and the bit was pulled above the mudline to spud 332A.

SITE 332A

The sediment basalt interface had been troublesome on some other legs and an exploratory hole was planned to evaluate the drillability of this interval prior to setting casing and a re-entry cone. Hole 332A was drilled to 1858 meters and then continuously cored to a total depth of 2288 meters. Two hundred meters of sediment were expected but the first basalt was encountered at 104 meters penetration. This was sufficient sediment to stabilize the bottomhole assembly while drilling the basalt.

The basalt was interlayered with sediment with the sediment fraction decreasing with depth. Very little sediment was recovered because pumping rates were maintained to provide a minimum annular velocity of 120 feet per minute and this tended to wash away the sediment. Because deep penetration into the basalt was the objective, the lack of sediment recovery was tolerated. Core recovery for the hole was 17.1%.

High bit torque and severe pipe sticking problems were encountered from 1990 to 2050 meters and two 75 barrel mud flushes were used to improve hole conditions. With deeper penetration, these problems decreased and the hole seemed to be in excellent condition at total depth. The four cone chisel-shaped insert bit was run 32.25 hours to complete destruction. Only one shank was retrieved. A directional survey at 315 meters penetration showed a hole deviation of 2.9°, N 73°W. The experience in this hole indicated that deep penetration of basalt at this site would be possible with re-entry.

SITE 332B

The re-entry cone had been assembled, welded and braced while enroute from Rio to Recife. The drain slots in the lower cone sections were closed because a mud cross was to be used to divert the cuttings outside the cone.

Arrangements had been made for the submarine "Alvin" to photograph the re-entry cone after operations were completed and a small pinger was installed on one reflector to guide the submarine. The cone was painted white with numbers and stripes to identify the cone sides and to estimate cone subsidence from photographs.

The re-entry cone and 13-3/8" casing was run to the mudline, jetted in 68 meters, and released in 17 hours. All latching and releasing tools functioned as designed and the entire operation appeared to be routine.

The basalt top was found at 1980 meters depth, 25 meters lower than in 332A. Hole conditons were essentially the same as they were in 332A. Spherical insert bits were used in the first 446 meters of penetration and chisel-shaped inserts were used below. Mud flushes averaging 75 barrels were pumped at approximately each 40 meters penetration below the basalt. Mud was also spotted in the hole for trips. This procedure may have been responsible for the lack of hole problems in the basalt. Almost no fill of cuttings or sloughing was found on bottom after trips. A total of 1038 barrels of 9.5 lb/gal (75 vis) mud was used as flushes and 650 barrels were spotted for trips.

A total of nine re-entries were made on Site 332B. Only four bits were used which would normally require only three re-entries but the extra re-entries on this hole were caused by a stuck sonar tool, a suspected break off, and confirmation of suspect re-entries. Parted casing and sidetrack hole complicated the re-entries into the drilled hole but finding and entering the cone became routine.

RE-ENTRY NO. 1

The first bit penetrated 183 meters of basalt and 139 meters of sediment in 19.9 hours. The mud cross was keelhauled and suspended at the top of the 8-1/4" drill collars and the drill string was run to 1832 meters; nine meters above the mudline. The scanning sonar tool landed in the bit at 0400 hours June 25. The reflectors were distinct on the screen at a range of 42 feet. The ship was maneuvered to three offset positions and the location of the cone with respect to the beacon was established. Re-entry was completed at 0545 hours for a total re-entry time of one hour and 45 minutes.

RE-ENTRY NO. 2

Bit No. 2 penetrated 114 meters of basalt in 19.3 hours. The cone search began at 2155 hours on June 27 and ended six hours and 50 minutes later with re-entry. Parts of the mud cross had been left on bottom and several targets appeared on the screen. Many maneuvers were made with the ship without successfully locating the cone as seen on the first re-entry. Another scanning sonar tool was run but the target was still elusive. Assuming that the cone was covered with sediment, re-entry interest focused on a mound of sediment and re-entry was accomplished on the first attempt in the center of the mound.

RE-ENTRY NO. 3

After reviewing the problems of finding the cone on the previous attempt, a plan was developed to pull out of the cone on the next trip out with the pump running to flush the cone and clear the reflectors of any sediment. A threat of a positioning failure resulted in a premature bit trip after penetrating 114 meters of basalt in 19.3 hours. The cone washing plan was used and after repairs were made, the cone search started at 0730 hours on June 30. A mound of sediment immediately appeared in the center of the screen and one stab at re-entry missed (a miss was immediately evident because of the firm sediments).

The scanning sonar connector separated when the search resumed, leaving the tool and thirty feet of lead wire in the drill pipe. Two wireline rope spear runs resulted in leaving all the spear barbs in the pipe with a stuck tool. The drill pipe was tripped to recover the tool. The search began again at 0230 hours, July 1. The sediment mound was located with one reflector visible. The ship was maneuvered and re-entry accomplished at 0537 hours for a total re-entry time of twenty-two hours and seven minutes.

RE-ENTRY NO. 4

After re-entry No. 3, the bit stopped at 1860 meters and fell free with rotation. At the time, this was interpreted as parted casing and it was assumed that the bit entered the casing. The bit actually rolled off and sidetracked the hole because a core was retrieved from the top of the basalt. The scanning sonar tool was run to scan the hole from 1885 to 1856 meters to see if the top of the casing could be detected. Casing response with the tool was unknown but the response at all points in this interval were the same; the screen was clear with no reflections. This section was assumed to be all sediment.

One stand of drill pipe was pulled and the procedure repeated between 1856 and 1843 meters (the mudline was at 1841 meters). At 1854, noise patterns were scattered on the entire screen. At 1853 meters, this noise covered approximately 60 degrees of the screen. This could have been the top of the casing viewed from alongside. The screen was clear again at shallower depths until 1843 meters. At this point, a large oval target appeared in the center of the screen which should have been the base of the cone. The drill string was raised to scan the upper part of the cone and the transducer was broken. The bit was pulled above the cone and another sonar tool was run in and re-entry completed after a 30 minute search.

RE-ENTRY NO. 5

After re-entry, the sonar tool was again used to scan the hole and the responses were repeated. To confirm re-entry, the bit was pulled above the mudline to view the cone from immediately above. We had switched gyros since re-entry No. 3 and to reproduce the same conditions, the bit was pulled nine meters above the mudline to switch back to the other gyro. The search and re-entry was completed in one hour and 25 minutes.

RE-ENTRY NO. 6

The bit was run to 1856 meters and by all indications, it stopped in the sediment. The pipe was again withdrawn from the cone at 0230 hours on July 2. At this time re-entry into the casing seemed almost hopeless and a 12 hour limit was set for completing the re-entry.

The area was searched for other targets and five hours and 35 minutes later the same sediment mound with one reflector visible was re-entered. The casing top was found at 1860 meters but the bit fell into the sidetrack Hole 332C. The bit was pulled back above the casing agin and this time entered the casing of 332B.

RE-ENTRY NO. 7

Bit No. 4 cored to 2562 meters penetrating 171 meters of basalt in 31.5 hours. The search for the cone began at 1730 hours on July 5 and the hole was re-entered at 1800 hours for a re-entry time of 30 minutes. A diamond bit was used this time with a pointed fiberglass nose which had been fabricated and installed by Scripps technicians. It was thought this might guide the bit into the casing as well as protect the bit.

RE-ENTRY NO. 8

After re-entry, a 15,000 pound weight loss was noted while pulling the sonar tool. There was much speculation as to what had happened but the decision was made to pull out of the cone, move off the hole, and drop a core barrel. This was done and the core barrel retrieved proving that the string was intact. The weight loss was attributed to a temperature change in the weight indicator. The cone search began at 2115 hours on July 5 and the hole was re-entered in 43 minutes.

The casing top was found at 1860 meters and resisted re-entry without rotation. A single joint of drill pipe was removed from the string to pick up the power sub. A small amount of sediment was encountered after picking up the power sub and there was some thought that we may have pulled out of the cone while laying down the single joint.

The top of the casing was found but the hole sidetracked. A core was cut and designated 332D. Further efforts to find the casing top were unsuccessful.

As a last check on re-entry, the bit was pulled above the mudline. The search with the sonar tool began at 0740 hours on July 6 but the sonar tool was not functioning properly. Another tool was run and the search began at 0901 hours. The pipe movement had increased with increasing wind and waves and the first stab at the cone missed. Re-entry was completed at 0929 hours for a total re-entry time of three hours and nine minutes. The casing top was found again but the bit appeared to be in the sidetrack hole again and the site was abandoned.

SITE 333

This site was across the small valley from Site 332 and hopefully would encounter the lower basalt section found in Site 332 at a much shallower depth through a possible fault. The first hole on the site again would determine mudline and casing setting depth; then it would core the Upper Basalt.

The beacon drop missed the selected site by 1000 feet and positioning offsets of this amount were required to place the ship over the site.

A diamond bit was used to evaluate its core recovery ability in the basalt. A firm mudline was found at 1682 meters and sediments were washed through to 1828 meters. The remaining 69 meters of sediment were cored and the bit stopped at 1913 meters recovering one small piece of basalt.

Hole 333A was the re-entry hole and to possibly encounter a shorter sediment layer, the ship was moved up slope an additional 200 feet west. To eliminate the excessive offsets and simplify future re-entries, another beacon was dropped at the site. The re-entry cone was assembled, keelhauled, and casing run and jetted in place at 70 meters penetration in 31 hours.

The first bit, a chisel shaped insert, plugged and the inner barrel stuck after coring 65 meters of the sediment basalt rubble zone to 1962 meters. The drill string was pulled and the bottomhole assembly cleared of fine cuttings.

The second chisel bit run experienced hole problems similar to that of the two previous holes on Site 332. The drill string stuck permanently at 2209 meters while pulling a core. The drill string was severed in the lower bumper sub with two severing tools leaving the bit, a monel core barrel, three 8-1/4" drill collars and a piece of bumper sub in the hole. A submarine pinger was dropped and the site abandoned.

RE-ENTRY

Re-entry was routinely accomplished without any maneuvering of the ship. The first view with the scanning sonar indicated that the cone was immediately below the bit. Polaroid photographs were taken of one scanning cycle from 13 meters and 6 meters above the cone. Re-entry was completed in 28 minutes including the time used for photographs.

After re-entry, the sonar tool was lowered again to photograph scanning cycles inside the casing. This information would be valuable in future re-entries as a method to confirm re-entry in very soft sediments. The image on the sonar screen when the tool is inside casing is very similar to the image when in drill pipe.

SITE 334

With only seven operating days remaining for the leg, setting up another re-entry site was not considered. The next site 334, would be a further extension west away from the median valley and along a flow line through Sites 332 and 333 in magnetic anomaly five. This would explore the effect of aging from 3-1/2 to 10 million years and hopefully, eliminate some of the hole problems experienced in the poorly cemented rubble zones in holes nearer the median valley.

The water depth at this site was 2632 meters. The sediments were very soft and the first 230 meters of the 259 meter sediment layer were penetrated with 10 to 20 thousand pounds of bit weight and only occasional use of the pump to break circulation. Core recovery in the sediment was 54.9%. A total of 117 meters of basalt were cored with 20.2% recovery. The interlayered sediment basalt section was trouble free.

Lower penetration rates and bit bouncing, which was severe at times, reduced the expected bit life by 50% in spite of the continued use of the heave compensator. Apparently a more massive basalt section had been penetrated in this hole.

SITE 335

This site was 41.5 miles west northwest of Site 334 along the same flow line from the median valley. The objective was to core 16 million year old crust to complete this leg's study of the effects of time and depth in this area.

The sediment layer was 454 meters thick and coring in this section was minimized to allow more time to core basalt. Core recovery in the sediment was 46.8%. Basalt recovery was very good with 37.7%. Hole conditions were generally good but some bit plugging did occur requiring 200 barrels of mud to flush the hole.

Core recovery became very poor and erratic bit torque was experienced from 3742 to 3760 meters, suggesting that the bit was not intact. The core recovery for this interval was 0.45 meters. The last two meters to 3762 meters cored very slowly with very little torque and no recovery. The bit was pulled but was in much better condition than expected with the bearing seals still effective. Apparently an abrupt formation change occurred which was misinterpreted as a bit failure.

REVIEW OF LEG 37 PROBLEMS

The first successful landing of the mud cross was on Site 332B and on the first retrieval it was inspected by divers and found to be severely damaged. The weather was too severe to risk divers and lines over the side to retrieve the cross and it was dropped 1000 feet from the cone. The casing parted on this hole just below the re-entry cone and it is possible and very probable that the mud cross was responsible for this damage.

Cuttings build-up in the cone did not seem to be a problem on this leg. Most of the problems were downhole and a cuttings removal system did not appear necessary. A means for jetting the cone clean periodically while the bit is in the hole circulating would appear to be sufficient. This would also aid re-entry by washing cuttings away from the reflectors.

The casing set in these sediments is poorly supported when initially installed and drilling vibrations probably weaken the sediments substantially. In some cases the re-entry cone may be the primary casing support. For multiple re-entries, the casing should support itself and the cone and in this area, this could best be accomplished with a second string of casing set and cemented into the basalt. Cementing between casing strings may be difficult and a mechanical connection between them may be preferred.

The diamond bit did not perform in the interbedded basalt and sediments but should do well in the lower more continuous basalt. Diamond bit cuttings are very small and hole problems may be minimized using the bit.

Hole problems in the Upper Basalt layers seem to be caused by the bit working its way through zones of rubble consisting of pillows of basalt in the lower sediments. These hole problems exist only while drilling the section and seem to diminish with depth.

The deeper hole problems seem to be related to core recovery. The unrecovered core may be more important to operations than the recovered core. When basalt core recovery is high, hole problems are almost nonexistent. There are layers in the basalt which are not recovered and these could be glass or other material which is crushed and washed away from the core barrel. These cuttings accumulate in the annulus and are difficult to flush out of the hole. A large weighted mud flush might successfully remove this material.

The hole problems seem to decrease with distance from the median valley of the mid Atlantic Ridge and deep penetration on future legs might take advantage of this.

Using core diameter to monitor bit condition worked very well but selection of the core segments for measuring is very critical. Only undamaged cores should be used. A good example of this is the last core measurement on Site 335 where only 0.35 meters were recovered. Large changes in core diameter should be suspected because sudden bit failure is abnormal. Losing a bit cone in the hole, especially in the Lower Basalt, would mean abandonment of the hole unless tools such as reverse circulating and core cutting junk baskets are available. Other retrieval tools such as overshots, etc., would be desirable.

COMMUNICATIONS

Except for a few days, incoming traffic could be received directly from WWD. Outgoing traffic could be sent via Navy (NST, Londonberry) or, in small amounts, via the Coast Guard, Norfolk (NMN). Commercial traffic was difficult with WWC (Chatham) however, it was easier via Radio Halifax (VCS). Radio telephone calls were made through Radio New York (WOO).

DRILL PIPE SEVERING TOOL

On Site 333A, the string was stuck below the bottom bumper sub. Three severing tools were run to sever the string in the bumper sub. The first tool apparently broke off in the latch sub. The second tool fired satisfactorily and ruptured the sub allowing fluid circulation. The third shot fired and after pulling 200,000 pounds above the string weight, the sub parted. This operation consumed 18 hours because of multiple runs and reheading the Schlumberger line.

HEAVE COMPENSATOR

The heave compensator worked very well when used but its use was restricted to periods of minimum seas. Handling the compensator in rough seas with the present equipment, especially picking it up or setting it back, is very difficult with unacceptable risks to drilling personnel safety. Heavier guide rails have been designed which will provide more support in the derrick, but improvements are needed in the setback equipment to make a safer operation. The usual stroke was from one to two feet with an occasional five foot stroke. Weight indicator fluctuations were usually less than 1500 pounds.

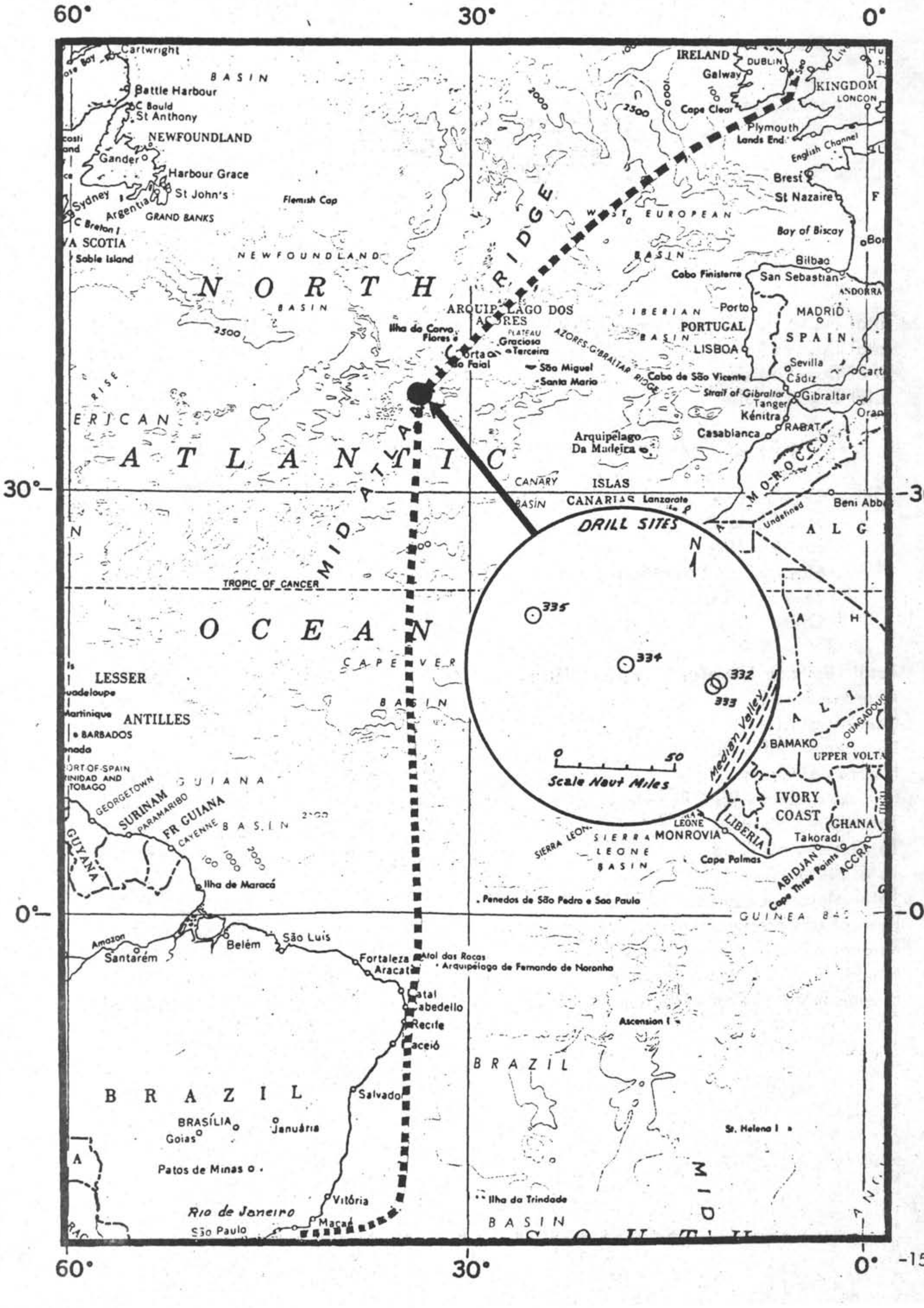
PERSONNEL

Commending the GMI and SIO personnel seems to be a ritual in these operations reports but it is well deserved because they are an excellent team. There seems to be an unusual desire for scientific and technical success throughout the ship in both groups and as a result, they are very conscientious and efficient in their work. Any credits for the successes of this leg should go to them.

We were also very fortunate in having a very congenial group of scientists representing France, Russia, Germany, Canada and the United States.

It was an honor and a pleasure to have been associated with all three groups.

D. L. Edmiston
Cruise Operations Manager
Deep Sea Drilling Project


60°
30°
0°
NORTH ATLANTIC OCEAN
MID ATLANTIC RIDGE
DRILL SITES
N
335
334
332
333
Median Valley
0
50
Scale Naut Miles
NEWFOUNDLAND
Cartwright
Battle Harbour
C Bauld
St Anthony
Gander
Harbour Grace
St John's
Sydney
Argentia
GRAND BANKS
C Breton I
Sable Island
Flemish Cap
NEWFOUNDLAND BASIN
ARQUIPELAGO DOS AÇORES
Ilha do Corvo
Flores
Graciosa
Terceira
Horta
do Faial
São Miguel
Santa Maria
AZORES-GIBRALTAR RIDGE
WEST EUROPEAN BASIN
IBERIAN BASIN
IRELAND
DUBLIN
Galway
Cape Clear
KINGDOM
LONDON
Plymouth
Lands End
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Bilbao
Cabo Finisterre
San Sebastian
ANDORRA
Porto
PORTUGAL
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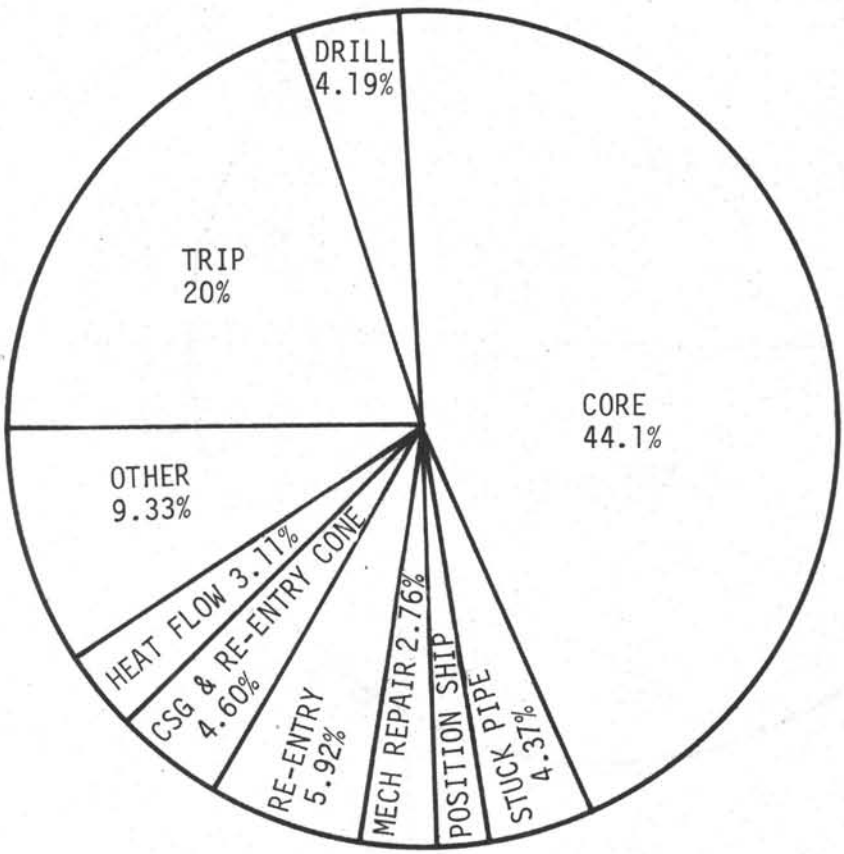
Sevilla
Cádiz
Cabo de São Vicente
Strait of Gibraltar
Gibraltar
Tanger
Kénitra
RABAT
Casablanca
MOROCCO
Arquipélago Da Madeira
CANARY BASIN
ISLAS CANARIAS
Lanzarote
Beni Abbes
Undefined
TROPIC OF CANCER
CAPE VERDE BASIN
LESSER ANTILLES
Guadeloupe
Martinique
BARBADOS
PORT-OF-SPAIN
TRINIDAD AND TOBAGO
GUIANA BASIN
GEORGETOWN
SURINAM
PARAMARIBO
FR GUIANA
CAYENNE
GUYANA
Ilha de Maracá
BAMAKO
UPPER VOLTA
OUAGADOUGOU
IVORY COAST
GHANA
LIBERIA
MONROVIA
SIERRA LEONE
SIERRA LEONE BASIN
Cape Palmas
Takoradi
ABIDJAN
Cape Three Points
ACCRA
Penedos de São Pedro e Sao Paulo
GUINEA BASIN
Amazon
Santarém
Belém
São Luis
Fortaleza
Aracati
Atol das Rocas
Arquipélago de Fernando de Noronha
Natal
Cabedello
Recife
Maceió
Salvador
Ascension I
BRAZIL BASIN
BRAZIL
BRASÍLIA
Goias
Januária
Patos de Minas
St. Helena I
Vitória
Rio de Janeiro
São Paulo
Macaé
Ilha da Trindade

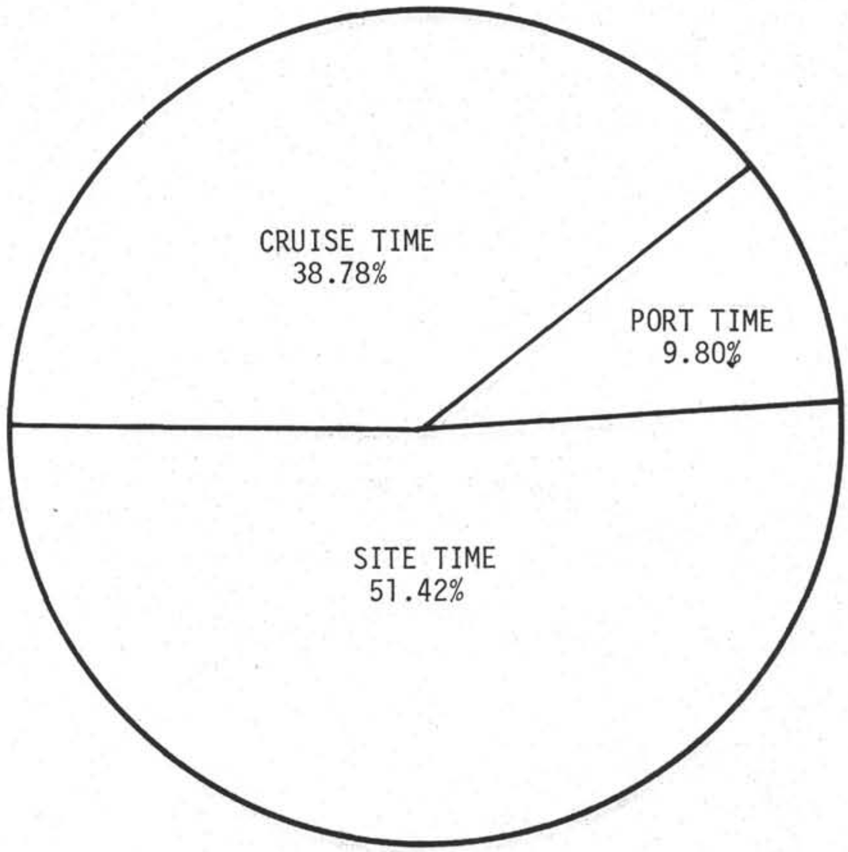
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 37

Total Days (May 22, 1974 - July 29, 1974)		67.67
Total Days In Port		6.63
Total Days Cruising		26.24
Total Days On Site		34.80
Trip Time	6.96	
Drilling Time	1.46	
Coring Time	15.35	
Stuck Pipe	1.52	
Position Ship	0.56	
Mechanical Downtime	0.96	
Re-entry Time	2.06	
Other	5.93	
Total Distance Traveled (Nautical Miles		5987.0
Average Speed		9.5
Number of Sites		4
Number of Holes Drilled		9
Number of Cores		156
Percent of Cores With Recovery		97.4
Total Penetration		3191.0
Total Meters Drilled		1414.5
Total Meters Cored		1776.5
Total Meters Recovered		405.8
Percent of Core Recovered		22.8
Percent of Total Penetration Cored		55.8
Maximum Water Depth (Meters)		3198.0
Minimum Water Depth (Meters)		1680.0

DEEP SEA DRILLING PROJECT
LEG 37
ON-SITE TIME DISTRIBUTION



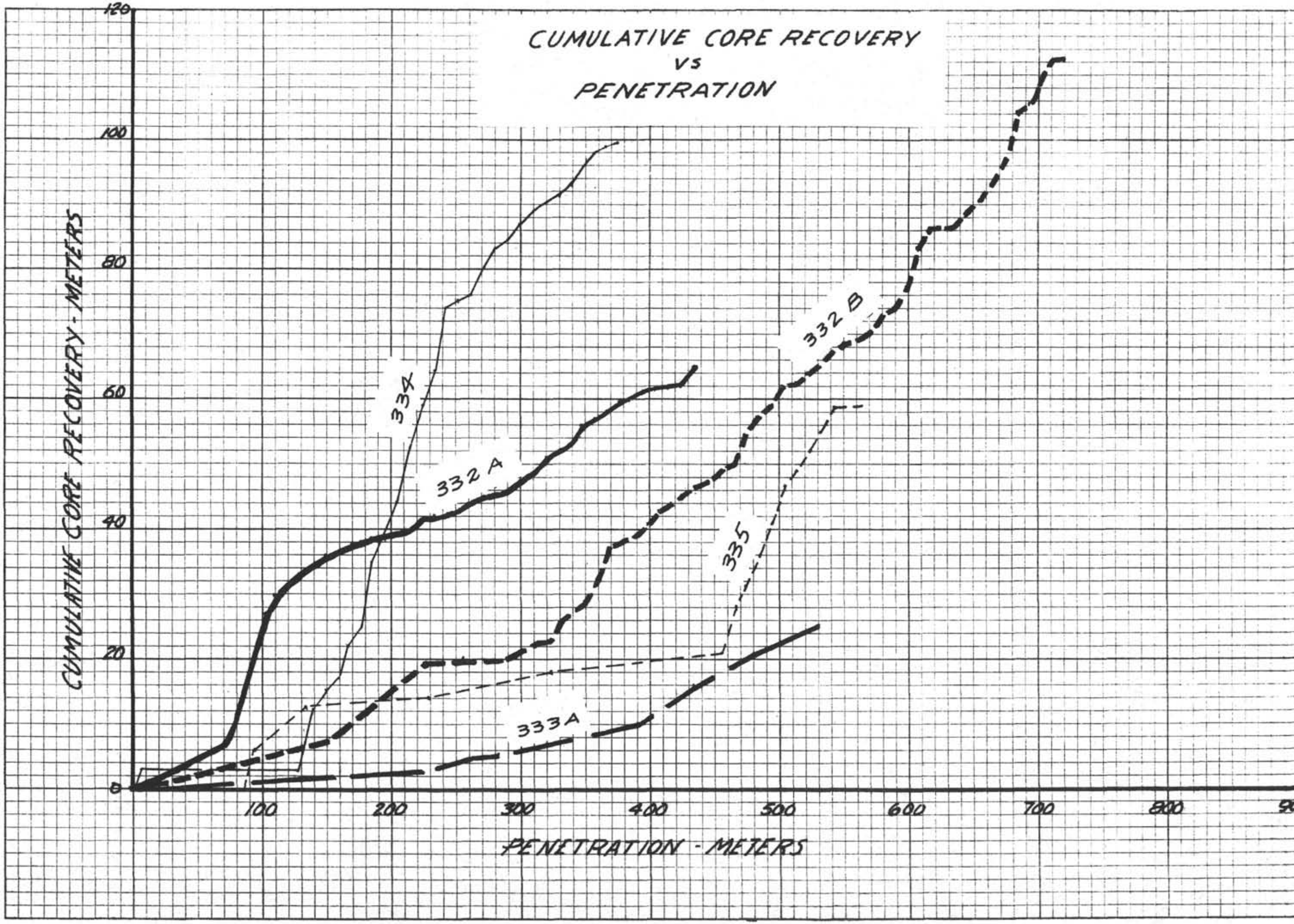
DEEP SEA DRILLING PROJECT
LEG 37
TOTAL TIME DISTRIBUTION

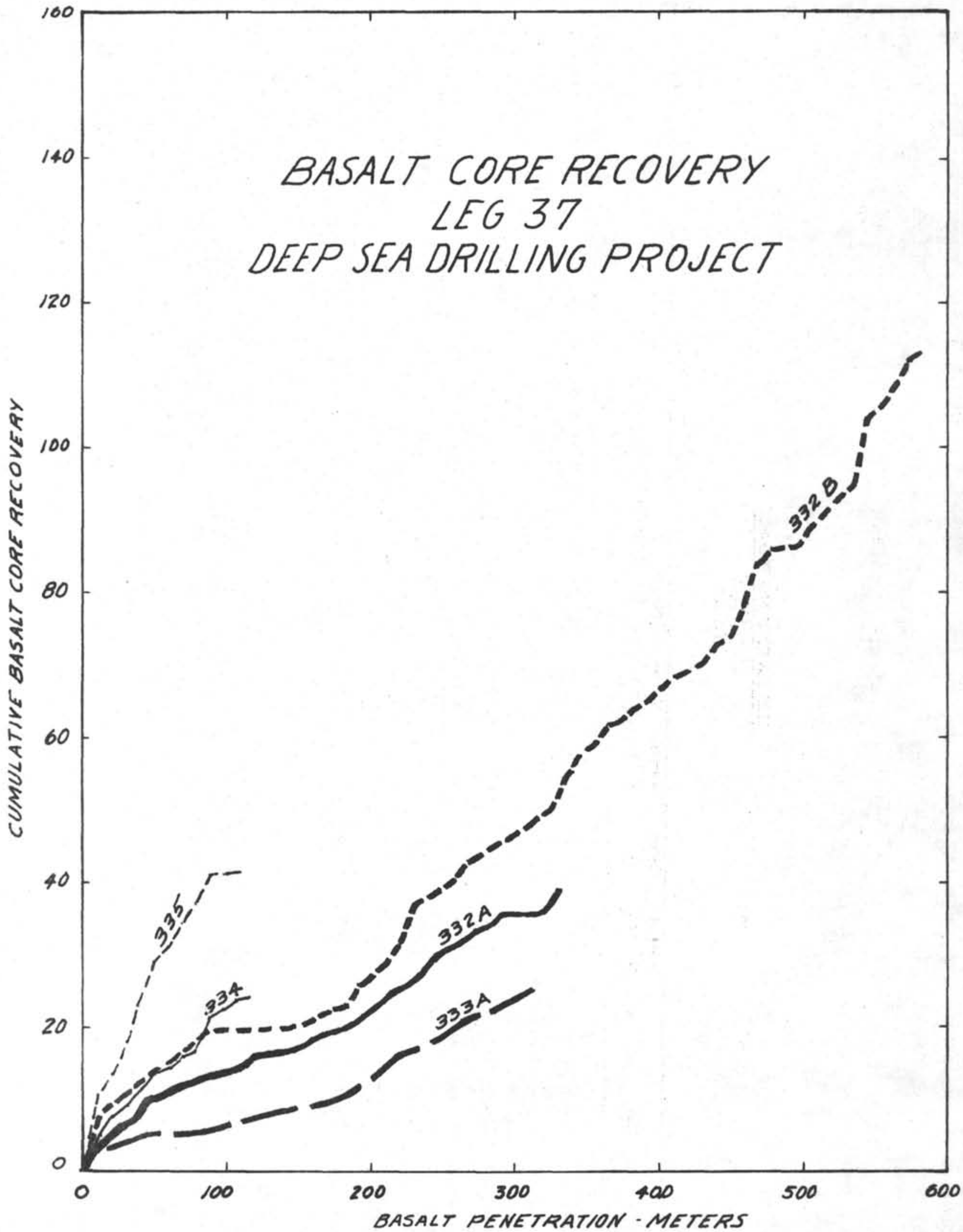


CORING DATA

Hole No.	Penetration		Basalt			Sediment	
		Top	Cored	Recovered	Drilled	Cored	Recovered
332	73.5				66.5	7.0	3.6
332A	437.5	104.0	333.5	39.75	54.5	49.5	26.9
332B	721.5	139.0	582.5	112.01	139.0	(9.5)	(9.5)
332C	129.0				119.5	9.5	1.1
332D	129.0				123.0	6.0	0.35
333	231.0			.03	161.5	69.5	38.0
333A	529.0	217.0	312.0	25.21	217.0	0.	0.
334	376.5	259.0	117.5	24.15	123.5	135.5	75.4
335	564.0	454.0	110.0	41.5	410.0	44.0	17.8
Total	3191.0		1455.5	242.65	1414.5	321.0	163.15

(9.5) Core full of cuttings after trip.


CUMULATIVE CORE RECOVERY
VS
PENETRATION
CUMULATIVE CORE RECOVERY - METERS
PENETRATION - METERS
120
100
80
60
40
20
0
100
200
300
400
500
600
700
800
900
334
332 A
332 B
335
333A



BASALT CORE RECOVERY
LEG 37
DEEP SEA DRILLING PROJECT
CUMULATIVE BASALT CORE RECOVERY
BASALT PENETRATION - METERS
0
20
40
60
80
100
120
140
160
100
200
300
400
500
600
335
334
332A
333A
332 B

DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 37

Hole	Mfg.	Size	Type	Serial Number	Meters Cored	Meters Drilled	Meters Total Penet.	Hours On Bit	Condition	Remarks
332	Smith	10-1/8"	F94CK	RC898	7.0	66.5	73.5	1.5	Not Pulled	Cored mudline & washed down to determine casing seat.
332A	Smith	10-1/8"	F94CK	RC898	383.0	54.5	437.5	32.25	T8, B8, Out Of Gage	All cones & 3 shanks missing. Cored 333.5m basalt.
332B	Smith	10-1/8"	F99CK	SV856	183.5	139.0	322.5	19.91	T2, B8, G 1/4"	183.5m basalt.
332B	Smith	10-1/8"	F99CK	SV839	114.0	0	114.0	19.33	T2, B-SE, GO	Bearing seals effective. 114m basalt.
332B	Smith	10-1/8"	F94CK	SZ080	114.0	0	114.0	16.08	T2, B-SE, GO	Bearing seals effective. Pulled for repairs.
332B	Smith	10-1/8"	F94CK	SZ072	171.0	0	171.0	31.56	T3, B-SE, GO	Bearing seals effective. 171 m basalt.
333	Christensen	10-1/8"	MC23	45712	69.5	161.5	231.0	10.55	5% salvage	
333A	Smith	10-1/8"	F94CK	SZ085	65.0	217.0	282.0	4.58	T1, B1, GO	Plugged BHA.
333A	Smith	10-1/8"	F94CK	SZ086	247.0		247.0	18.15	Left In Hole	Drill string stuck & severed.
334	Smith	10-1/8"	F94CK	SZ085	253.0	123.5	376.5	20.9	T8, B8, G 1/4"	Two cones missing. 117m basalt.
335	Smith	10-1/8"	F94CK	SZ073	154.0	410.0	564.0	22.77	T4, B-SE, GO	110m basalt.

DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 37

Hole	Latitude	Longitude	Water Depth Meters	Number Of Cores	Cores With Recovery	Percent With Recovery	Meters Cored	Meters Recovered	Percent Recovered	Meters Drilled	Total Penet. Meters	Avg. Rate Penet.	Time On Hole	Time On Site
Famous Area Mid-Atlantic Ridge														
332	36° 52.76'N	33° 38.57'W	1851	1	1	100.0	7.0	3.6	51.4	66.5	73.5	15.0	15.5	
332A	36° 52.76'N	33° 38.57'W	1851	41	40	97.5	383.0	66.65	17.4	54.5	437.5	11.7	98.0	
332B	36° 52.76'N	33° 38.57'W	1841	48	48	100.0	582.5	112.01	19.2	139.0	721.5	8.3	346.0	
332C	36° 52.76'N	33° 38.57'W	1841	1	1	100.0	9.5	1.1	11.6	119.5	129.0	64.5	2.0	
332D	36° 52.76'N	33° 38.57'W	1841	1	1	100.0	6.0	0.35	5.8	123.0	129.0	43.0	3.0	
														464.5
333	36° 50.45'N	33° 40.05'W	1682	9	8	88.9	69.5	38.0	54.6	161.5	231.0	21.9	36.5	
333A	36° 50.45'N	33° 40.05'W	1680	11	11	100.0	312.0	25.21	8.0	217.0	529.0	23.27	132.5	
														169.0
334	37° 02.13'N	34° 24.87'W	2632	27	27	100.0	253.0	99.55	39.3	123.5	376.5	18.01	76.5	76.5
335	37° 17.74'N	35° 11.92'W	3198	17	15	88.0	154.0	59.3	38.5	410.0	564.0	24.77	86.0	86.0
		Totals		156	152	97.4	1776.5	405.77	22.8	1414.5	3191.0		796.0	796.0

DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 37

Site No.	Make	Freq. kHz	Serial Number	Site Time Hours	
332	ORE	13.48	287	78.0	Complete signal lost in 30 minutes.
332	ORE	16.01	259	386.4	12 day beacon still at normal power at departure.
332	ORE	13.5	316	169.2	Quad life beacon dropped on 9th day of beacon 259.
333	ORE	16.01	254	169.0	Six day beacon.
333	ORE	13.48	280	110.25	12 day beacon.
	ORE	13.5	217	0	Weak signal during soak. Battery life exceeded.
	ORE	13.5	227	0	Weak signal during soak. Battery life exceeded.
334	ORE	16.0	252	76.5	6 day beacon.
335	ORE	13.49	288	86.0	Signal level dropped after 43 hours. Fluctuated, then stabilized.
335	ORE	16.01	253	43.0	6 day beacon dropped when beacon #288 signal dropped.

TIME DISTRIBUTION
LEG - 37

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
5.22.74		.	.	.	.	.	.	.	.	14.75	.	.	14.75	
5.23.74		.	.	.	.	.	.	.	.	24.0	.	.	24.0	
5.24.74		.	.	.	.	.	.	.	.	24.0	.	.	24.0	
5.25.74		.	.	.	.	.	.	.	.	24.0	.	.	24.0	
5.26.74		.	.	.	.	.	.	.	.	24.0	.	.	24.0	
5.27.74		.	.	.	.	.	.	.	.	24.0	.	.	24.0	
5.28.74		.	.	.	.	.	.	.	.	20.7	.	.	20.7	Depart 2042 Hrs.
TOTAL PORT TIME RIO DE JANEIRO, BRAZIL										155.45			155.45	
5.28.74	TEST	3.3	.	.	.	.	.	.	.	.	.	.	3.3	
5.29.74		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
5.30.74		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
5.31.74		2.0	.	.	.	.	.	.	.	.	.	7.0	9.0	Test S-Auto Thrusters
. .		.	.	.	.	.	.	.	.	.	.	10.5	10.5	Test Scan Sonar
. .		.	1.0	.	.	.	.	.	.	.	.	3.5	4.5	Test Heave Comp.
6.1.74		.	2.0	.	.	.	.	.	.	.	.	4.0	6.0	Test & Repair Auto Thrusters
TOTAL		53.3	3.0									25.0	81.3	
6.1.74	332	13.5	.	.	.	.	.	.	.	.	.	4.5	18.0	Test & Repair Position Syst.
6.2.74		19.5	.	.	.	.	.	.	.	.	.	4.5	24.0	"
6.3.74		23.2	.	.	.	.	.	.	.	.	.	0.8	24.0	"
6.4.74		24.0	.	.	.	.	.	.	.	.	.	.	24.0	

TIME DISTRIBUTION
LEG - 37

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
6.5.74	332	19.4	.	.	.	.	.	.	.	Recife 3.6	.	.	23.0	Advanced clock 1 Hr.
6.6.74		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
6.7.74		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
6.8.74		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
6.9.74		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
6.10.74		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
6.11.74		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
6.12.74		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
6.13.74		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
6.14.74		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
6.15.74		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
6.16.74		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
6.17.74		11.0	9.0	.	1.5	.	.	1.0	.	.	.	1.5*	24.0	*Survey Site
6.18.74		.	1.0	1.5*	1.5	.	.	.	.	.	.		4.0	*wash down to determine casing seat
TOTAL	332	374.6	10.0	1.5	3.0	.	.	1.0	.	3.6	.	11.3	405.0	
6.18.74	332A	.	.	1.0	16.5	1.0	.	.	.	.	.	1.5*	20.0	*Heat Flow @ 1934 m
6.19.74		.	.	.	22.0	1.0	.	1.0	.	.	.	.	24.0	
6.20.74		.	.	.	23.0	.	.	.	.	.	.	1.0*	24.0	*Beacon Failure
6.21.74		.	.	.	21.0	.	.	.	1.0**	.	.	2.0*	24.0	* Multi-Shot ** Power Sub
6.22.74		.	4.5	.	.	.	.	.	.	.	.	1.5*	6.0	* Spot 75 Bbl mud
TOTAL	332A		4.5	1.0	82.5	2.0		1.0	1.0			6.0	98.0	

TIME DISTRIBUTION

LEG - 37

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
6.22.74	332B	.	5.0	.	.	.	.	.	.	.		10.0 * 3.0**	18.0	*Pick Up Csg, Cone, & Jet string **Jetting Casing
6.23.74		.	.	12.5	9.0	.	.	.	.	.	.	2.5*	24.0	*Heat Probe
6.24.74		.	12.0	2.0	4.5	1.5	.	.	.	.	3.0	1.0*	24.0	Spot 100 Bbl mud for trip
6.25.74		.	3.0	2.0	6.0	.	.	.	4.0	.	6.5	1.5* 1.0**	24.0	* Fish ** Ream 4M
6.26.74		.	.	.	22.0	.	.	.	.	.	.	2.0	24.0	Fish Core Barrel Shoe
6.27.74		.	13.0	.	2.0	2.5	.	1.0	.	.	4.0	1.5	24.0	Move Ship & Drop Mud Cross
6.28.74		.	7.5	.	10.0	.	.	.	.	.	4.5	2.0	24.0	Pick Up Heave Comp.
6.29.74		.	.	.	17.0	0.5	.	.	6.5*	.	.	.	24.0	* Thrusters
6.30.74		.	5.5	.	.	.	.	.	7.0	.	3.5	8.0*	24.0	*Trip to fish Edo tool
SUB TOTAL	332B		(46.0)	(16.5)	(70.5)	(4.5)	.	(1.0)	(17.5)	.	(21.5)	(32.5)	(210.0)	
7.1.74	332C	.	.	1.0	1.0	.	.	.	.	.	.	.	2.0	Sidetrack from 332 B
TOTAL	332C			1.0	1.0								2.0	
7.1.74	332B	.	3.5	.	.	.	.	.	4.5*	.	11.0	3.0**	22.0	*EDO Repair **Wash to Bottom
7.2.74		.	6.0	.	9.0	.	.	.	.	.	3.0	2.0* 4.0**	24.0	*Wash to Bottom **Heat Flow
7.3.74		.	.	.	24.0	.	.	.	.	.	.	.	24.0	
7.4.74		.	.	.	22.5	.	.	.	.	.	.	1.5*	24.00	*Deviation Survey
7.5.74		.	13.5	.	1.0	.	.	.	.	.	9.5	.	24.0	
7.6.74		.	9.0	.	.	.	.	5.0	.	.	2.0	2.0*	18.0	*Soak Beacons
TOTAL	332B	.	78.0	16.5	127.0	4.5	.	6.0	22.0	.	47.0	45.0	346.0	
7.6.74	332D	.	.	2.0	1.0	.	.	.	.	.	.	.	3.0	Sidetrack from 332 B
TOTAL	332D			2.0	1.0								3.0	

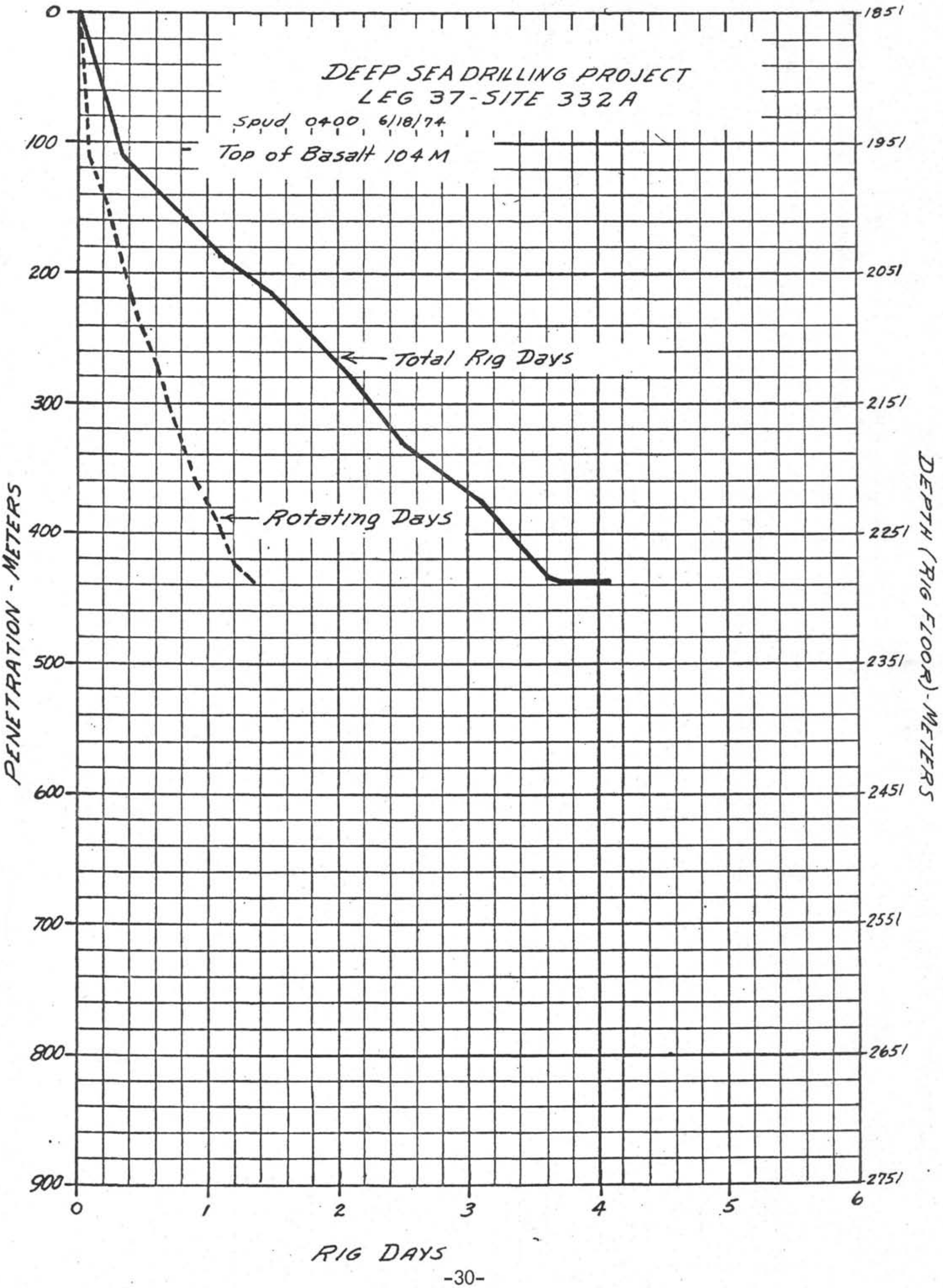
TIME DISTRIBUTION
LEG - 37

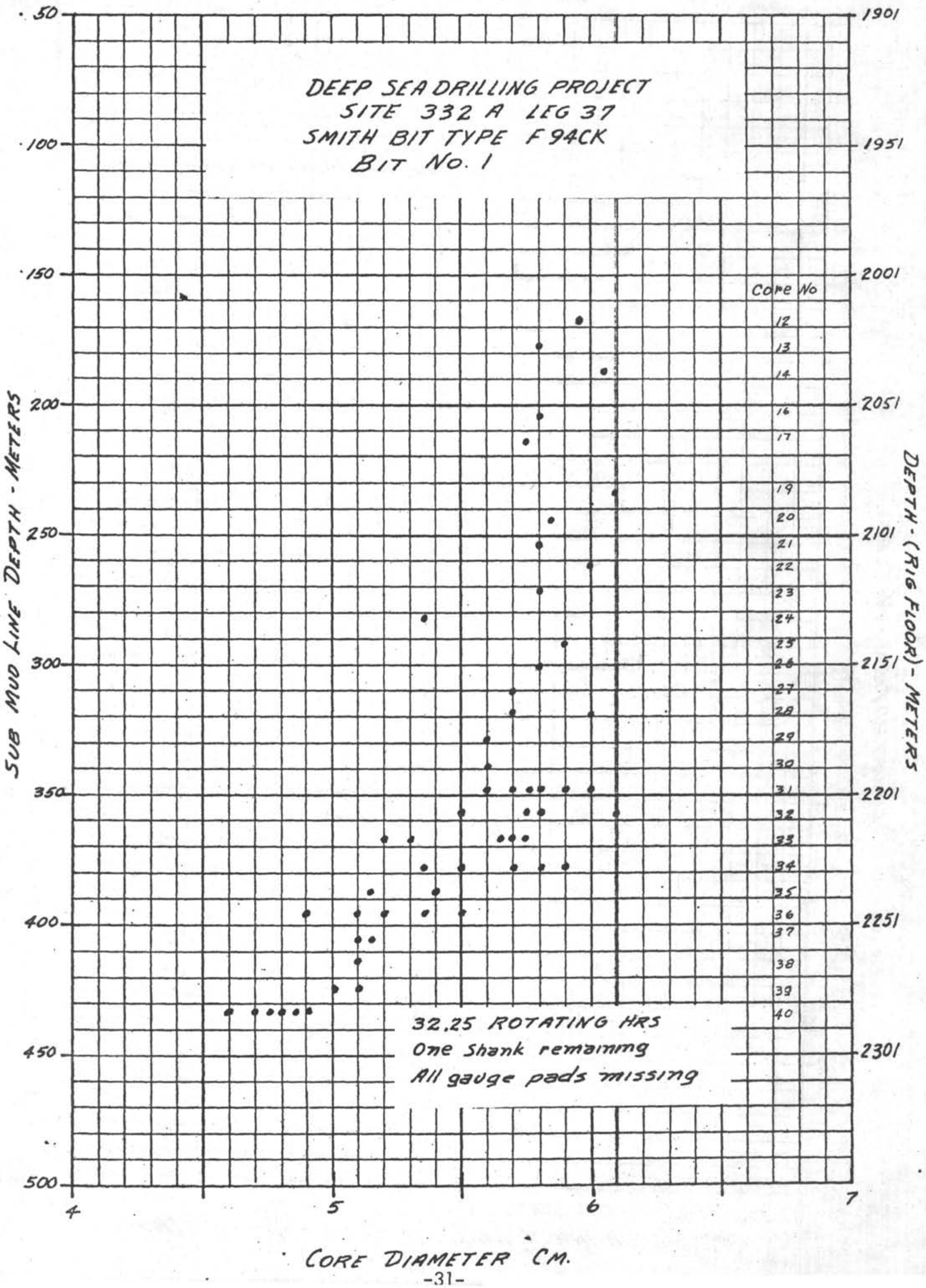
Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
7.6.74	333	3.0	.	.	.	.	.	.	.	.	.		3.0	
7.7.74		1.5	7.0	2.5	9.5	.	.	2.5	.	.	.	1.0*	24.0	*Heat Probe
7.8.74		.	5.5	.	8.5	.	.	.	.	.	.	.	14.0	
TOTAL	333	4.5	12.5	2.5	18.0	.	.	2.5	.	.	.	1.0	41.0	
7.8.74	333A	.	.	.	.	.	.	.	.	.	.	10.0*	10.0	* Assemble Re-entry Cone
7.9.74		.	7.5	1.0	.	.	.	.	.	.	.	9.5* 6.0**	24.0	* and. Keel haul **Run & det Csg
7.10.74		.	9.5	1.5	7.0	2.0	.	.	.	.	.	4.0*	24.0	*Plugged bit
7.11.74		.	4.5	.	15.0	.	.	.	.	.	2.5	2.0*	24.0	*Ream to bottom
7.12.74		.	.	.	18.5	5.5	.	.	.	.	.	.	24.0	
7.13.74		.	1.5	.	.	22.5	.	.	.	.	.	.	24.0	
7.14.74		.	1.5	.	.	.	.	.	.	.	.	1.0*	2.5	*Soak beacons
TOTAL	333A	.	24.5	2.5	40.5	30.0	.	.	.	.	2.5	32.5	132.5	
7.14.74	334	7.0	8.0	1.5	2.0	.	.	2.0	.	.	.	1.0*	21.5	* Heat Probe
7.15.74		.	.	.	22.0	.	.	.	.	.	.	2.0*	24.0	* Heat Probe
7.16.74		.	.	.	20.0	.	.	.	.	.	.	1.0* 3.0**	24.0	* Plugged bit ** Heat Probe
7.17.74		.	6.5	.	7.5	.	.	.	.	.	.	.	14.0	
TOTAL	334	7.0	14.5	1.5	51.5	.	.	2.0	.	.	.	7.0	83.5	
7.17.74	335	10.0	.	.	.	.	.	.	.	.	.	.	10.0	
7.18.74		.	8.0	6.0	4.5	.	.	1.0	.	.	.	4.5*	24.0	*Heat Probe
7.19.74		.	.	0.5	22.5	.	.	.	.	.	.	1.0*	24.0	*Plugged bit

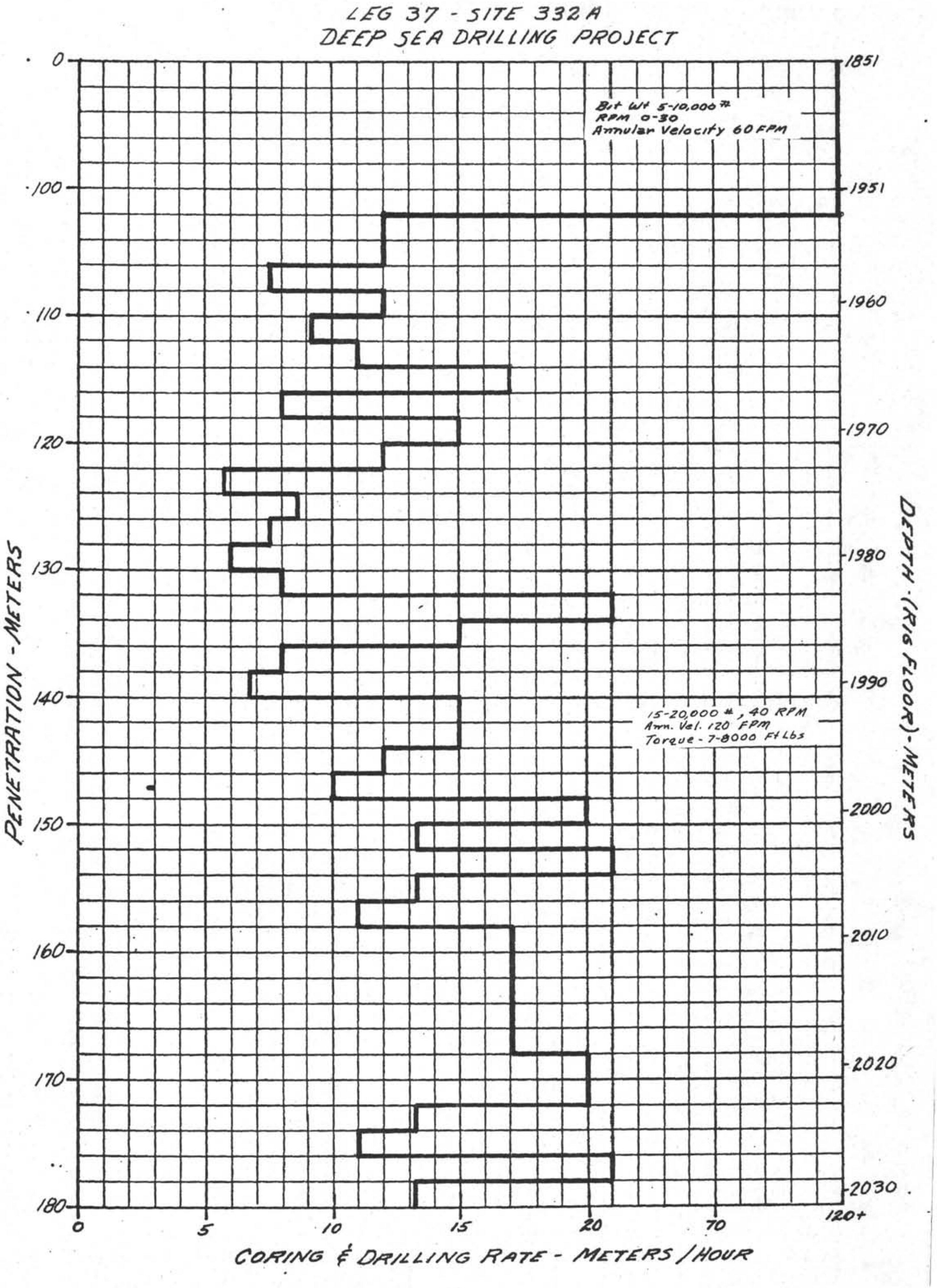
TIME DISTRIBUTION

LEG - 37

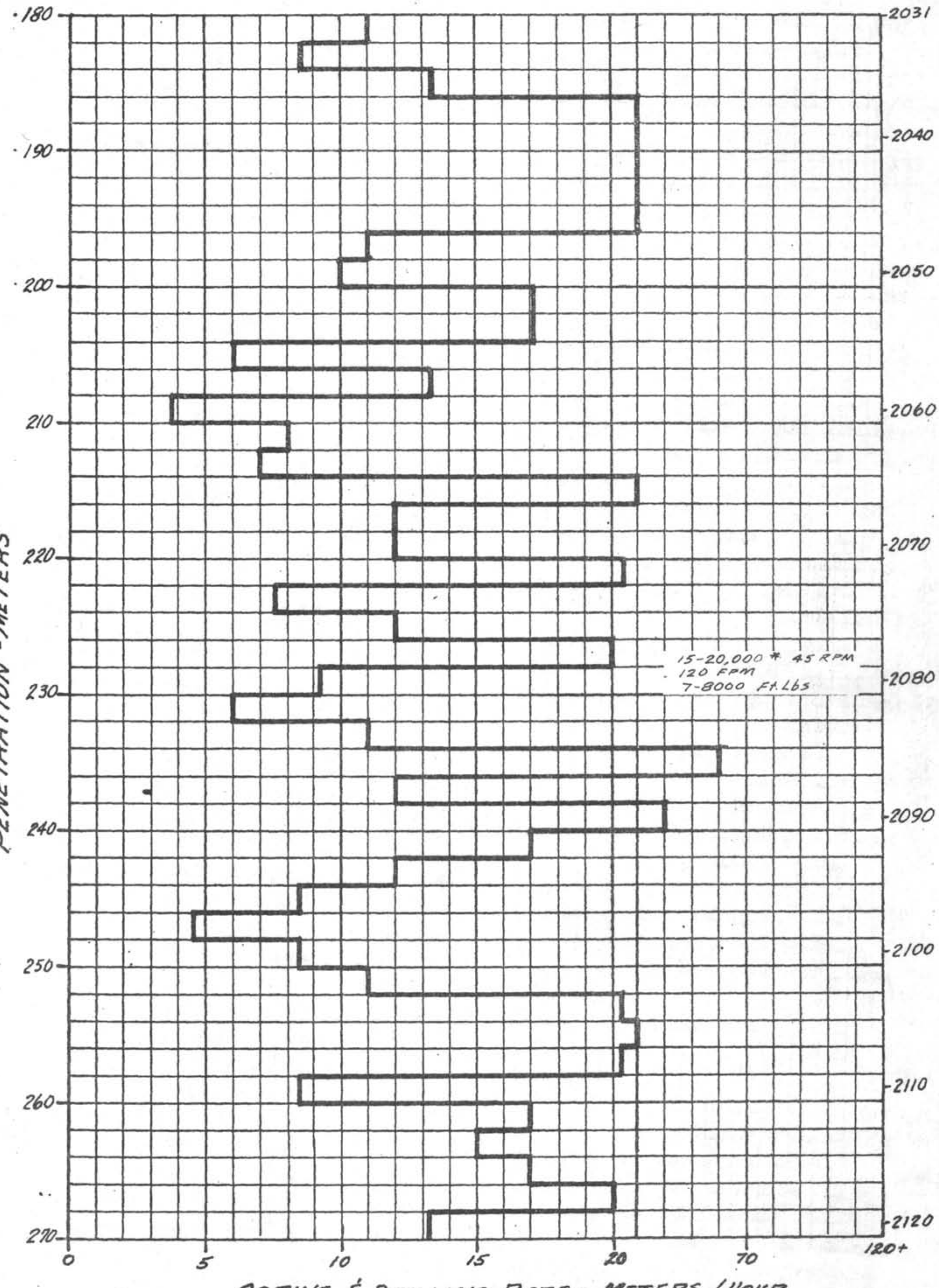
Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
7·20·74	335	.	.	.	17.0	.	.	.	.	.	.	4.5* 2.5**	24.0	* Heat Probe **Plugged Bit
7·21·74		.	12.0	.	.	.	.	.	.	.	.	2.0*	14.0	* Heat Probe
TOTAL	335	10.0	20.0	6.5	44.0	.	.	1.0	.	.	.	14.5	96.0	
7.21.74	Dublin	8.0	.	.	.	.	.	.	.	.	.	2.0*	10.0	*Test thrusters
7.22.74		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
7.23.74		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
7.24.74		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
7.25.74		23.0	.	.	.	.	.	.	.	.	.	.	23.0	
7.26.74		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
7.27.74		23.0	.	.	.	.	.	.	.	.	.	.	23.0	
7.28.74		23.0	.	.	.	.	.	.	.	.	.	.	23.0	
7.29.74		5.4	.	.	.	.	.	.	.	.	.	.	5.4	
TOTAL		178.4	.	.	.	.	.	.	.	.	.	2.0	180.4	
. .		.	.	.	.	.	.	.	.	.	.	.	.	
. .		.	.	.	.	.	.	.	.	.	.	.	.	
. .		.	.	.	.	.	.	.	.	.	.	.	.	
. .		.	.	.	.	.	.	.	.	.	.	.	.	
. .		.	.	.	.	.	.	.	.	.	.	.	.	
. .		.	.	.	.	.	.	.	.	.	.	.	.	
. .		.	.	.	.	.	.	.	.	.	.	.	.	


DEEP SEA DRILLING PROJECT
LEG 37-SITE 332 A
Spud 0400 6/18/74
Top of Basalt 104 M
Total Rig Days
Rotating Days
PENETRATION - METERS
DEPTH (RIG FLOOR) - METERS
RIG DAYS
0
100
200
300
400
500
600
700
800
900
1851
1951
2051
2151
2251
2351
2451
2551
2651
2751
0
1
2
3
4
5
6

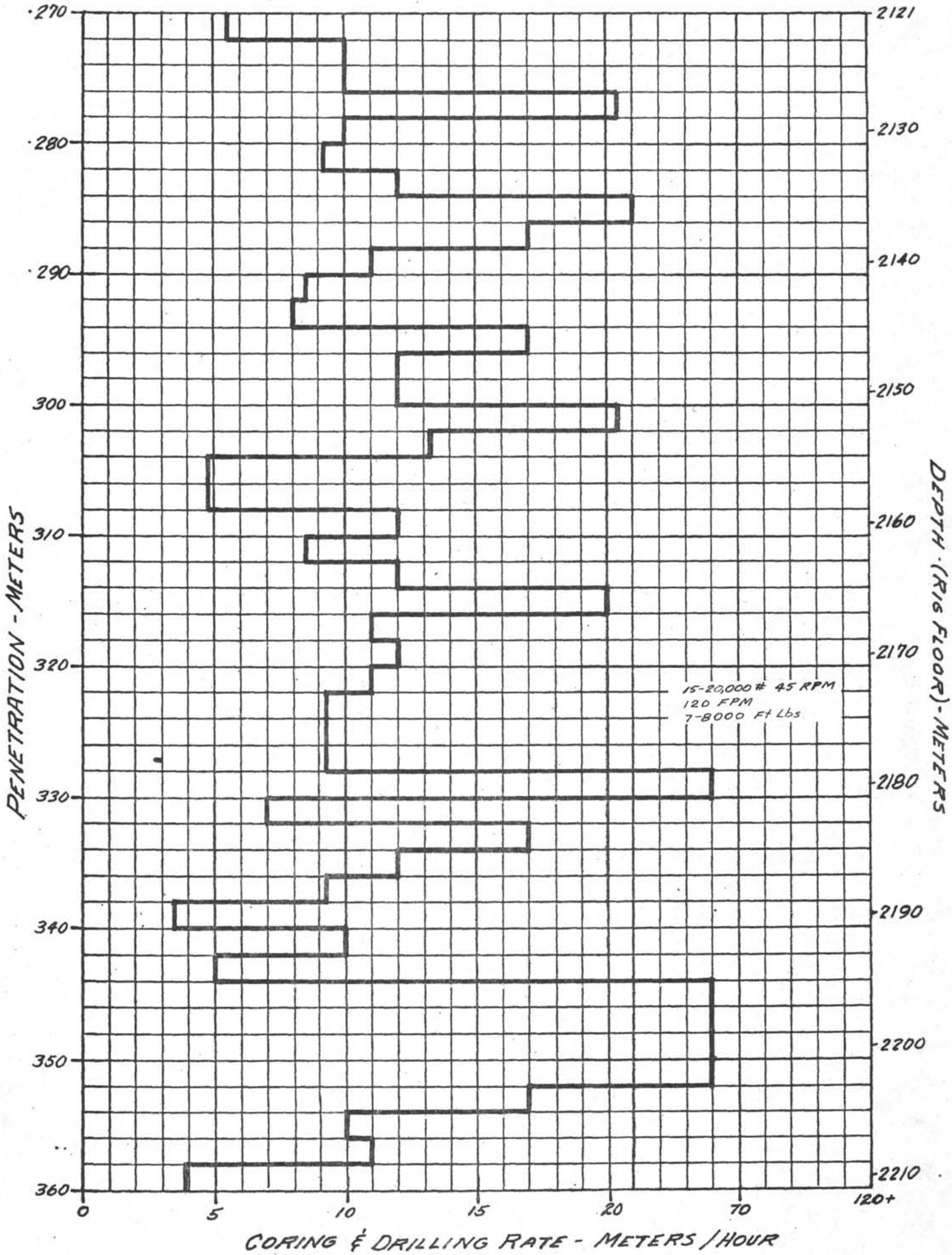

DEEP SEA DRILLING PROJECT
SITE 332 A LEG 37
SMITH BIT TYPE F94CK
BIT No. 1
SUB MUD LINE DEPTH - METERS
DEPTH - (RIG FLOOR) - METERS
50
100
150
200
250
300
350
400
450
500
1901
1951
2001
2051
2101
2151
2201
2251
2301
Core No
12
13
14
16
17
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
32.25 ROTATING HRS
One Shank remaining
All gauge pads missing
4
5
6
7
CORE DIAMETER CM.

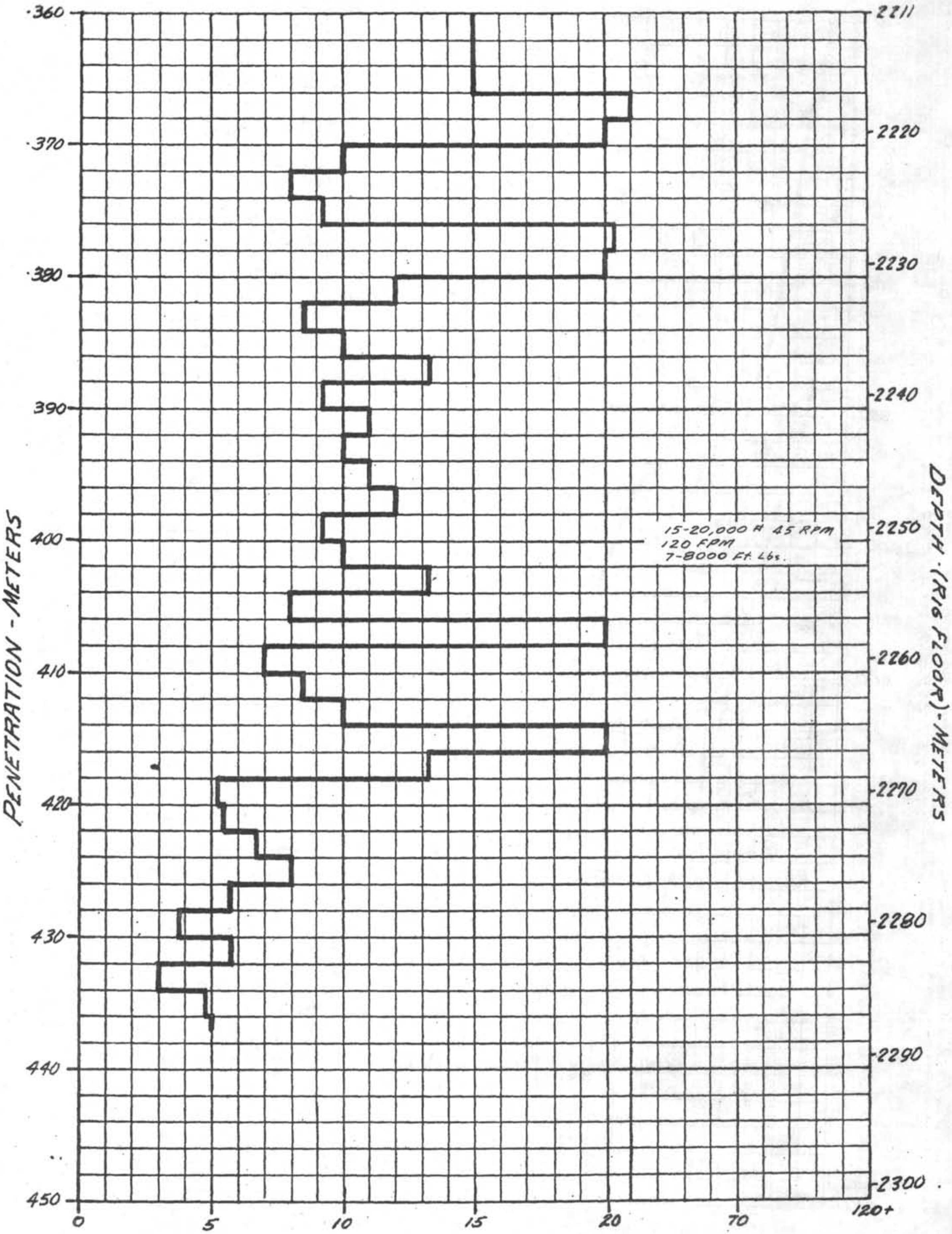

LEG 37 - SITE 332 A
DEEP SEA DRILLING PROJECT
Bit Wt 5-10,000 #
RPM 0-30
Annular Velocity 60 FPM
15-20,000 #, 40 RPM
Ann. Vel. 120 FPM
Torque - 7-8000 Ft Lbs
PENETRATION - METERS
0
100
110
120
130
140
150
160
170
180
DEPTH (RIG FLOOR) - METERS
1851
1951
1960
1970
1980
1990
2000
2010
2020
2030
0
5
10
15
20
70
120+
CORING & DRILLING RATE - METERS / HOUR

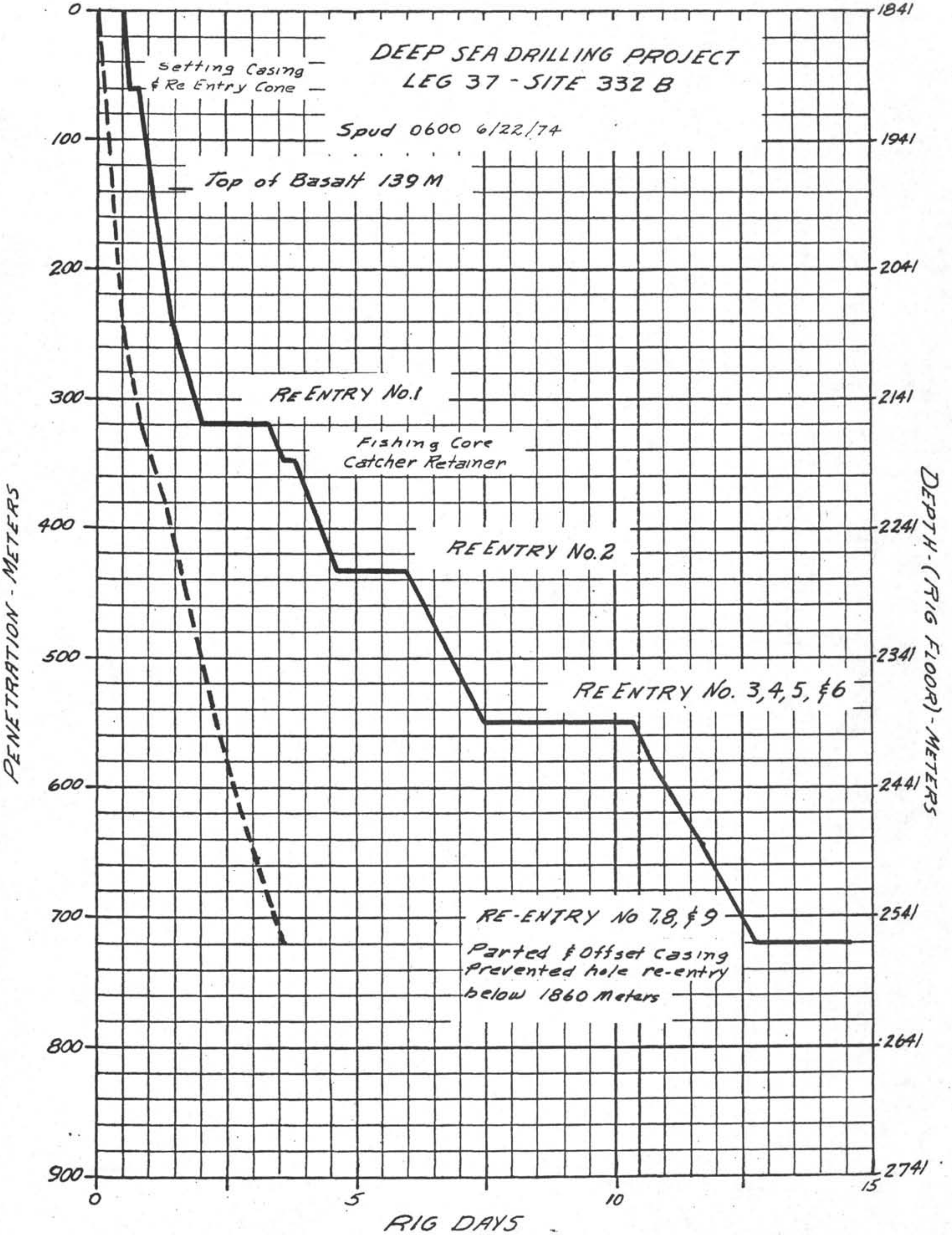
LEG 37 - SITE 332A
DEEP SEA DRILLING PROJECT



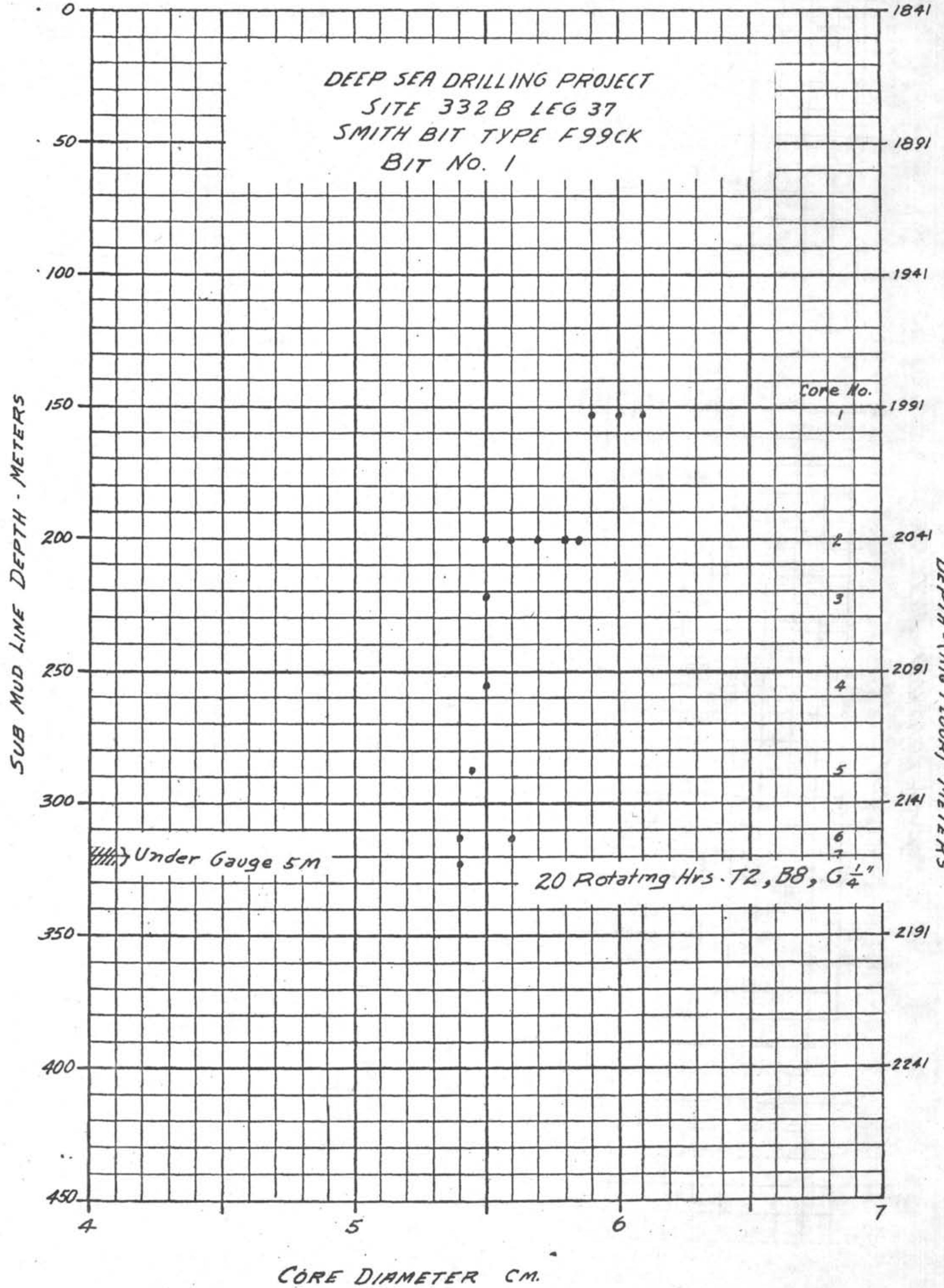
LEG 37 - SITE 332A
DEEP SEA DRILLING PROJECT

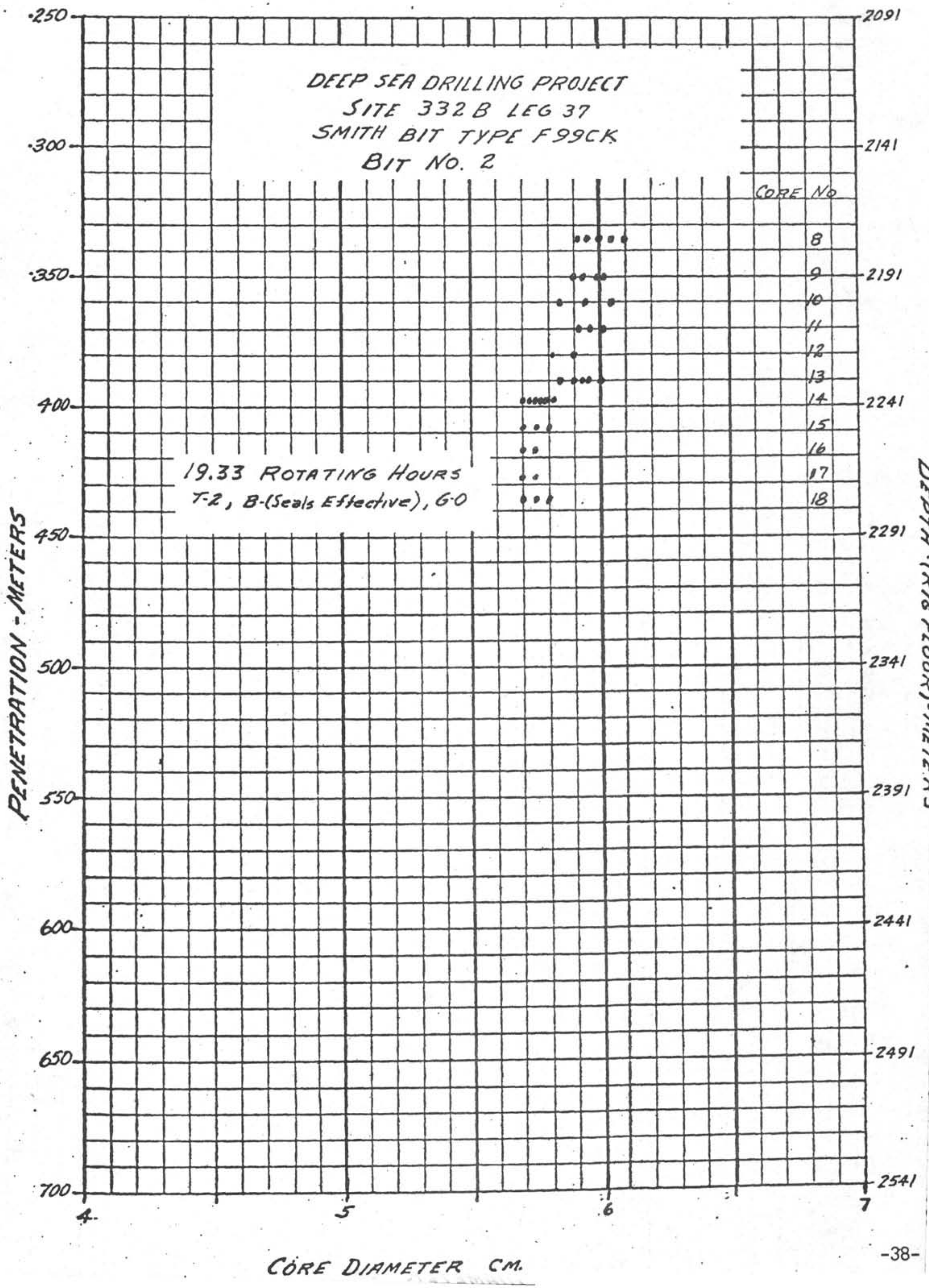


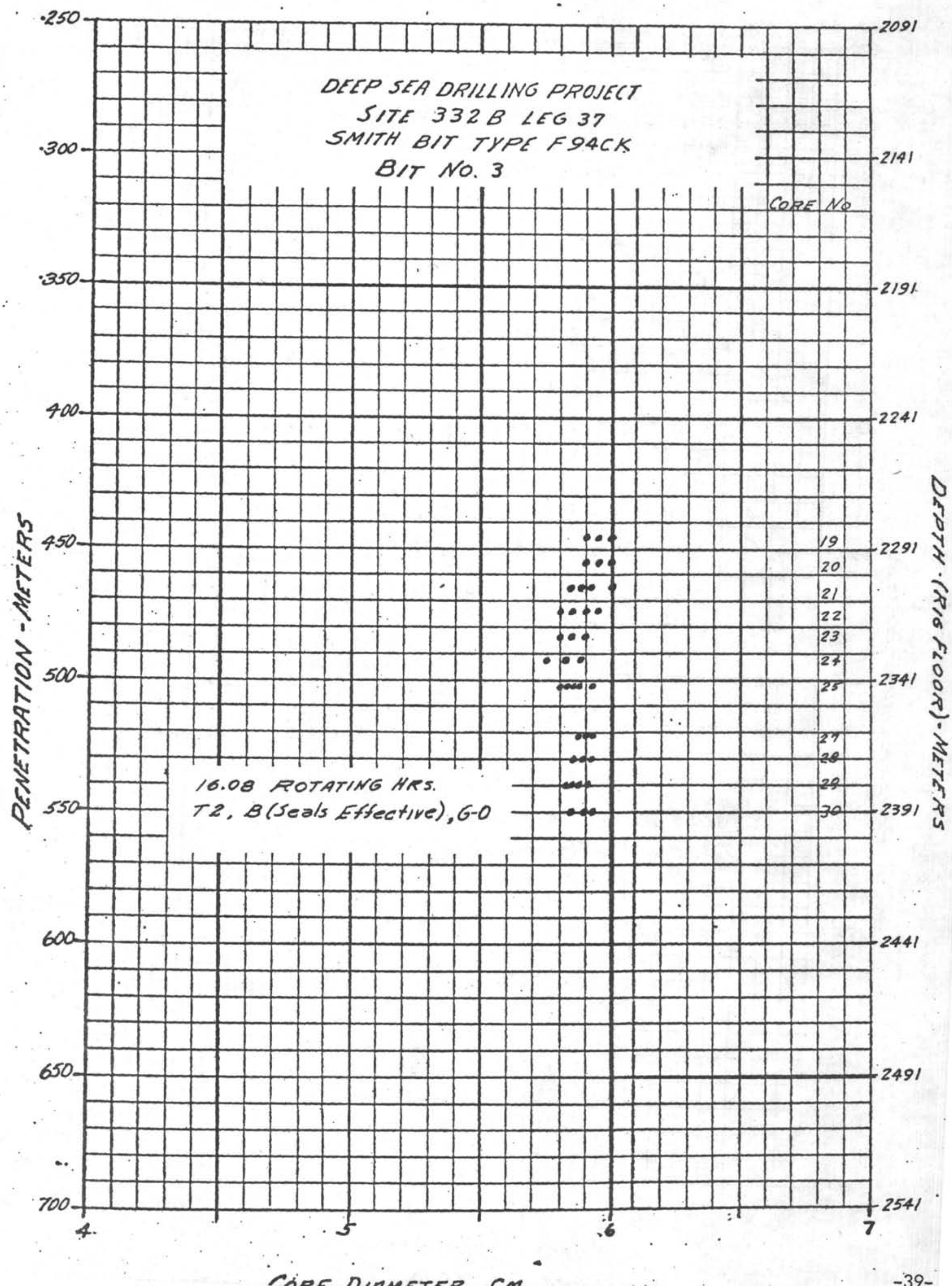

360
370
380
390
400
410
420
430
440
450
PENETRATION - METERS
2211
2220
2230
2240
2250
2260
2270
2280
2290
2300
DEPTH (RIG FLOOR) - METERS
15-20,000 # 45 RPM
120 FPM
7-8000 Ft. Lbs.
0
5
10
15
20
70
120+
CORING & DRILLING RATE - METERS / HOUR



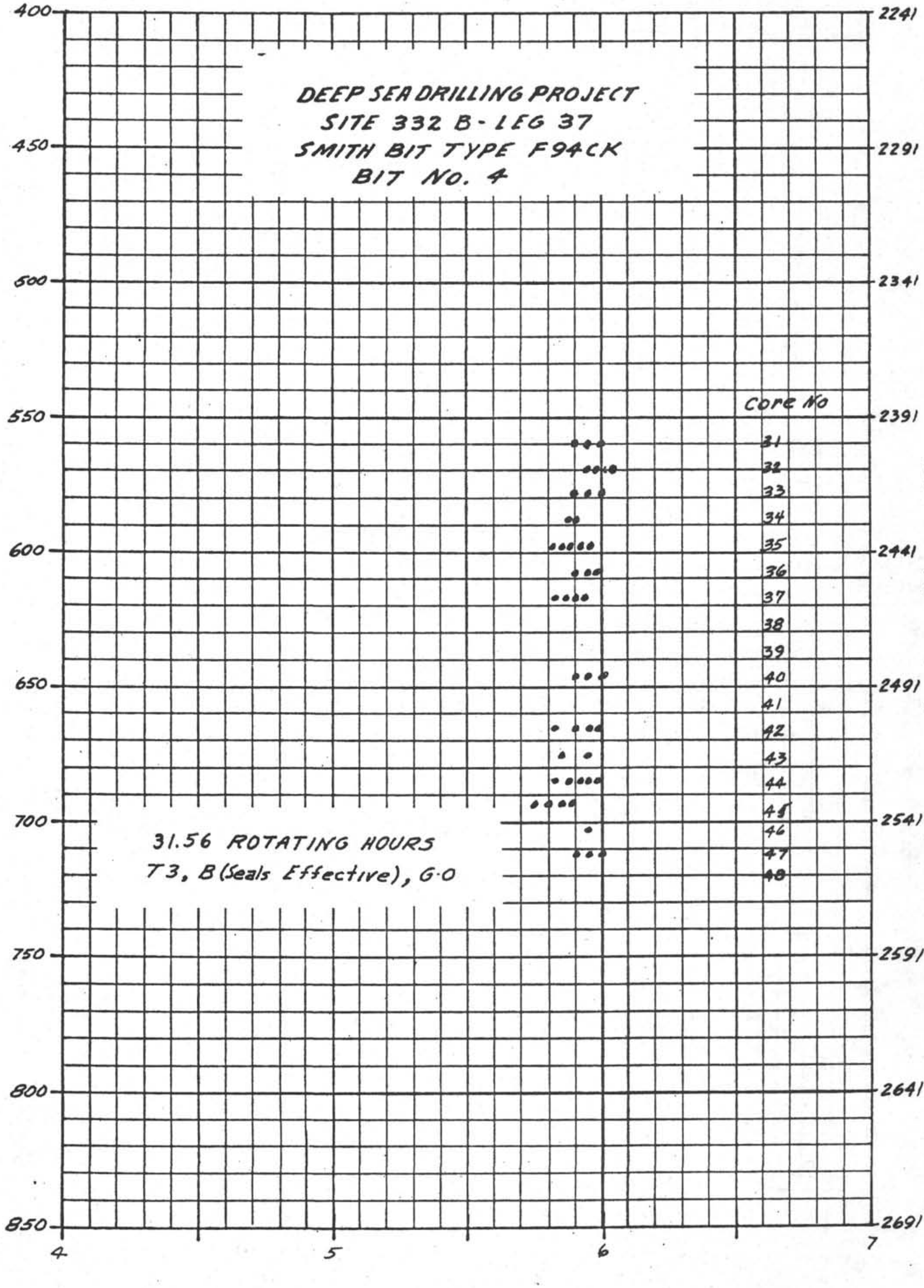
DEEP SEA DRILLING PROJECT
LEG 37 - SITE 332 B
Spud 0600 6/22/74
Setting Casing & Re Entry Cone
Top of Basalt 139 M
RE ENTRY No.1
Fishing Core Catcher Retainer
RE ENTRY No.2
RE ENTRY No. 3,4,5, & 6
RE-ENTRY No 7,8, & 9
Parted & Offset Casing Prevented hole re-entry below 1860 Meters
PENETRATION - METERS
DEPTH - (RIG FLOOR) - METERS
RIG DAYS
0
100
200
300
400
500
600
700
800
900
1841
1941
2041
2141
2241
2341
2441
2541
2641
2741
5
10
15

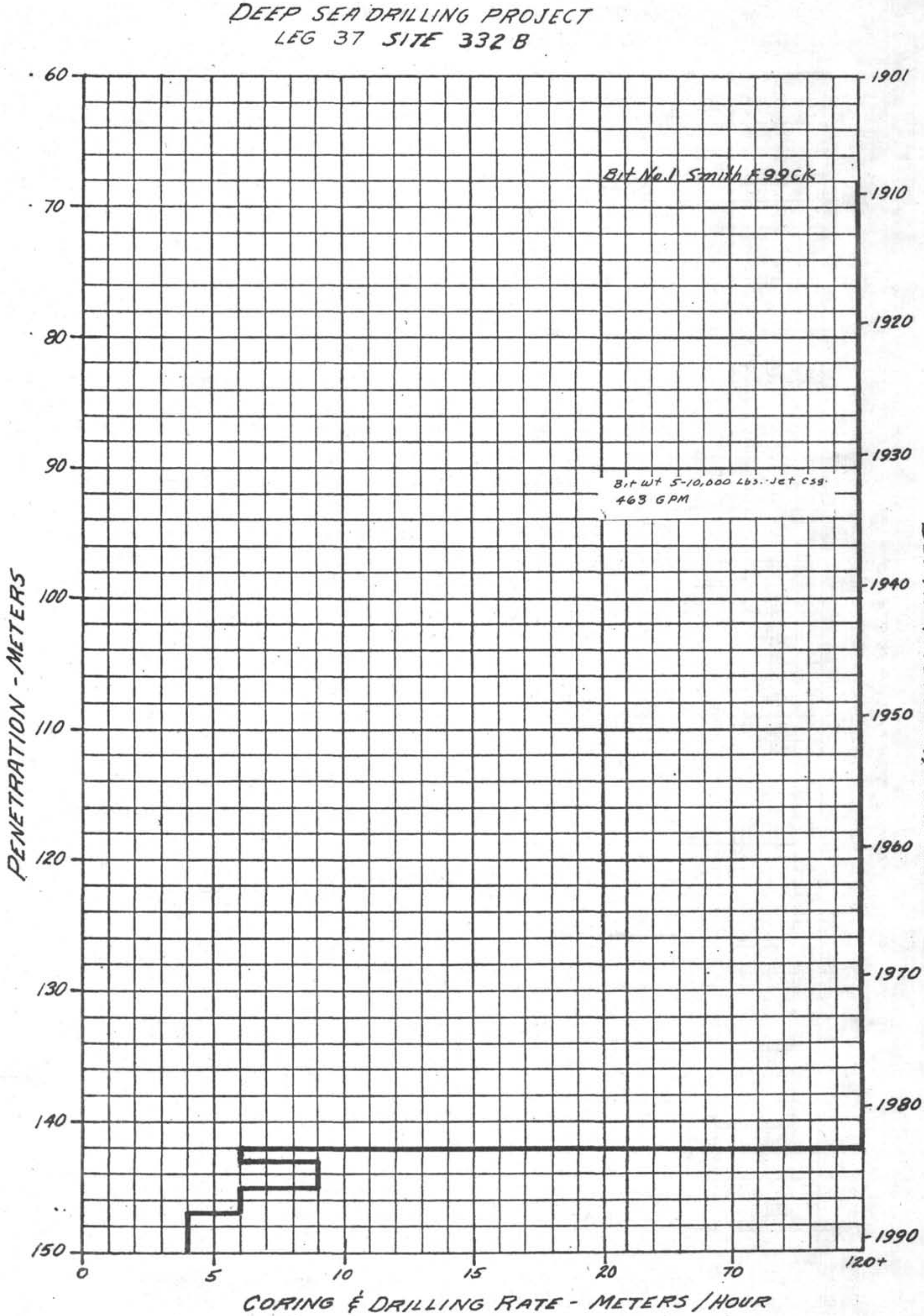

DEEP SEA DRILLING PROJECT
SITE 332 B LEG 37
SMITH BIT TYPE F99CK
BIT NO. 1
SUB MUD LINE DEPTH - METERS
DEPTH - (RIG FLOOR) - METERS
Core No.
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350
400
450
1841
1891
1941
1991
2041
2091
2141
2191
2241
Under Gauge 5M
20 Rotating Hrs · T2, B8, G 1/4"
4
5
6
7
CORE DIAMETER CM.


DEEP SEA DRILLING PROJECT
SITE 332 B LEG 37
SMITH BIT TYPE F99CK
BIT No. 2
19.33 ROTATING HOURS
T-2, B-(Seals Effective), G-0
CORE No
8
9
10
11
12
13
14
15
16
17
18
250
300
350
400
450
500
550
600
650
700
2091
2141
2191
2241
2291
2341
2391
2441
2491
2541
4
5
6
7
PENETRATION - METERS
DEPTH - (RIG FLOOR) - METERS
CORE DIAMETER CM.

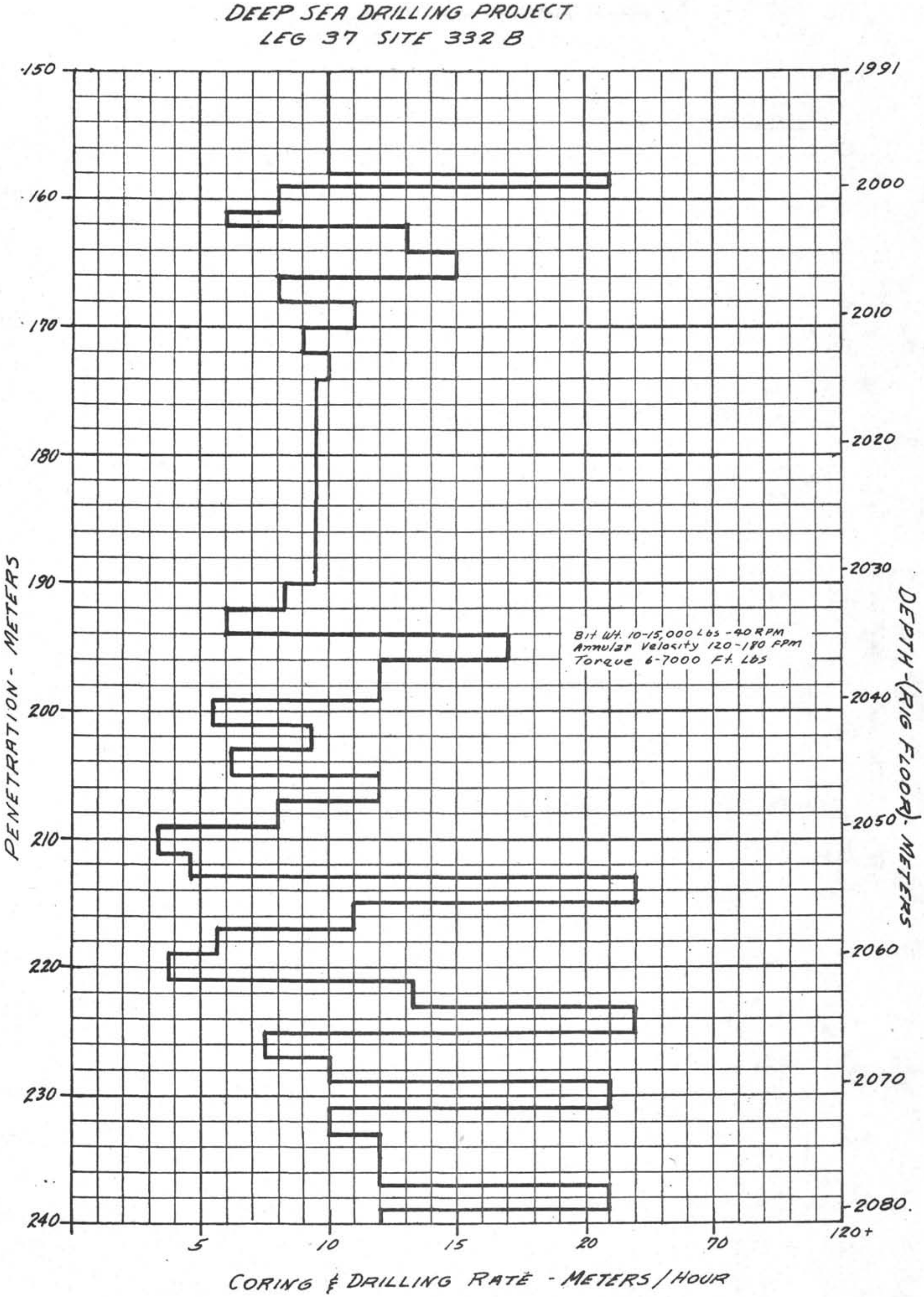


DEEP SEA DRILLING PROJECT
SITE 332B LEG 37
SMITH BIT TYPE F94CK
BIT NO. 3
CORE No
19
20
21
22
23
24
25
27
28
29
30
16.08 ROTATING HRS.
T2, B(Seals Effective), G-0
PENETRATION - METERS
250
300
350
400
450
500
550
600
650
700
DEPTH (RIG FLOOR) - METERS
2091
2141
2191
2241
2291
2341
2391
2441
2491
2541
4
5
.6
7
CORE DIAMETER CM.

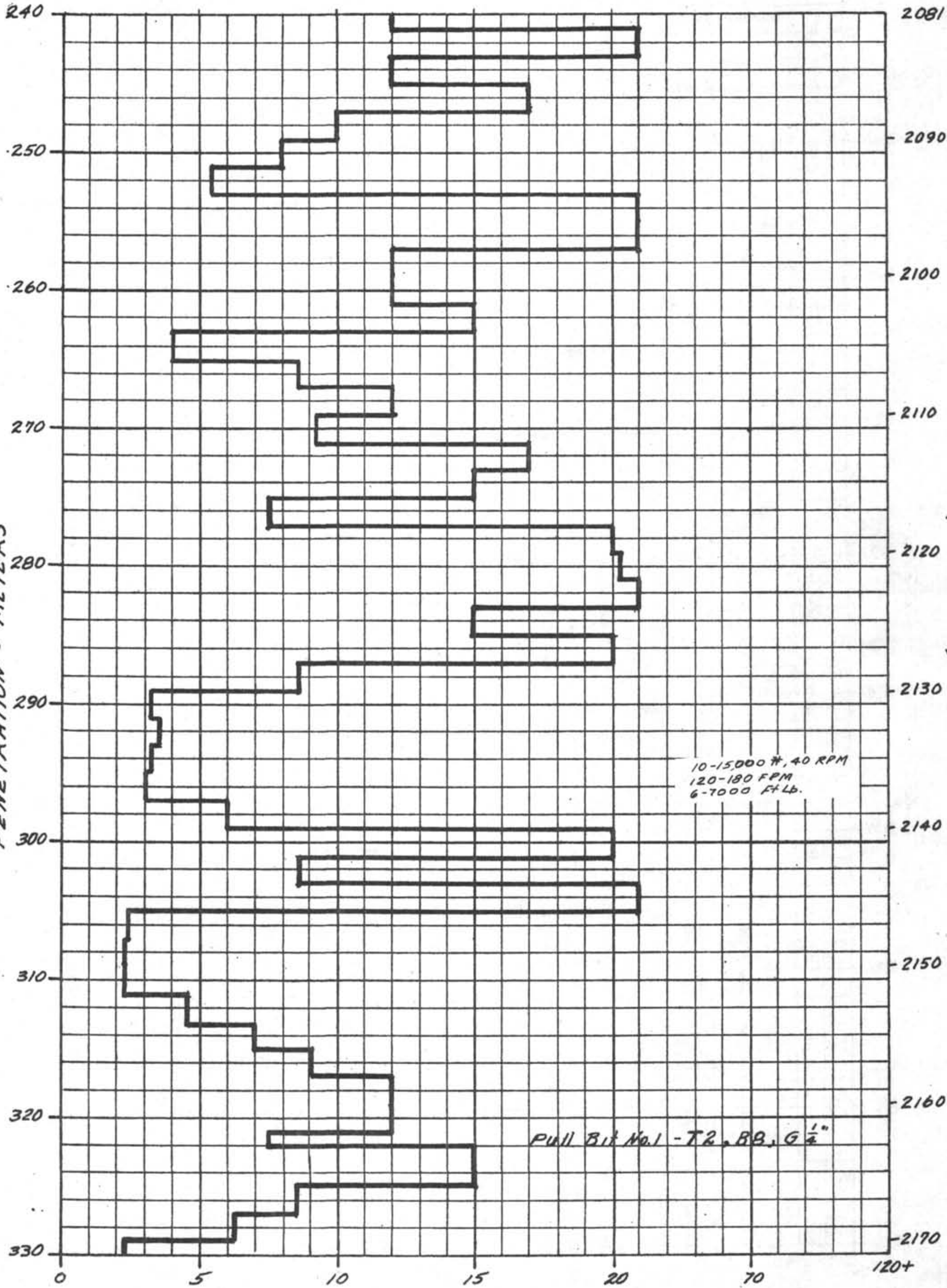

DEEP SEA DRILLING PROJECT
SITE 332 B - LEG 37
SMITH BIT TYPE F94CK
BIT No. 4
31.56 ROTATING HOURS
T3, B (Seals Effective), G-O
Core No
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
PENETRATION - METERS
DEPTH - (RIG FLOOR) - METERS
400
450
500
550
600
650
700
750
800
850
2241
2291
2341
2391
2441
2491
2541
2591
2641
2691
4
5
6
7
CORE DIAMETER CM



DEEP SEA DRILLING PROJECT
LEG 37 SITE 332 B
Bit No.1 Smith F99CK
Bit wt 5-10,000 Lbs.-Jet Csg.
463 GPM
PENETRATION - METERS
DEPTH (RIG FLOOR) - METERS
CORING & DRILLING RATE - METERS/HOUR
60
70
80
90
100
110
120
130
140
150
1901
1910
1920
1930
1940
1950
1960
1970
1980
1990
0
5
10
15
20
70
120+

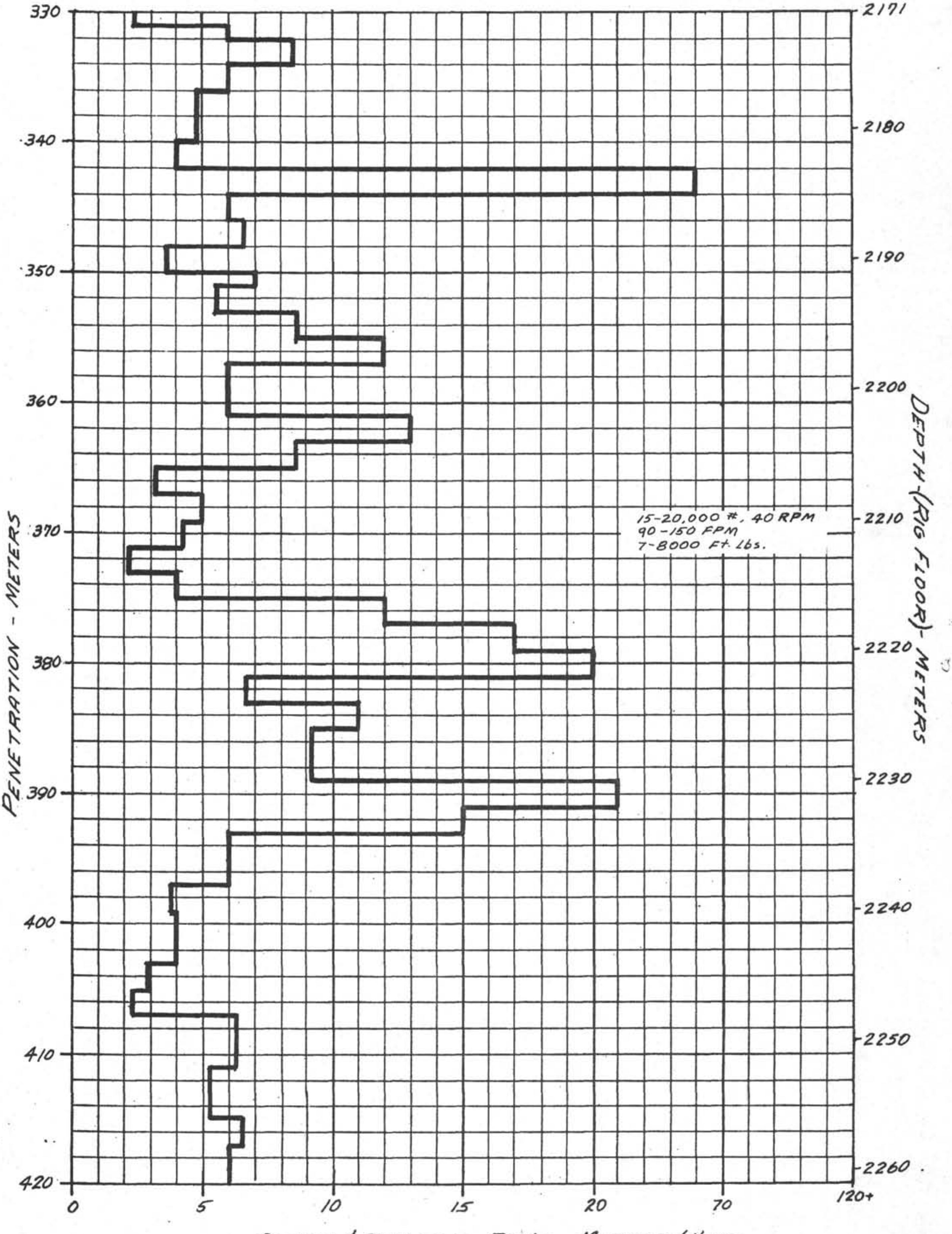

DEEP SEA DRILLING PROJECT
LEG 37 SITE 332 B
PENETRATION - METERS
150
160
170
180
190
200
210
220
230
240
DEPTH -(RIG FLOOR)- METERS
1991
2000
2010
2020
2030
2040
2050
2060
2070
2080
Bit Wt. 10-15,000 Lbs - 40 RPM
Annular Velocity 120-180 FPM
Torque 6-7000 Ft. Lbs
5
10
15
20
70
120+
CORING & DRILLING RATE - METERS/HOUR

DEEP SEA DRILLING PROJECT
LEG 37 - SITE 332 B

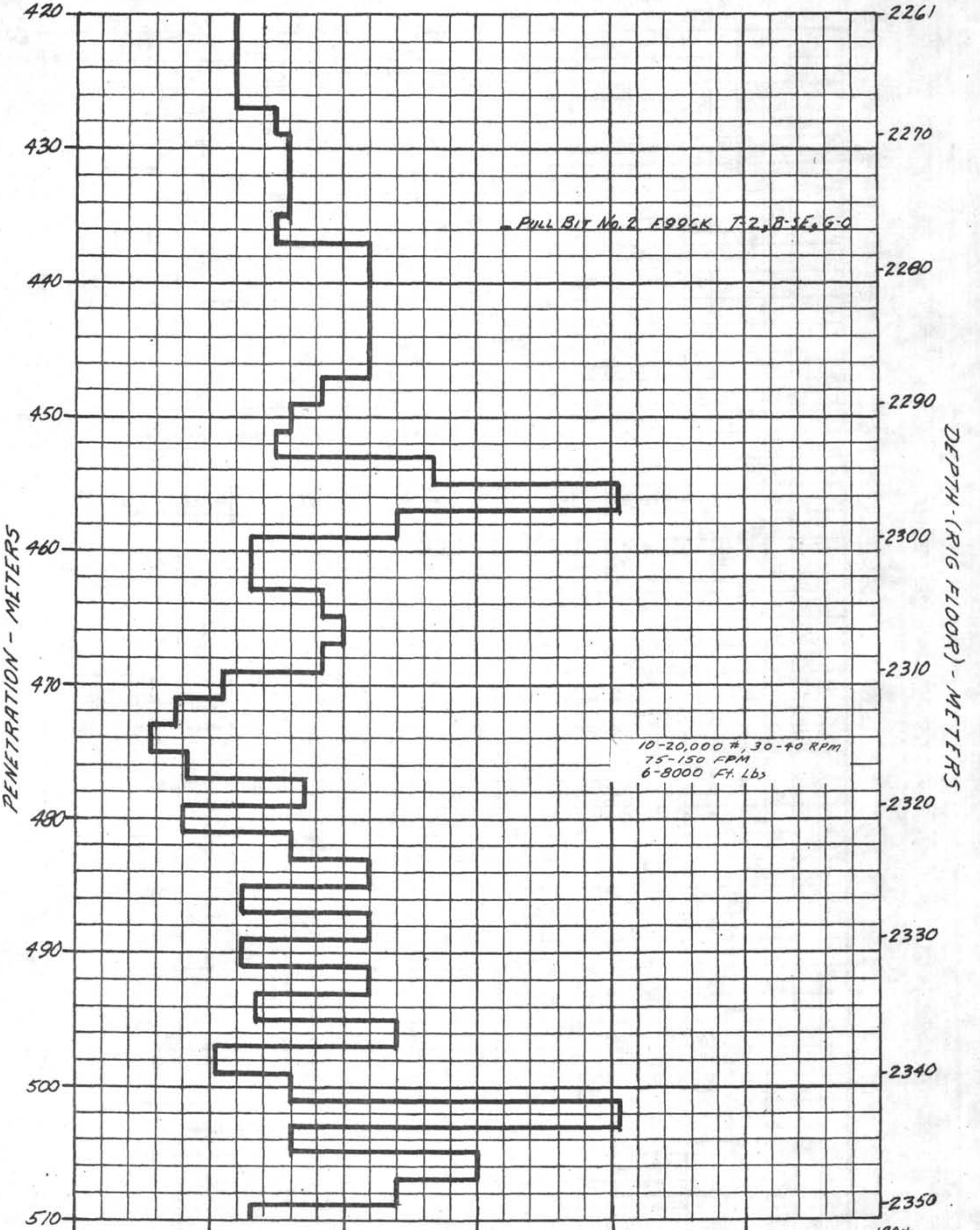


CORING & DRILLING RATE - METERS / HOUR

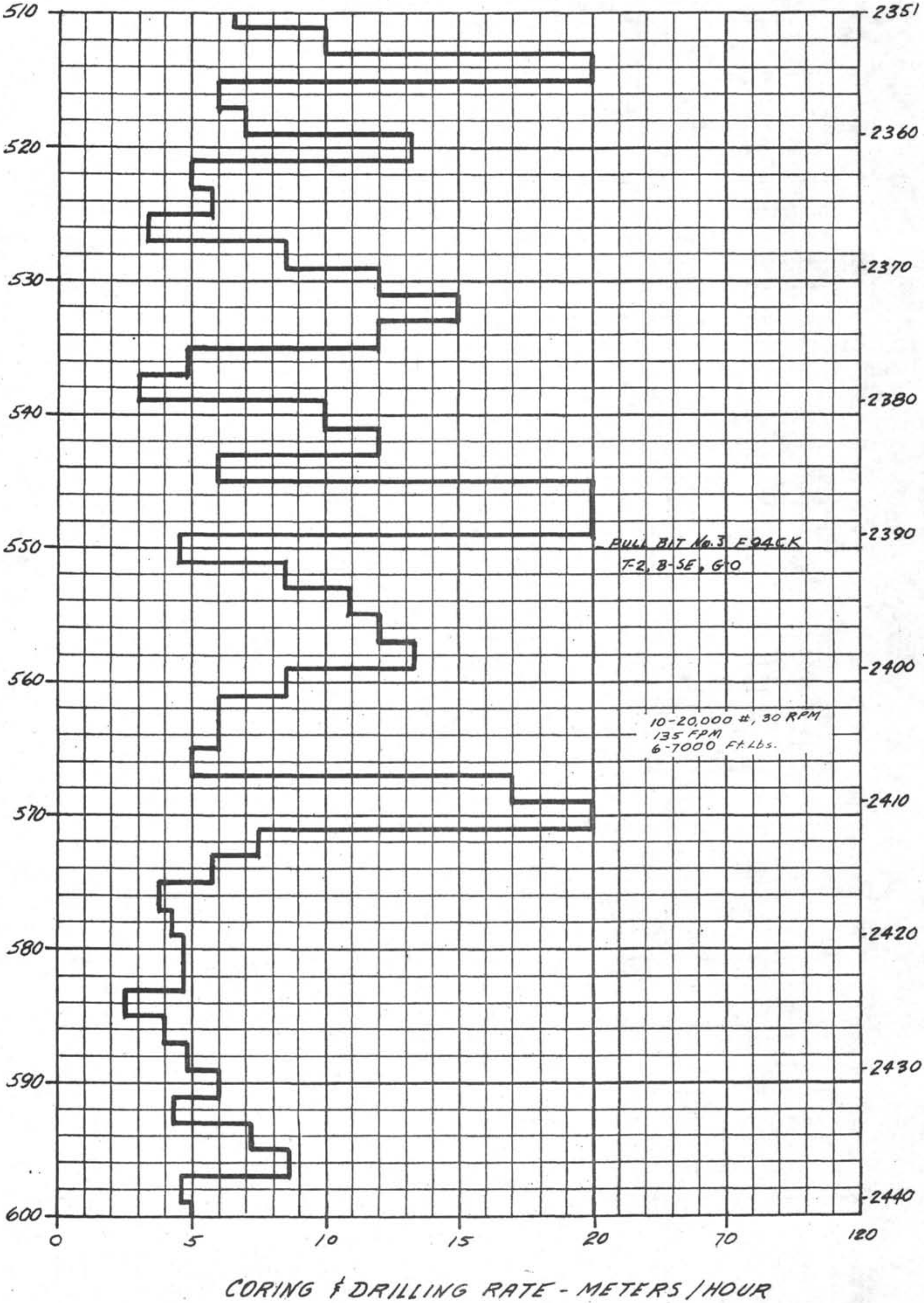
DEEP SEA DRILLING PROJECT
LEG 37 - SITE 332 B

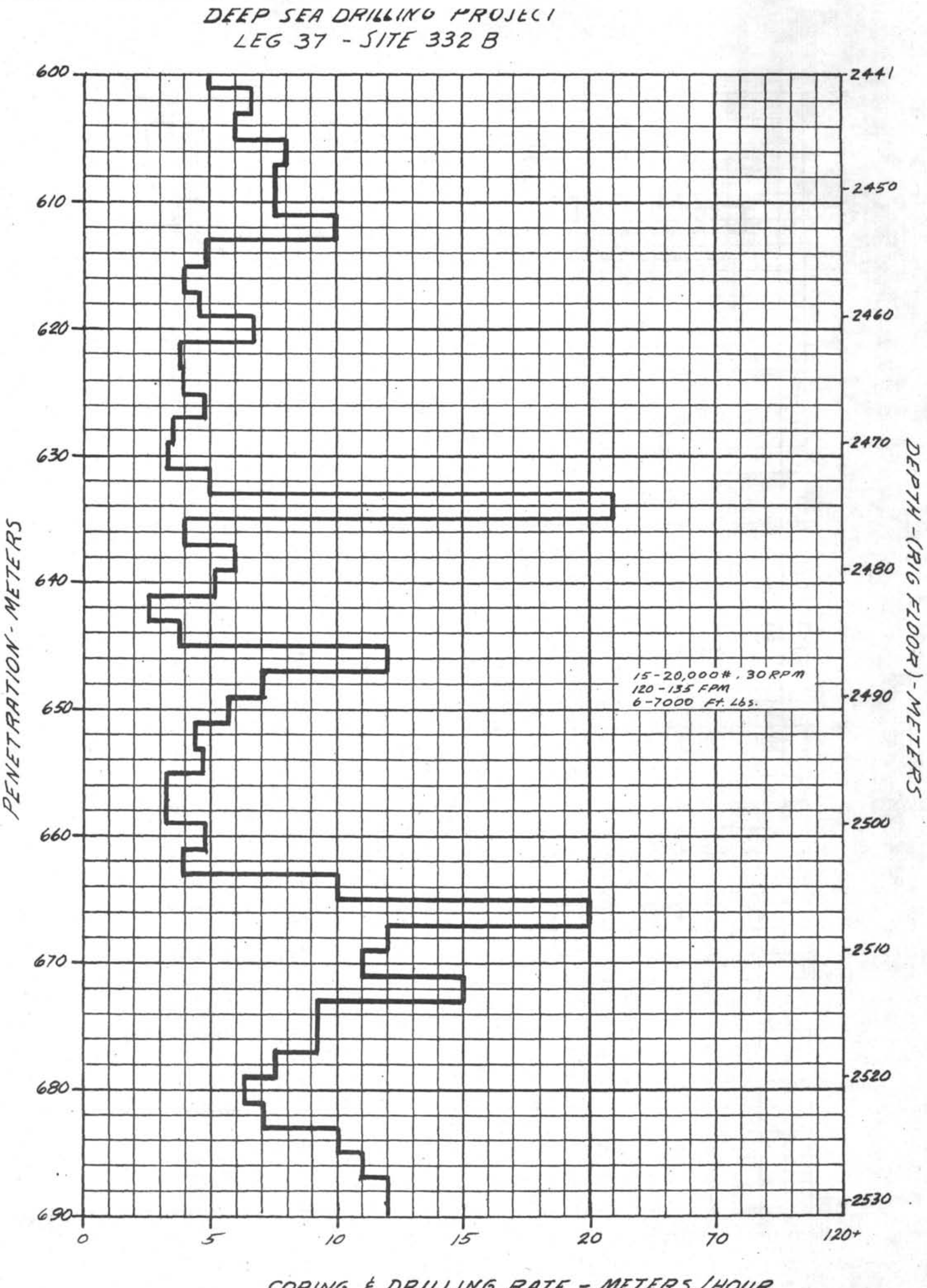


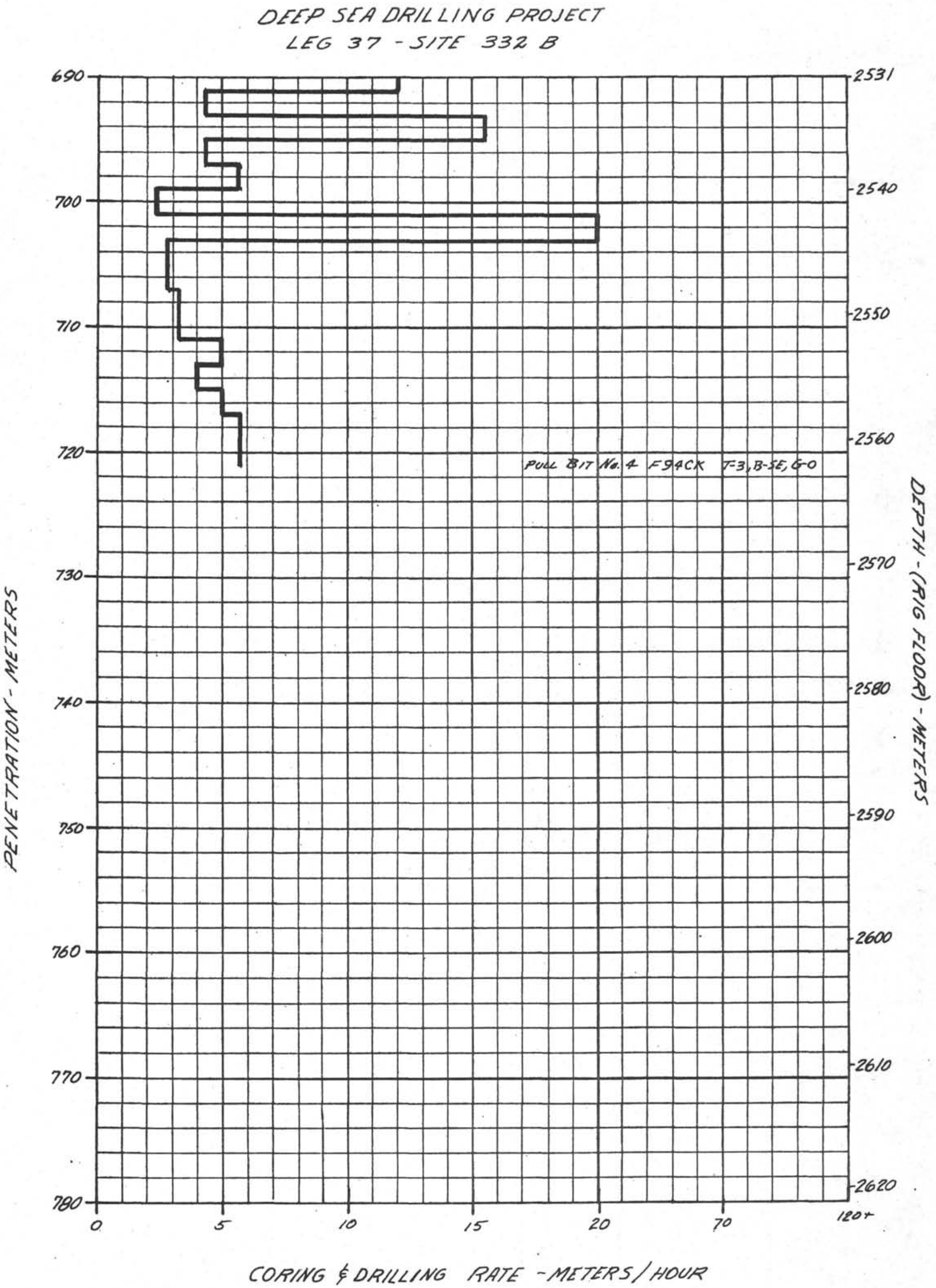
DEEP SEA DRILLING PROJECT
LEG 37 - SITE 332 B

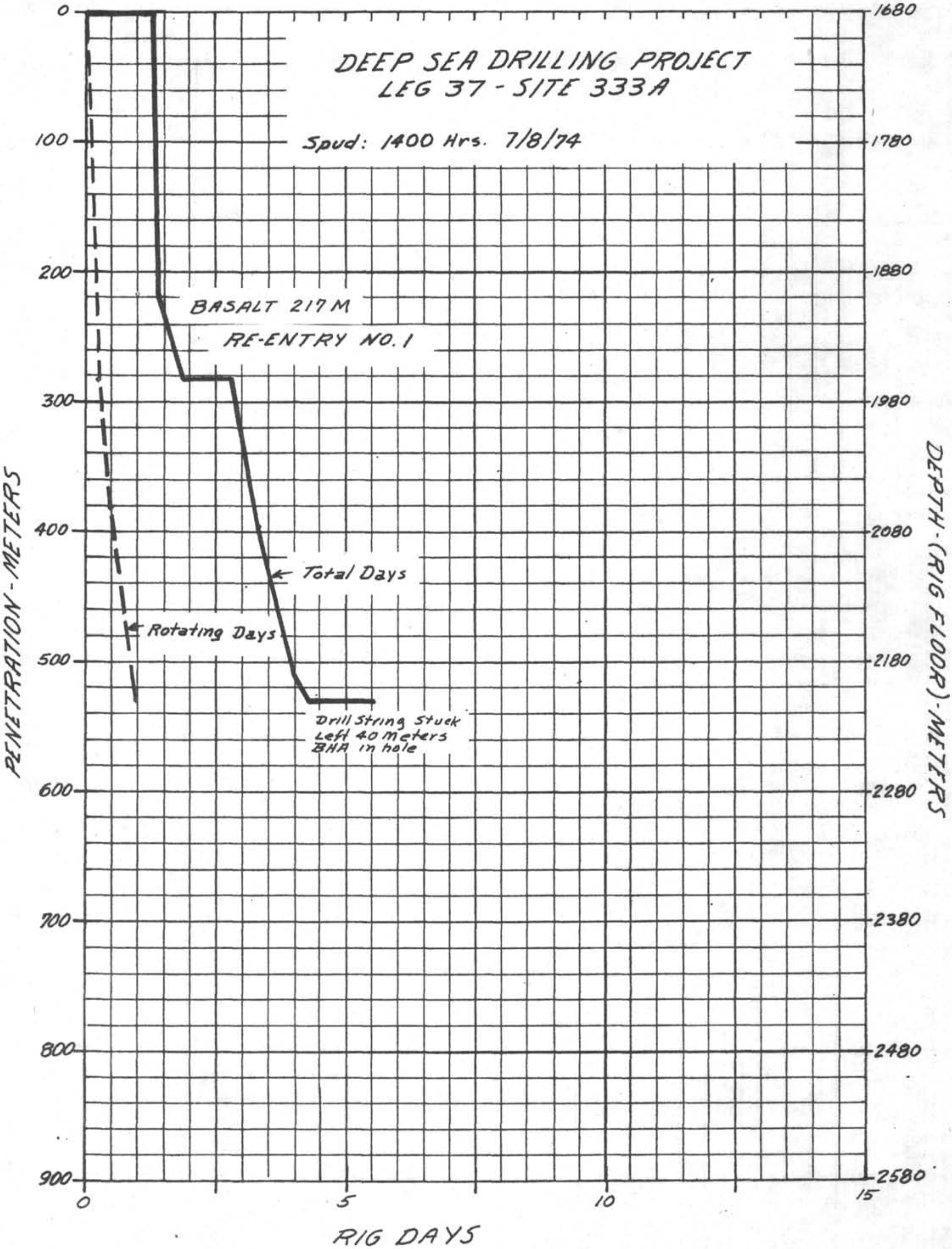


DEEP SEA DRILLING PROJECT
LEG 37 - SITE 332 B

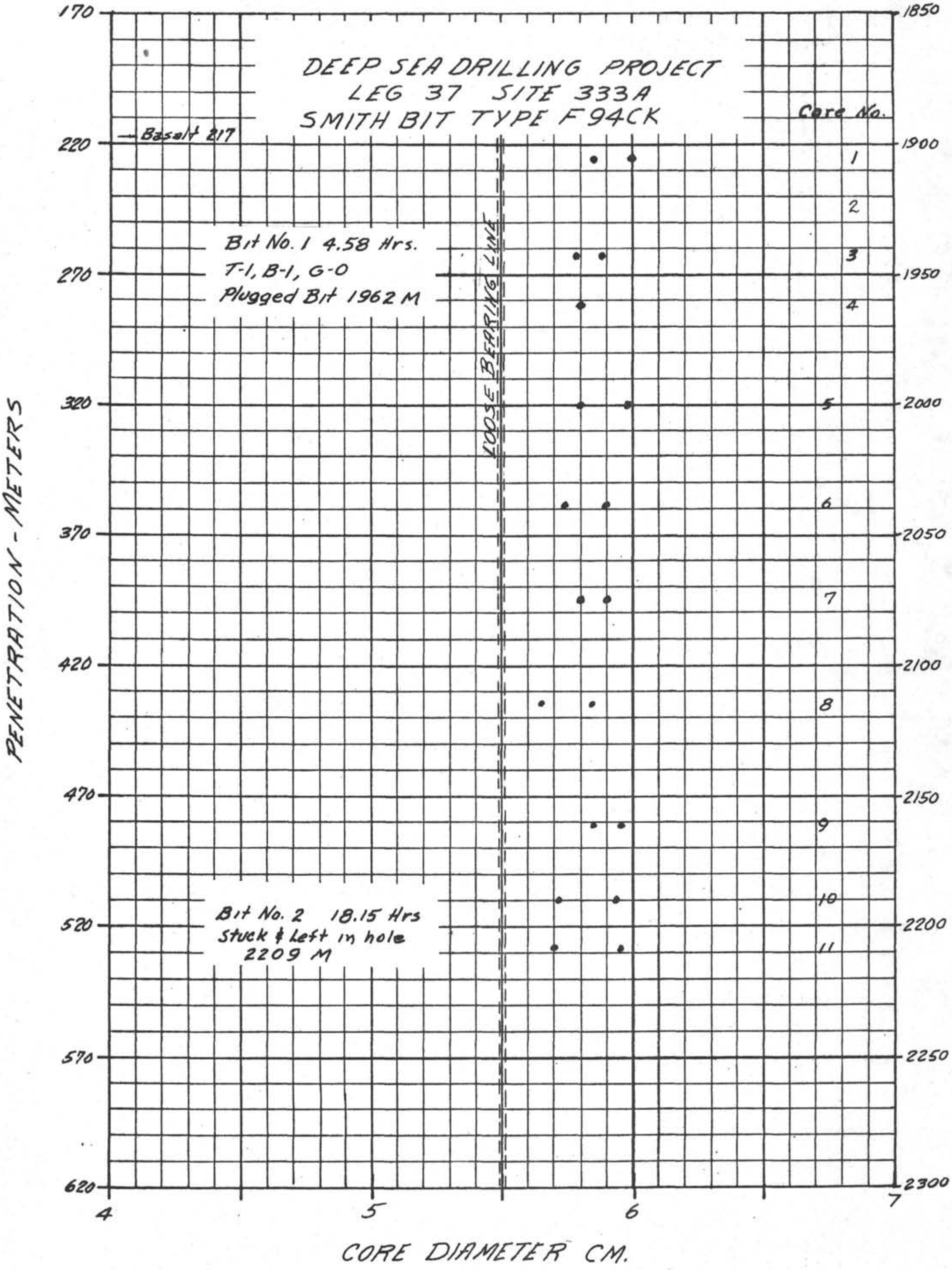


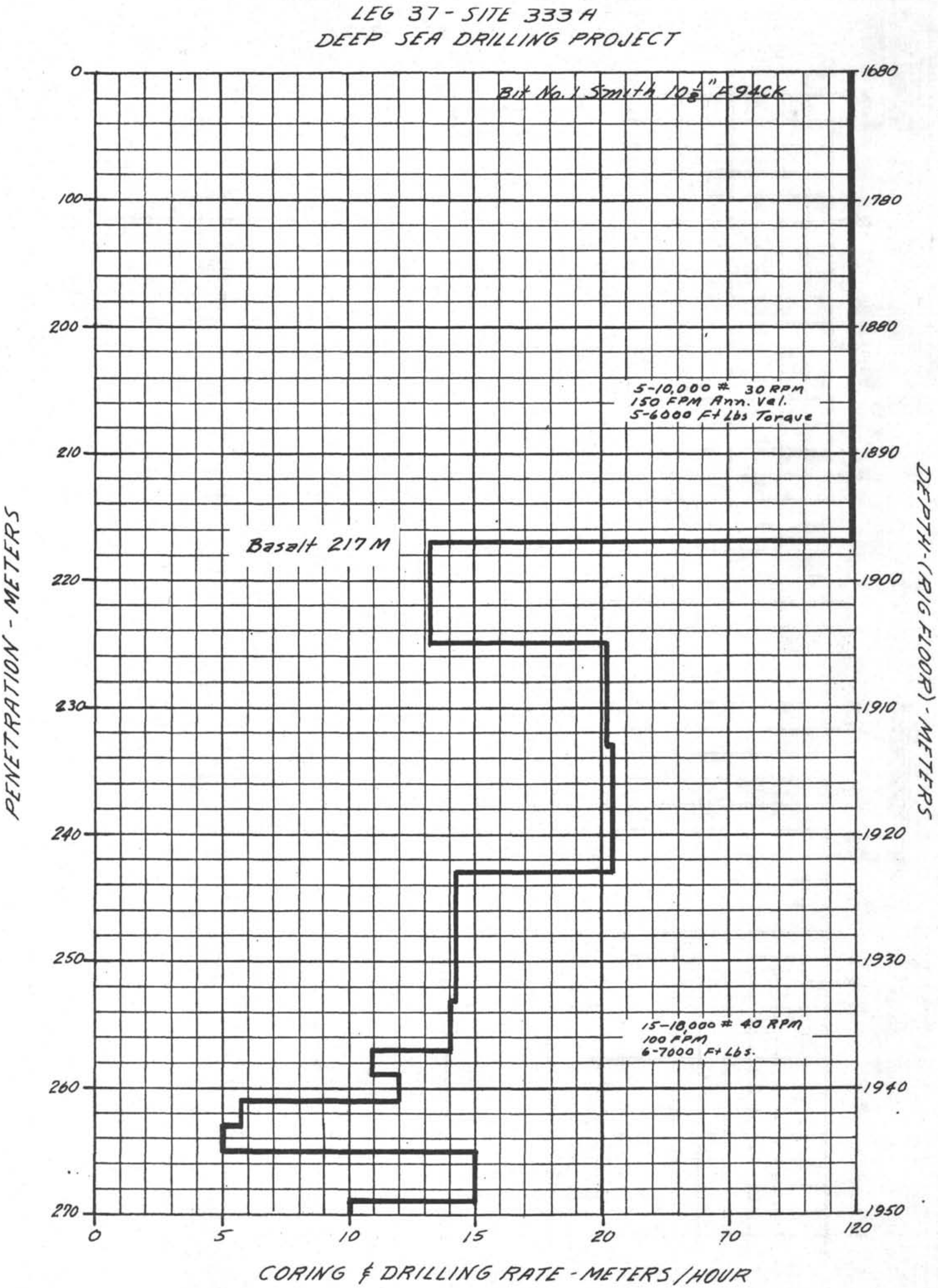

DEEP SEA DRILLING PROJECT
LEG 37 - SITE 332 B
PENETRATION - METERS
600
610
620
630
640
650
660
670
680
690
DEPTH - (RIG FLOOR) - METERS
2441
2450
2460
2470
2480
2490
2500
2510
2520
2530
0
5
10
15
20
70
120+
15-20,000#, 30 RPM
120-135 FPM
6-7000 Ft. Lbs.
CORING & DRILLING RATE - METERS/HOUR


DEEP SEA DRILLING PROJECT
LEG 37 - SITE 332 B
PENETRATION - METERS
DEPTH - (RIG FLOOR) - METERS
690
700
710
720
730
740
750
760
770
780
2531
2540
2550
2560
2570
2580
2590
2600
2610
2620
PULL BIT No. 4 F94CK T-3, B-SE, G-O
0
5
10
15
20
70
120+
CORING & DRILLING RATE - METERS/HOUR

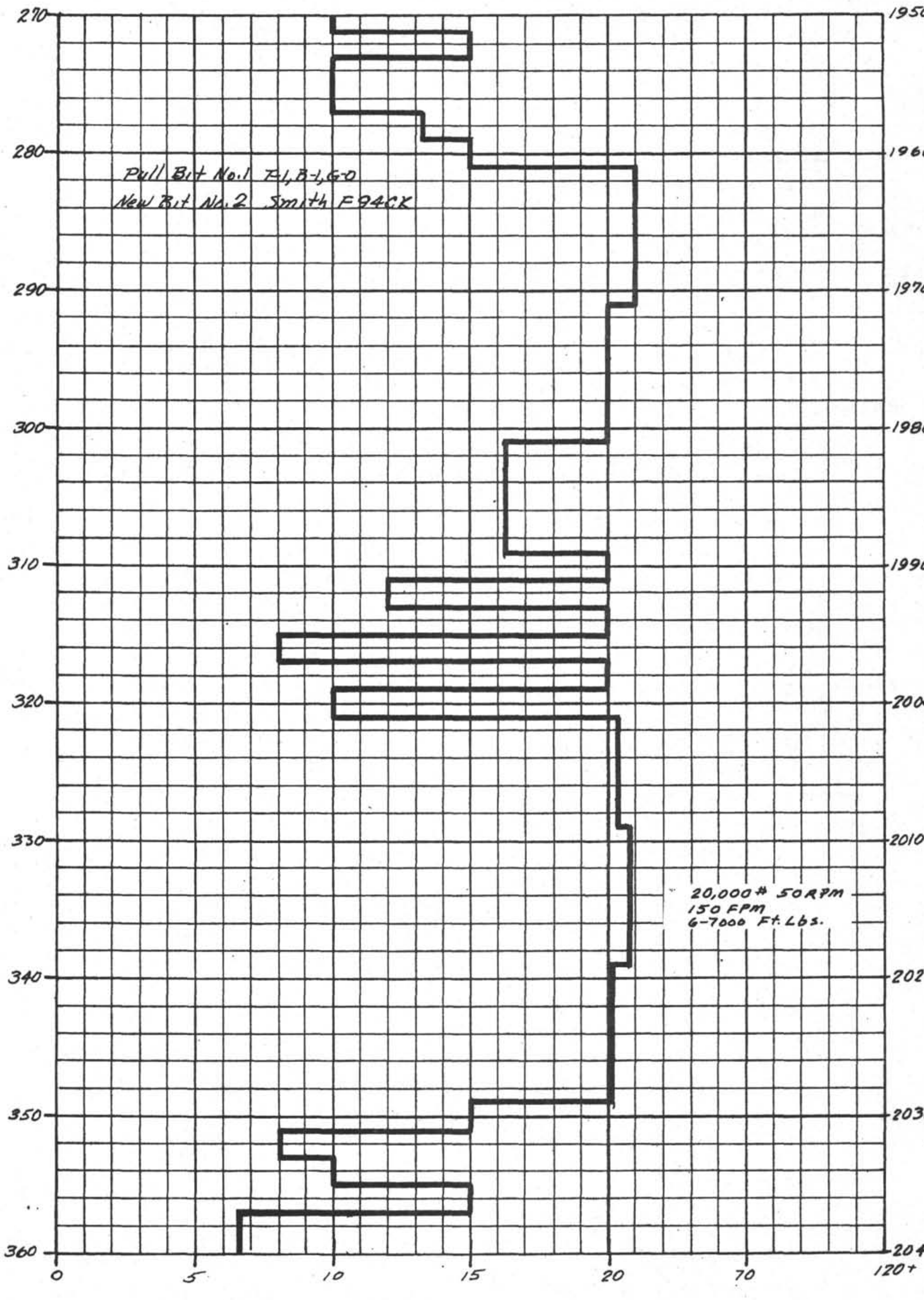


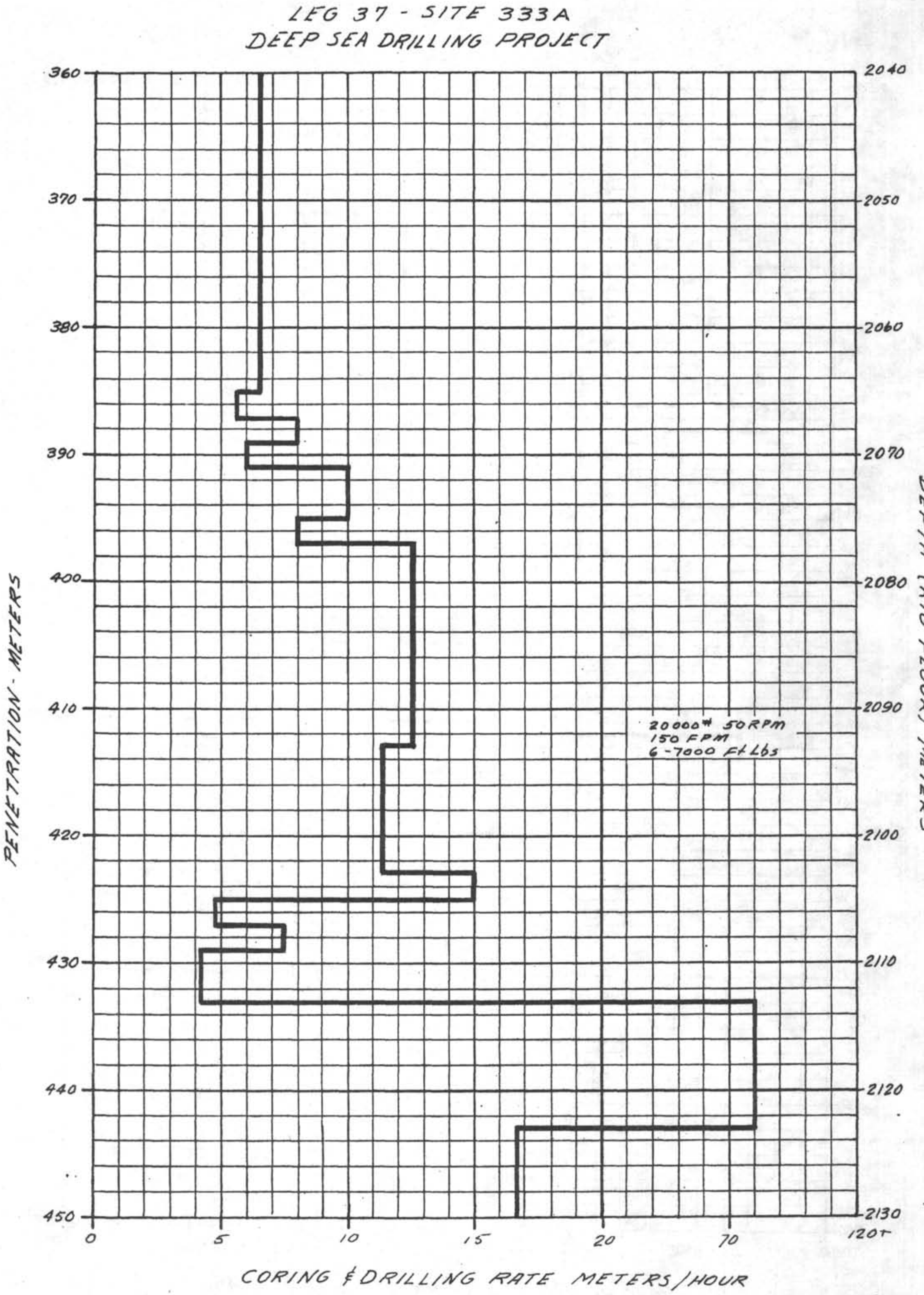
DEEP SEA DRILLING PROJECT
LEG 37 - SITE 333A
Spud: 1400 Hrs. 7/8/74
BASALT 217 M
RE-ENTRY NO. 1
Total Days
Rotating Days
Drill String Stuck
Left 40 meters
BHA in hole
PENETRATION - METERS
DEPTH - (RIG FLOOR) - METERS
RIG DAYS
0
100
200
300
400
500
600
700
800
900
1680
1780
1880
1980
2080
2180
2280
2380
2480
2580
0
5
10
15


DEEP SEA DRILLING PROJECT
LEG 37 SITE 333A
SMITH BIT TYPE F94CK
Core No.
→ Basalt 217
Bit No. 1 4.58 Hrs.
T-1, B-1, G-0
Plugged Bit 1962 M
Bit No. 2 18.15 Hrs
Stuck & Left in hole
2209 M
LOOSE BEARING LINE
1
2
3
4
5
6
7
8
9
10
11
170
220
270
320
370
420
470
520
570
620
1850
1900
1950
2000
2050
2100
2150
2200
2250
2300
4
5
6
7
PENETRATION - METERS
DEPTH (RIG FLOOR) - METERS
CORE DIAMETER CM.

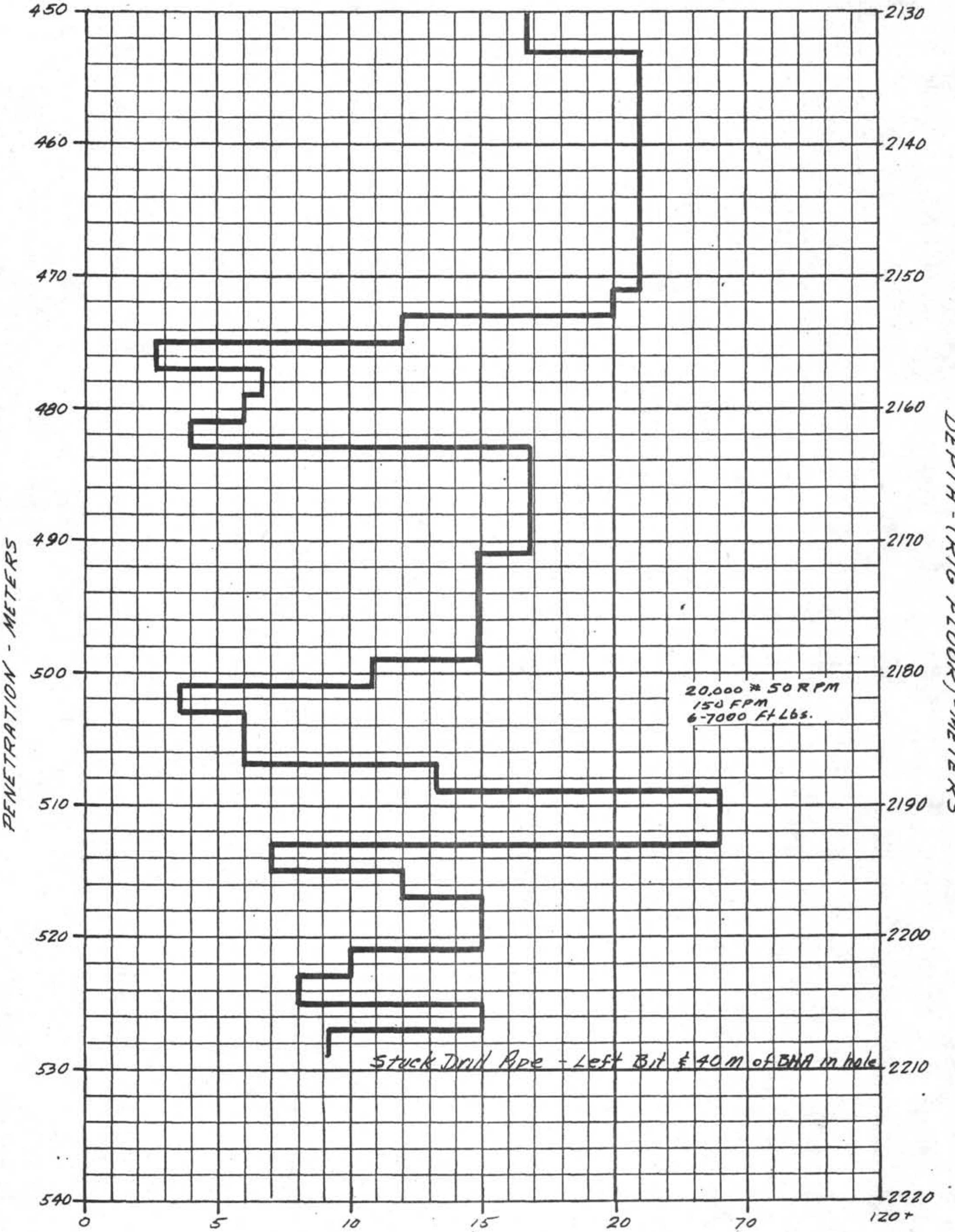

LEG 37 - SITE 333 A
DEEP SEA DRILLING PROJECT
Bit No. 1 Smith $10\frac{5}{8}$" F94CK
5-10,000 # 30 RPM
150 FPM Ann. Vel.
5-6000 Ft Lbs Torque
Basalt 217 M
15-18,000 # 40 RPM
100 FPM
6-7000 Ft Lbs.
PENETRATION - METERS
DEPTH - (RIG FLOOR) - METERS
CORING & DRILLING RATE - METERS / HOUR
0
100
200
210
220
230
240
250
260
270
1680
1780
1880
1890
1900
1910
1920
1930
1940
1950
0
5
10
15
20
70
120

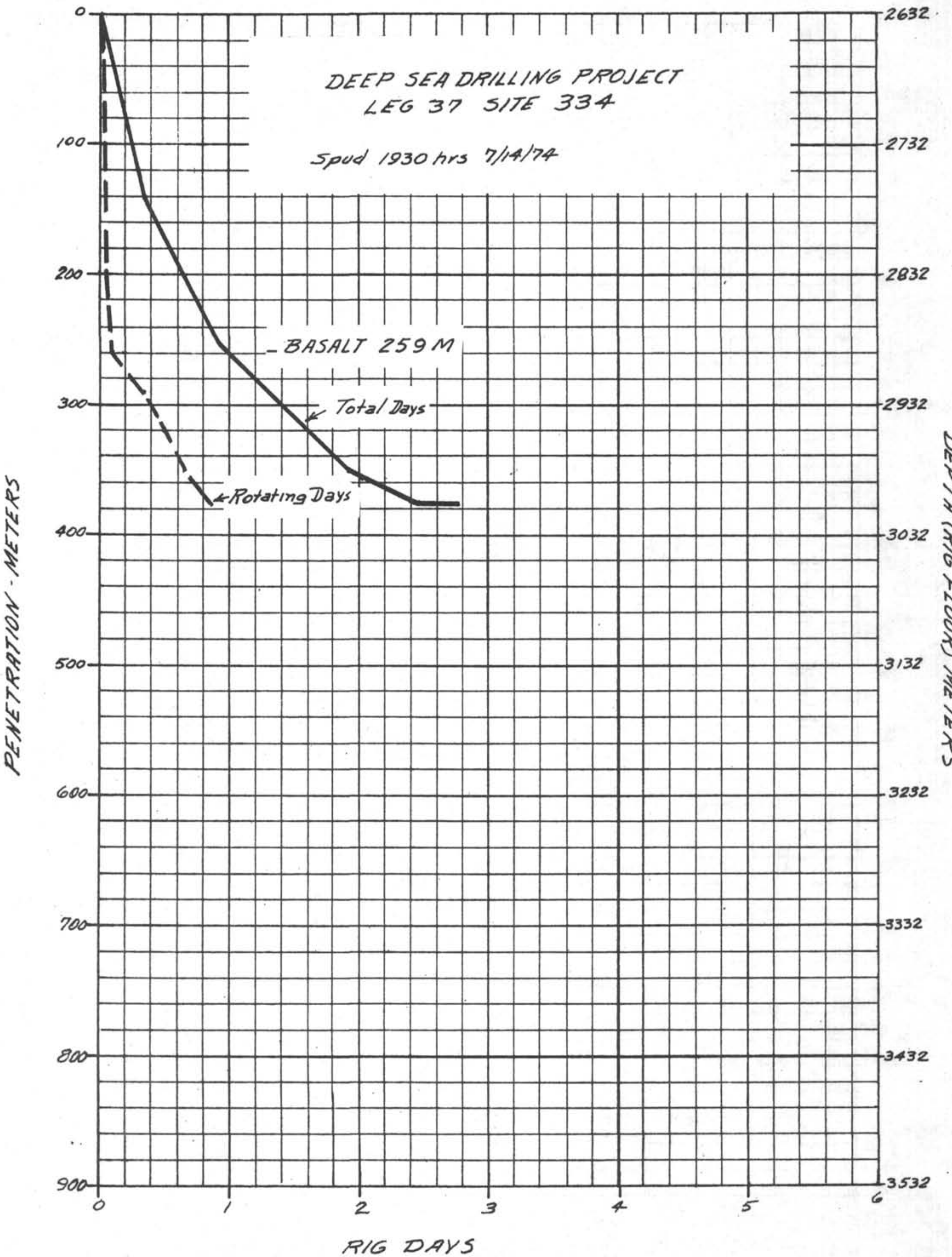
LEG 37 - SITE 333A
DEEP SEA DRILLING PROJECT

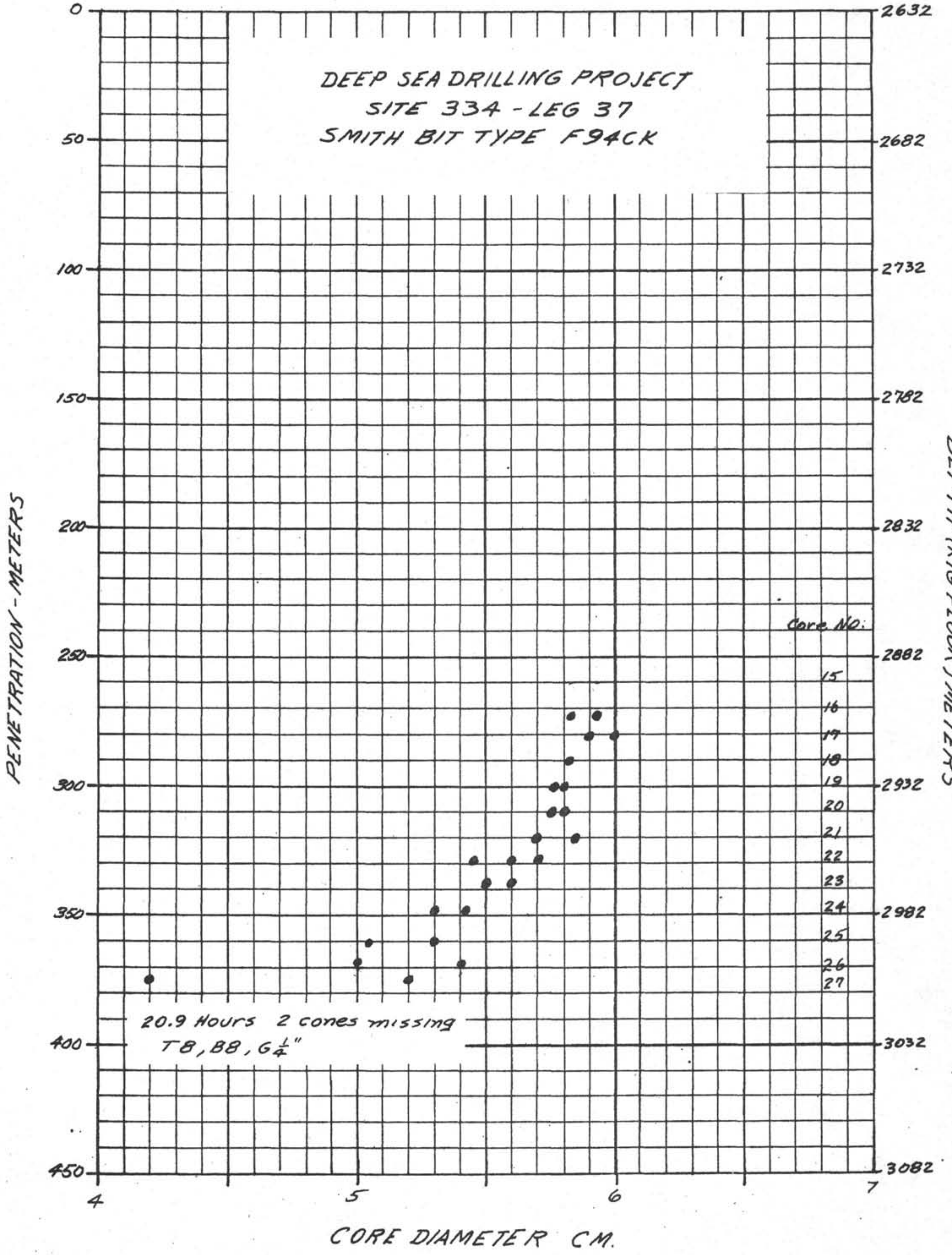



LEG 37 - SITE 333A
DEEP SEA DRILLING PROJECT
PENETRATION - METERS
360
370
380
390
400
410
420
430
440
450
DEPTH - (RIG FLOOR) - METERS
2040
2050
2060
2070
2080
2090
2100
2110
2120
2130
20000# 50RPM
150 FPM
6-7000 Ft Lbs
0
5
10
15
20
70
120+
CORING & DRILLING RATE METERS/HOUR

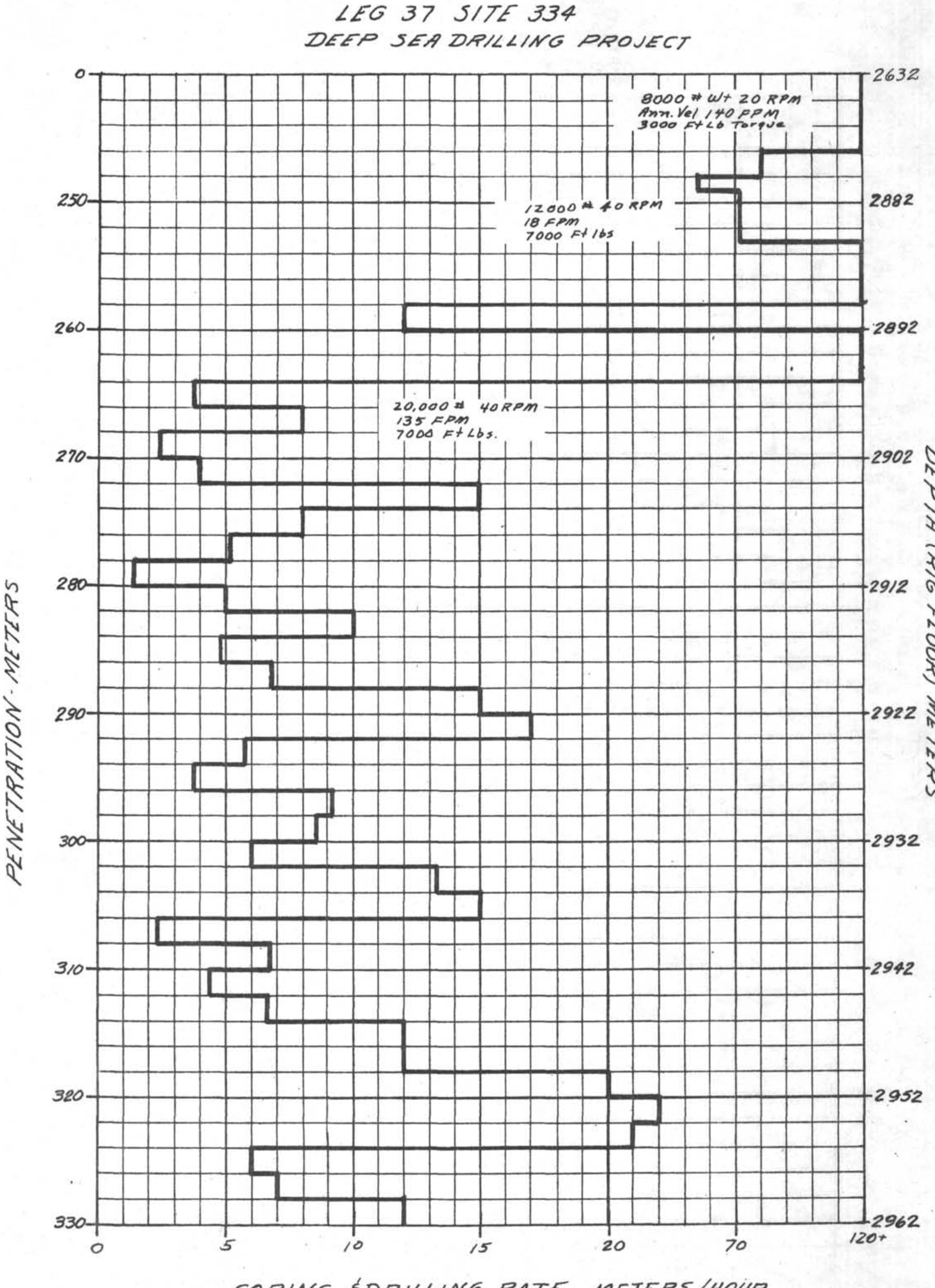
LEG 37 - SITE 333A
DEEP SEA DRILLING PROJECT




DEEP SEA DRILLING PROJECT
LEG 37 SITE 334
Spud 1930 hrs 7/14/74
BASALT 259 M
Total Days
Rotating Days
PENETRATION - METERS
DEPTH (RIG FLOOR) METERS
RIG DAYS
0
100
200
300
400
500
600
700
800
900
2632
2732
2832
2932
3032
3132
3232
3332
3432
3532
1
2
3
4
5
6

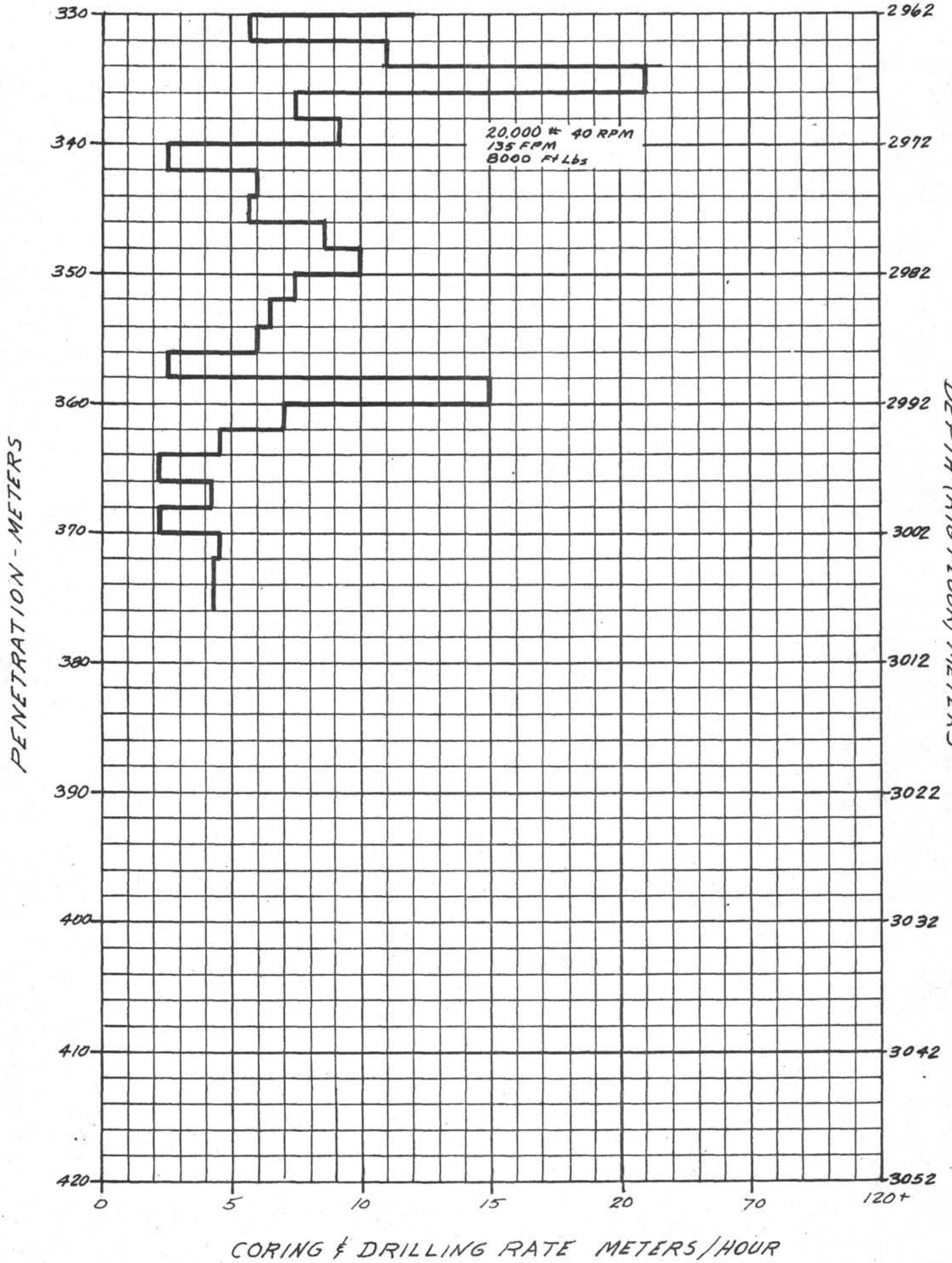


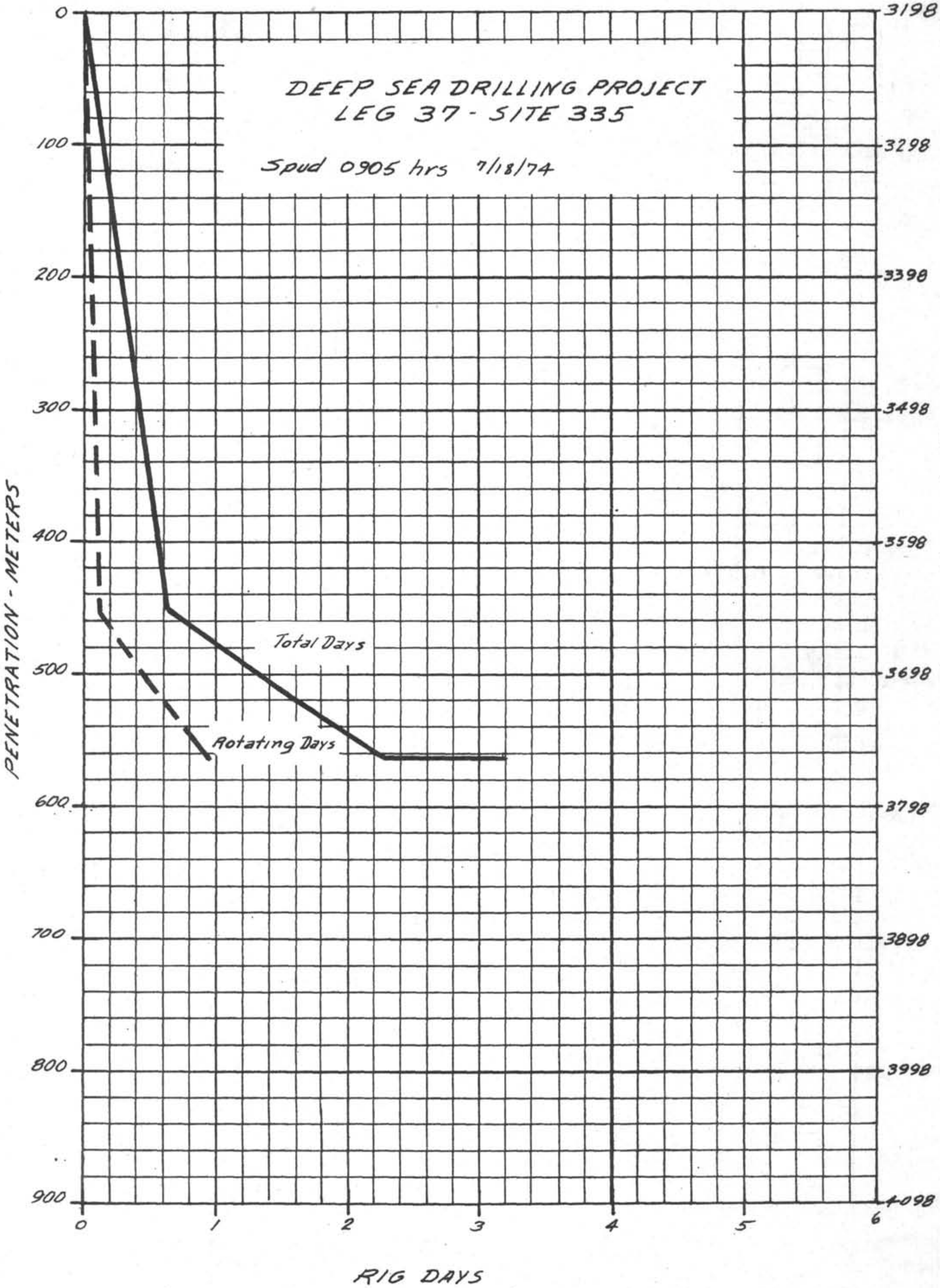
DEEP SEA DRILLING PROJECT
SITE 334 - LEG 37
SMITH BIT TYPE F94CK
PENETRATION - METERS
DEPTH (RIG FLOOR) METERS
CORE DIAMETER CM.
Core No.
15
16
17
18
19
20
21
22
23
24
25
26
27
20.9 Hours 2 cones missing
T8, B8, G$\frac{1}{4}$"
0
50
100
150
200
250
300
350
400
450
2632
2682
2732
2782
2832
2882
2932
2982
3032
3082
4
5
6
7



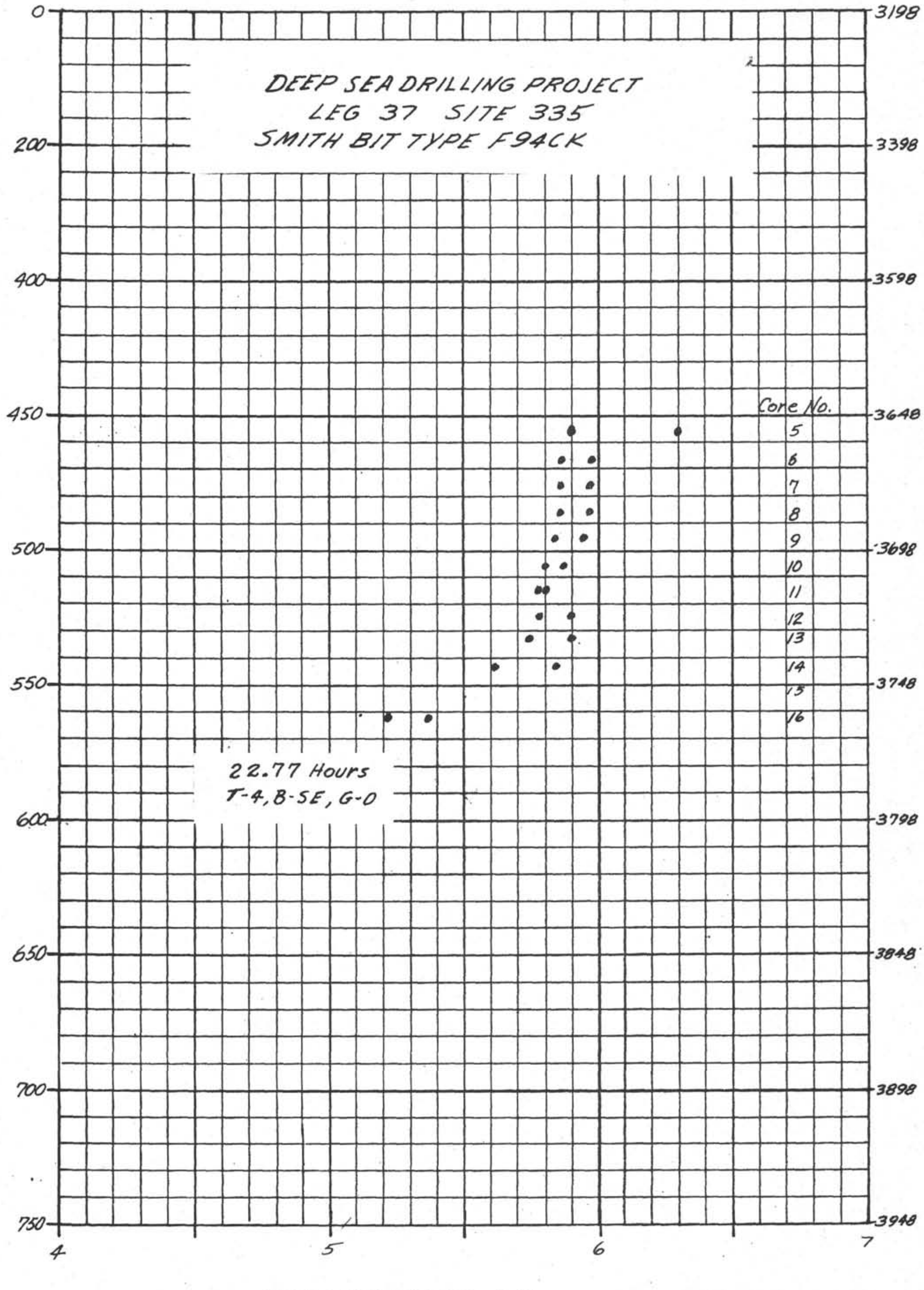
LEG 37 SITE 334
DEEP SEA DRILLING PROJECT
8000 # Wt 20 RPM
Ann. Vel 140 FPM
3000 Ft Lb Torque
12000 # 40 RPM
18 FPM
7000 Ft lbs
20,000 # 40RPM
135 FPM
7000 Ft Lbs.
PENETRATION - METERS
0
250
260
270
280
290
300
310
320
330
DEPTH (RIG FLOOR) METERS
2632
2882
2892
2902
2912
2922
2932
2942
2952
2962
0
5
10
15
20
70
120+
CORING & DRILLING RATE METERS/HOUR

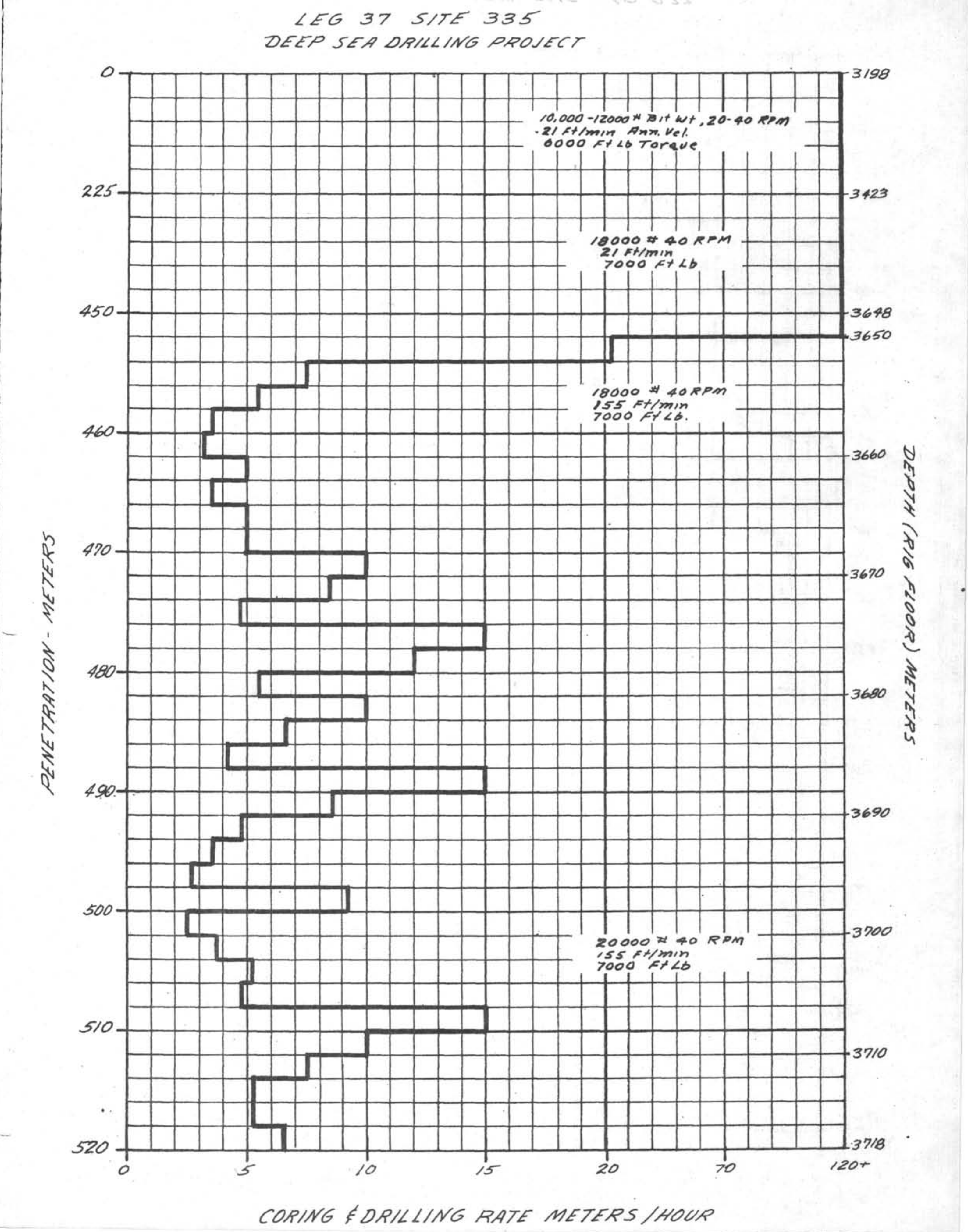
LEG 37 SITE 334
DEEP SEA DRILLING PROJECT

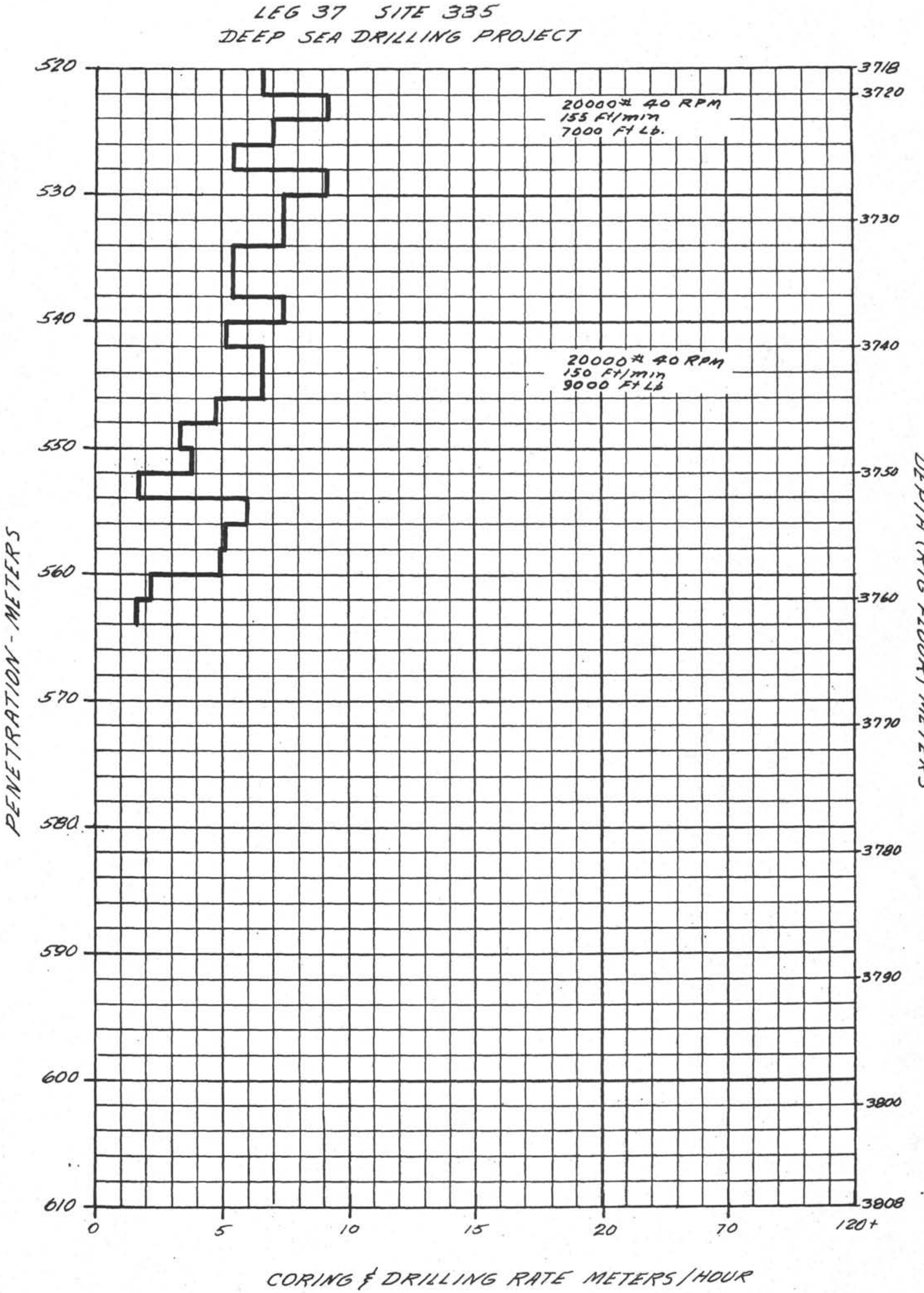




DEEP SEA DRILLING PROJECT
LEG 37 - SITE 335
Spud 0905 hrs 7/18/74
Total Days
Rotating Days
PENETRATION - METERS
DEPTH - (RIG FLOOR) - METERS
RIG DAYS
0
100
200
300
400
500
600
700
800
900
3198
3298
3398
3498
3598
3698
3798
3898
3998
4098
0
1
2
3
4
5
6


DEEP SEA DRILLING PROJECT
LEG 37 SITE 335
SMITH BIT TYPE F94CK
Core No.
5
6
7
8
9
10
11
12
13
14
15
16
22.77 Hours
T-4, B-SE, G-0
0
200
400
450
500
550
600
650
700
750
3198
3398
3598
3648
3698
3748
3798
3848
3898
3948
4
5
6
7
CORE DIAMETER CM.


LEG 37 SITE 335
DEEP SEA DRILLING PROJECT
10,000 -12000 # Bit Wt, 20-40 RPM
-21 Ft/min Ann. Vel.
6000 Ft Lb Torque
18000 # 40 RPM
21 Ft/min
7000 Ft Lb
18000 # 40 RPM
155 Ft/min
7000 Ft Lb.
20000 # 40 RPM
155 Ft/min
7000 Ft Lb
PENETRATION - METERS
DEPTH (RIG FLOOR) METERS
0
225
450
460
470
480
490
500
510
520
3198
3423
3648
3650
3660
3670
3680
3690
3700
3710
3718
0
5
10
15
20
70
120+
CORING & DRILLING RATE METERS/HOUR



LEG 37 SITE 335
DEEP SEA DRILLING PROJECT
20000# 40 RPM
155 Ft/min
7000 Ft Lb.
20000# 40 RPM
150 Ft/min
9000 Ft Lb
PENETRATION - METERS
DEPTH (RIG FLOOR) METERS
CORING & DRILLING RATE METERS/HOUR
520
530
540
550
560
570
580
590
600
610
3718
3720
3730
3740
3750
3760
3770
3780
3790
3800
3808
0
5
10
15
20
70
120+

DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 38

SUMMARY

DUBLIN PORT CALL

Leg 38 commenced in Dublin, Ireland at 0524 hours, July 29, 1974. During the port call of 4.2 days important maintenance work was completed, including the repair of a main fuel tank seepage. Intense Dublin port activities determined that the CHALLENGER had to wait in turn before discharging and onloading supplies, including some 5,000 feet of new drill pipe.

Dr. M.N.A. Peterson, Project Manager, visited the CHALLENGER and a number of press conferences and public relations meetings were held relating to the Project - past and future.

LEG OBJECTIVES - STRATEGIC PLANNING

This leg represented the first GLOMAR CHALLENGER expedition into the Northern Arctic latitudes and was planned to take advantage of the optimum seasonal weather window. Primary concerns were the deciphering of the structural and stratigraphic enigma of this relatively young region and its evolutionary detail and also the determining of the profoundly interesting boundaries between oceanic and continental basement.

Advanced scientific and operational planning was undertaken enroute to Site 336 with the object of familiarizing and informing personnel and identifying collective and individual requirements. This type of scientific and operational planning was continued for each site and/or group of sites and contributed towards a rewarding and efficient leg.

RESULTS

A considerable amount of valuable scientific data, ranging from tectonic history to the presence of hydrocarbons, was collected. The volume of work accomplished made Leg 38 probably the most work intensive since Project inception.

Footage cored was greater than on any previous leg; which, in combination with the joint highest number of site moves and relatively shallow water, intensified individual effort and produced a most commendable individual response.

From Site 351 on, the prevailing inclement weather frustrated sustained operations and some crucial scientific information was not obtained.

SITE OPERATIONS

Site 336

The standard bottomhole assembly was employed. Bit, core barrel, one stand 8-1/4" drill collar, one long stroke bumper sub, one stand 8-1/4" drill collar, one long stroke bumper sub, one stand 8-1/4" x 7-1/4" drill collar and the heavy wall pipe joint (5-1/2" drill pipe).

Only one long stroke bumper sub was used above and below the center drill collar to conserve equipment.

Normal coring and washing. Recovered basalt 485-515 m below sea floor.

No indications of hydrocarbons. Normal abandonment.

Site 337

Same bottomhole assembly as Site 336.

Normal coring.

Cored basalt 113-132 m below sea floor.

Site 338

Same bottomhole assembly as Site 336.

Normal drilling and coring. Basalt 401-427.5 m below sea floor.

Ran temperature probe.

Employed motion compensator.

Conducted first Lynes retrievable formation tester evaluation (passive test).

No indications of hydrocarbons. Normal abandonment.

Site 339

Same bottomhole assembly as Site 336.

Site 339 (Continued)

Diapiric structure. Cored to depth limit.

No indications of hydrocarbons. Emplaced barytes plug (heavy mud).

Site 340

Same bottomhole assembly as Site 336.

Continuous coring.

Diapiric structure. Cored to depth limit.

No signs hydrocarbons. Emplaced barytes plug.

Site 341

Same bottomhole assembly as Site 336.

Normal coring and drilling.

Conducted second retrievable formation tester evaluation (passive test).

Ran thermal probe.

Ran extended core barrel.

Evidence continuous methane and what appeared to be sweet light interstitial oil.

Emplaced cement plug followed by barytes plug.

Site 342

Same bottomhole assembly as Site 336.

Normal coring and drilling.

Recovered basalt 151.5-170.5 m below sea floor.

Conducted third retrievable formation tester evaluation (active test).

No evidence hydrocarbons. Normal abandonment.

Site 343

Added additional long stroke bumper sub above lowermost collars.

Ran pinger/piston core barrel.

Normal coring and drilling.

Recovered basalt 251 m below sea floor.

No evidence of hydrocarbons. Normal abandonment.

Site 344

Storm delayed approach to site.

Ran same bottomhole assembly as Site 343.

Suspended trip in hole and wait on weather.

Stopped rotating. Exceeded 3% displacement criteria.

Normal coring/drilling.

Recovered basalt 378-414 m below sea floor.

Faint trace 'natural' methane. Normal abandonment.

Site 345

Site chosen to avoid major turbidites.

Same bottomhole assembly as Site 344.

Normal coring/drilling.

Recovered basalt 770-802 m below sea floor.

Conducted fourth retrievable formation tester (active) test. Only able to test circulating valve due to the conditions obtaining.

No indications of hydrocarbons. Normal abandonment.

Site 346

Same bottomhole assembly as Site 344.

Continuous coring.

Compacted strata impeded penetration. Due to this and electrical problem which caused stationkeeping difficulty, site was terminated.

No indications of hydrocarbons. Normal abandonment.

Site 347

Same bottomhole assembly as Site 344.

Normal coring and drilling.

Tough compacted older sediments impeded progress.

No indications of hydrocarbons. Normal abandonment.

Site 348

Added extra stand drill collars to center bottomhole assembly.

Normal coring and drilling.

Reciprocated and circulated pipe in seabed during 24 hour electrical problem.

Recovered basalt 530.5-544 m below sea floor.

Conducted No. 5 retrievable formation tester (active) test.

Magnafluxed bottomhole assembly.

No indications hydrocarbons. Normal abandonment.

Site 349

Ran same bottomhole assembly as Site 348.

Ran long compact bit (Type 93C). Good average rate of penetration (AROP) improvement in harder sediments.

Normal coring/drilling.

Site 349 (Continued)

Twice delayed by exceeding 3% displacement criteria (automatic positioning).

No hydrocarbon indications. Normal abandonment.

Site 350

Ran same bottomhole assembly as Site 348.

Ran long compact bit.

Normal coring and drilling.

Recovered basalt 366-388 m below ocean floor.

No hydrocarbon indications. Normal abandonment.

Site 351

Same bottomhole assembly as Site 348.

Ran long compact bit.

Wait on weather. Conditions deteriorated.

Pulled out.

Storm developed Abandoned site.

Site 352

Same bottomhole assembly as Site 348.

Ran medium compact bit (for extra basalt cores).

Delayed by weather and automatic position repair.

Cored seabed. Sloughing gravels and sands enforced drilling. Slugged hole with mud.

Insufficient power to hold station in confused sea state, winds and 2 knot current.

Recovered bottomhole assembly above seabed.

Site 352A

Same bottomhole assembly/bit as Site 352.

Relocated Challenger. Found optimum heading for confused sea, wind, current state.

Normal drilling and coring.

Wind changed. Insufficient power to hold station.

Recovered bottomhole assembly to seabed.

Wait on weather.

Pulled bottomhole assembly to surface. Storm conditions.

DRILING SYSTEM

CORE BITS

Undoubtedly the realiable and versatile performance of the F94CK 4-cone, journal bearing, medium length compact core bit has proved its evolutionary development process. Little can be added to improve its efficiency.

CORE BARREL

The existing core barrel system is an excellent and balanced selection for this type of work. Care will be needed when engineering a Lynes RFT formation test when the packer is positioned above the core barrel, which is rated at 300,000 lbs minimum static axial compressive load. The theoretical total depth limit (water plus hole) is only some 3075 meters when assuming a dry hole with a regulator valve malfunction.

The inner barrel functioned well, apart from some difficulty attaching the center bits due to thread stand off. Also, adaption was required for employing the long compact core bits.

LONG STROKE BUMPER SUBS

The latest model in use leaves little room for improvement. They function very well over long periods. There were no signs of fluid leaks when tested to 1500 psi prior to the retrievable formation tester runs.

Their position in the string no doubt embodies much positional experience and appears to be an optimum compromise for the general drilling techniques.

BOTTOMHOLE ASSEMBLY CONDITION

A complete magnaflux inspection, including the long stroke bumper sub but excluding the heavy weight pipe, was performed after Site 348. There were no indications of developed or incipient flaws. Some damage was caused to the outer case of one long stroke bumper sub during the attempts to penetrate the sloughing section in Site 352. This damage occurred before the bottomhole assembly was buried, probably due to string misalignment and eccentric loading on the box section of the body.

SLUSH PUMPS

A critical situation can arise when the minimum speed of the pump, some 7 strokes per minute (60 gpm), is too great for very soft sediments, but some fluid movement is required even if just to prevent nozzle plugging and/or to lubricate. This could not be achieved by throttling the output or bypassing fluid. It became necessary to remove two suction valves from No. 2 pump in case the situation arose again.

CORING AND DRILLING TECHNIQUE AND PERFORMANCE

The overall coring operation was rewarding with a reasonably good percentage of recovery. However at some sites, where the sequential washing and coring method predominated and where interspersed dissimilar hardness materials persisted, a lower than average recovery was produced.

In the interest of maximum AROP and latest control core data, the wash and core technique was applied rather than the core and wash sequence. The latter, however, invariably produced a substantially improved recovery. The AROP ratio between washing and coring the same material varied between 10:1 and 1:1. The long compact bits consistently produced a high ratio, particularly in the more compact sediments.

The principal reason for reduced recoveries, when continuously coring, was the conflicting circulation requirements of interlayered hard and soft strata. The compromise is between total fluid erosion of incohesive friable sands and volcanic ash, or insufficient fluid for the tougher consolidated layers causing compacting and jamming.

On various occasions all combinations of applied weight, rotational speed, circulation rate, and core catcher types were employed to improve recovery. Sometimes these changes met with success, but at times elusive changes in formation characteristics could defeat all efforts. Improvements were achieved on occasions by employing a soft and hard core catcher combination thereby using the smaller closure diameter of the hard catcher to arrest the plastic sock and entrap the thixotropic ooze and silt before it could commence to extrude.

Also, the greater leverage of the springs, on the alternate short fingers, prevented the fingers from becoming plastered and locked in the retracted position.

The extended core barrel was employed at Site 341 with good results to obtain an important control core. In other places sufficient crucial interface, or transitional cored material, was recovered for adequate geological interpretation and for safety control and penetration tactics.

It was observed on some sites, particularly Site 344, that there was a direct association between string torque requirements and corresponding compressive strengths subsequently recorded in the core laboratory. Although theoretically this was to be anticipated, it was not expected to be so clearly observable.

After the experience of older and more compact sediments at Sites 346 and 347, an additional stand of 8-1/4" drill collar was added to the bottomhole assembly to provide more flexibility and options at subsequent sites. The use of the long compact bit, in combination with the available additional weight, allowed the specific bit tooth weight to be increased with a corresponding substantial increase in AROP in the tougher and compacted older sediments, also basalt.

PROBLEM AREAS

Few problems arose and apart from the thread stand-off problem with the center bits and shipboard adaptions required to use the long compact bits, most were readily rectified. They included the inner barrel jamming in the outer barrel and the tough protective coating of the core line occasionally collecting in the wireline overshot requiring a rerun.

CORE BIT CONSUMPTION

Core bit performance was good and consumption was planned on the expected hole conditions, and residue life, of four bits circulated between the first 13 wells. It was expected to consume two long compact bits between Sites 349 to 352, however the abandonment of Site 351, and the changed program for Site 352, where basalt penetration was increased from 15 to 50 meters, required the use of a new F94CK type bit which in effect was virtually unused as both Sites 352 and 352A were abandoned.

The bit employed in Site 348 was probably overstrained during the RFT formation test; this kind of situation had been anticipated. Axial compressive load exerted during the test foundered the bit on bottom and splayed at least one of the core guide fingers thus locking the cone. Surface inspection and freeing of the cone allowed the finger to relax into the original position and the bit appeared in good condition when superficially examined, however, the journal bearings may have been strained and deformed warranting a detailed inspection. This situation could arise subsequent RFT operations.

MOTION COMPENSATOR

The system could not be employed as planned to make an early assessment of its behavior, and performance, under the principally soft to medium hardness penetration conditions forecast for most of the sites. When initially installed at the first site it would not properly function due to a combination of externally introduced problems (detritus ingress into the vital hydraulic circuit, which promptly blocked the anti-slingshot valve filter and an electrical discontinuity in the superficial remote control circuit). Both problems rendered the unit inoperative. Good weather fortunately allowed the unit to be suspended on the travelling blocks between Sites 337 and 338 where the problems were isolated and resolved.

At Site 338, the unit performed perfectly as a motion compensator in both the passive and active operating modes. Both its responses and operating use were assessed for the soft and medium hardness sediment penetration conditions.

It was revealed that under the specific conditions, which were expected to persist generally throughout the leg, the associated additional time accruing from handling the unit and drill pipe, outweighted the direct advantages. Also, plainly, the unit had been engineered and procured to provide the vital (and from Site 338, experience), excellent control of the drill string under hard sea bed, heavy string, or continuous hard sediment of basement penetration conditions where its potential is yet to be fully realized.

It was not employed again during the remainder of the leg. This was determined, however, only by individual site requirements to meet the particular circumstances (a separate report is available).

LYNES RETRIEVABLE FORMATION TESTER (RFT)

It had been programmed to field evaluate this equipment during Leg 38 for downhole durability and in both operating modes, (as a safety tool and formation tester). Five specific evaluation tests, absorbing one half day direct operating time, were conducted.

Two passive tests, Sites 338 and 341, were made to provide data on the abrasion resistance and wear rate of the packer element when reciprocated and rotated in both sedimentary and basaltic formation. Two active evaluation tests, Sites 342 and 348, provided operating data and experience of the formation testing fuction and confirmed the satisfactory performance, potential value and acceptability of the tool in this role.

An active test in the safety tool made at Site 345 was frustrated by an inadequate packer seat and attendant inherent risk of massive hydraulic fracturing and stuck pipe. The secondary function of the circulation valve system was proved to be completely dependable and satisfactory.

Valuable experience as gained during the active and passive tests, which were deliberately conducted under non-ideal conditions, to "practically" assess the operational function in conjunction with the designed function.

The DSDP engineer associated with this Project, Mr. Mike Storms, commendably ensured the availability and fully functional condition of the tool, and its accessories, and planned its effective deployment during the leg when multifarious interacting circumstances limited suitable test sites.

Both the scientists and GMI personnel enthusiastically assisted with the evaluation program. GMI drilling staff were particularly helpful and diligently ensured that the tests were smoothly organized and had minimum adverse affect on the main objectives and were operationally efficient.

It should be recorded that open hole packer setting and formation testing operations are not enthusiastically sought after because of the inherent risks involved. They are virtually unheard of from a floating drilling rig. This is further intensified by the unique CHALLENGER drilling technique because the vital annulus control, and downhole information feedback, is absent. Manipulation from the surface is less definitive.

A detailed evaluation report has been submitted by Mr. Mike Storms and comments and recommendations by the undersigned.

THERMAL PROBE

Heat flow measurements were successfully accomplished at Sites 338 and 341. The equipment was operated and functioned in the correct manner and meaningful data was retrieved.

PINGER/PISTON CORER

Some problems were experienced recommissioning the equipment. These were both electrical, where specialized shipboard cable splicing was necessary for each proposed run; and mechanical, whereby the original design of detent latch collar would not go through the RFT.

For these reasons, it could not be employed prior to Site 343 where an undisturbed seabed piston core was successfully recovered and an accurate seabed depth provided (in relation to the drill string), proving the equipment efficiency. The depth value obtained helped to confirm the correction scale to be applied to the PDR for these waters.

The disproportionate surface handling time needed determined that the system should only be employed when conditions warranted such time and effort.

WEATHER

The weather was generally good and favorable for the operations during the majority of the leg, however, there were occasions when conditions adversely affected operations. In particular, virtually continuous storm conditions seriously curtailed and frustrated activities at the last two sites. While underway to Site 344, a storm demanded a temporary course change. At Site 351 and also at Site 352A, a storm forced abandonment.

On occasions, variable combinations of wind, swell and current left little, if any, reserve power for positional recuperation which was critical at some shallow water sites where the 3% displacement (excursion) criteria amounted to only 73 feet. Waiting on weather occurred only three times during the first 15 sites and three times on the remaining two sites.

Good, meaningful and accurate meteorological information was available from a number of different sources and generally adequate forecasting was received with good onboard interpretation and local prediction.

NAVIGATION AND UNDERWAY

All moves were accomplished in an efficient, confident manner with total cooperation aimed at achieving the specific objectives expeditiously. The satellite navigation computer needed additional "independent" air conditioning to enable it to function correctly. Otherwise the system performed satisfactorily.

BEACONS

All beacons functioned effectively and no repeat beacons had to be dropped. An additional beacon was consumed at Site 341 as the original was mispositioned. An excess stock of older 13.5 kHz beacons was consumed.

STATIONKEEPING

Locating and locking onto the beacon in the automatic positionkeeping mode was usually proficiently achieved and only affected by the prevailing weather conditions. These conditions at Site 352 accounted for 5-3/4 hours before finally locking onto the beacon. Confused and strong current, swell and wind absorbed almost the total positioning power available.

Overall stationkeeping was vigilantly maintained and was very good. This was true in particular when adverse weather demanded corrective power approaching the maximum available. Only three off hole excursions developed where string rotation was prohibited. Once, it became necessary to start withdrawing the string towards seabed. In most instances, the off hole translation criteria curtailing operations was enforced because of the relatively shallow water conditions in particular at Sites 336, 346, 347, 349 and 352.

The intense and variable swell, current and wind conditions at Site 352 eventually combined requiring positioning power demands which threatened to overheat the generator system and the bottomhole assembly was retrieved above seabed. After hunting a more favorable heading and allowing for anticipated wind direction changes, Hole 352A was spudded and reached a depth of 112.5 m before the combined weather elements again demanded positioning power which threatened to overtax the system. The bottomhole assembly was again retrieved. Further weather deterioration required the drill string to be pulled to surface and secured.

COMMUNICATIONS

Generally, a reliable communication contact, in either direction, was virtually impossible except by commercial networks. This ever present fact caused considerable frustration and considerable repeat efforts. Also, there was a perpetual concern that information could not be readily sent and received. Outgoing messages were maintained at a minimun; however, an embarrassingly large backlog accumulated from time to time.

Should it be intended to operate again in areas such as this and be able to properly communicate in a manner consistent with Project requirements and the state of communication development, then the system needs basic improvement.

SHUT DOWNS AND REPAIRS

SHIP AND ASSOCIATED SYSTEMS

A delay occurred shortly after leaving Dublin when the Master prudently decided to test all propulsion and positioning systems before departing for Site 336. Two independent problems were detected. The CHALLENGER returned to an anchorage off Dublin while the malfunctions were identified. One was found and repaired on No. 3 propulsion motor and one, on the after stern thruster, was resolved only after talking directly to GMI in the U.S.A. A total of 37.75 hours were lost. Two points emerge from this incident. Firstly, that procedurally all systems should be checked out before finally sailing for the first site, and secondly, that GMI and DSDP personnel who attend the port call should not leave the area until these sailing tests are satisfactorily completed. On August 26-27, a six hour delay was caused when attempting to assign power to the forwardmost thruster.

On three other separate occasions there was disruption to the drilling operation due to electrical problems. In one case a 24 hour serious disruption occurred during which the bottomhole assembly had to be continuously moved and withdrawn towards the seabed due to the inability to assign power to the Bowen power sub prime mover unit. The first instance, August 17, lasted two hours and no defined solution emerged. On September 10-11, a similar problem occurred and remained elusive for 24 hours during which advice was sought directly from GMI, U.S.A. On this occasion, the prime mover motor rotated in the reverse direction further confusing the problem. Again, no systematic solution emerged. The third occasion lasted one hour. By continuous diligent effort, the staff isolated the mysterious defect to probably be a sporadic earthing (ground) fault in No. 2 generator.

A short duration positioning malfunction arose on September 7 which was resolved in half an hour.

These types of problems are to be expected with a comprehensive control and power assignment system, however, efforts should be directed at a more effective prevention and erratication procedure. The Chief Engineer and Electrician worked hard and long to efficiently detect and remove the problems. The Electrician, being unfamiliar with this particular system, had a substantial and unenviable handicap to overcome.

SHUT DOWNS AND REPAIRS

DRILLING AND ASSOCIATED SYSTEM

A total of five hours was lost attempting to commission the motion compensator including make up and break out time. Since the unit had reportedly functioned well on the previous leg, there was no reason to suspect any problem. This fact, coupled with the nature of the malfunction (detritus in the hydraulic circuit and damaged electrical control cable), would suggest that the cause was the hose inspection exercise in Dublin. This, again, emphasizes the need for strict procedural instructions and test routines covering equipment of this nature.

Between Sites 336 and 337, it was essential to respool the core reel due to persistent wrap jumping which was both delaying operations and damaging the new line. This was caused by unpacked and slack wrapped original spooling.

At Site 350, the dual elevator actuating cylinder malfunctioned causing a two hour delay and a reversion to drill pipe slips for the trip out. At Site 351, the stabber unit control valve temporarily failed causing the unit to be inoperative for 3-1/2 hours.

On all occasions, personnel conscientiously endeavored to rectify the problems expeditiously. The degree of failure is consistent with the hard work to which the equipment is subjected.

SAFETY

DOWNHOLE CONTROL

The controls and restraints recommended by the JOIDES and SIO Safety Panels were observed on all occasions. Sites 339 and 340, which were located on diapirs, were limited to the nominal 100 meter penetration. Full, correct, and diligent monitoring of cores was undertaken and appropriate tests and inspections made, where necessary, including additional cores, fluorescence, salinity, clathrate checks and awareness and avoidance of undercompacted shales, caprocks, closures, unconformities and structures.

Particular attention was paid to ensuring a properly engineered and emplaced cement plug, and follow up barytes plug, at Site 341 to plug and seal the methane and apparent sweet interstitial oil bearing section of the hole. A western most site was chosen for Site 346 as recommended; also, the minimum turbidite thickness was selected.

It was necessary to clarify site reference numbers (available and employed in three different "varieties") which were without geographical coordinates, to ensure which sites were referred to in the safety recommendations. Hopefully, this was an isolated case. Management was requested to insist that coordinates are always associated with the numerical site references to ensure an absolute identification (particularly safety panel references).

PERSONNEL SAFETY

A simple format was introduced which includes the name, cabin number, bunk number and lifeboat station of all scientific and technical staff to simplify locating and mustering during emergency practice and to help newcomers quickly learn the first name of their colleagues (copy attached).

During the regular emergency drills, the Master showed the British Petroleum film "Fire Down Below" to impress, by visual aid, the importance of fire and safety drills aboard ship and the correct procedures in case of emergency. Demonstrations of fire fighting equipment and emergency breathing apparatus were also given.

PERSONNEL AND THE IMPORTANT HUMAN ASPECT

As the leg statistics showed, this was one of, if not the most intense leg of the Project in terms of personnel work commitments. The greatest distance ever cored on one leg was superimposed on the joint highest number of sites visited. This resulted in continuous concentrated duty and effort with virtually no respite.

Occasionally, the air conditioning in the scientists/technical accommodations and science lounge was imbalanced and could not be adjusted to requirements (due to intrinsic design conditions), which was not conducive to maximum efficiency.

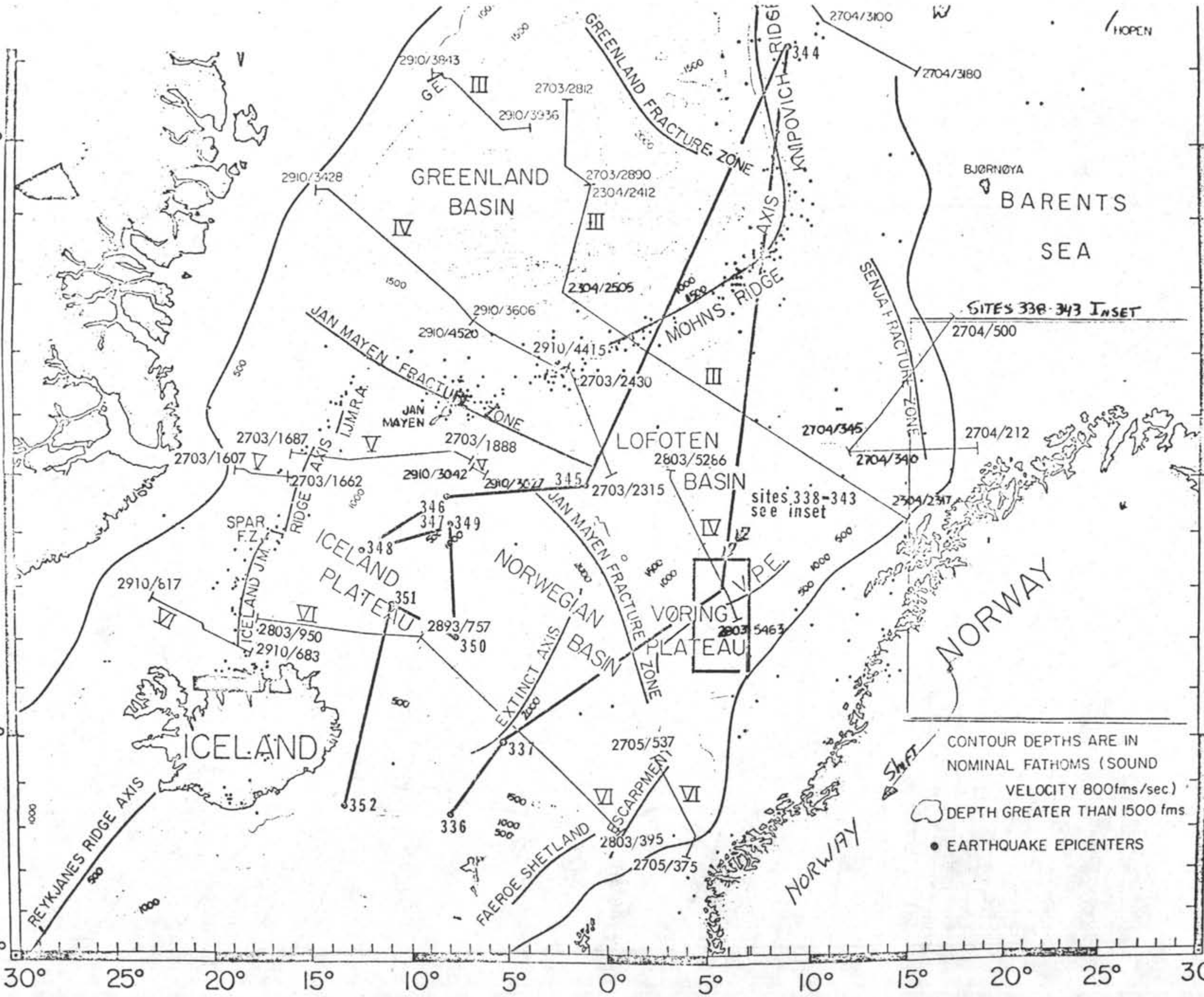
The intervals of wet, cold and otherwise adverse weather conditions were accepted with the professional stoicism expected.

All personnel conscientiously, willingly and diligently worked with enthusiasm to produce an excellent team effort and exceptionally rewarding expedition. Individual and collective performance was of commendably high order. I feel honored to have been associated with the team and the individuals.

Michael D. Pennock
Cruise Operations Manager
Deep Sea Drilling Project

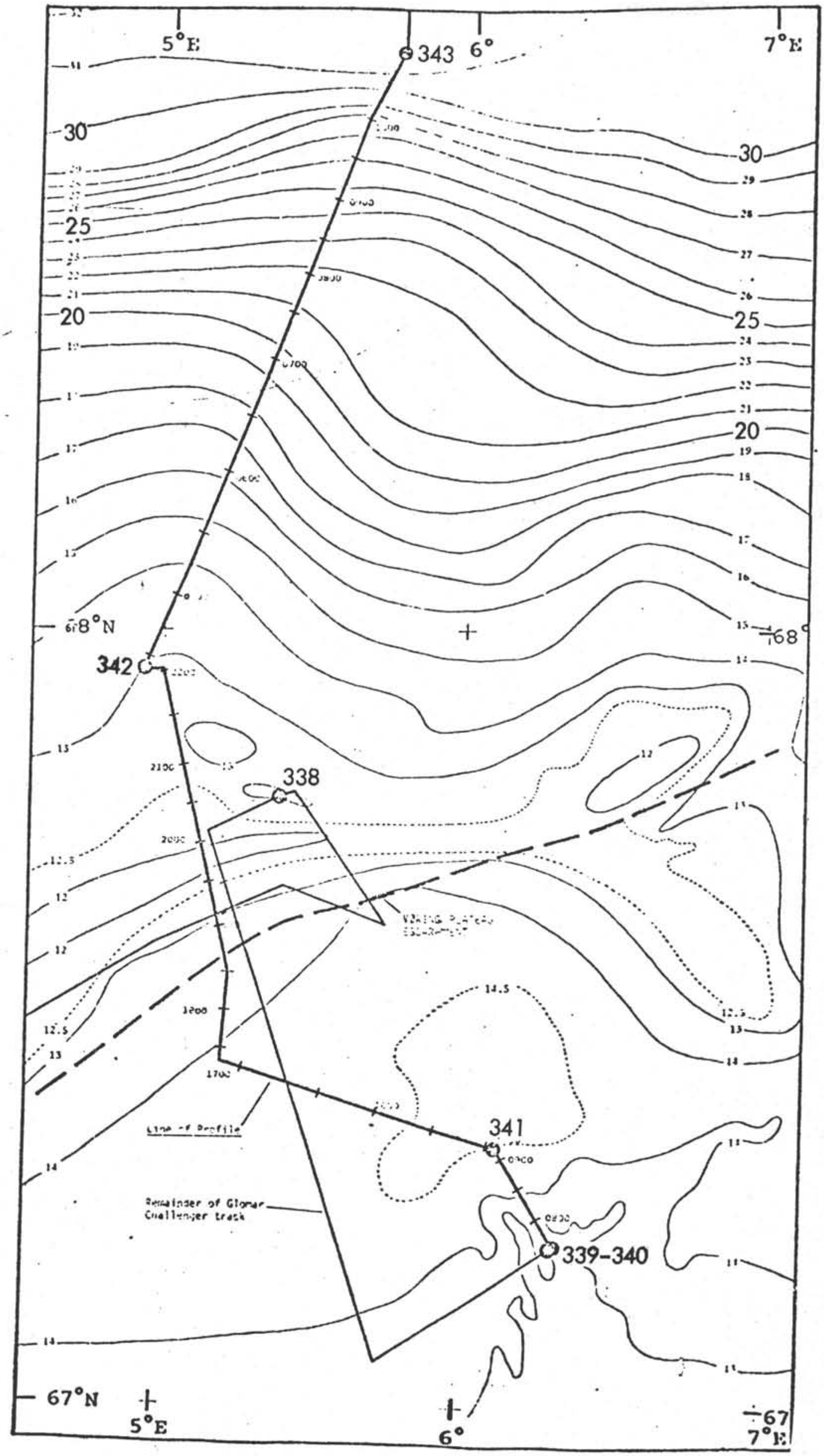
DEEP SEA DRILLING PROJECT
SUMMARY OF OPERATIONS
LEG 38

Total Days Leg		58.46
Total Days In Port (Dublin)		4.16
Total Days Cruising (Including Site Survey)		22.44
Total Days On Site		31.86
Trip Time	5.63	
Drilling Time	1.71	
Coring Time	6.93	
Lost Time (Mechanical Downtime)	3.49	
Positioning Ship	0.74	
Other (Wireline, Reaming, Etc.)	12.89	
Wait On Weather	0.47	
Total Distance Traveled (Nautical Miles)		4285.8
Average Speed (Knots)		8.95
Sites Investigated		17
Holes Drilled		17
Number Of Cores Attempted		354
Number of Cores With Recovery		352
Percent Of Cores With Recovery		99.4
Total Meters Cored		3236.5
Total Meters Recovered		1804.7
Percent Of Cored Interval Recovered		55.8
Total Meters Drilled		2041.5
Total Penetration		5278.0
Percent Of Penetration Cored		61.3
Maximum Penetration At Single Hole		802.0
Maximum Water Depth		3216.0
Minimum Water Depth		741.0
Average Water Depth		1541.0

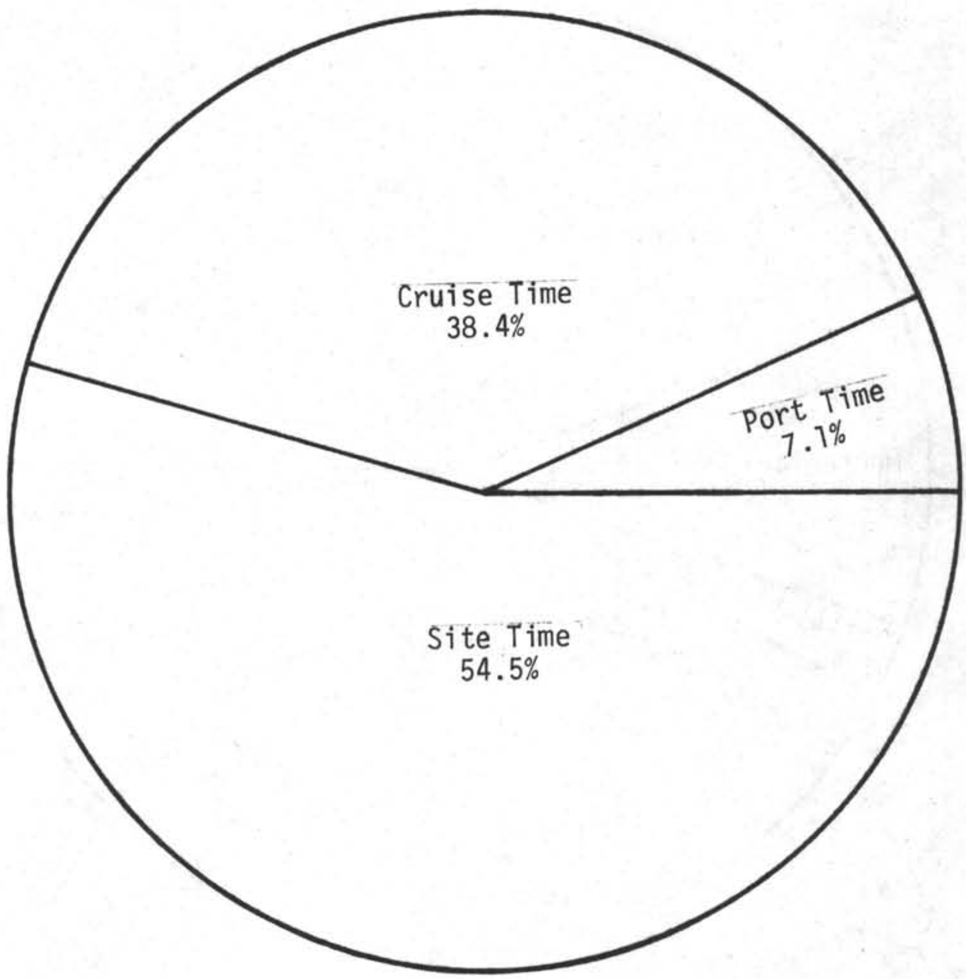


GREENLAND BASIN
BARENTS
SEA
BJØRNØYA
HOPEN
GREENLAND FRACTURE ZONE
KNIPOVICH RIDGE
AXIS
MOHNS' RIDGE
SENJA FRACTURE ZONE
SITES 338-343 INSET
JAN MAYEN FRACTURE ZONE
JAN MAYEN
LOFOTEN
BASIN
sites 338-343
see inset
ICELAND PLATEAU
NORWEGIAN
BASIN
VØRING
PLATEAU
V.P.E.
NORWAY
ICELAND
REYKJANES RIDGE AXIS
EXTINCT AXIS
FAEROE SHETLAND ESCARPMENT
SPAR F.Z.
ICELAND JM. RIDGE AXIS
I.J.M.R.A.
2910/3843
2910/3936
2703/2812
2703/2890
2304/2412
2304/2505
2910/3428
2910/3606
2910/4520
2910/4415
2703/2430
2703/1687
2703/1607
2703/1662
2703/1888
2910/3042
2910/3027
2703/2315
2803/5266
2704/3100
2704/3180
2704/500
2704/345
2704/340
2704/212
2304/2317
2910/617
2803/950
2910/683
2893/757
2803/5463
2705/537
2803/395
2705/375
344
345
346
347
348
349
350
351
352
336
337
CONTOUR DEPTHS ARE IN
NOMINAL FATHOMS (SOUND
VELOCITY 800fms/sec)
DEPTH GREATER THAN 1500 fms
EARTHQUAKE EPICENTERS
Shift
75°
70°
65°
60°
30°
25°
20°
15°
10°
5°
0°

SITES 338 - 343 INSET MAP.

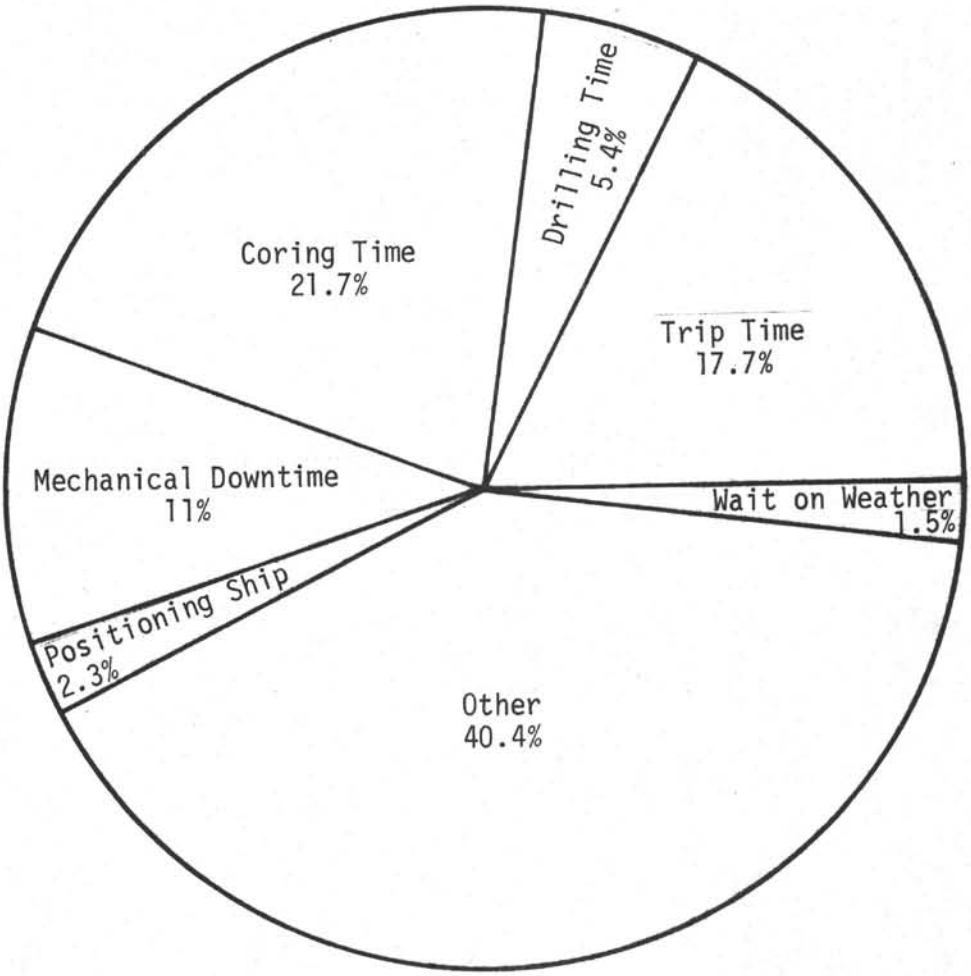


DEEP SEA DRILLING PROJECT
TOTAL TIME DISTRIBUTION
LEG 38



START LEG: July 29, 1974
FINISH LEG: September 25, 1974
TOTAL TIME: 58.46 Days

DEEP SEA DRILLING PROJECT
ON-SITE TIME DISTRIBUTION
LEG 38



TOTAL TIME ON SITE:	31.86 Days
TOTAL SITES:	17
TOTAL HOLES:	17

DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 38

Site No.	Make	Freq. kHz	Serial Number	Site Time Hours	Soaked Dropped Functioned	Remarks
336	ORE	13.5	216	71.22	Satisfactorily	
337	ORE	16.0	261	45.00	Satisfactorily	
338	ORE	13.5	270	63.03	Satisfactorily	
339	ORE	16.0	262		Satisfactorily	
340	ORE	16.0	262	31.88	Satisfactorily	Offset from Site 339.
341	ORE	13.5	272			Mispositioned
341	ORE	16.0	263	53.02	Satisfactorily	
342	ORE	13.5	274	29.73	Satisfactorily	
343	ORE	16.0	264	49.98	Satisfactorily	
344	ORE	13.5	275	79.60	Satisfactorily	
345	ORE	13.5	276	97.93	Satisfactorily	
346	ORE	13.5	277	35.53	Satisfactorily	
347	ORE	16.0	266	23.93	Satisfactorily	
348	ORE	13.5	279	82.65	Satisfactorily	
349	ORE	16.0	265	33.88	Satisfactorily	
350	ORE	13.5	283	33.35	Satisfactorily	
351	ORE	16.0	267	11.85	Satisfactorily	Commenced running BHA. Abandoned.
352	ORE	13.5	284	19.75		
352A	ORE	13.5	284	15.00	Satisfactorily	Adjacent replacement hole.

DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 38

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	Average Rate Penet.	Time On Hole	Time On Site
336	63° 21.06'N	07° 47.27'W	830.0	44	43	97.7	396.5	220.9	55.7	118.5	515.0	10.2	50.45	71.22
337	64° 52.30'N	05° 20.51'W	2657.0	15	15	100.0	132.5	98.3	74.2	0.0	132.5	5.6	23.83	45.00
338	67° 47.11'N	05° 23.26'E	1315.0	45	45	100.0	427.5	208.7	48.8	9.5	437.0	9.1	48.42	63.03
339	67° 12.65'N	06° 19.05'E	1276.0	12	12	100.0	108.0	50.5	46.7	0.0	108.0	11.9	9.08	15.33
340	67° 12.47'N	06° 18.38'E	1244.0	11	11	100.0	104.5	67.2	64.3	0.0	104.5	12.1	8.70	16.55
341	67° 20.10'N	06° 06.64'E	1443.5	34	34	100.0	313.5	213.0	67.9	142.5	456.0	11.6	39.42	53.02
342	67° 57.04'N	04° 56.02'E	1316.0	8	8	100.0	75.5	48.0	63.6	95.0	170.5	12.8	13.33	29.73
343	68° 42.91'N	05° 45.73'E	3165.0	16	16	100.0	132.0	59.0	44.7	152.0	284.0	11.7	24.33	49.18
344	76° 08.98'N	07° 52.52'E	2201.0	37	37	100.0	338.0	140.2	41.5	76.0	414.0	8.3	50.25	79.60
345	69° 50.23'N	01° 14.26'W	3216.0	36	36	100.0	336.5	189.5	56.3	465.5	802.0	10.8	74.1	97.94
346	69° 53.35'N	08° 41.14'W	741.0	20	20	100.0	187.0	120.4	64.4	0.0	187.0	8.2	22.7	35.53
347	69° 52.31'N	08° 41.80'W	762.0	4	4	100.0	24.0	13.2	55.0	166.0	190.0	11.8	16.0	23.93
348	68° 30.18'N	12° 27.72'W	1777.0	34	34	100.0	316.0	214.0	66.7	228.0	544.0	14.4	37.8	82.65
349	69° 12.41'N	08° 05.80'W	928.0	13	13	100.0	120.0	81.2	67.7	199.5	319.5	14.4	22.25	33.88
350	67° 03.34'N	08° 17.68'W	1289.0	16	15	93.8	150.5	49.5	32.9	237.5	388.0	18.1	21.4	33.35
351	67° 47.34'N	11° 18.26'W	1854.0	Site Abandoned Due To Storm										
352	63° 38.97'N	12° 28.26'W	1018.0	6	6	100.0	46.0	26.0	56.0	57.5	103.5	14.6	7.08	19.75
352A	63° 38.97'N	12° 28.26'W	1018.0	3	3	100.0	28.5	5.1	17.9	94.0	122.5	21.0	5.83	15.0
		Totals		354	352	99.4	3236.5	1804.7	55.8	2041.5	5278.0	11.1	474.97	764.69

Time In Hole = Spud To Total Depth
Time On Site = Drop Beacon To Underway

Average Time Per Hole = 27.94 hr
Average Time On Site = 31.86 hr

DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 38

Hole	Mfg.	Size	Type	Serial Number	Meters Cored	Meters Drilled	Meters Total Penet.	Hours On Bit	Condition	Remarks
336	Smith	10-1/8"	F94CK	SZ153	396.5	118.5	515.0	21.3	T1, B1, G1	30m basalt - good
345	Smith	10-1/8"	F94CK	SZ153	336.5	465.5	802.0	32.8	T3, B4, G-1/8	32m basalt
					733.0	584.0	1317.0	54.1	Scrapped	Compacts lost. One bearing out of gage.
337	Smith	10-1/8"	F94CK	SZ154	132.5		132.5	9.6	T1, B1	18m basalt
344	Smith	10-1/8"	F94CK	SZ154	338.0	76.0	414.0	22.27	T4, B3, G-1/4	36.5m basalt
					470.5	76.0	546.5	31.87	Scrapped	Compacts damaged
338	Smith	10-1/8"	F94CK	RC911	427.5	9.5	437.0	15.27	T1, B1, G	26.5 basalt
343	Smith	10-1/8"	F94CK	RC911	132.0	152.0	284.0	9.27	T1, B2, G1	33.0 basalt (soft)
					559.5	161.5	721.0	24.54	Good for shallow sediment hole.	
339	Smith	10-1/8"	F94CK	RC894	108.0		108.0	2.83	T1, B1	
340	Smith	10-1/8"	F94CK	RC894	104.5		104.5	1.92	T1, B1	
341	Smith	10-1/8"	F94CK	RC894	313.5	142.5	456.0	13.33	T2, B2, G2	
342	Smith	10-1/8"	F94CK	RC894	75.5	95.0	170.5	8.12	T2, B3, G3	19m basalt
					601.5	237.5	839.0	26.2	Scrapped	
346	Smith	10-1/8"	F94CK	RF034	187.0		187.0	16.6	T2, B1, G1	Cone metal fluid erosion
347	Smith	10-1/8"	F94CK	RF034	24.0	166.0	190.0	12.0	T5, B2, G2	Compacts lost
					211.0	166.0	377.0	28.6	Scrapped	Old compacted sediments
348	Smith	10-1/8"	F94CK	RC909	316.0	228.0	544.0	14.3	Overloaded-RFT Test -	Do not rerun. Send for inspection.
349	Smith	10-1/8"	F93CK	NK144*	120.0	199.5		10.8	T1, B1, G*	Drilled hard sediment
351	Smith	10-1/8"	F93CK	NK144*	Nil	Nil			T1, B1, G*	Ran BHA. Hole abandoned.
					120.0	199.5		10.8	Good	Rerun for hard sediments.
350	Smith	10-1/8"	F93CK	NK147*	150.5	237.5	388.0	9.7	T3, B2, G1*	24m basalt. Broken teeth. Good for shallow sediment hole.
352	Smith	10-1/8"	F94CK	RC902.	46.0	57.5	103.5	3.08	As New	No work. Hole abandoned.
352A	Smith	10-1/8"	F94CK	RC902	28.5	94.0	112.5	2.38	As New	No work. Hole abandoned.
					74.5	151.5	216.0	5.46		Suitable for any hole.

* Long compact with ring welded in throat.

DEEP SEA DRILLING PROJECT
SITE TIME DISTRIBUTION (Hrs)
LEG 38

Date	Site	Cruise	Trips	Drill	Core	Stuck Pipe	Wait On Weather	Position Ship	Mech Repair	Other	Total Time	Remarks
Aug 06-09	336		7.0	2.75	16.5			1.22	5.0	38.75	71.22	Motion Compensator.
Aug 10-12	337		13.5		9.75			1.25		19.0	43.50	
Aug 13-16	338		11.0		17.25			0.75		34.03	63.03	
Aug 16-17	339		4.8		3.25			1.25		6.03	15.33	
Aug 17-18	340		4.6		3.25			0.5	2.0	6.2	16.55	Lost electrical pwr to swivel.
Aug 18-20	341		7.1	6.5	5.25			0.75		33.42	53.02	
Aug 20-22	342		11.0		8.25			0.48		10.0	29.73	Drilling line guide.
Aug 22-24	343		7.75	6.0	8.0			0.5	2.0	25.73	49.98	Power swivel swab valve.
Aug 26-30	344		12.5	3.25	20.0		2.0	0.5	6.0	35.35	79.6	Power to forward thruster.
Sept 01-05	345		12.5	11.75	21.25			0.5		40.74	86.74	
Sept 06-07	346		6.25		14.5			1.13	0.5	13.15	35.53	Positioning.
Sept 07-08	347		4.75	5.75	6.75			1.0		5.68	23.93	
Sept 09-12	348		7.75	3.5	11.0			0.5	24.0	35.9	82.65	Electrical to Bowen.
Sept 13-14	349		6.0	2.75	9.5		1.08	0.5	1.0	13.05	33.88	Dual elevator system.
Sept 15-16	350		6.25	2.50	6.0			0.75	2.0	15.85	33.35	
Sept 17	351		1.0				5.58	0.5	3.5	1.27	11.85	
Sept 19	352		3.5	1.75	1.25		1.25	5.75		6.25	19.75	
Sept 20	352A		3.5	2.0	1.5		3.5			4.5	15.00	
	Totals		130.75	48.50	163.25		13.41	17.83	46.0	344.90	764.64	

DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 39

Leg 39 began September 25, 1974 at Amsterdam, Netherlands and ended 82.58 days later at Cape Town, South Africa on December 17, 1974.

This leg was planned to position the Challenger for a summer leg, 40 in the Antarctic and resulted in the longest DSDP cruise to date both in time and distance traveled. The drill sites were across the Atlantic from both the departure and arrival ports which required crossing the Atlantic Ocean twice. This long cruising time and the accepted emotional endurance limits of the scientific and technical personnel limited the time available for on-site operations. The Global Marine crews were relieved at the mid-point of the leg in Recife, Brazil.

One site in the Vema Fracture Zone was selected to drill igneous rocks but hole problems in two holes forced abandonment of this site. The remaining planned sites were devoted to drilling sediments in the Ceara Rise, Brazil Basin, Sao Paulo Ridge, Rio Grande Rise, and Argentine Basin which are areas associated with the opening of the South Atlantic Ocean. Another site on the Walvis Ridge was drilled enroute to Cape Town to use the remaining operational time. The low penetration rate in the deep sediments and the time schedule prevented reaching basement on all but two of these sites. A storm with winds up to 80 mph and 30 foot swells stopped operations 19 hours early on the last planned site, 358.

The Challenger traveled 9895 miles and drilled 11 holes on seven sites in water depths from 1668 to 5177 meters. Total penetration was 4660 meters of which 1535 meters were cored with 68.9 percent recovery.

Time distribution for the leg was 12.13 days in port, 43.18 days cruising, and 27.27 days on-site. The on-site time consisted of 5.94 days on trips, 5.93 days drilling. 12.58 days coring, 0.69 days positioning ship, 1.36 days mechanical downtime, and 0.77 days miscellaneous time.

This leg had its share of operational successes and failures to add to the Project experience. The 90 foot piccolo, designed to provide lateral support to the drill string in and below the moon pool to minimize bending of the string from vessel roll and pitch, was successfully installed. Handling the 60 foot section was easier than expected.

The Bowen power sub failed and was replaced with the new power sub with a time loss of one half day.

The heave compensator leaked hydraulic fluid from the top vent and the lower seals each time it was installed. It did function on the first half of the leg but the crew on the last half of the leg was unable to operate it.

The dynamic positioning system logged 12 hours downtime. Most of the problems were in the computer.

AMSTERDAM PORT CALL

Ten days in the shipyard were planned for modifications to the drilling and electronics equipment and the following work items were completed:

1. Baylor Brake installation
2. Travelling Block Guide Rail replacement and lengthening
3. Replace air conditioner and radiator on Logging Unit
4. Stabilizer Arms
    a. Bowen Sub - new arms
    b. Heave Compensator - modify
    c. Travelling Block - repair pins and rollers
5. Heave Compensator maintenance and repair
    a. Cylinder and Accumulator modifications
        1. New position indicator on cylinder
    b. Hydraulic Pump modifications
        1. Install thermometer
        2. Replace piping
    c. Bi-monthly and semi-annual maintenance
    d. Install Stroke Indicator on Driller's Console
6. Overhaul Caterpillar engines No. 10 and No. 11
7. Overhaul AC Generator on engine No. 11
   Overhual DC Generator No. 2
8. Install engine-evaporator room door
9. Develop Piccolo handling procedure
10. Inspect drill pipe
11. ABS continual survey
12. Modifications to ship Stabilizer System
13. B. J. Cementing Unit Pump overhaul
14. SIO Satellite Navigation System installation
15. SIO Air Sampler System (only 50% complete)
16. Normal ship's mainenance
17. U.S.C.G. approval of Callao drydock accomplishments

18. Inspect propulsion shaft bearings
19. Inspect propulsion motor bearings (60% completed - new bearings on motors No. 1, No. 2, No. 5)
20. TOTCO drilling recorder repair (completed for hookloads to 400,000 lbs - additional parts needed for greater loads)

The following work items were not completed or cancelled:

1. Heave Compensator Cylinder and Accumulator modifications
    a. Install new guard on cylinder (new guard would not fit)
    b. Remove top accumulator cover (unable to loosen)
    c. Install deck level vent lines from sensors (cancelled)
    d. Install new cylinder block (cancelled)
    e. Rotate cylinder block (cancelled)
2. Heave Compensator Hydraulic Pump modifications
    a. Replace tank level gauge (cancelled)
    b. Install external filters on reservoir tanks (cancelled)
3. Install propulsion motor No. 6 and reinstall pump motor No. 2 (propulsion motor not ready - will schedule for Cape Town)
4. Replace propulsion board ventilation (cancelled)
5. U.S.C.G. Certificate (not completed)
6. Operational lights installation (cancelled)
7. Galley equipment installation (cancelled)
8. Install and replace Solatron Units for computer and TMC radio unit (rescheduled for Cape Town)

UNDERWAY

We departed Amsterdam at 2030 hours October 6, 1974 for the first Atlantic crossing of the leg with 48 GMI personnel, 22 scientific personnel, a harbor pilot, and a channel pilot. The two pilots, Joe Stevens, GMI Mechanical Superintendent, Bill Henderson, GMI Electrical Superintendent, and R. Glaccum, University of Miami, disembarked at Dover Pilot Station. R. Glaccum had been installing air sampling equipment and Joe Stevens and Bill Henderson made the trip to Dover to operationally test shipyard repairs to the power generating and propulsion system. The first site was 3508 miles from Amsterdam and the cruise consumed 14.6 days for an average speed of 10.01 knots.

The new automatic satellite navigation system with the CRT display is a significant and fascinating improvement with the automatic printout and screen display of coordinates, course, speed, great circle distance and bearing, and ETA. The ETA is very sensitive to minor speed changes on long cruises with arrival time fluctuating several days within a few hours cruising time.

The first two sites were completed and the Challenger left Site 354 and headed for Recife, Brazil at 1000 hours, October 31, 1974. The GMI crew change was scheduled for November 5, 1974. Strong southwest tradewinds were encountered and this 1059 mile cruise used 4.98 days for an average speed of 8.86 knots. The first line on the dock at Recife was at 1115 hours, November 5, 1974. The total distance and steaming time including site surveys for this half of the leg was 4895 miles and 21.2 days. The average speed was 9.62 knots.

Drill water was the most critical supply needed and 103,500 gallons were purchased. Drill water tanks had been very low since leaving Amsterdam because filling the fuel tanks in that shallow water port required dumping drill water and leaving with tanks 40 percent full. Recife departure was delayed until 0940 hours, November 6, 1974 to clear all personnel through customs.

The first site out of Recife was 536 miles southeast and the cruise used 2.25 days for an average speed of 9.93 knots. The next four sites were located along the Brazilian coast with the last planned site (358) in the Argentine Basin 2700 miles west of Cape Town, South Africa. The cruise east from this site started in a storm 19 hours ahead of schedule at 1812 hours, December 3, 1974. The storms, which had stopped operations at Site 358, was moving southeast with 75 mph winds and the Challenger traveled in its wake for two days at reduced speed in the 30 foot waves. As the storm moved south, cruising speeds increased.

When we reached the Walvis Ridge we were 30 hours ahead of schedule and shallow water, Site 359, was selected to use the operation time available.

After spending 32.5 hours drilling and coring, we departed Site 359 at 2300 hours, December 11, 1974 for Cape Town and arrived at the pilot station at 0626 hours, December 17, 1974. The first line on the dock at 0715 hours ended the leg. The total distance and steaming time including site surveys for this half of the leg was 5000 miles and 21.98 days. The average speed was 9.48 knots.

DRILLING AND CORING

The bottomhole assembly used on all sites was as follows: Bits, core barrel, three 8-1/4" drill collars, one Baash Ross bumper sub, three 8-1/4" drill collars, two Baash Ross bumper subs, two 8-1/4" drill collars, one 7-1/4" drill collar, one joint 5-1/2" heavy weight drill pipe. The Smith F94CK bit used on all sites was the best compromise between penetration rate in the softer sediments and endurance in the chert or basalt expected at all sites. Only the first bit showed any wear and this was gauge wear from rotating in sloughing basalt rubble.

Core recovery was good as shown by the overall average of 69%. A 1.1 meter section of basalt core dropped through the core catcher during core retrieval on Site 354 and plugged the drill pipe near the surface and the hole was abandoned.

The pinger piston corer was run on the first site but the pinger failed before reaching the mudline. The inner core barrel stuck and two wireline runs were required to retrieve it. Core recovery was 0.01 meters. The pinger transducer was damaged beyond field repair and the entire tool was set aside. A spare transducer was not available.

POSITIONING

Problems with the positioning system accounted for 12 hours downtime on Sites 354, 355, and 359. Some of the other sites had minor equipment problems which were solved without loss of time.

On Site 354, six hours downtime were logged for initial positioning problems. Positioning over the beacon was complicated by 40 mph east by northeast winds and a three knot south by southwest current which taxed the expertise of the marine crew and amplified positioning system problems. Switching tachometer generators on the bow thrusters and setting exciter feedbacks solved the equipment problems. Shifting winds occasionally caused excursions to 160 feet and a maximum error of 300 feet on October 28.

Five hours downtime for positioning on Site 355 was due to faulty hydrophone pre-amps and a bad D/A power regulator. Maximum excursion was 120 feet.

Site 359 logged only one hour downtime but more than 12 hours would have been shown if the bottomhole assembly inspection and the trip in were delayed until accurate positioning was established. A second beacon was dropped after troubleshooting six hours but the erratic display with apparent rapid excursions to 3000 feet remained. The display problem finally reduced to a short oscillation in phase with ship's roll and the hole was spudded.

The on-site weather, with the exception of the last day on Site 358, was ideal resulting in a mean positioning error of 35 feet for the leg. An attached table lists the percentage of time thrusters and main propulsion shafts were operated in various speed ranges. With the exception of Site 354, which had a three knot current to stem, the positioning system generally was operated at less than half speed.

Nine beacons were dropped on sites. One of these, beacon No. 289, was dropped on Site 359 and the signal was reported to be weakening. Another beacon had a depleted battery and a loose starting plug.

SITE 353 - VEMA FRACTURE ZONE

This site was selected primarily to penetrate basement. A minimum sediment cover was preferred which for drilling assembly stabilization is 100 meters. After 37 hours of operation, 384.5 meters of sediment had been penetrated when the Bowen power sub failed. A spare sub was on board but the replacement time was expected to exceed 12 hours which without rotation or circulation was a risk of losing some of the drill string. The bit was pulled 244 meters above the mudline and the new sub was installed in 11-1/2 hours.

SITE 353A

The 3000 foot move north to Site 353A was accomplished in 3-1/2 hours with the drill string suspended. Drill pipe and piccolo reaction to the move was monitored visually through the openings in the bottom of the moon pool. No noticeable deflection was detected. This hole was abandoned after penetrating 181 meters because of hole conditions. At 168 meters penetration, the rotating torque started increasing steadily and the power sub stalled at 181 meters. Pipe sticking and increasing pump pressure indicated a sloughing, packed-off hole. A 50 barrel and a 100 barrel mud flush (75 vis) failed to improve hole conditions. The retrieved core contained clay with a small amount of basalt and coarse sand.

SITE 353B

The 700 foot west by northwest offset from Site 353A was made in two hours with the drill string suspended 30 meters above the mudline. The torquing and sticking problems were experienced at the same depths as in Site 353A from 168 to 181 meters penetration. A 100 barrel mud flush (75 vis) failed to improve hole conditions and the site was abandoned. The excessive bit body gauge wear, coupled with the basalt recovery, indicated that the bit had been in a very loosely packed basalt rubble zone.

SITE 354 - CEARA RISE

The initial plan was to core 30 percent of the estimated 1100 meters sediment, but low penetration rates and limited time reduced the cored interval to 20 percent. Eleven hours of a 24 hour extension were used to reach and core basalt basement which was encountered at 886 meters and cored to 900 meters penetration. The lower 1.1 meters of the 9.5 meter basalt core dropped through the stripped core catcher and bridged the drill pipe at 365 meters depth. Additional basement coring had been planned but the major scientific objectives were completed and the site was abandoned.

SITE 355 - BRAZIL BASIN

Positioning equipment failures interrupted operations for five hours but the coring operations were conducted as planned. Forty one percent of the first 338 meters penetrated were cored with 70% recovery, then the remaining 122 meters were continuously cored with 47% recovery. Basalt basement was found at 449 meters penetration and cored to 460 meters.

SITE 357 - RIO GRANDE RISE

The water depth at this site was 2109 meters, which was less than half the water depth of most other sites on this leg. This reduced the wireline time and allowed more time for coring and drilling. Eighty percent of the first 200 meters was cored with 76% recovery. Forty-three percent of the next 400 meters was cored with 71% recovery. Seventy-two percent of the lower 197 meters was cored with 71% recovery. This lower section drilled and cored slowly consuming 53% of the total drilling and coring time with penetration rates averaging eight meters per hour. Basalt basement was not penetrated.

SITE 358 ARGENTINE BASIN

This was the second attempt to drill in this basin. Leg 36, Site 331, penetrated and cored 18 meters before weather forced them to abandon the hole.

Basement was an important goal on this site and with an estimated 1100 meters of sediment, 5000 meters of water and 4-1/2 days scheduled, the cored interval was reduced. Nine percent of the first 200 meters penetrated were cored. Fourteen percent of the next 200 meters and then 19 percent of the next 200 meters were cored. Twenty-seven percent of the last 243 meters were cored. Penetration rates exceeded 140 meters per hour to 450 meters penetration then slowed to 25 meters per hour and decreased sharply to ten meters per hour and less below 760 meters.

Positioning system power demands stopped drilling and coring operations 19 hours early. Winds and seas were increasing and the heave compensator and power sub were set back easily with four and five degrees vessel roll and pitch. The new longer guide rails allowed fast, safe handling of both assemblies in the rough seas. The entire drill string was pulled and after clearing the mudline, the ship was allowed to drift slowly away from the beacon. During the 12 hours trip time, wind gusts had increased to 75 mph and 30 foot swells induced five degree roll and 10 degree pitch.

SITE 359 - WALVIS RIDGE

This shallow water site was selected primarily to use the remaining operating time of the leg. Firm sediments were encountered before the bottomhole assembly was buried. Penetration rate slowed to 11 meters per hour at 85 meters penetration, then to six meters per hour at 94 meters. This slow rate prevented reaching basement in the available time and coring was stopped at 107 meters penetration. Supplemental surface coring was done with Site 359A, which resulted in 66 percent recovery of 28 meters penetration.

REVIEW OF LEG 39 PROBLEMS

The three section piccolo was first installed on Site 353. The center 60 foot section of the 27,000 pound piccolo is difficult to handle from the upper deck storage area. The Schlumberger logging unit is an obstacle which will probably be damaged if the piccolo is handled from the storage area continually.

After Site 353, the lower 90 feet consisting of the two lower sections were stored assembled and suspended from the travelling blocks with the lower end in the horn just above the keel. This simplified installation of the piccolo when arriving on site. It was stored in this position to Recife and Site 355 with very little movement noted.

While drilling Site 355 some indications of wear were noticed on the guide rails at the travelling block position with the piccolo suspended. The piccolo was laid down at the conclusion of this site for the remainder of the leg. A safe method of laying the piccolo down is needed and this could be easily managed if the logging unit was relocated and the walkway reinforced and extended.

The heave compensator was not successfully used on this leg. The first attempt was made on Site 354. The compensator functioned well but excessive oil leakage from the lower seal prevented using it for any extended period. The lower seals were replaced enroute to Recife.

The compensator was not used on Site 355. One half of the connections from the mousehole are 19 meter doubles if the compensator is not used and this is generally believed to substantially reduce the connection time and allow more rotating time. The compensator was left out of the string on this site to accumulate this connection time data. A graph is included in this report showing actual cumulative connection time versus penetration of four sites of this leg. This graph does not indicate any definite time saving and suggests that other factors may be involved. The compensator was used on the last site shown and crew experience may be a factor. A simple time and motion study would accurately find the difference.

Use of the compensator was planned for Site 356. It was to be installed when drilling rate slowed but it was difficult to interrupt a very smooth and productive operation for three hours to pick up and adjust the compensator and it was not used. This will be a frequent problem when the compensator installation is delayed.

The heave compensator was installed in the string prior to spud on Site 357 but the locking latches stuck and could not be operated hydraulically. Four operating hours were lost and the compensator was set back in its cradle. While enroute to Site 358, it was picked up and one latch removed. The starboard latch pin could not be removed but both latches were made operable by increasing the hydraulic pressure from 200 to 400 psi. Intermittent leakage from the lower compensating cylinder seals was observed but the leaking stooped when the cylinder was pressured.

The compensator was placed in the string on Site 358 prior to spud but was not unlocked and energized until the penetration rate slowed after penetrating 712 meters. The crew was unable to operate the compensator. The piston traveled to the lower end of the cylinder and failed to move with changes of air and hydraulic pressure. It was locked after eight hours and drilling and coring continued with single connections. A troubleshooting manual for this equipment is badly needed.

Bumper subs jammed in some of the deeper chalky sediments resulting in large bit weight fluctuations with an unknown effect on core and recovery. When drilling and coring requires maximum circulation, the bumper subs action stiffen resulting in large weight fluctuations. Incremental penetration rate data is inaccurate. Only the average rate for the connection length can be used with any accuracy.

The heave compensator should be used during any coring operations requiring bit weights within the sensitivity range of the unit to evaluate core disturbance and recovery in the soft sediments. The compensator, when completely developed and thoroughly understood by drilling crews, should maximize the drilling effort and provide drilling data accuracy consistent with the scientific segment of the Project.

COMMUNICATIONS

Daily communication with WWD San Diego was possible after local dusk using frequency 17105. Radio telephone connections were excellent through WOO (New York) and WOM (Miami). Miami was especially good on the 12 and 17 MHZ bands. Many excellent personal telephone patches to the U.S.A. were made on the HAM set.

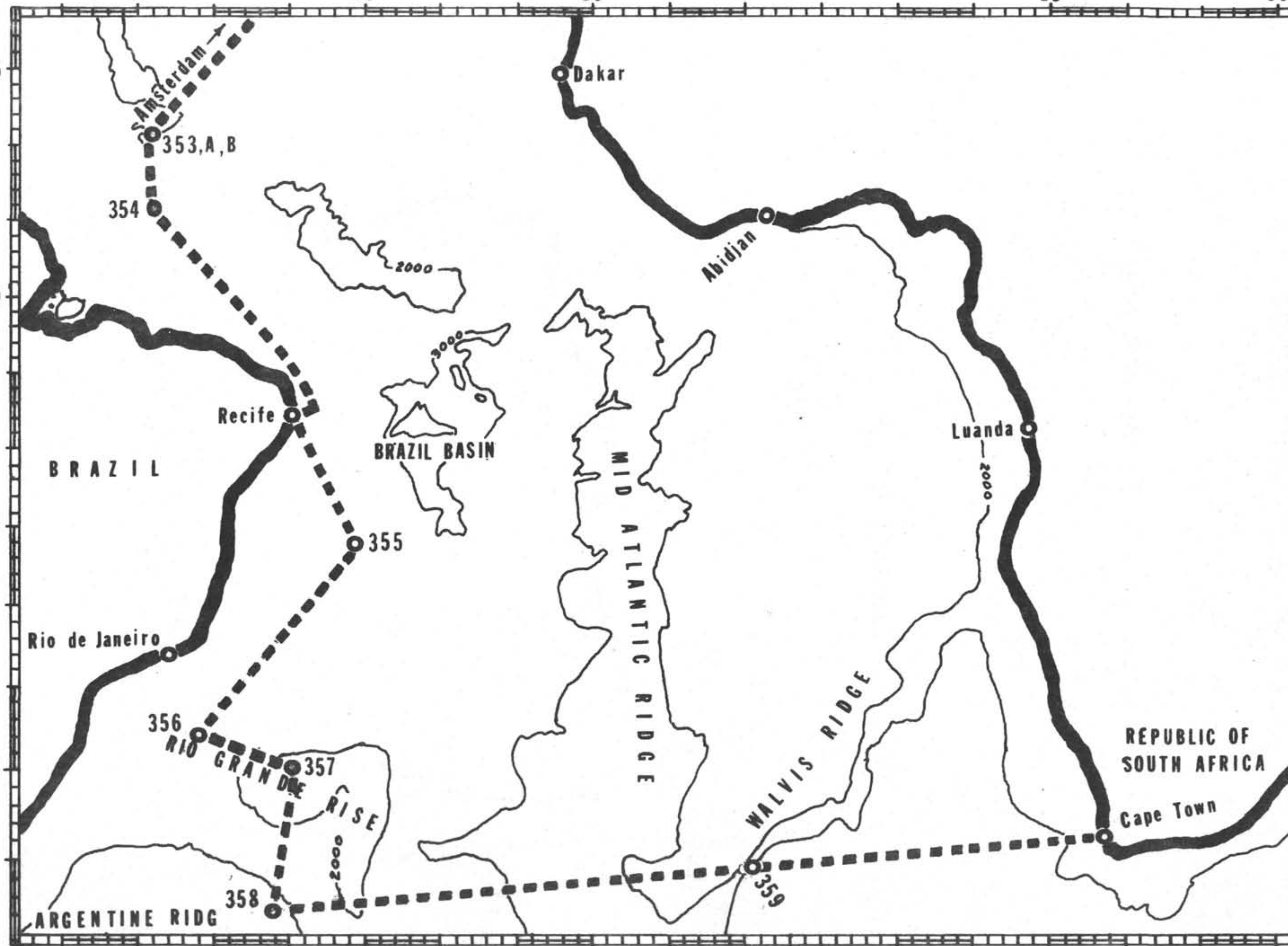
PERSONNEL

Working with both Global Marine crews was very interesting. They use contrasting supervisory techniques but both are cooperative and efficient. The difference of the crews was an interesting break in the long voyage of the scientific group.

David L. Edmiston
Cruise Operations Manager
Deep Sea Drilling Project

DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 39

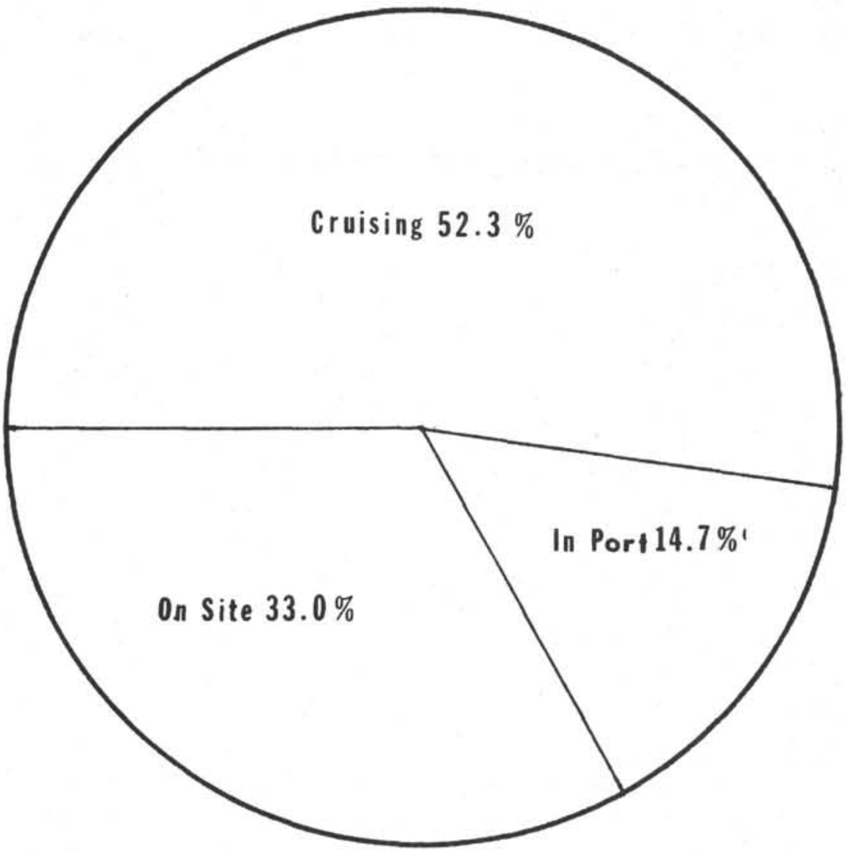
Total Days (Sept. 25, 1974 - Dec. 17, 1974)		82.58
Total Days in Port		12.13
Total Days Cruising Including Site Survey		43.18
Total Days On Site		27.27
Trip Time, Days	5.94	
Drilling Time, Days	5.93	
Coring Time, Days	12.58	
Position Ship, Days	.69	
Mechanical Downtime, Days	1.36	
Other, Days	.77	
Total Distance Traveled (Nautical Miles)		9849.0
Average Speed, Knots		9.5
Number of Sites		7.0
Number of Holes Drilled		11.0
Number of Cores		165.0
Percent of Cores With Recovery		96.4
Total Penetration		4660.0
Total Meters Drilled		3126.0
Total Meters Cored		1535.0
Total Meters Recovered		1057.05
Percent of Core Recovered		68.86
Percent of Total Penetration Cored		32.94
Maximum Water Depth (Meters)		5177.0
Minimum Water Depth (Meters)		1668.0



LEG 39
Amsterdam — Cape Town

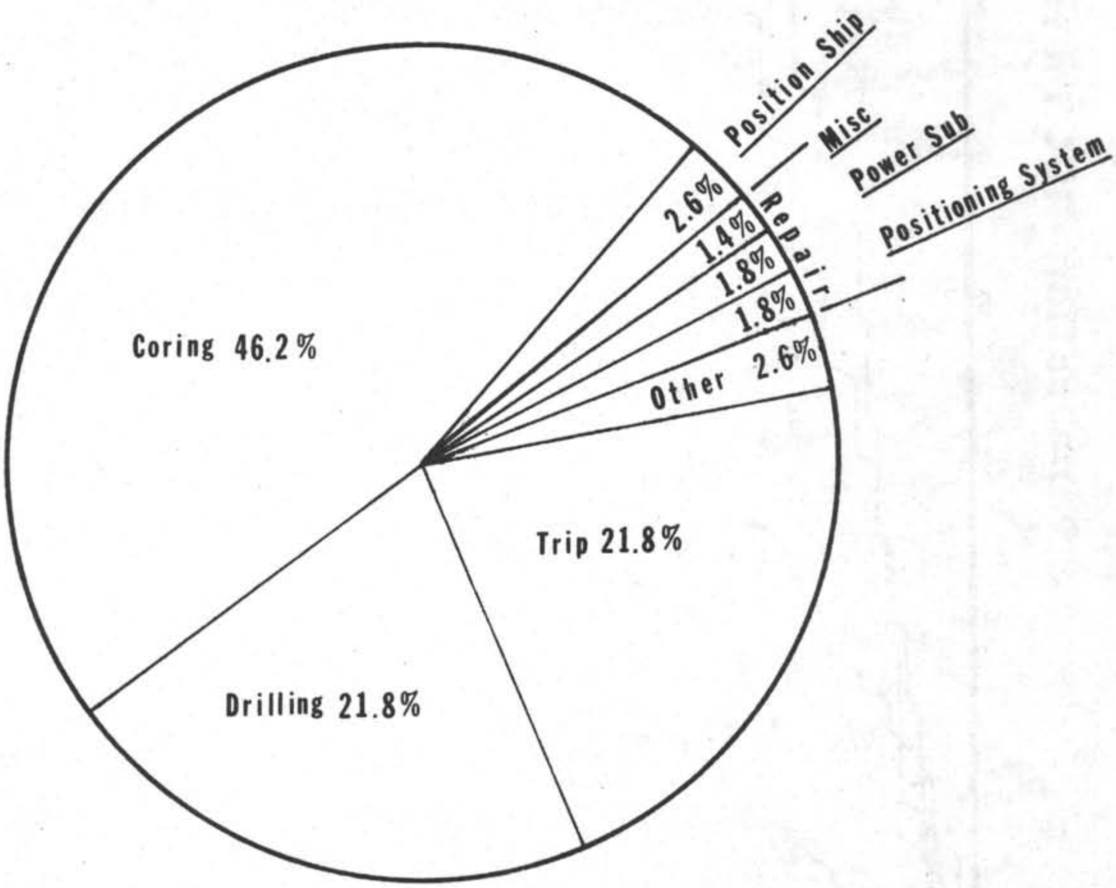
DEEP SEA DRILLING PROJECT
LEG 39

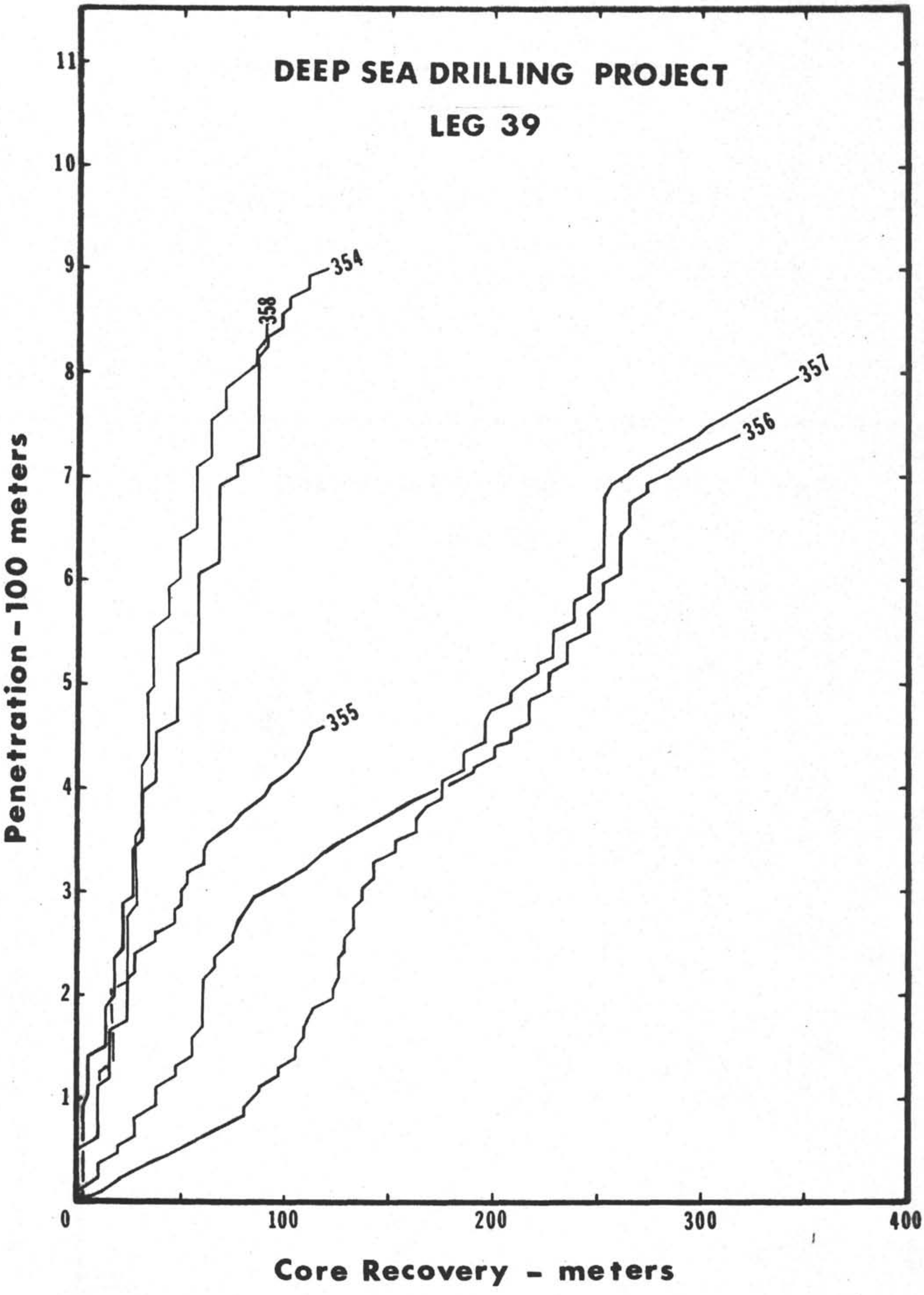
TOTAL TIME DISTRIBUTION

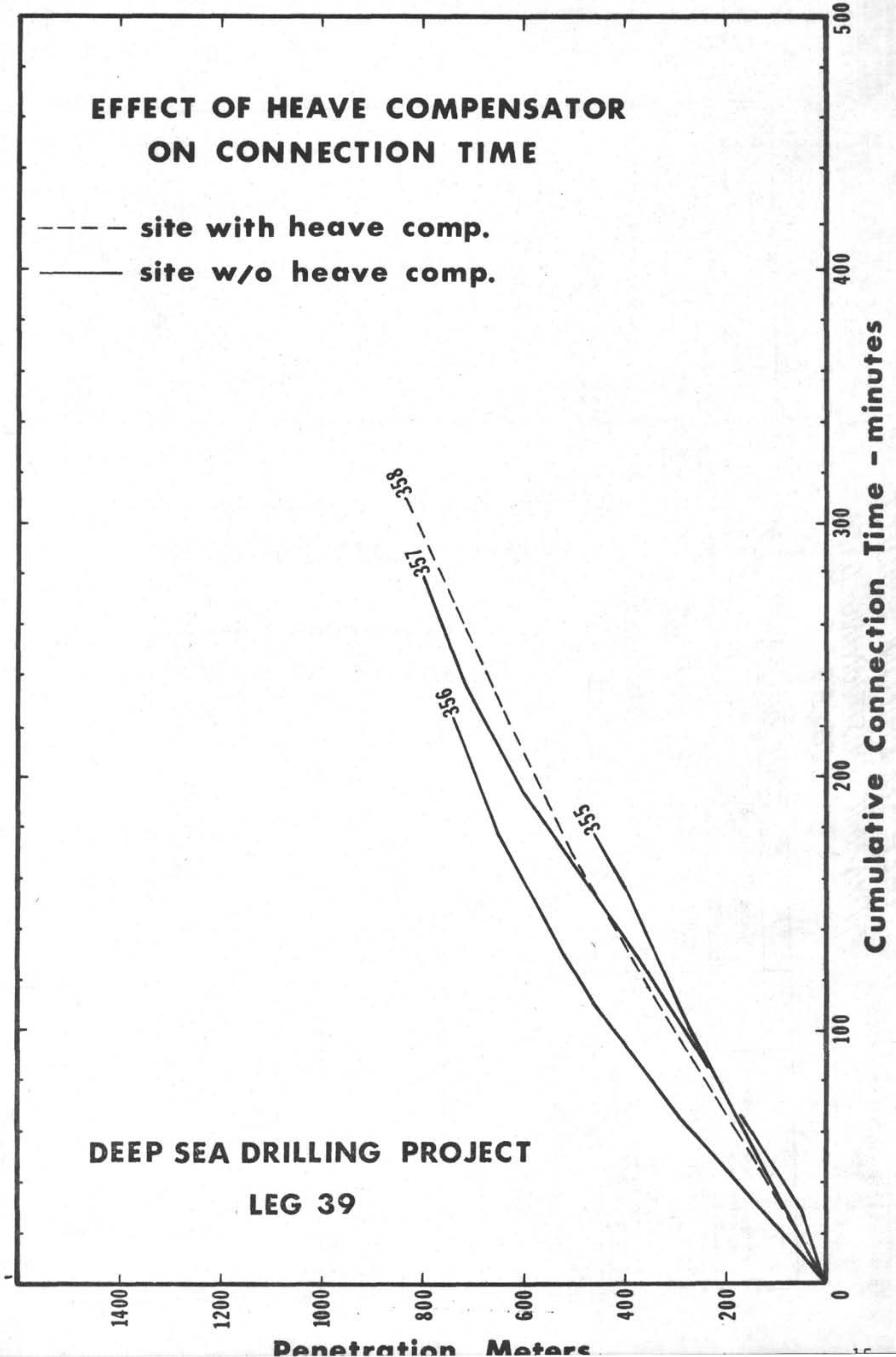


DEEP SEA DRILLING PROJECT
LEG 39

ON-SITE TIME DISTRIBUTION




DEEP SEA DRILLING PROJECT
LEG 39
354
358
357
356
355
Penetration - 100 meters
Core Recovery - meters
0
100
200
300
400
1
2
3
4
5
6
7
8
9
10
11


EFFECT OF HEAVE COMPENSATOR
ON CONNECTION TIME
site with heave comp.
site w/o heave comp.
358
357
356
355
DEEP SEA DRILLING PROJECT
LEG 39
0
100
200
300
400
500
Cumulative Connection Time - minutes
1400
1200
1000
800
600
400
200
Penetration Meters

DEEP SEA DRILLING PROJECT
DYNAMIC POSITIONING DATA
LEG 39

SITE No.	Avg. Head. °	Avg. Wind mph	Avg. Swell ft.	TIME OPERATED - PERCENT									Remarks
				Main Prop. RPM			Bow Thrusters RPM			Stern Thrusters RPM			
				0 - 75	75 - 100	100 +	0 - 200	200 - 300	300 +	0 - 200	200 - 300	300 +	
353	060	15 ENE	4 - 6	98.2	1.8	0.0	43.0	37.0	20.0	64.0	27.0	9.0	Position ± 40 ft
353A	084	20 ENE	6	23.8	57.1	19.1	66.7	23.8	9.5	52.3	28.6	19.1	" ± 30 ft
353B	082	25 ENE	6 - 8	41.8	37.2	21.0	37.2	41.9	20.9	51.2	30.2	18.6	" ± 30 ft
354	218	14 ENE	6	14.5	33.7	51.8	24.9	33.7	41.4	42.6	39.1	8.3	2-3 Kt Current Position ± 30 ft
355	032	13 NE	3	87.7	9.4	2.9	56.8	32.2	11.0	54.2	35.6	10.2	Position ± 40 ft
356	205	14 SW	4	91.4	6.6	2.0	42.4	45.7	11.9	30.8	55.3	13.9	Position ± 30 ft
356	015	18 NE	4	68.2	24.0	7.8	45.3	40.2	14.5	31.8	46.4	21.8	Position ± 40 ft.
357	055	20 NE	3	91.0	8.3	0.7	62.0	29.9	8.1	51.3	38.2	10.5	Position ± 30 ft.
358	359	28 NW	4	62.0	26.1	11.9	41.0	44.1	14.6	41.1	42.3	16.6	Position ± 40 ft.
359	306	24 NNW	5	0	38.0	62.0	76.0	8.5	15.5	24.0	53.5	22.5	Position ± 50 ft.

Maximum Thrust - Main Propulsion 225 RPM, Thrusters 486 RPM

DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 39

Site No.	Make	Freq. kHz	Serial Number	Site Time Hours	
353	ORE	16.0	269	48.5	5177 Meters Water - Good signal
353A	ORE	13.5	285	14.0	5172 Meters Water 3000 ft No. Site 353
353B	ORE	13.5	285	22.5	5172 Meters Water 700 ft WNW Site 353-B
354	ORE	16.0	290	120.5	4062 Meters Water - Good Signal
355	ORE	13.5	320	—	Loose plug in Beacon & battery depleted
355	ORE	13.5	322	87.5	4896 Meters Water - Good signal
356	ORE	16.0	302	114.5	3203 Meters Water - Good signal
356A	"	"	"	11.0	
357	ORE	13.5	321	117.0	2109 Meters Water Good signal
358	ORE	16.0	258	85.0	5000 Meters Water, Double Life Beacon
359	ORE	13.5	289	6.0	1668 Meters Water. Rapid weakening of signal - Double Life
359	ORE	16.0	256	21.0	1668 Meters Water Good Signal - Double Life
359A	"	"	"	5.5	" " " " " " "

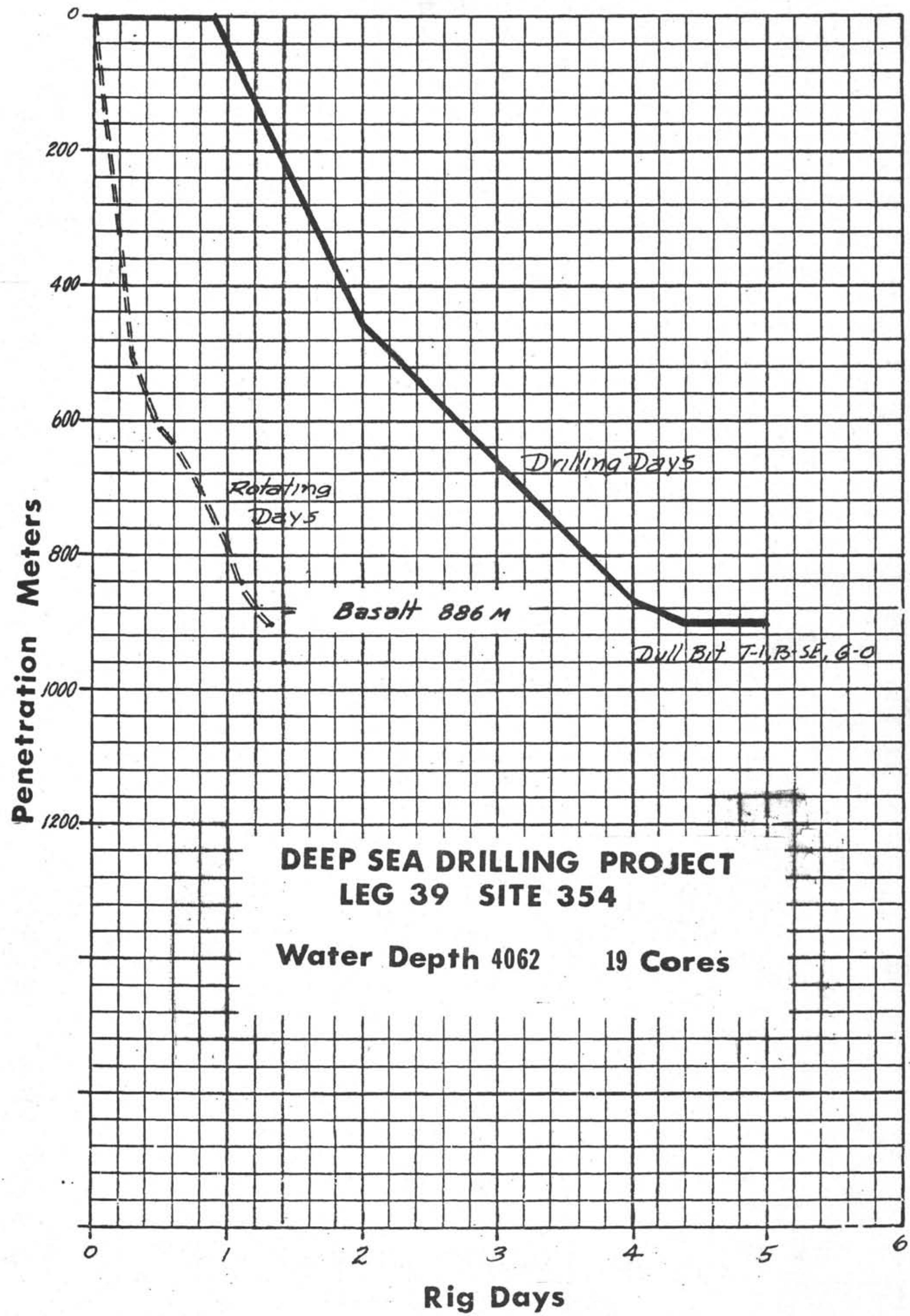
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 39

Hole	Mfg.	Size	Type	Serial Number	Meters Cored	Meters Drilled	Meters Total Penet.	Hours On Bit	Condition	Remarks
353	Smith	$10\frac{1}{8}$"	F 94CK	RC 908	23.5	361.0	384.5	2.7	Not pulled	Power sub failed. Pull above mudline for repair
353 A	"	"	"	"	0.0	181.0	181.0	1.6	" "	Basalt rubble sticking pipe. Pull above mudline
353 B	"	"	"	"	0.0	181.0	181.0	1.5	T-1, B-SE, G-0	Basalt rubble sticking pipe. Abandon hole
				Total	23.5	723.0	746.5	5.8		
354	Smith	$10\frac{1}{8}$"	F94CK	RF 033	173.0	727.0	900.0	32.4	T-1, B-SE, G-0	14 meters basalt
355	Smith	$10\frac{1}{8}$"	F 94CK	RC 900	207.5	252.5	460.0	16.6	T-2, B-SE, G-0	11 meters basalt
356	Smith	$10\frac{1}{8}$"	F94CK	RC 926	437.0	342.0	779.0	51.3	T-1, B-SE, G-0	
357	Smith	$10\frac{1}{8}$"	F94CK	RC889	473.0	324.0	797.0	54.3	T-1, B-SE, G-0	Last 100 meters limestone 7 meters/Hr.
358	Smith	$10\frac{1}{8}$"	F94CK	PC 158	152.0	691.5	843.5	28.5	T-1, B-SE, G-0	Severe weather & position problems - Abandon hole
359	Smith	$10\frac{1}{8}$"	F94CK	RC 902RR	50.0	57.0	107.0	5.4		
359A	"	"	"	"	18.0	9.0	27.0	.2	T-1, B-SE, G-0	
				TOTAL	68.0	66.0	134.0	5.6		

DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 39

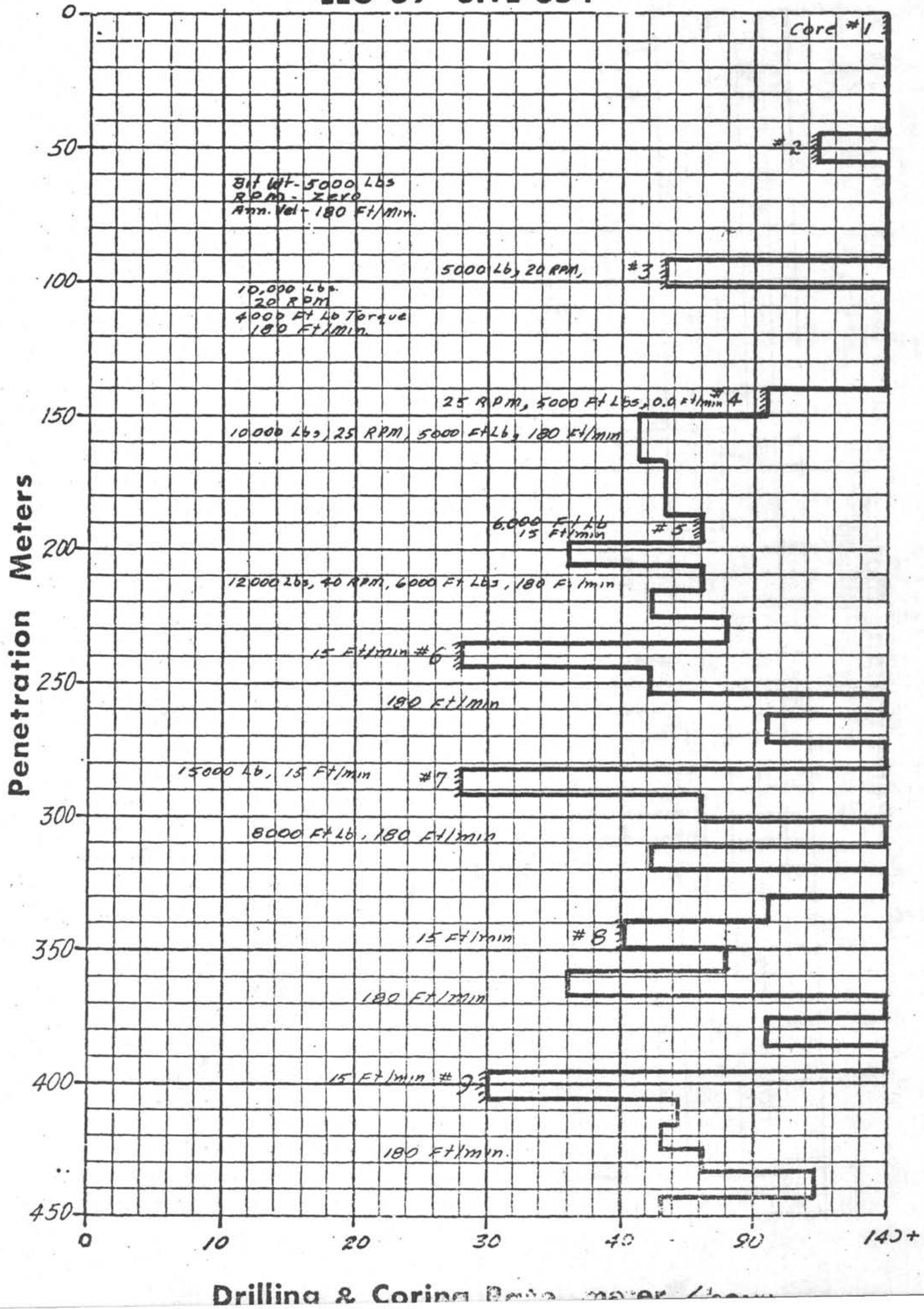
Hole	Latitude	Longitude	Water Depth Meters	Number Of Cores	Cores With Recovery	Percent of Cores With Recovery	Meters Cored	Meters Recovered	Percent Recovered	Meters Drilled	Total Penet Meters	Avg. Rate Penet.	Time On Hole	Time On Site
VEMA FRACTURE ZONE														
353	10°54.9'N	44°02.25'W	5177	3	2	66.6	23.5	5.4	22.9	361.0	384.5	143.5	48.5	
353A	10°55.39'N	44°02.21'W	5172	0	0	0.	0.	3.1	–	181.0	181.0	114.5	14.0	
353B	10°55.49'N	44°02.29'W	5172	0	0	0.	0.	1.1	–	181.0	181.0	118.3	22.5	85.0
CEARA RISE														
354	5°53.95'N	44°11.78'W	4062	19	18	94.7	173.0	119.0	68.8	727.0	900.0	27.8	120.5	120.5
BRAZIL BASIN														
355	15°42.59'S	30°36.03'W	4896	22	22	100.0	207.5	118.05	56.9	252.5	460.0	27.7	87.5	87.5
SAO PAULO RIDGE														
356	28°17.22'S	41°05.28'W	3203	44	43	97.7	418.0	315.9	75.6	323.0	741.0	14.5	114.5	
356A	28°17.22'S	41°05.28'W	3203	2	2	100.0	19.0	17.6	92.6	19.0	38.0	114.0	11.0	125.5
RIO GRANDE RISE														
357	30°0.25'S	35°33.59'W	2109	51	49	96.0	473.0	345.2	73.0	324.0	797.0	14.7	117.0	117.0
ARGENTINE BASIN														
358	37°39.31'S	35°57.82'W	5000	16	16	100.0	152.0	89.3	58.7	691.5	843.5	29.6	85.0	85.0
WALVIS RIDGE														
359	34°59.10S	4°29.83'W	1668	6	5	83.0	50.0	27.5	55.0	57.0	107.0	19.9	27.0	
359A	34°59.10S	4°29.83W	1668	2	2	100.0	19.0	14.9	78.0	9.0	27.0	135.0	5.5	32.5

1535 3126.0 4660.0

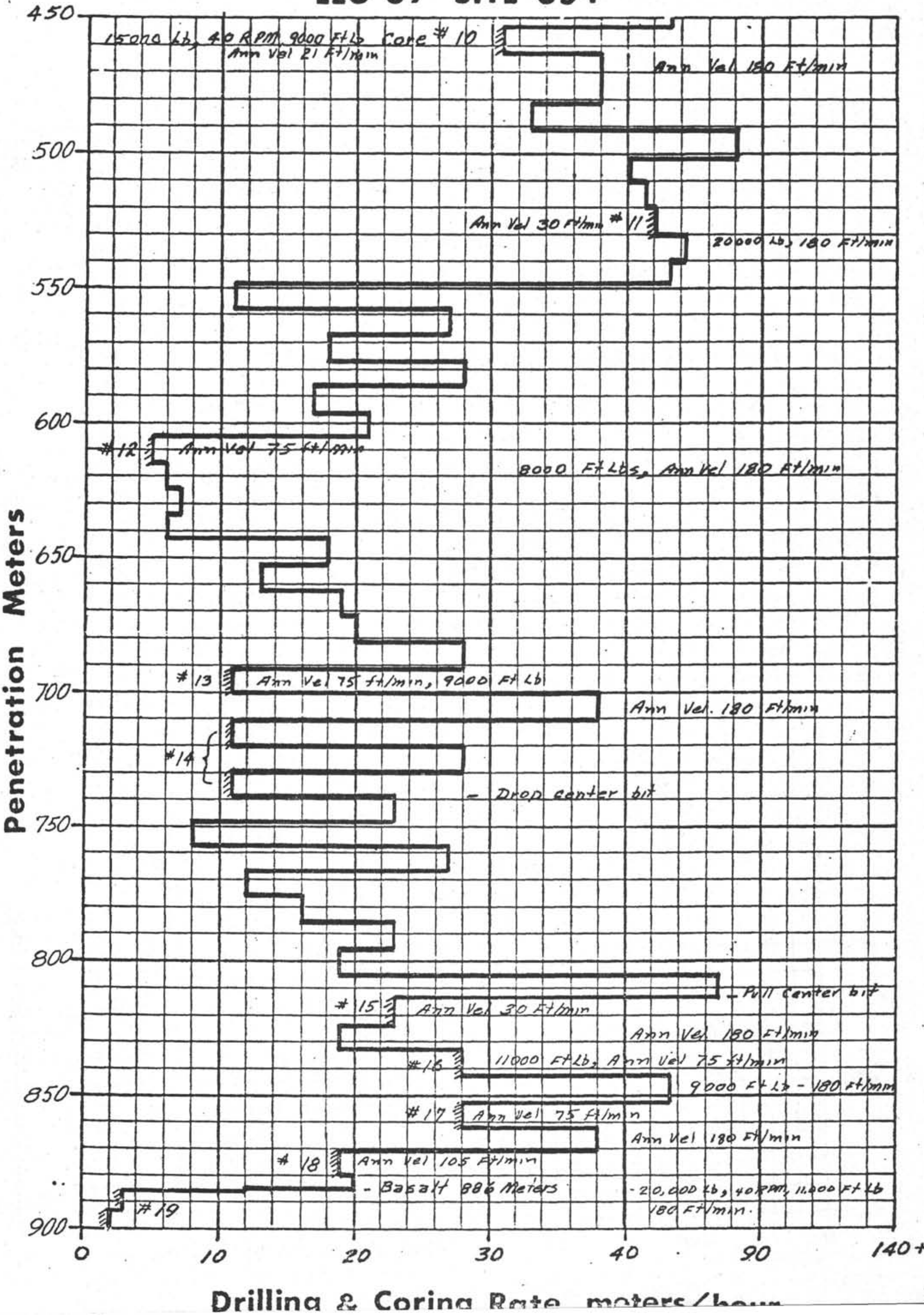


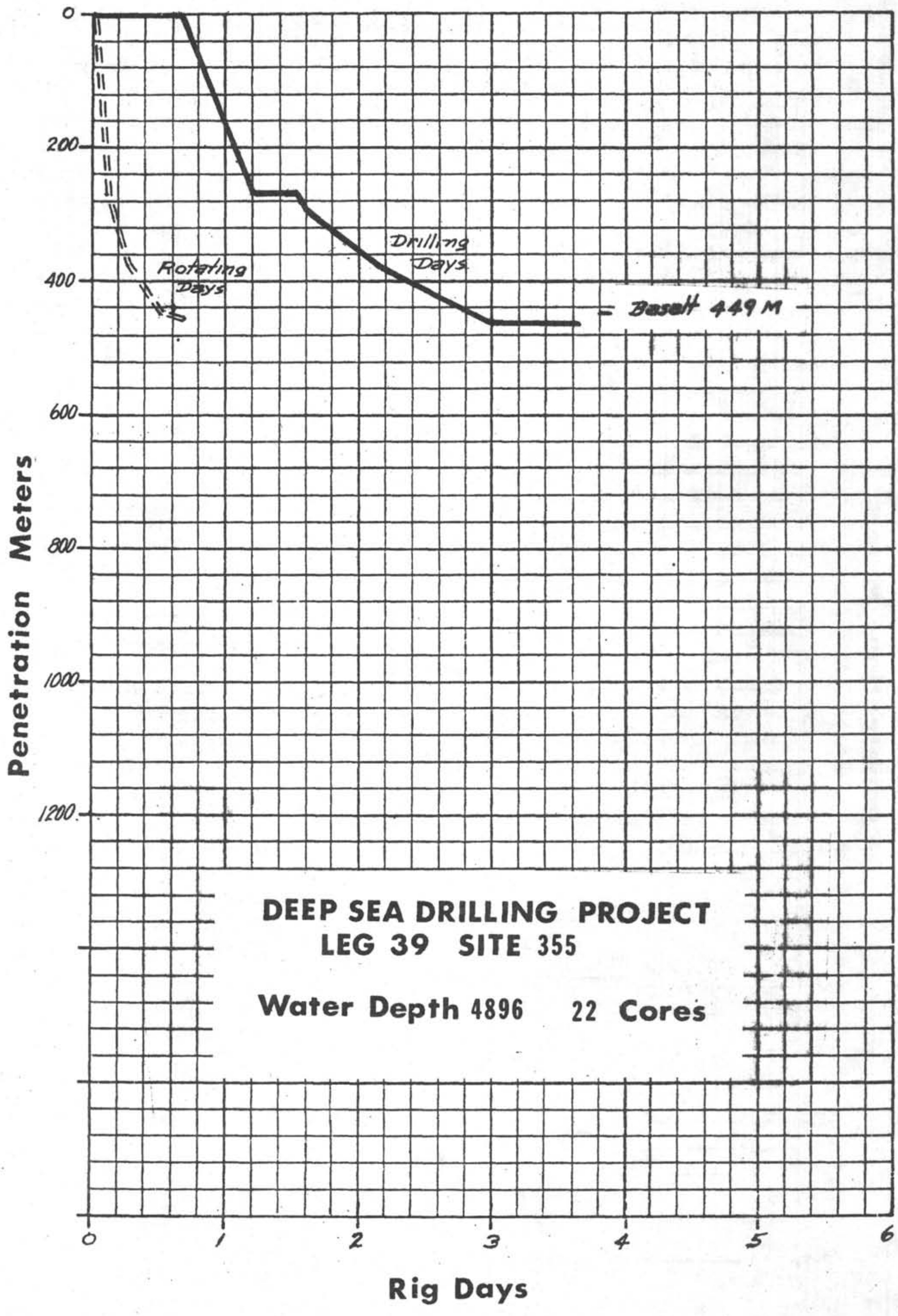
0
200
400
600
800
1000
1200
Penetration Meters
Drilling Days
Rotating Days
Basalt 886 M
Dull Bit T-1, B-SE, G-O
DEEP SEA DRILLING PROJECT
LEG 39 SITE 354
Water Depth 4062 19 Cores
0
1
2
3
4
5
6
Rig Days

DEEP SEA DRILLING PROJECT
LEG 39 SITE 354



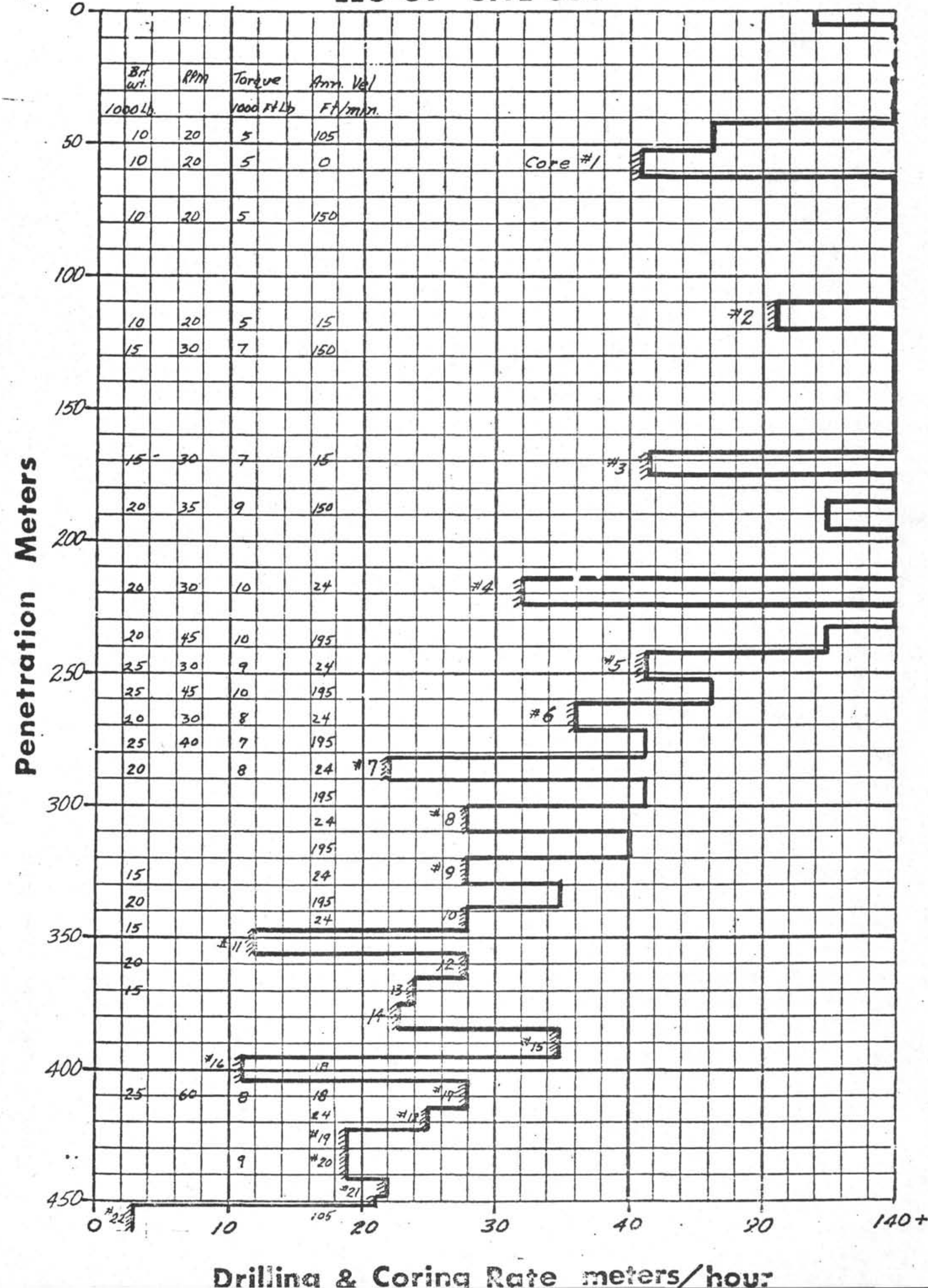
DEEP SEA DRILLING PROJECT
LEG 39 SITE 354

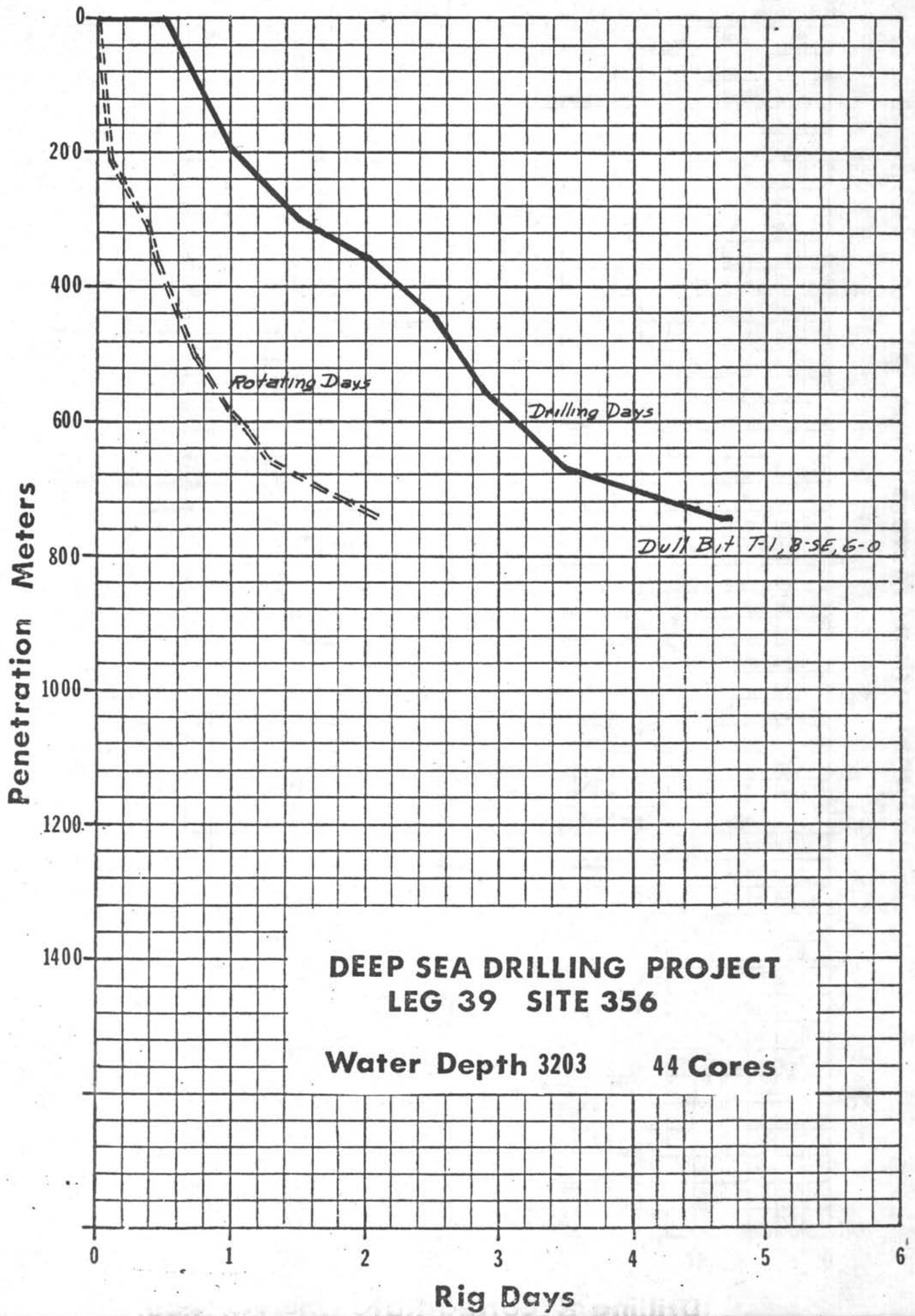




0
200
400
600
800
1000
1200
Penetration Meters
Rotating Days
Drilling Days
Basalt 449 M
DEEP SEA DRILLING PROJECT
LEG 39 SITE 355
Water Depth 4896 22 Cores
0
1
2
3
4
5
6
Rig Days

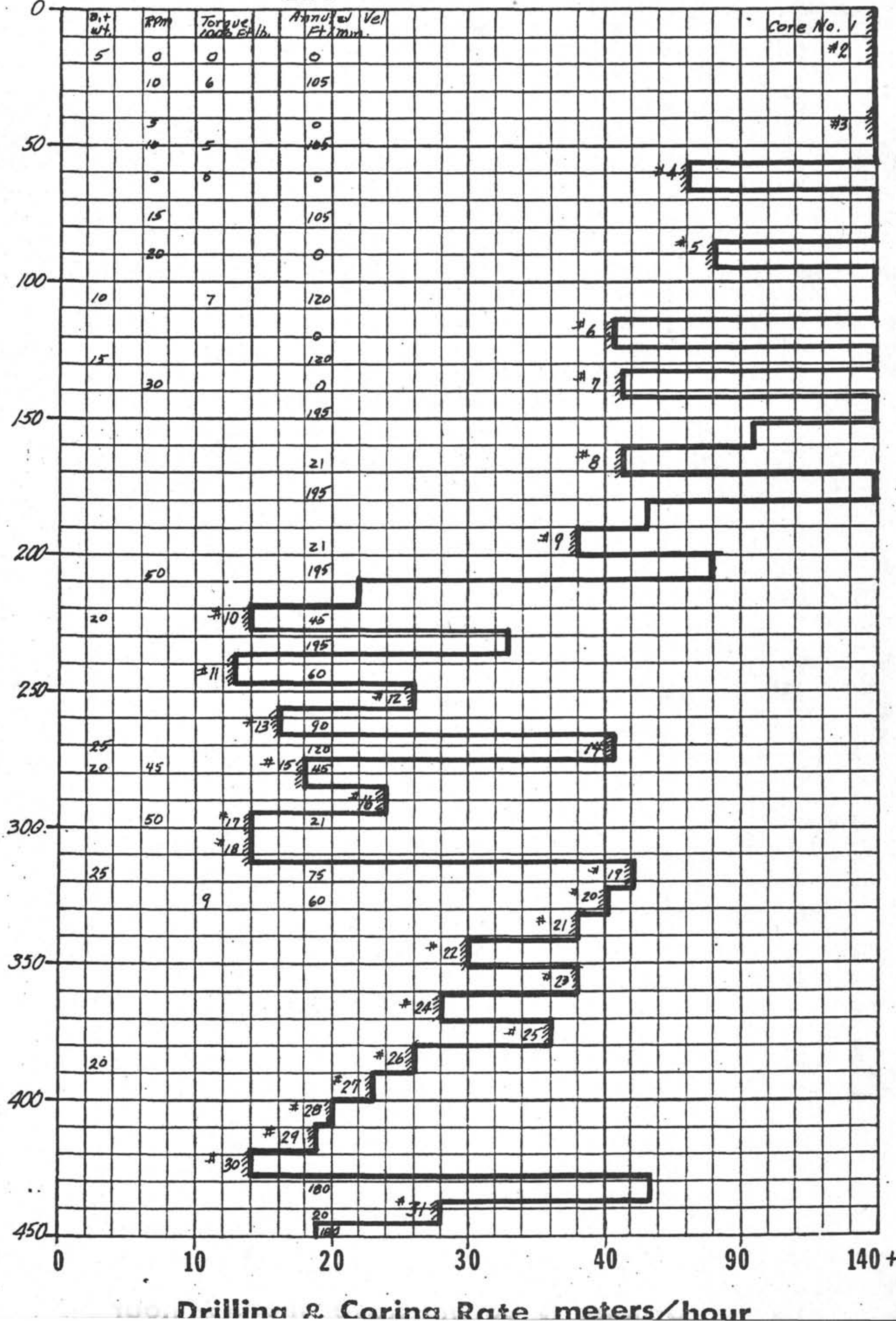
DEEP SEA DRILLING PROJECT
LEG 39 SITE 355



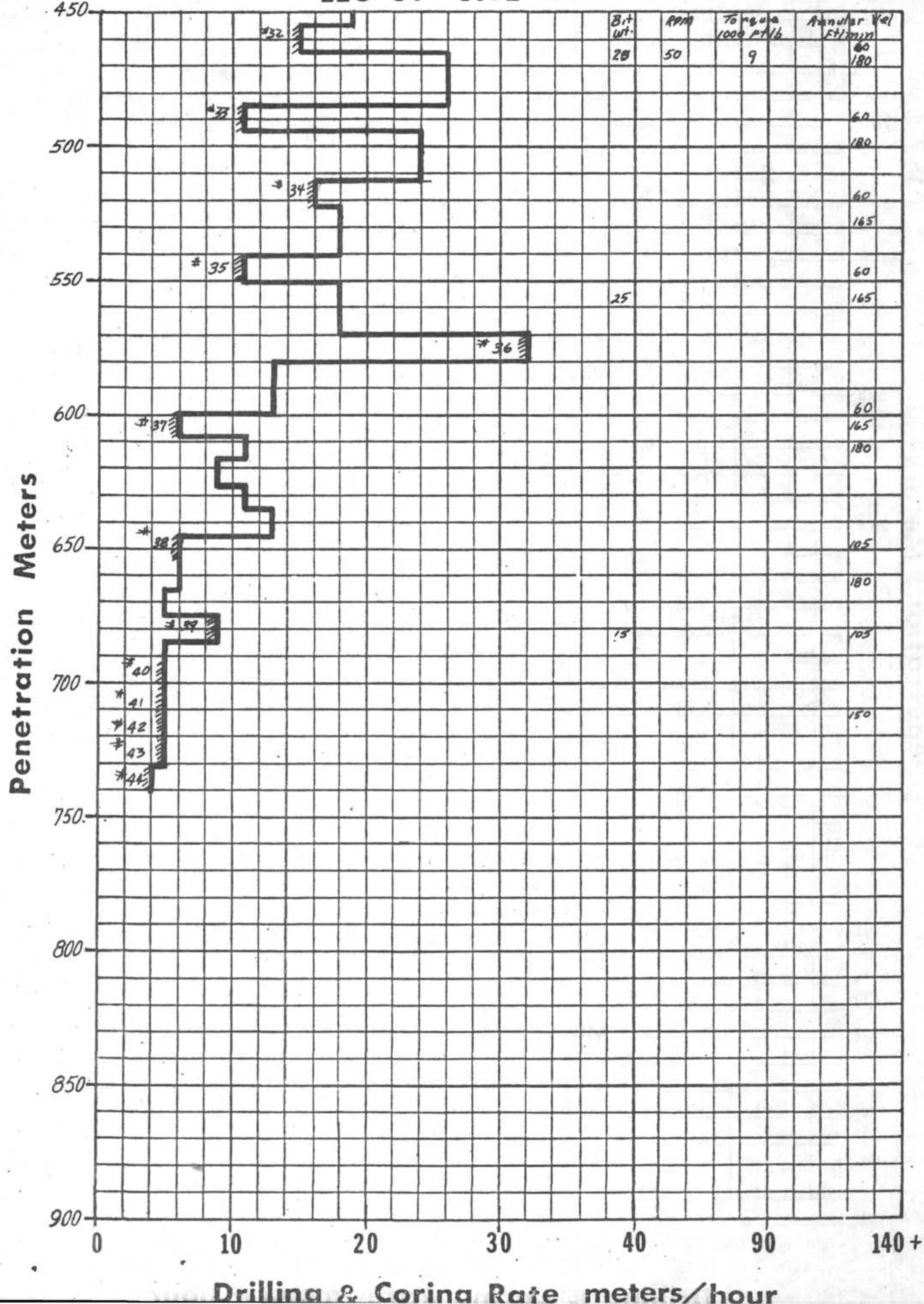


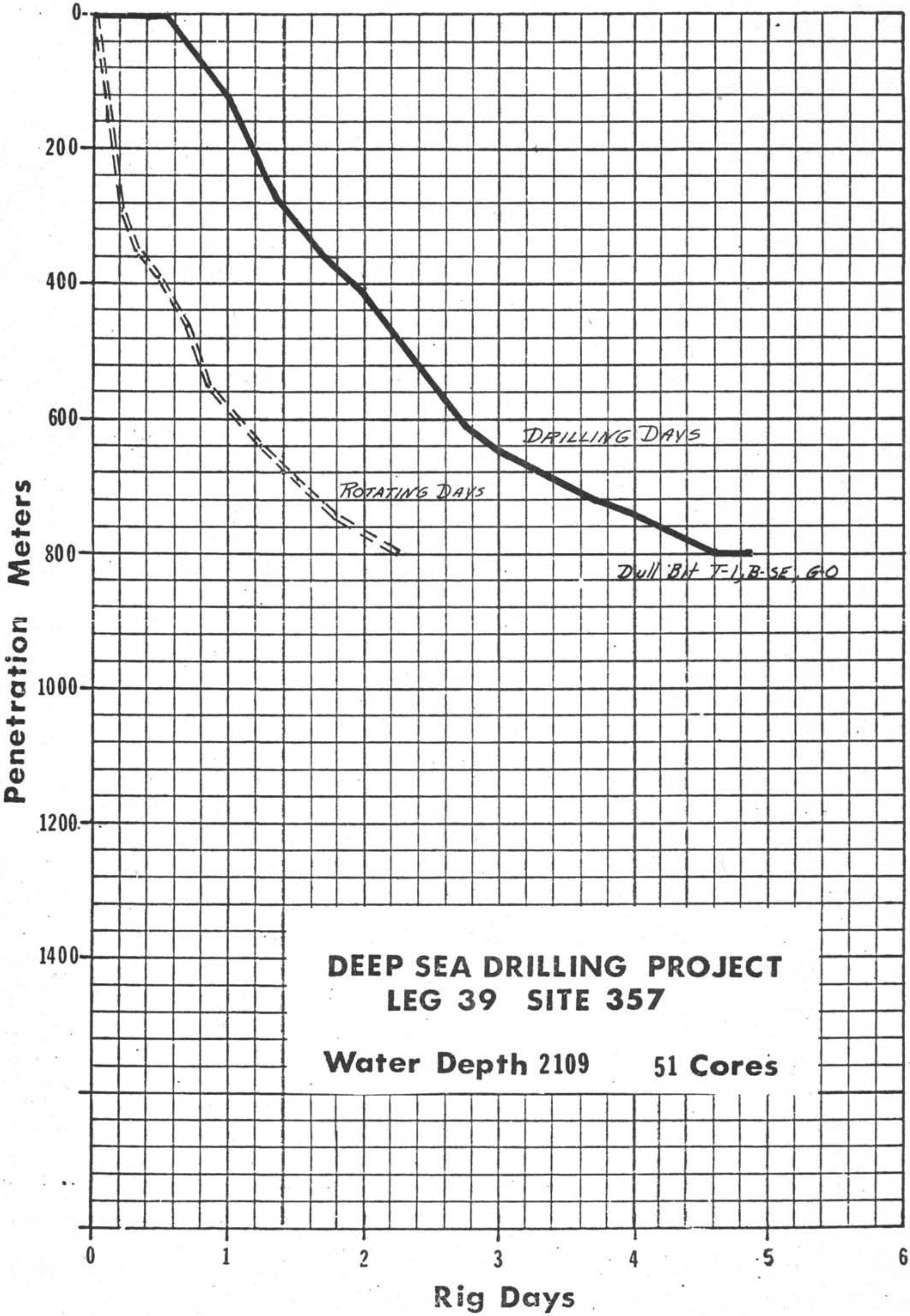
0
200
400
600
800
1000
1200
1400
Penetration Meters
Rotating Days
Drilling Days
Dull Bit T-1, B-SE, G-0
DEEP SEA DRILLING PROJECT
LEG 39 SITE 356
Water Depth 3203
44 Cores
0
1
2
3
4
5
6
Rig Days

DEEP SEA DRILLING PROJECT
LEG 39 SITE 356



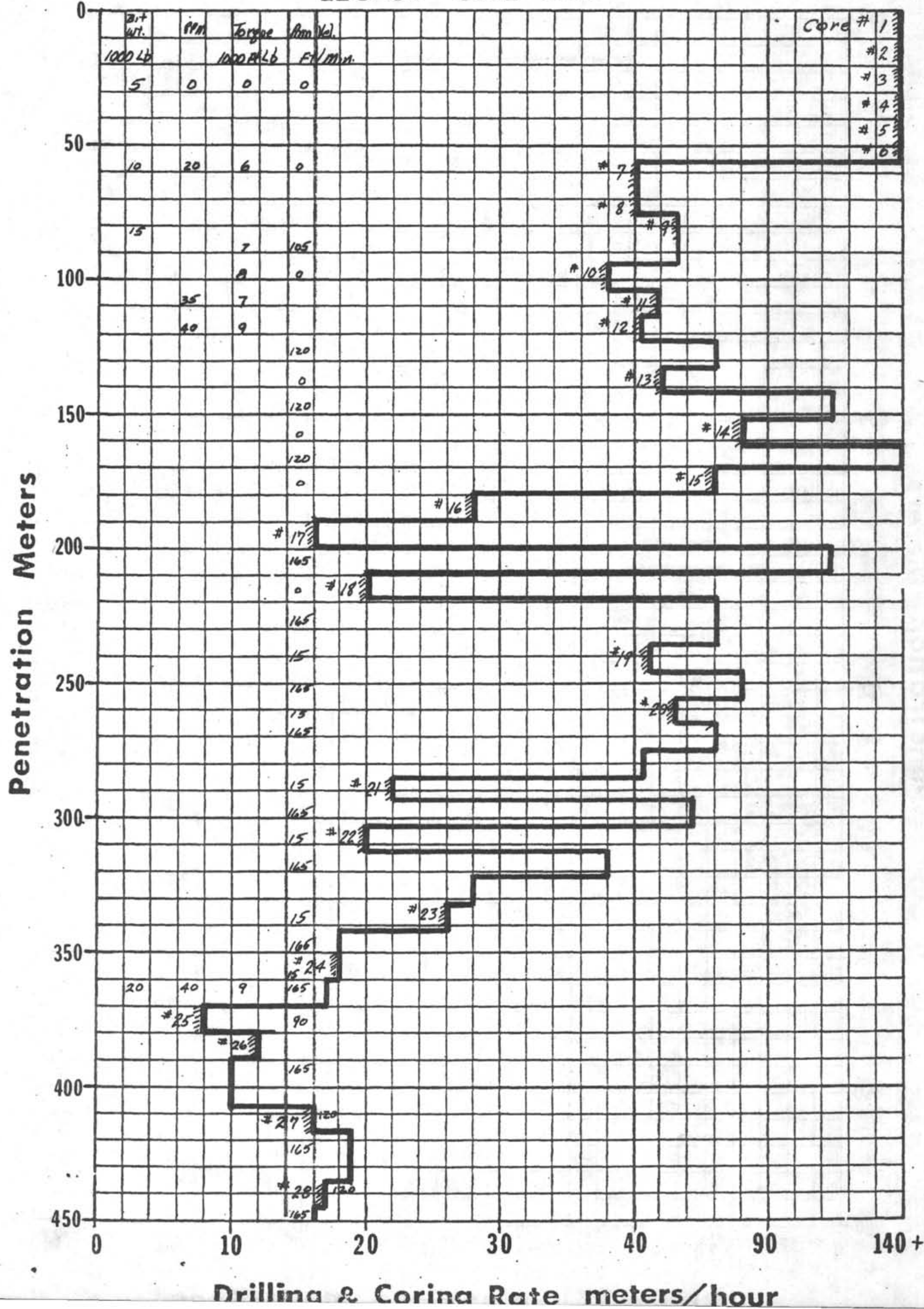
DEEP SEA DRILLING PROJECT
LEG 39 SITE 356



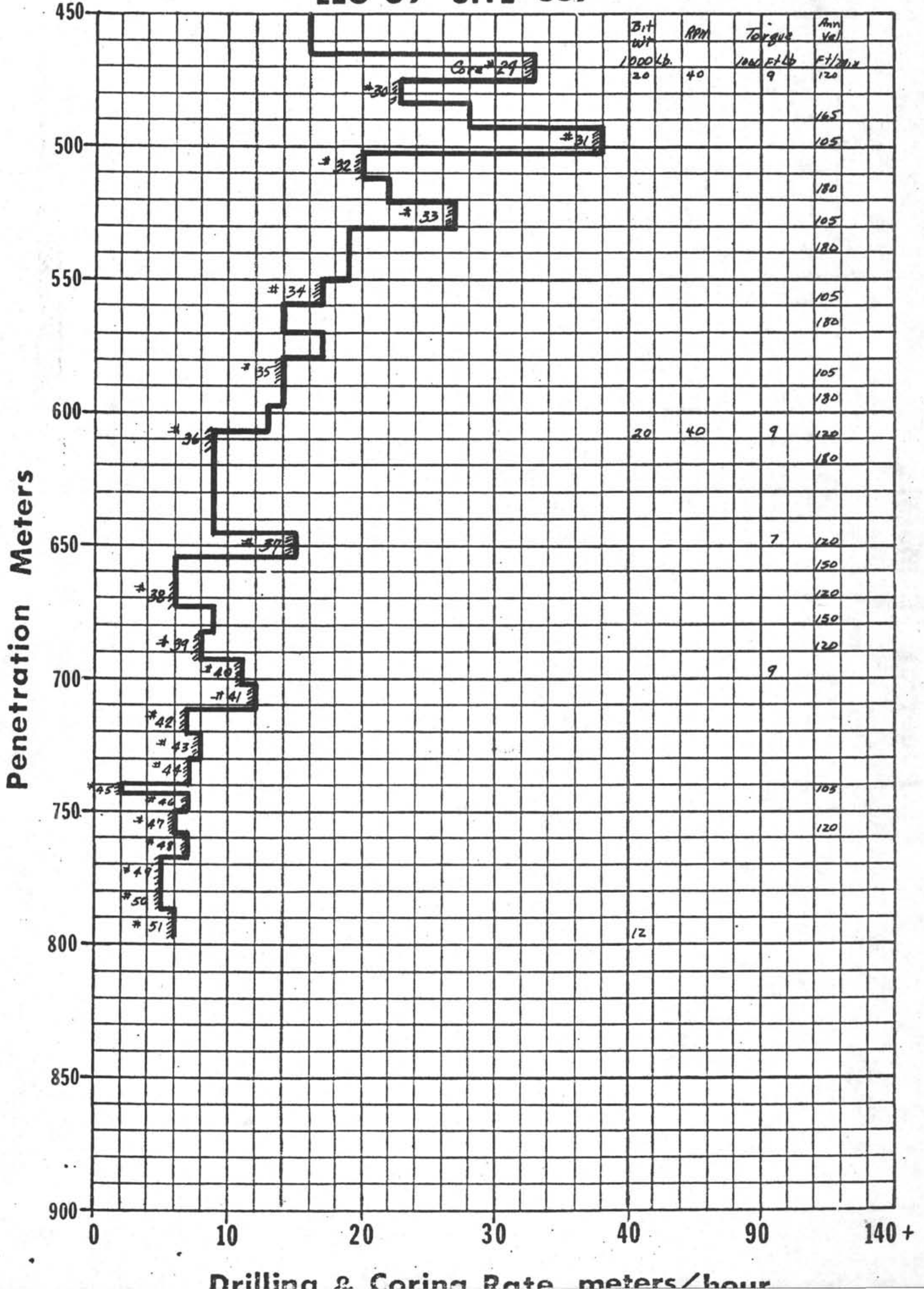


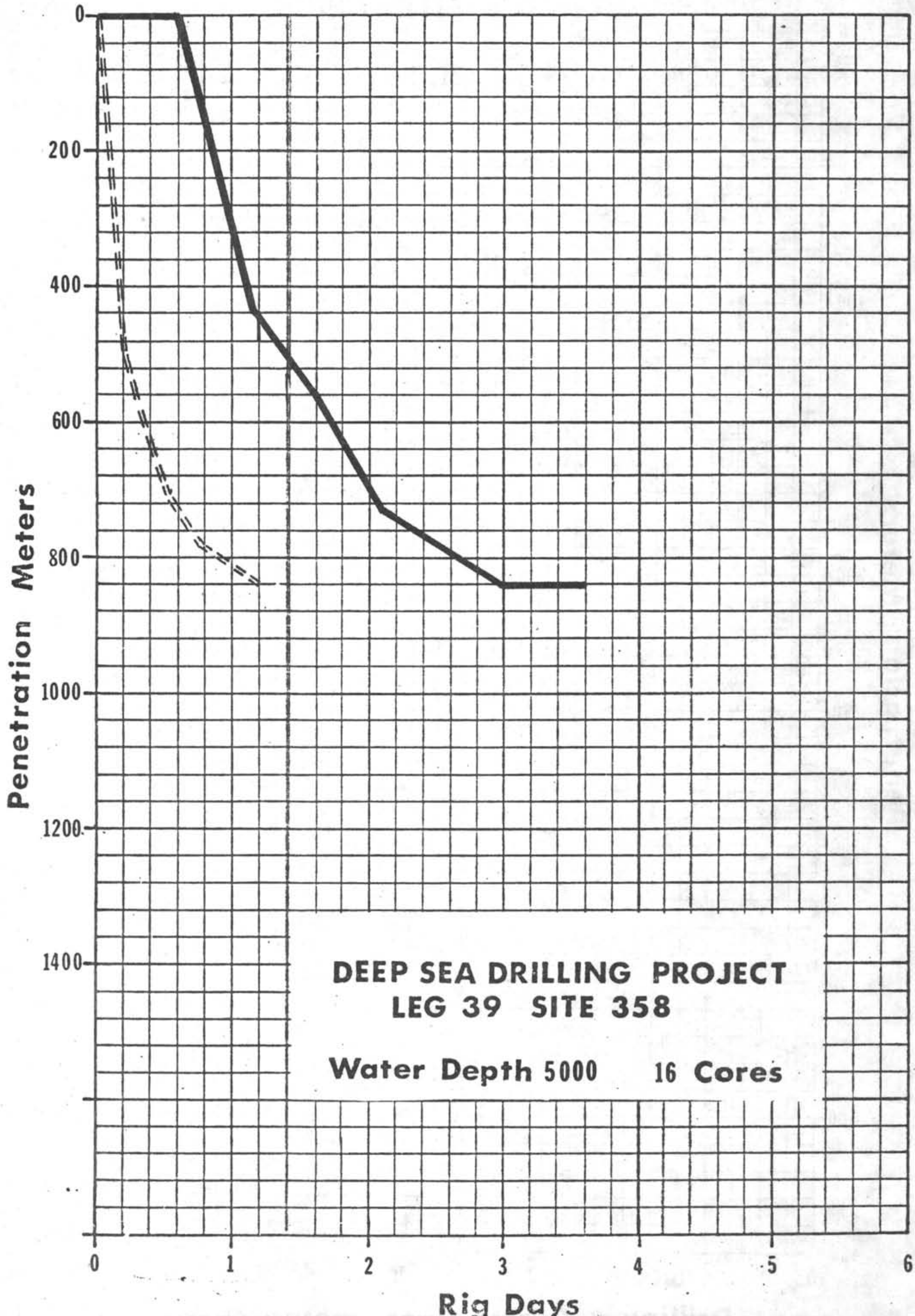
0
200
400
600
800
1000
1200
1400
Penetration Meters
DRILLING DAYS
ROTATING DAYS
Dull Bit T-1, B-SE, G-O
DEEP SEA DRILLING PROJECT
LEG 39 SITE 357
Water Depth 2109
51 Cores
0
1
2
3
4
5
6
Rig Days

DEEP SEA DRILLING PROJECT
LEG 39 SITE 357



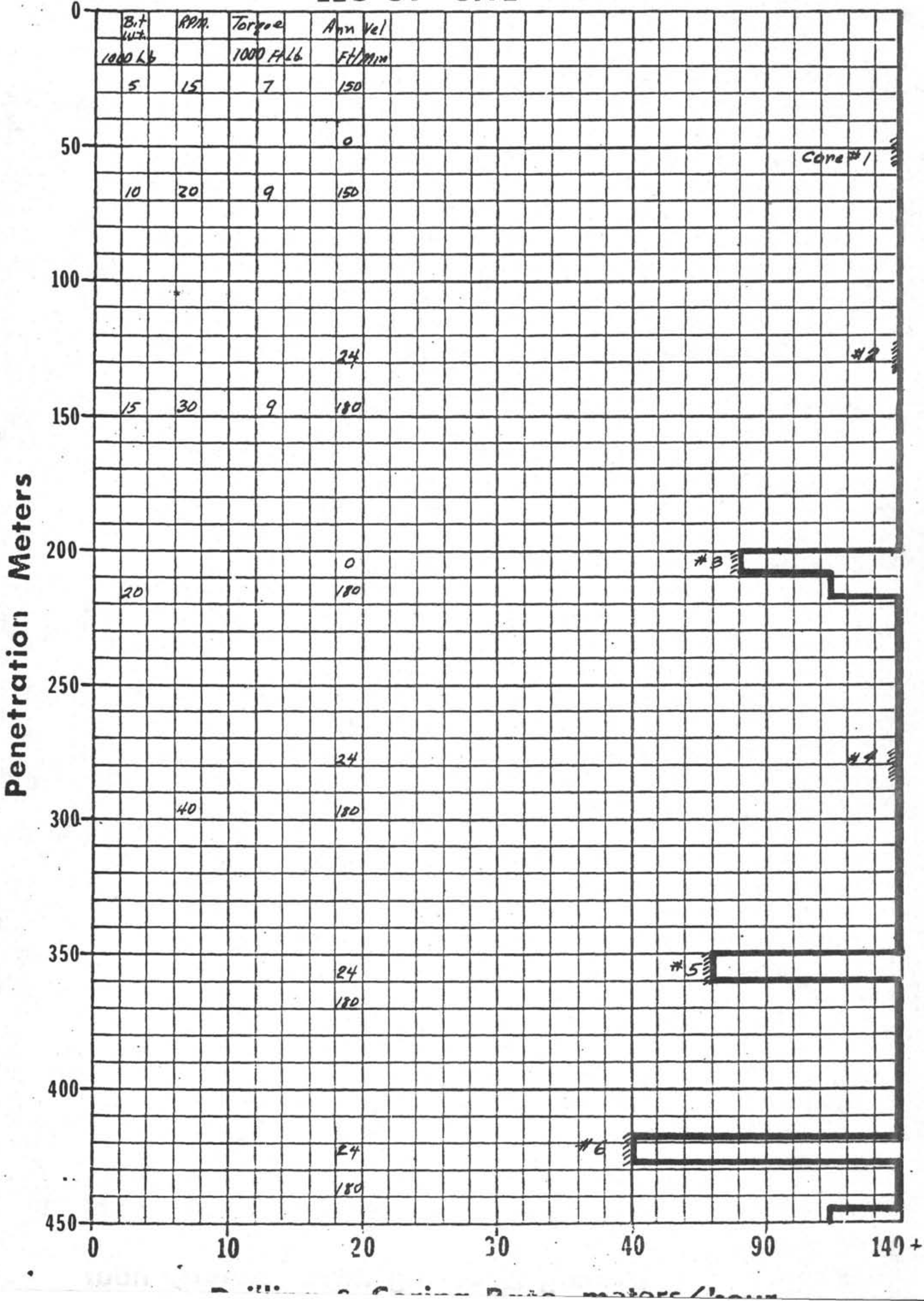
DEEP SEA DRILLING PROJECT
LEG 39 SITE 357

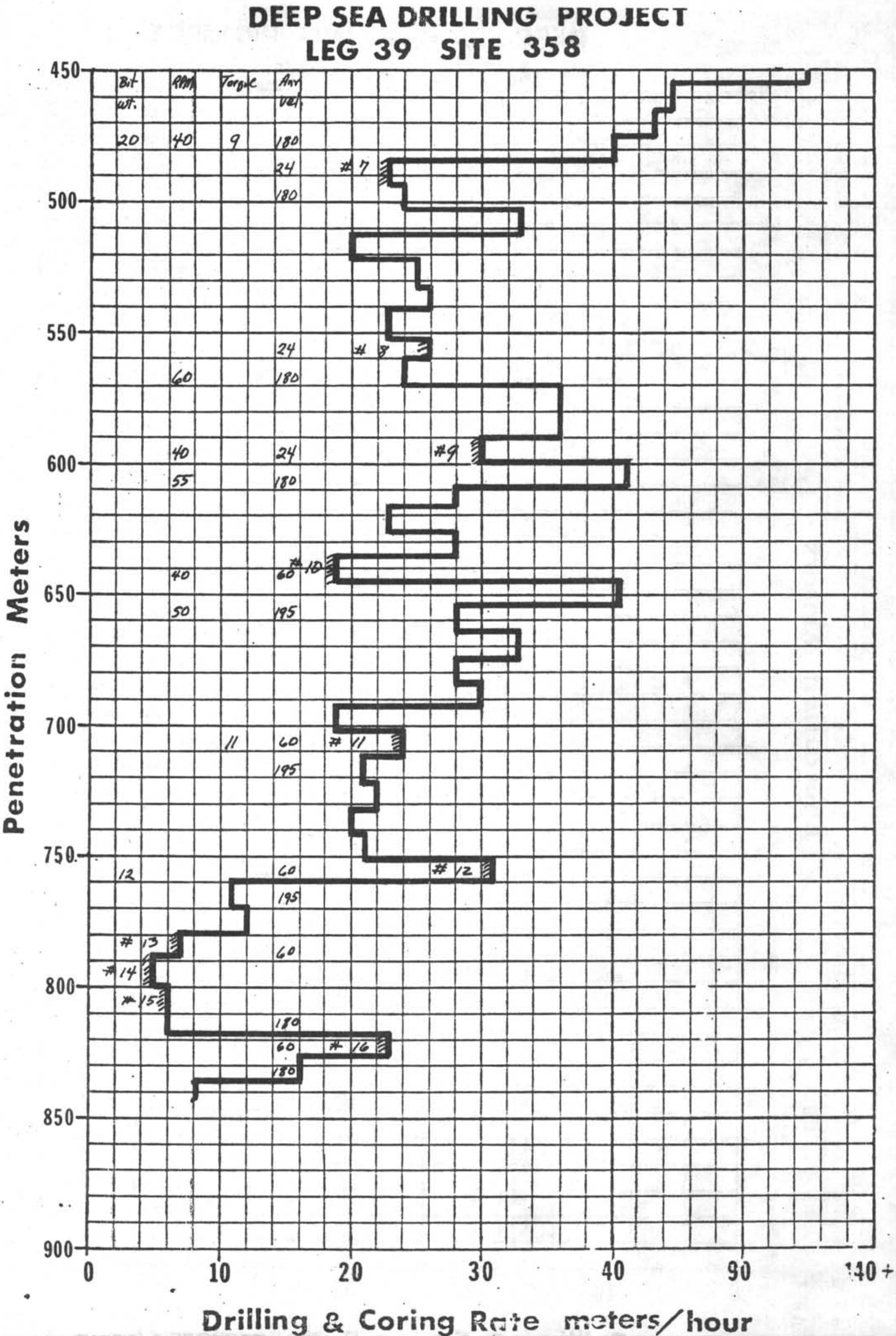




0
200
400
600
800
1000
1200
1400
Penetration Meters
0
1
2
3
4
5
6
Rig Days
DEEP SEA DRILLING PROJECT
LEG 39 SITE 358
Water Depth 5000
16 Cores

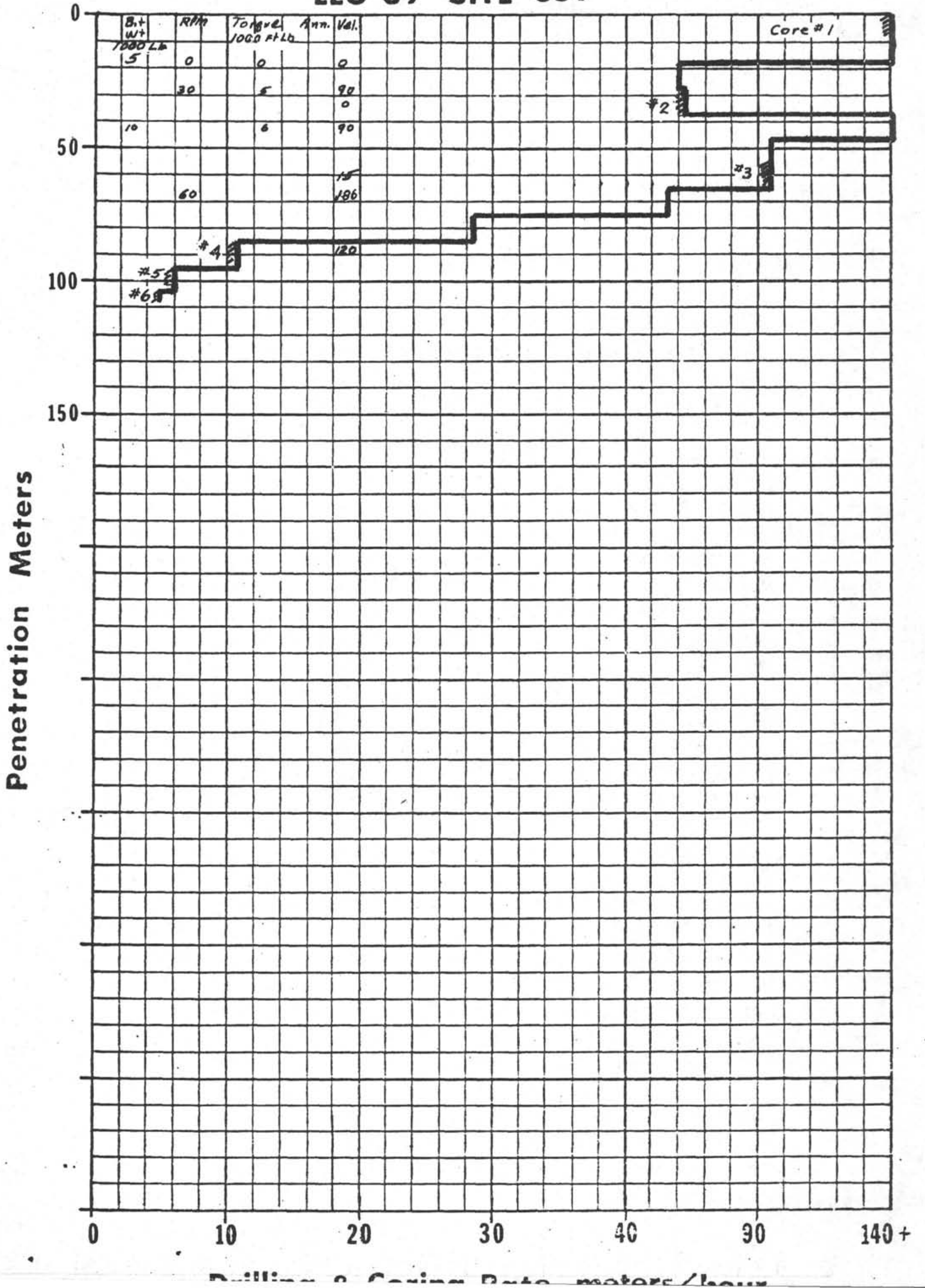
DEEP SEA DRILLING PROJECT
LEG 39 SITE 358





DEEP SEA DRILLING PROJECT
LEG 39 SITE 358
Bit wt.
RPM
Torque
Ann vel.
20
40
9
180
24
180
#7
24
#8
60
180
40
24
#9
55
180
60
#10
40
50
195
11
60
#11
195
12
60
#12
195
#13
60
#14
#15
180
60
#16
180
Penetration Meters
450
500
550
600
650
700
750
800
850
900
0
10
20
30
40
90
140+
Drilling & Coring Rate meters/hour

DEEP SEA DRILLING PROJECT
LEG 39 SITE 359



DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 39

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
9.25.74		.	.	.	.	.	.	.	.	7.5	.	.	7.5	
9.26.74		.	.	.	.	.	.	.	.	24.0	.	.	24.0	
9.27.74		.	.	.	.	.	.	.	.	24.0	.	.	24.0	
9.28.74		.	.	.	.	.	.	.	.	24.0	.	.	24.0	
9.29.74		.	.	.	.	.	.	.	.	24.0	.	.	24.0	
9.30.74		.	.	.	.	.	.	.	.	24.0	.	.	24.0	
10.1.74		.	.	.	.	.	.	.	.	24.0	.	.	24.0	
10.2.74		.	.	.	.	.	. .	.	.	24.0	.	.	24.0	
10.3.74		.	.	.	.	.	.	.	.	24.0	.	.	24.0	
10.4.74		.	.	.	.	.	.	.	.	24.0	.	.	24.0	
10.5.74		.	.	.	.	.	.	.	.	24.0	.	.	24.0	
10.6.74		.	.	.	.	.	.	.	.	20.5	.	.	20.5	
TOTAL PORT TIME AMSTERDAM, NETHERLANDS										268.0			268.0	
10.6.74		3.5	.	.	.	.	.	.	.	.	.	.	3.5	
10.7.74		24.0	Noon	Position		51° 41.0'N,		02° 22.0'E	:	.	.	.	24.0	Avg. 7.36 Kt
10.8.74		24.0	"	"		49° 58.0'N,		02° 20.0'W	.	.	.	.	24.0	" 9.54 Kt
10.9.74		25.0	"	"		47° 44.9'N,		06° 58.9'W	.	.	.	.	25.0	" 9.16 "
10.10.74		24.0	"	"		44° 48.9'N,		10° 49.9 W	.	.	.	.	24.0	" 10.08 "
10.11.74		25.0	"	"		41° 23.0'N,		14° 36.0 W	.	.	.	.	25.0	" 10.60 "
10.12.74		24.0	"	"		38° 13.0N,		18° 07.9 W	.	.	.	.	24.0	" 10.50 "

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 39

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
10.13.74		24.0	Noon	Position		34° 59.0'N,		21° 28.0 W	.	.	.	.	24.0	Avg 10.5 Kt
10.14.74		25.0	"	"		31° 37.0'N,		24° 45.1' W	.	.	.	.	25.0	" 10.4 "
10.15.74		24.0	"	"		28° 27.5'N,		27° 48.2' W	.	.	.	.	24.0	" 10.3 "
10.16.74		24.0	"	"		25° 16.3'N		30° 52.0'W	.	.	.	.	24.0	" 10.1 "
10.17.74		24.0	"	"		22° 05.5'N		33° 45.8'W	.	.	.	.	24.0	" 10.3 "
10.18.74		24.0	"	"		18° 57.5'N		36° 41.9'W	.	.	.	.	24.0	" 10.5 "
10.19.74		25.0	"	"		15° 43.0'N		39° 28.0 W	.	.	.	.	25.0	" 10.1 "
10.20.74		24.0	"	"		12° 31.5'N		42° 10.0 W	.	.	.	.	24.0	" 10.5 "
10.21.74		8.0	"	"		10° 54.68'N		44° 02.13'W	.	.	.	.	8.0	"10.4
TOTAL		351.5											351.5	
10.21.74	353	.	10.0	.	.	.	.	2.0	1.0	.	.	1.0* 2.0**	16.0	*Pick Up Piccolo **Test Sever Tool
10.22.74	"	.	5.0	9.5	6.5	.	.	.	3.0*	.	.	.	24.0	* Power Sub failure - includes Trip time
10.23.74	"	.	.	.	.	.	.	.	8.5*	.	.	.	8.5	* ditto
TOTAL	353		15.0	9.5	6.5	.	.	2.0	12.5	.	.	3.0	48.5	
10.23.74	353A	.	4.0	6.0	.	.	.	4.0	:	.	.	.	14.0	
TOTAL	353A	.	4.0	6.0	.	.	.	4.0	.	.	.	.	14.0	
10.23.74	353B	.	.	.	.	.	.	1.5	.	.	.	.	1.5	
10.24.74	"	.	11.5	7.0	.	.	.	0.5	1.0	.	.	1.0*	21.0	* Secure Piccolo for Travel
TOTAL	353B		11.5	7.0	.	.	.	2.0	1.0	.	.	1.0	22.5	
10.24.74		3.0	.	.	.	.	.	.	.	.	.	.	3.0	

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 39

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
10.25.74		24.0	Noon Position			8° 51.3'N, 44° 17.8'W				.	.	.	24.0	Avg 10.0 Kt.
10.26.74		9.5	"	"		5° 55.16'N, 44° 12.15 W							9.5	" 9.1 "
TOTAL		36.5											36.5	
10.26.74	354	.	5.0	.	.	.	.	1.0	6.0* 1.0**	.	.	1.5‡	14.5	* Position System ** Pipe Racker ‡ Install Piccolo
10.27.74	"	.	7.5	8.5	8.0	.	.	.	.	.	.	.	24.0	
10.28.74	"	.	.	14.5	8.5	.	1.0*	.	.	.	.	.	24.0	* Squall off location 200 ft
10.29.74	"	.	.	18.0	6.0	.	.	.	.	.	.	.	24.0	
10.30.74	"	.	1.5	7.0	15.5	.	.	.	.	.	.	.	24.0	
10.31.74	"	.	10.0	.	.	.	.	.	.	.	.	.	10.0	
TOTAL	354		24.0	48.0	38.0	.	1.0	1.0	7.0	.		1.5	120.5	
10.31.74		14.0	Noon Position			5° 51.4'N, 44° 10.9'W				.	.	.	14.0	Avg 6.0 Kt
11.1.74		24.0	"	"		2° 58.0'N, 41° 52.0 W				.	.	.	24.0	" 9.3 "
11.2.74		24.0	"	"		0° 21.0 N, 39° 35.0 W				.	.	.	24.0	" 8.6 "
11.3.74		24.0	"	"		2° 9.5'S, 37° 24.0 W				.	.	.	24.0	" 8.4 "
11.4.74		24.0	"	"		4° 15.0'S, 35° 18.0 W				.	.	.	24.0	" 8.4 "
11.5.74		11.0	"	"		Recife, Brazil				.	.	.	11.0	" 9.4 "
TOTAL		121.0											121.0	
11.5.74		.	.	.	.	.	.	.	.	13.0	.	.	13.0	
11.6.74		.	.	.	.	.	.	.	.	10.0	.	.	10.0	
TOTAL			Port Time Recife, Brazil							23.0			23.0	

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 39

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
11.6.74		12.5	Noon Position 8° 10.5' S, 34° 47.6' W							.	.	1.5*	14.0	* Test thruster Avg 3.6 Kts
11.7.74		24.0	" " 11° 43.5' S, 32° 47.4' W							.	.	.	24.0	" 10.1 "
11.8.74		16.0	" " 15° 25.8' S, 30° 59.4' W							.	.	.	16.0	" 10.2 "
TOTAL		52.5										1.5	54.0	
11.8.74	355	.	3.5	.	.	.	.	2.0	1.5*	.	.	.	7.0	* Rebuild latch sleeve
11.9.74	"	.	9.0	6.5	8.5	.	.	.	.	.	.	.	24.0	
11.10.74	"	.	.	1.0	18.0	.	.	.	5.0*	.	.	.	24.0	* Positioning Computer
11.11.74	"	.	4.0	.	20.0	.	. .	.	.	.	.	.	24.0	
11.12.74	"	.	7.5	.	.	.	.	.	.	.	.	1.0*	8.5	* Secure Piccolo
TOTAL	355		24.0	7.5	46.5	.	.	2.0	6.5	.	.	1.0	87.5	
11.12.74		15.5	Noon Position 16° 06.5' S, 30° 55.5' W							.	.	.	15.5	Avg 8.4 Kts
11.13.74		24.0	" " 19° 09.0' S, 33° 23.0' W							.	.	.	24.0	" 9.3 "
11.14.74		24.0	" " 22° 23.14' S, 36° 02.9' W							.	.	.	24.0	" 10.2 "
11.15.74		24.0	" " 25° 38.0' S, 38° 52.5' W							.	.	.	24.0	" 10.3 "
11.16.74		11.5	" " 28° 17.24' S, 41° 5.37' W							.	.	.	11.5	
TOTAL		99.0											99.0	
11.16.74	356	.	8.0	.	3.0	.	.	1.0	.	.	.	0.5*	12.5	* Install Piccolo
11.17.74	"	.	.	2.5	21.5	.	.	.	.	.	.	.	24.0	
11.18.74	"	.	.	0.5	23.5	.	.	.	.	.	.	.	24.0	
11.19.74	"	.	.	11.0	13.0	.	.	.	.	.	.	.	24.0	

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 39

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
11.20.74	356	.	.	6.0	18.0	.	.	.	.	.	.	.	24.0	
11.21.74	"	.	2.0	.	4.0	.	.	.	.	.	.	.	6.0	
TOTAL	356		10.0	20.0	83.0			1.0				0.5	114.5	
11.21.74	356A	.	9.0	.	2.0	.	.	.	.		.	.	11.0	
TOTAL	356A		9.0		2.0								11.0	
11.21.74		7.0	.	.	.	.	.	.	.	.	.	.	7.0	
11.22.74		24.0	Noon Position			29° 13.4'S, 38° 16.1'W				.	.	.	24.0	Avg 8.4 Kts.
11.23.74		6.5				Site 357				.	.	.	6.5	
TOTAL		37.5											37.5	
11.23.74	357	.	6.5	.	5.5	.	.	1.5	4.0*	.	.	.	17.5	* Heave Compensator
11.24.74	"	.	.	4.0	20.0	.	.	.	.	.	.	.	24.0	
11.25.74	"	.	.	8.5	15.5	.	.	.	.	.	.	.	24.0	
11.26.74	"	.	.	8.5	15.5	.	.	.	.	.	.	.	24.0	
11.27.74	"	.	2.5	.	21.5	.	.	.	.	.	.	.	24.0	
11.28.74	"	.	3.5	.	.	.	.	.	.	.	.	.	3.5	
TOTAL	357		12.5	21.0	78.0			1.5	4.0				117.0	
11.28.74		20.5	Noon Position			31° 25.0'S, 35° 29.0'W				.	.	.	20.5	Avg 10 Kts
11.29.74		24.0	" "			35° 7.0'S, 35° 48.0'W				.	.	.	24.0	" 9.2 "
11.30.74		5.0	" "			Site 358				.	.	.	5.0	
TOTAL		49.5											49.5	

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 39

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
11.30.74	358	.	11.5	1.75	3.5	.	.	1.5	.75*	.	.	.	19.0	* Pipe Stabber
12.1.74	"	.	.	12.0	12.0	.	.	.	.	.	.	.	24.0	
12.2.74	"	.	.	7.5	16.5	.	.	.	.	.	.	.	24.0	
12.3.74	"	.	12.5	1.0	4.5	.	.	.	.	.	.	.	18.0	
TOTAL 358			24.0	22.25	36.5			1.5	.75				85.0	
12.3.74		6.0	Noon Position Site 358							.	.	.	6.0	Avg 9.7 Kts
12.4.74		24.0	" " 37° 10.5'S, 32° 23.5'W							.	.	.	24.0	Avg 9.7 Kts
12.5.74		24.0	" " 36° 24.0'S, 28° 5.0'W							.	.	.	24.0	" 8.8 "
12.6.74		24.0	" " 36° 1.5'S, 23° 5.0'W							.	.	.	24.0	" 10.1 "
12.7.74		23.0	" " 35° 45.0'S, 18° 27.2'W							.	.	.	23.0	" 9.8 "
12.8.74		24.0	" " 35° 19.3'S, 13° 52.8'W							.	.	.	24.0	" 9.4 "
12.9.74		24.0	" " 35° 7.7'S, 9° 7.5'W							.	.	.	24.0	" 9.7 "
12.10.74		14.0	" " 35° 0.5'S, 4° 40.5'W							.	.	.	14.0	" 9.5 "
TOTAL		163.0											163.0	
12.10.74	359							1.5				7.5*	9.0	* Magna Flux BHA.
12.11.74	"	.	4.0	1.0	10.5				1.0**	.	.	1.5*	18.0	* " " " ** Position System
TOTAL 359			4.0	1.0	10.5			1.5	1.0			9.0	27.0	
12.11.74	359A	.	4.5		1.0					.	.	.	5.5	
TOTAL 359A			4.5		1.0								5.5	
12.11.74		0.5	Noon Position Site 359A							.	.	.	0.5	

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 39

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
12·12·74		24.0	Noon Position 34° 52.3'S, 2° 10.2' W										24.0	Avg 9.4 Kts
12·13·74		24.0	" " 34° 40.3'S, 3° 7.4'E										24.0	" 11.1 "
12·14·74		23.0	" " 34° 29.6'S, 7° 50.0E										23.0	" 10.2 "
12·15·74		24.0	" " 34° 12.5'S, 12° 28.9'E										24.0	" 9.7 "
12·16·74		23.0	" " 34° 01.6'S, 15° 57.3'E										23.0	" 7.5 "
12·17·74		7.25	" " Cape Town, So. Africa										7.25	
		125.75											125.75	

TOTAL TIME DISTRIBUTION FOR LEG 39

		Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	
		1036.25	142.5	142.25	302.0	–	1.0	16.5	32.75	291.0	–	17.5	1981.75	

DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 40

Leg 40, of the Deep Sea Drilling Project, was historically significant as the first voyage of the Project dealing primarily with continental margin drilling. The consistently thick stratigraphic sections penetrated in the six sites drilled tested the limits of the technology developed through the history of the Project for single bit penetrations.

The leg commenced on December 17, 1974 at Capetown, South Africa and terminated February 15, 1975 at Abidjan, Ivory Coast. About seven days of operating time were lost in two unscheduled returns to Capetown; once for emergency repairs and once to offload an injured man. Despite the slow start, a total of 6528 meters of penetration were logged. 2338.5 meters of core were attempted with 1501.6 meters recovered. The overall recovery rate was 64.2%.

Total length of the leg was 60.1 days, of which 34.4 days were spent on-site; 17.1 days, underway and 8.6 days, in port. One half day of on-site time was lost due to mechanical repair.

A Project penetration record of 1314 meters was set at Site 361. In addition, the rotating bit life record was broken three times and now stands at 89.25 hours. Part of the credit for these successes must be attributed to consistently good weather and the fact that no chert or basalt was drilled.

HISTORY

The GLOMAR CHALLENGER's initial stay in Capetown consumed less than three days. Priority work items included emergency repairs to the starboard engine room ventilation intake fan and the installation of an additional Solatron unit to regulate power to vital electronic equipment. A direct ship's heading input from the gyrocompass to the satellite navigation system was also installed. Approximately 380,000 gallons of diesel fuel and 2800 gallons of lube oil were onloaded, along with a large quantity of consumable provisions. In addition, about 24 tons of core samples were offloaded for shipment to the repository at the Lamont-Doherty Geological Observatory.

SITE 360 - CAPE BASIN

The first site was the most southerly, approximately 120 miles south of the Cape of Good Hope. The scientific objective was to obtain a complete Tertiary stratigraphic record. Basement penetration was not anticipated due to the sediment thickness. The beacon was dropped on Site 360 less than 20 hours after leaving Capetown and the work began.

The positioning computer program was functioning improperly while the ship was taking its station initially over the beacon and positioning was continued in the manual mode until the computer was reprogrammed. The hole was spudded in 2977 meters of water and washed to 80 meters where coring commenced. Positioning problems reappeared on the second day of operations when a malfunction affecting the bridge CRT display in all modes necessitated pulling the drill string. An apparent excursion had occurred. Fortunately, semi-automatic positioning was regained before the mudline was cleared and the hole was not lost. Full automatic positioning was eventually regained after two simultaneous problems in the system were isolated and at least provisionally repaired.

All then went smoothly with business as usual on Christmas Day. On December 26, a check of an apparent tachometer malfunction indicated that the motor of No. 2 bow thruster (forward tunnel) was freewheeling and somehow disconnected from the thruster propeller. The weather, which had been unsettled for days, became a critical factor now that position-holding capabilities were reduced. An unfavorable forecast by the ship's meteorologist prompted a consensus decision to abandon the hole slightly short of the original projected penetration.

Although no hydrocarbons were detected, the location of Site 360 on the landward flank of the Cape Basin placed it technically on the continental rise. The hole was filled with weighted mud prior to abandonment in compliance with the recommendations of the JOIDES Panel on Pollution/Prevention and Safety.

A mudline punch core was attempted on the trip out of the hole but yielded no recovery. The string was pulled in deteriorating weather and a full gale was blowing by the time the ship was secured for sea. As the transit back to Capetown for thruster repairs began, 80 mph winds were experienced and the CHALLENGER took rolls in excess of 20 degrees.

RETURN TO CAPETOWN

Although Site 360 was completed with only three thrusters, there was insufficient holding power to complete the leg without undue hazard to the drill string. Also the repair facilities at Capetown were far superior to those of subsequent scheduled ports. The decision was to return to Capetown for emergency repairs. The tunnel for bow thruster No. 2 passes through ballast tank K3B and when pumped dry and entered to assess thruster damage, three small leaks from the thruster tunnel into the tank were discovered. It was obvious that the work in Capetown would include repair of the tunnel, although the extent would not be known until the tunnel could be entered. The preferred method of effecting repairs was drydocking the ship but all Capetown drydocks were booked far in advance and no others were available within a reasonable distance. Thus, it became necessary to utilize the thruster tunnel covers carried on board for such contingencies.

Work commenced immediately upon our return to Capetown. Ned Hastings (GMI) and Mr. McLeod (Schottel America) arrived from the United States to supervise repairs. Repair progress was beset by frustrations. First, the fitting and sealing of the tunnel "earmuffs" took nearly 2-1/2 days. Second, adequate labor and services during the 2-1/2 day New Year's holiday were difficult to secure. The main vertical drive shaft of No. 2 thruster was found to be twisted off just inside the upper coupling (on the drive motor). The entire below decks thruster assembly was removed and the shaft, bearings, couplings and propeller were replaced with new components and a rebuilt right angle gear drive was installed. Local eroded and/or corroded areas in the stainless steel wear ring and in the tunnel proper were ground out and weld filled. A steel doubler plate was fabricated and welded into place over the area affected by leakage. Great difficulty was encountered in removing the upper coupling from the motor shaft as an electrical induction puller was not available in Capetown.

Other repair work accomplished included replacement of a cracked vane on the new engine room ventilation fan installed during the first Capetown visit. An attempt was made to install a new style rod packing on the heave compensator.

It also developed, coincidentally, that Scripps personnel were on hand to supervise personally the loading of our core shipment onto the MORMACPRIDE, bound for New York. This was fortuitous as a breakdown in communications within the shipping company had resulted in our shipment being allocated space in frozen storage. Cargo had to be shifted from one chill hold to another to accommodate our cores. This probably would not have been done had our representatives not been present.

A total of 5.7 days were spent at Capetown for emergency repairs on the second port call.

SITE 361 - CAPE BASIN

Site 361 was located to the northwest of Site 360 and slightly deeper into the Cape Basin. The objectives of this site were to sample the Lower Tertiary and Cretaceous sediments not penetrated at Site 360 and to determine the nature of the basement.

A marginal card in the digital/analog converter of the dynamic ship's positioning system made positioning somewhat "shaky", but due to good weather and relatively deep water, excursions stayed well within safe operating limits.

At about 1000 meters penetration, a small amount of methane gas was detected in a core. Some gas persisted in subsequent cores with the appearance of an ethane component. Continuous coring commenced with the first detection of gas and the methane/ethane ratio was monitored closely. No trends of increasing gas content or ethane percentage were noted. In fact, both parameters seemed to show, in general, a slight decrease with depth. The gas was found in organic rich shales which were interbedded with sandstones and appeared to be in situ rather than migratory.

Basement was not reached in this hole due to bit failure at 1314 meters penetration which was a DSDP record for both penetration and bit rotating life (70 hours). A few basalt fragments in the last core indicated that basement was very close and age determination of the sediments showed them to be the oldest expected in this area. As gas had been encountered, the hole was plugged with cement and weighted drilling mud.

While cementing was in progress, a main circuit breaker tripped causing the loss of all electrical power for several minutes. By the time propulsion and positioning were regained, a 500 foot excursion had occurred. Because of nearly windless conditions and the depth of the water, however, no damage was done to the drill string.

CAPETOWN AGAIN

Upon completion of Site 361, we again headed for Capetown on the recommendation of the ship's surgeon that a rotary helper be put ashore for finger surgery. He was transferred to a boat outside Capetown Harbor and the ship was immediately underway for Site 362. Some medical supplies and perishable food items were taken aboard from the boat. About 15 hours were lost in going via Capetown.

SITE 362 - WALVIS RIDGE

Located about 120 miles off the coast of South West Africa, Site 362 was situated atop the Frio Ridge segment of the Walvis Ridge. The objective was to sample a thick stratigraphic section, including several important regional seismic reflectors.

After testing the drill pipe severing system, the hole was spudded in 1336 meters of water. Some methane gas was encountered in the shallower, unconsolidated sediments, but decreased to nothing with depth. Although concentrations were too low to detect by shipboard instruments, a powerful hydrogen sulfide odor permeated the core handling areas while the uppermost sediments were being processed.

Early on the second day of drilling, an AC power failure caused the positioning computer's program to be dumped. One hour of operating time was lost while reprogramming the computer and repositioning the ship. An excursion of approximately 100 feet was taken. No damage to the drill string was sustained.

Shortly after this it was noted that the cores showed indications that the inner core barrel was rotating with the outer barrel rather than remaining stationary during the coring operation. After several of these cores, two consecutive cores were pulled with recovery limited to the core catcher section. Subsequent tests (chalking and running the extended core barrel) indicated that the inner barrels were no longer latching into place within the outer core barrel. At this point drilling was terminated and the drill string pulled. Examination of the bit revealed that the top plate of the experimental inner barrel seal assembly had deformed, preventing the inner barrels from seating properly.

A new bit (without bit seal) was installed and a second hole, 362A, was spudded without offsetting the ship's position. No cores were taken from this hole until just short of the total depth of Hole 362. The trip to bottom and penetration to 796 meters were accomplished in one day's time. Harder sediments in the form of Eocene hard chalks and limestones were soon encountered, however, and the drilling rate dropped sharply. Drilling was terminated at 1081 meters subbottom in the face of very slow penetration rates and indications of bit locking.

The unforeseen thickness and degree of induration of the Tertiary sequence had caused the limitations of time and bit life to be exceeded and had frustrated any hope of reaching the Cretaceous objective at this site.

SITE 363 - WALVIS RIDGE

This site, located roughly 80 miles west of Sites 362, was drilled in an attempt to sample the lower Tertiary and Cretaceous sections not penetrated at Site 362. The ultimate drilling objective was at least nominal penetration into the basement.

Water depth at this site was 2247 meters. Drilling and coring proceeded smoothly until the third day, when the "bow sense" relay of the positioning system failed causing an excursion of approximately 200 feet off the beacon. No drill string damage occurred and only a few minutes of operating time were lost.

No hydrocarbons were encountered at Site 363.

Premature bit failure occurred and was masked at this site as the failure occurred while progressively softer sediments were being drilled and fairly rapid penetration was being achieved. In fact, the failure was mistaken for a combination of hole sloughing problems and a plugged bit. The decision to pull out of the hole was not made until after a center bit had been pumped down to clear the bit and could not be pulled free by the sandline. When the bit cleared the rig floor, it was discovered that all the cones and the shanks were gone and only the "body" remained. The center bit protruded several inches below the core throat.

SITE 364 - ANGOLA BASIN

Site 364, located about 100 miles off the coast of Angola, was selected as an optimum site for sampling the Tertiary and Upper Cretaceous stratigraphic sections and the evaporite sequence directly overlying a massive Lower Cretaceous salt stratum. The ultimate drilling objective was to cut sufficient core in the salt to study its depositional history.

While rigging the Bowen power sub just prior to spudding, electrical power was lost to the Bowen hydraulic unit. Four hours were lost before the problem was traced to a faulty pressure switch and rectified.

After spudding in 2449 meters of water and making 55 meters penetration, the WKM ball valve atop the swivel began leaking copiously. An additional 1-1/2 hours were lost in pulling above the mudline, repairing the valve and respudding.

The only indications of hydrocarbons noted at Site 364 were petroliferous odors given off by organic and carbonaceous shales which were common through a fairly long section. No gas or fluorescence were encountered.

The drilling effort was again dogged by a stubbornly thick and well indurated sediment section, this time Upper Cretaceous limestones and shales. In addition, high angle fractures and bedding planes introduced a persistent tendency for cores to jam at or near the core catcher. After a week on site and a heroic 89 hours and 15 minutes of rotating time, all the cones were run off the bit and the hole was abandoned. Pore water salinities indicated the salt was tantalizing near.

SITE 365 - ANGOLA BASIN

With the leg's operating time running out, the final site was a desperate attempt to reach the evaporite body by drilling on a steeply sloping subcrop area about seven miles southwest of Site 364. Rapid penetration was achieved in a section of shales, mudstones and sand much softer than the sediments of Site 364 and only spot coring was done. Some organic shale and sapropelic material similar to that of Site 364 was encountered, but there were no signs of "live" hydrocarbons.

After 687 meters penetration and no salt, time ran out and drilling was terminated. There were some indications that the drill may have entered the evaporites in the last few meters, but none were recovered in the final core.

Considerable drag was experienced in pulling to the mudline. This could have been caused by unstable hole conditions or by deviation of the hole from vertical due to bedding dips of up to 70° measured in the cores.

The bottomhole assembly was magnafluxed as it was recovered. No serious defects were found.

The 6.6 day journey from Site 365 to Abidjan was uneventful except for an equator crossing at the vernal equinox and 5.1 hours spent dead in the water while uncoupling and recoupling main propulsion motor No. 5 for bearing repair. The cause of the overheated bearing was found to be a cracked race, apparently the result of faulty installation in Amsterdam.

Leg 40 ended at 0926 on February 15, 1975 when the first line was put over in Abidjan, Ivory Coast.

DRILLING AND CORING ASSEMBLY

A standard DSDP bottomhole assembly was used on all sites. This consisted of a bit, bit sub (with float valve), core barrel, three 8-1/4" drill collars, two 5' stroke Baash-Ross bumper subs, 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" heavy wall drill pipe. No drilling tools were lost.

While drilling Hole 362A, the drill pipe saver sub failed at the last engaged thread of the pin while a mousehole connection was being made. This failure was identical to that which occurred on Leg 37 and was attributed to soft steel in the sub. As the same defect was suspected in this case, a five foot drill pipe pup joint was used for the remainder of the leg in place of a saver sub. New subs were delivered in Abidjan. The makeup cathead air clutch was adjusted to reduce the maximum torque produced.

When the drill string was pulled upon completion of Site 364, a one inch horizontal crack was noted about two feet above the pin end of a joint of drill pipe near the top of the string. The joint was removed and set aside for further study of the failure. Except for its location at the opposite end of the joint, this crack appeared identical to a failure noted on Leg 35.

CORING AND DRILLING EQUIPMENT

The standard DSDP core barrel assembly was used on all sites. In general, core recovery was quite good except in intervals of interbedded sediments of variable induration. Due to time limitations, greater than optimum pump pressures often were utilized while coring in order to achieve more rapid penetration. Although this reduced recovery somewhat and caused moderate to severe erosion of the core (reduced diameter), the compromise was needed to meet the scientific penetration objectives.

In one instance, the inner core barrel check valve assembly was found to have come unscrewed and was recovered, intact but disassembled, atop a very meager core. A locking feature is needed to prevent future occurrences.

Except for local failures associated with severe jamming, only two or three collapsed butyrate core tube liners were encountered.

Core barrel jamming was the common cause for low recovery, expecially at Sites 364 and 365. The jamming appeared to be the result of a wedging action caused by oblique fractures in limestones and hard chalks and by high angle bedding and parting planes in shaly and laminar formations. It did not seem attributable to any defect in equipment or technique.

From time to time, the cores showed spiral markings indicating that the inner barrel had been rotating and causing the catcher dogs to groove the core. The lower support bearing assembly was changed out between sites and eliminated as a possible cause. It has also occurred with more than one inner barrel swivel assembly. While not a serious problem, it may warrant some design review.

BITS

The performance of the core bits was a credit to the years of development the tungsten carbide insert roller cone core bit has undergone. Of the seven bits run, the average rotating time was 49.3 hours. Four of these bits were run until they failed. The average penetration rate for the leg was 19.52 meters per hour. Long chisel insert Type 93 bits were run at Sites 360, 361 and 365 where sedimentary lithologies of low compressive strength were anticipated and where little or no chert or basalt were expected. Predictably they achieved a faster penetration rate in shales, mudstones and hard clays than did the Type 94 bit with shorter inserts used on the other holes. In hard chalks, limestones and very soft formations, no real difference could be noted. Both types had difficulty penetrating well indurated waxy marls.

Only one three-cone bit, a model F94C, was used. It failed after less than 29 hours rotating time; a much shorter lifespan than the pattern established by the four cone bits used.

POSITIONING

Considering the criterion of staying within a distance of the beacon equal to three percent of the water depth, positioning on Leg 40 was satisfactory with one exception. This was an excursion caused by a power failure. However, several problems did occur that could have easily caused either the loss of a hole or at least part of a drill string had it not been for the skill of operating personnel and/or good fortune. It is believed that these problems are representative of what can be expected in future operations and that they point out significant weaknesses in the present system.

Although a complete new system would be most desirable, it is felt the present installation could be significantly upgraded at relatively low cost by adding redundancy to certain components peripheral to the computer and by installing a fail safe power supply. Since considerably more time and money will be invested in individual drill sites in future operations, improvement in the system's reliability should be considered.

PROBLEMS

While drilling at Site 360, thrust and position display became quite erratic in all modes, forcing a decision to pull for the mudline. Troubleshooting revealed two concurrent problems which were corrected in time to save the hole. A loose wire splice between the digital interface unit and the computer and a malfunctioning vertical reference gyro analog/digital converter were causing the computer program to cycle erratically. Three hours of operating time were lost.

Overall positioning performance was degraded at this site due to the fact that the bow thrusters were found to be running about 90 rpm faster than the stern thrusters. To prevent undue abuse of the bow thruster systems, maximum thrust was limited to 45% for the duration of the site. In one instance, the drilling operation was shut down for about 20 minutes when positioning could not cope with a divergence of wind and current.

On the final day of operations, at Site 360, bow thruster No. 2 tachometer began indicating speeds in excess of 650 rpm. Investigation revealed that power was not being transmitted from the motor to the propeller although the exact nature and location of the failure could not be determined at sea. The thruster was taken off the line and the site completed with one bow thruster. This failure necessitated returning to Capetown for repairs.

At Site 361, display problems were encountered immediately and were traced to dirty contacts on a circuit card in the gyro analog/digital converter.

Erratic thrusting and display problems reappeared after operations had commenced. Although positioning was "shaky", the relatively deep water made the numerous excursions of up to 200 feet tolerable for the duration of site operations. In addition, maximum thrust could not be produced by the thrusters because the positioning system was unable to transmit a full ten volt signal to the thruster exciters. After the mudline was cleared, troubleshooting traced both of these problems to a faulty circuit card in the digital/analog converter and the problems were, at least temporarily, alleviated.

While plugging Hole 361, all AC power was lost for about ten minutes due to an overheated circuit breaker in the emergency generator room. An excursion of about 500 feet was taken, but no damage was sustained to the drill string.

At Site 362, a power surge and about five minutes loss of AC power were experienced due to a sticky brush on one of the AC generators. The computer program was retained while switching to and running on emergency power. Power was lost again, however, while switching back to ship's power and this time the program was dumped. One hour was lost while reprogramming and repositioning the ship in the manual mode.

It was necessary to position in manual at Site 363 for about 30 minutes when a "bow sense" relay malfunctioned and an excursion of about 250 feet occurred. Very little time was lost and again, there was no drill string damage.

BEACONS

The performance of the five ORE beacons used on this leg was consistently excellent. The only anomaly noted was a marked variation of signal strength in beacon No. 306 used on Site 363. The signal was quite strong when the site was abandoned.

The rubber diaphragm on the transducer of beacon No. 329 was inadvertently punctured with loss of fluid while rigged in the mud room. Beacon No. 305 failed to operate on dry testing. Both have been set aside pending inspection and disposition.

As the two Burnett beacons on board were nearing the end of their recommended shelf life, it was decided that they should be expended on this leg although it was necessary to improvise both shorting plugs and part of one flotation. Beacon No. 18, upon its drop at Site 364, showed an excessive pulse width and a very poor signal envelope, both of which were marginal for positioning. Shortly after the back-up ORE beacon was dropped, both pulse characteristics of No. 18 rectified themselves considerably. The signal was checked periodically during site operations and was lost completely after five days.

Beacon No. 14, used on Site 365, also produced a wide pulse but it was within acceptable limits. Signal strength dropped fairly rapidly during the two days of site occupation.

TEFLON BIT SEAL

An experimental bit seal assembly was run in Holes 360, 361 and 362. The assembly is installed in the throat of the bit and is designed to pack off the core catcher sub diverting nearly all the drilling fluid through the bit jets. It is anticipated that this will improve core recovery by eliminating the "venturi" effect of the fluid moving past the terminal end of the inner core barrel and that it will improve drilling hydraulics.

The first test was inconclusive as the assembly was inadequately welded into place and broke free. The tests at Sites 361 and 362 produced failures of the top plate and teflon sealing rings. There is some indication that the seal does, indeed, improve bit hydraulics. Nearly 88 percent of the 418 meters cored at Hole 362 was recovered before deformation of the top plate forced abandonment of the hole. Recovery figures at Site 361 were less impressive, however, and considerable more testing will be required to evaluate the seal's effectiveness due to the many variables encountered in drilling conditions.

HEAVE COMPENSATOR

During the first Capetown port call, the heave compensator was picked up and work commenced to solve problems encountered on Leg 39. There are indications that the major operating problems were solved by venting the hydraulic system and repairing a leak in the Cameron standpipe relief valve. Efforts were then directed toward stemming the excessive Pydraul leakage around the piston ring seals and wiper seal at the base of the compensator cylinder. The piston rod nut and lifting lug were removed and a modified seal assembly was installed with negative results. At this point, work was interrupted to pick up the piccolo and get underway for Site 360. Work recommenced upon return to Capetown and another type of seal assembly was installed. Attempts to replace the piston rod nut resulted in the threads locking and galling. The lower 1-1/2 inches of threads on the rod were severely damaged and were ground away by shipboard personnel. The nut was sent to the shipyard machine shop where the threads were chased. All threads were dressed with emery cloth before an attempt was made to replace the nut. Repeated subsequent attempts to make up the nut ended with the threads seizing. Efforts were discontinued due to fear of irreparable damage to both nut and rod. The piston rod was then removed so that both components may be sent to a machine shop in Abidjan.

In addition to the above damage, there are several spots on the piston rod where the chrome plating has flaked off.

PICCOLO

The 90 foot guide piccolo was employed on Sites 360 and 361. No significant problems were encountered in its handling or transportation. The piccolo rode quite well through the storm encountered after departing Site 360 and no damage to the derrick or other structures occurred. The piccolo was laid down to permit heave compensator work enroute Site 362 and was left in the casing rack for the remainder of the leg. It was felt the relatively remote chance of rough weather on the remaining sites did not warrant the risk of picking up the piccolo while at sea.

HYDROCARBONS

Methane gas was present in cores recovered at Sites 361 and 362. The presence of an ethane component at Site 361 resulted in continuous coring and very careful monitoring of the gas analysis. The methane/ethane ratio did not show an increasing trend and the amount of gas present decreased with depth. No heavier hydrocarbons were detected.

At Site 362, methane, associated with a strong hydrogen sulfide odor, was encountered. This gas was limited to shallow incompetent sediments and the amount decreased markedly with depth.

In several instances (especially at Sites 361 and 364) black organic shales and sapropelic sediments were encountered. Much of this material gave off a distinct petroliferous odor but no gas, fluorescence or other signs of "live" hydrocarbons were detected.

No liquid hydrocarbons, remanent fluorescence or oil staining were detected during the leg. However, with the increasing importance of hydrocarbon safety in this type of drilling, the present method of fluorescence detection should be improved.

WEATHER

Although there were no on-site delays directly attributable to weather, operations at Site 360 were terminated slightly earlier than planned by deteriorating weather conditions. The same storm sharply reduced speed during the transit from Site 360 to Capetown. At Site 360, wind and seas were building rapidly while the drill string was being pulled and the ship was secured for sea with no time to spare. Had it not been for satellite weather photographs and the alert counsel of Mr. Fields, our National Weather Service representative, we would certainly have been caught by the full force of the storm before all the drill pipe was on deck. This would have resulted in shutting down to ride out the storm and a likelihood of losing part of the drill string.

We were fortunate in avoiding inclement weather at Site 361 and predictably good conditions were encountered for the remainder of operations, which were conducted in the shelter of the African continent.

COMMUNICATIONS

Generally, good communications were maintained throughout this leg being out of direct contact with radio WWD (Scripps) only a few days while locating "windows". All incoming traffic was via radio WWD, except for a few messages relayed via radio Capetown (ZSC). A great deal of outgoing traffic was easily handled through the U. S. Naval Communications Station, NPN, at Guam, which provided a high degree of cooperation, even to the extent of scheduling their directional beam on us daily at 1100-1300z on 17156 MHZ. Some outgoing traffic was sent directly to radio WWD.

On 21 January, some trouble was experienced with the TMC transmitter, as the tube installed on 8 November became weak. The new spare tube, Type PL264/8576, was found to be defective upon initial installation. However, by reinstalling the old tube and increasing its filament voltage to that specified in the instruction manual, it was found possible to obtain between 2.2 and 2.5 kilowatts output (maximum) as of 24 January. Therefore, this unit (TMC) was in good condition nearly all the voyage.

The volume of traffic was rather high due to port calls concerning personnel and machinery, however, no material delays in transmission were encountered.

It should be noted that only two "radio windows" between the West Coast and the area off South Africa were established: one at 0430 to 0530z on 8698 KHZ, the other at 1700-1900z on 17105 KHZ. Best "window" for voice communications by radiotelephone was at 0430z to radio Miami (WOM) on their 8 MHZ band with another "window" to KMI Oakland at about 1730z on the 17 MHZ band.

The omni-directional satellite weather antenna was previously located within 41 inches of the 2.5 KW TMC antenna and as a result, was severely damaged. It also adversely affected the tuning of the TMC transmitter. It was removed from this location on 20 January 1975 and placed in storage for repairs.

PERSONNEL

Two medical situations of sufficient gravity to have operational significance arose on Leg 40.

While drilling at Site 360, an oiler became too ill to stand watches and complained of severe headaches. As meningitis was considered a possibility, a lumbar puncture was performed by the ship's surgeon and the disease was diagnosed as viral encephalitis. When the ship put in to Capetown for emergency repairs, he was transferred to a local hospital for further tests and treatment. He had not sufficiently recovered at the end of the port call to sail with the CHALLENGER. His progress ashore indicated that shipboard treatment would not have been adequate and that some provision would have been required for putting him ashore, if the ship had not gone in for repairs. A local resident of British citizenship was hired on short notice as a replacement for the duration of the leg. He proved to be a fully capable and satisfactory substitute.

In a rig floor accident on Site 361, a rotary helper sustained an injury to his left middle finger in which the flesh was mangled and pulled off the first joint. When efforts by the ship's surgeon to replace the end of the finger were unsuccessful, the ship returned for a rendezvous with a service boat outside Capetown Harbor. The injured man was transferred ashore for surgery. The finger was found to be gangrenous and was amputated at the first joint. A bedroom steward was promoted to rotary helper for the remainder of the leg.

The majority of other medical cases consisted of the usual colds, fevers and finger injuries.

The Global Marine drilling and marine crews performed with the high degree of professionalism to which the Project has become accustomed.

The Scripps technical staff performed with cheerful efficiency even though the tempo of operations became hectic at times.

Despite the diversity of backgrounds and nationalities, the scientific staff worked very effectively together and with the ship's company.

The presence of geochemist James Foresman of Phillips Petroleum Corporation was a definite asset to the voyage. His consultation was of considerable value in making operational decisions concerning the various hydrocarbon compounds encountered.

Glen N. Foss

Glen N. Foss
Cruise Operations Manager
Deep Sea Drilling Project

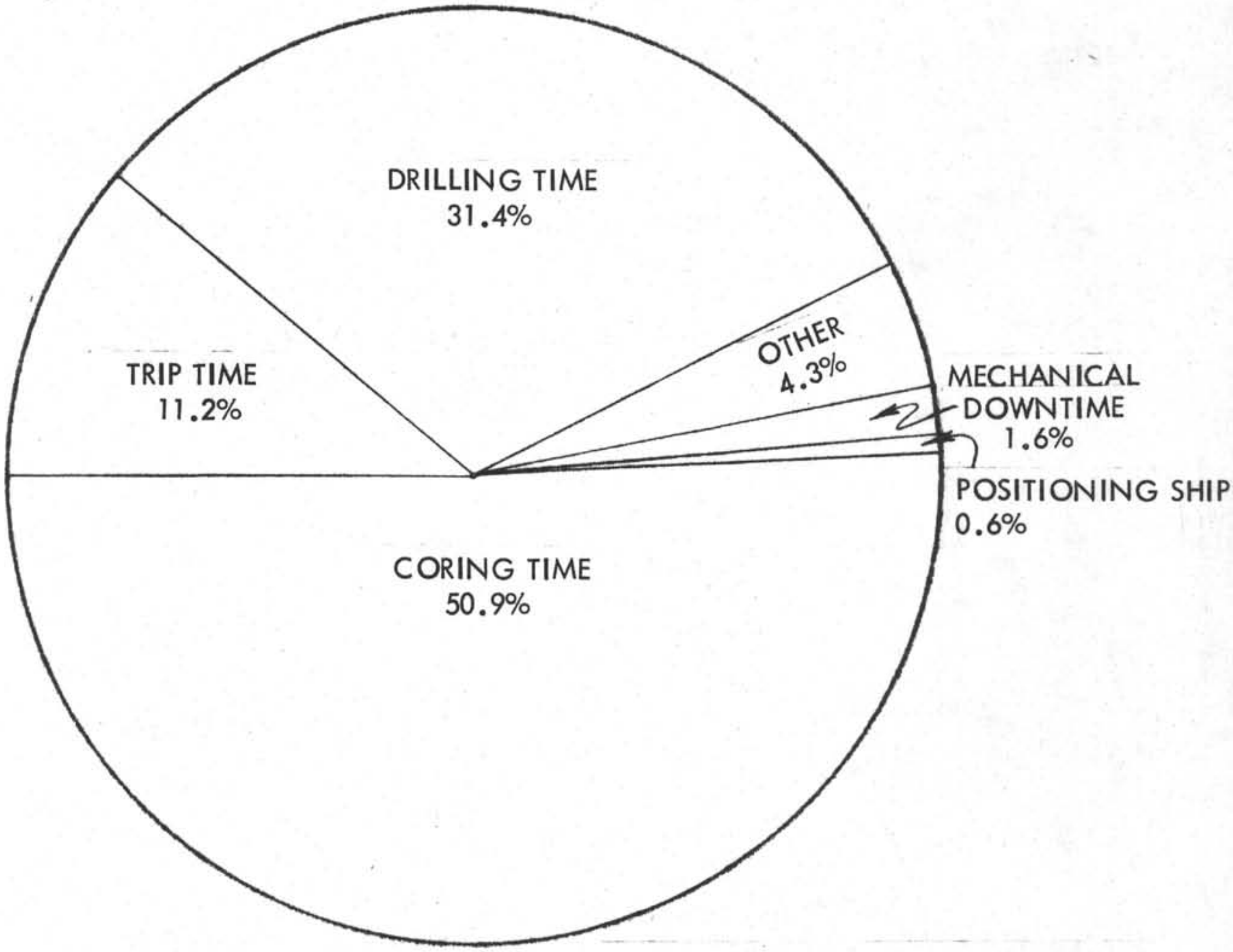
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 40

Total Days (December 17, 1974 - February 15, 1975)		60.10
Total Days in Port		8.60
Total Days Cruising*		17.10
Total Days on Site		34.40
Trip Time	3.9	
Drilling Time	10.8	
Coring Time	17.5	
Mechanical Downtime	.5	
Position Ship	.3	
Other	1.4	

Total Distance Traveled (Nautical Miles)	3549
Average Speed (Knots)	9
Sites Investigated	6
Holes Drilled	7
Number of Cores Attempted	249
Number of Cores With Recovery	248
Percent of Cores With Recovery	99.6
Total Meters Cored	2338.5
Total Meters Recovered	1501.6
Percent Recovery	64.2
Total Meters Drilled	4189.5
Total Meters of Penetration	6528.0
Percent of Penetration Cored	35.8
Maximum Penetration (Meters)	1314.0
Minimum Penetration (Meters)	687.0
Maximum Water Depth (Meters	4557.5
Minimum Water Depth (Meters	1336.0

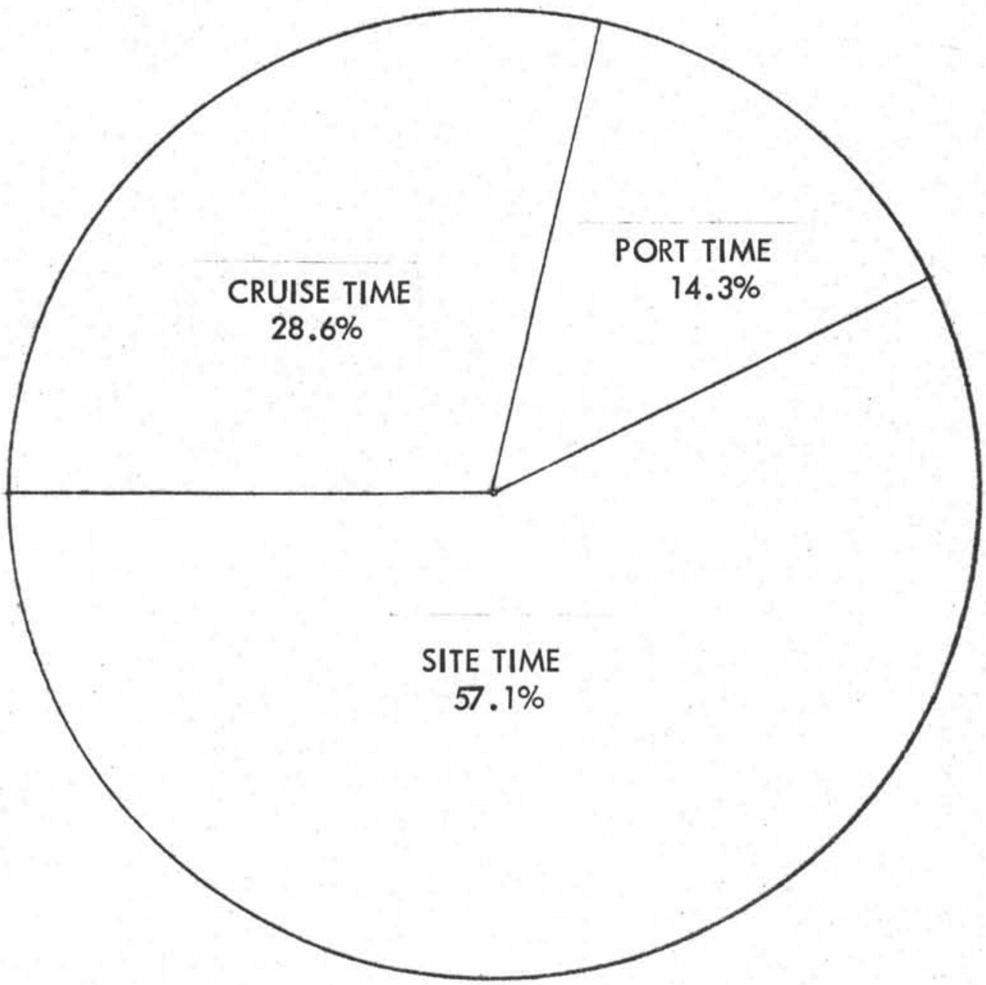
*Includes inside steaming, survey and DIW time

DEEP SEA DRILLING PROJECT
ON-SITE TIME DISTRIBUTION
LEG 40

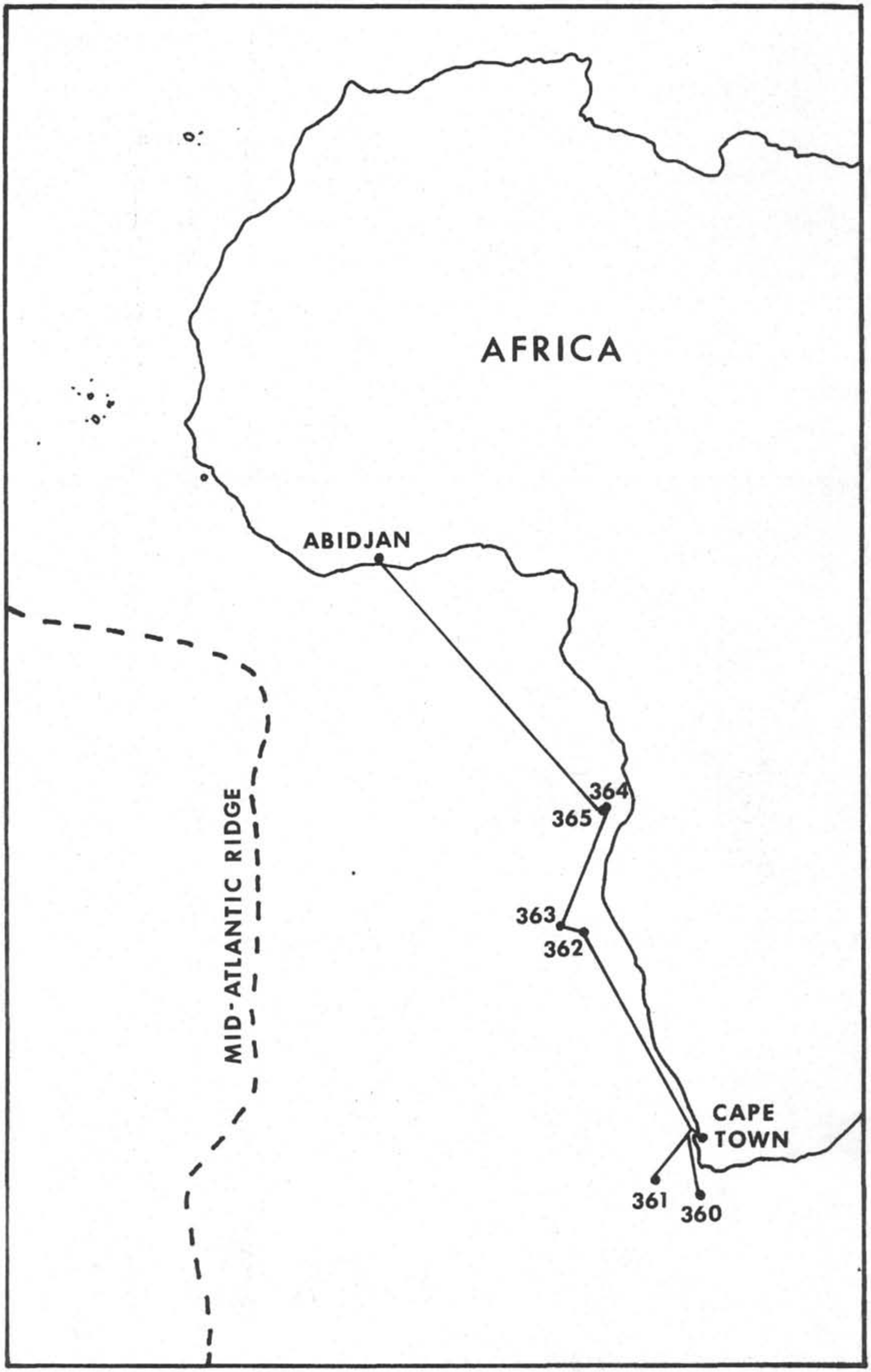


TOTAL TIME ON SITE: 34.35 Days
TOTAL SITES: 6
TOTAL HOLES: 7

DEEP SEA DRILLING PROJECT
TOTAL TIME DISTRIBUTION
LEG 40



START LEG: December 17, 1974
FINISH LEG: February 15, 1975
TOTAL TIME: 60.14 Days



LEG 40 DRILL SITES

CAPE TOWN-ABIDJAN

DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 40

Site No.	Make	Freq. kHz	Serial Number	Site Time Hours	Remarks
360	ORE	13.5	325	166	Single life. Strong signal on departure.
361	ORE	16.0	300	194	Double life.
362	ORE	13.5	313	145.3	Double life.
363	ORE	16.0	306	91.6	Single life. Fluctuating signal.
364	Burnett	13.5	18	177	Single life. Initial wide pulse & poor envelope. Lasted 5 days
364	ORE	16.0	303	176	Single life. Signal strong at site departure.
365	Burnett	13.5	14	50.4	Single life. Signal level dropped fairly rapidly.

DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 40

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	Average Rate Penet.	Time On Hole	Time On Site
360	35° 50.75'S	18° 05.79'E	2977	51	50	98	475.0	278.11	58.6	364.5	839.5	13.4	166.0	166.0
361	35° 03.97'S	15° 26.91'E	4557.5	49	49	100	465.5	222.07	47.7	848.5	1314.0	18.8	194.0	194.0
362	19° 45.45'S	10° 31.95'E	1336	44	44	100	418.0	367.25	87.9	387.5	805.5	45.5	70.3	
362A	19° 45.45'S	10° 31.95°E	1336	12	12	100	109.5	77.05	70.4	971.5	1081.0	24.8	75.0	145.3
363	19° 38.75'S	09° 02.80'E	2247	40	40	100	380.0	226.90	59.7	335.0	715.0	25.0	91.7	91.7
364	11° 34.32'S	11° 58.30'E	2449	46	46	100	427.5	295.61	69.2	658.5	1086.0	12.2	177.0	177.0
365	11° 39.10'S	11° 53.72'E	3050	7	7	100	63.0	34.65	55.0	624.0	687.0	30.5	50.4	50.4
				249	248	99.6	2338.5	1501.64	64.2	4189.5	6528.0	19.5		824.0

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG 40

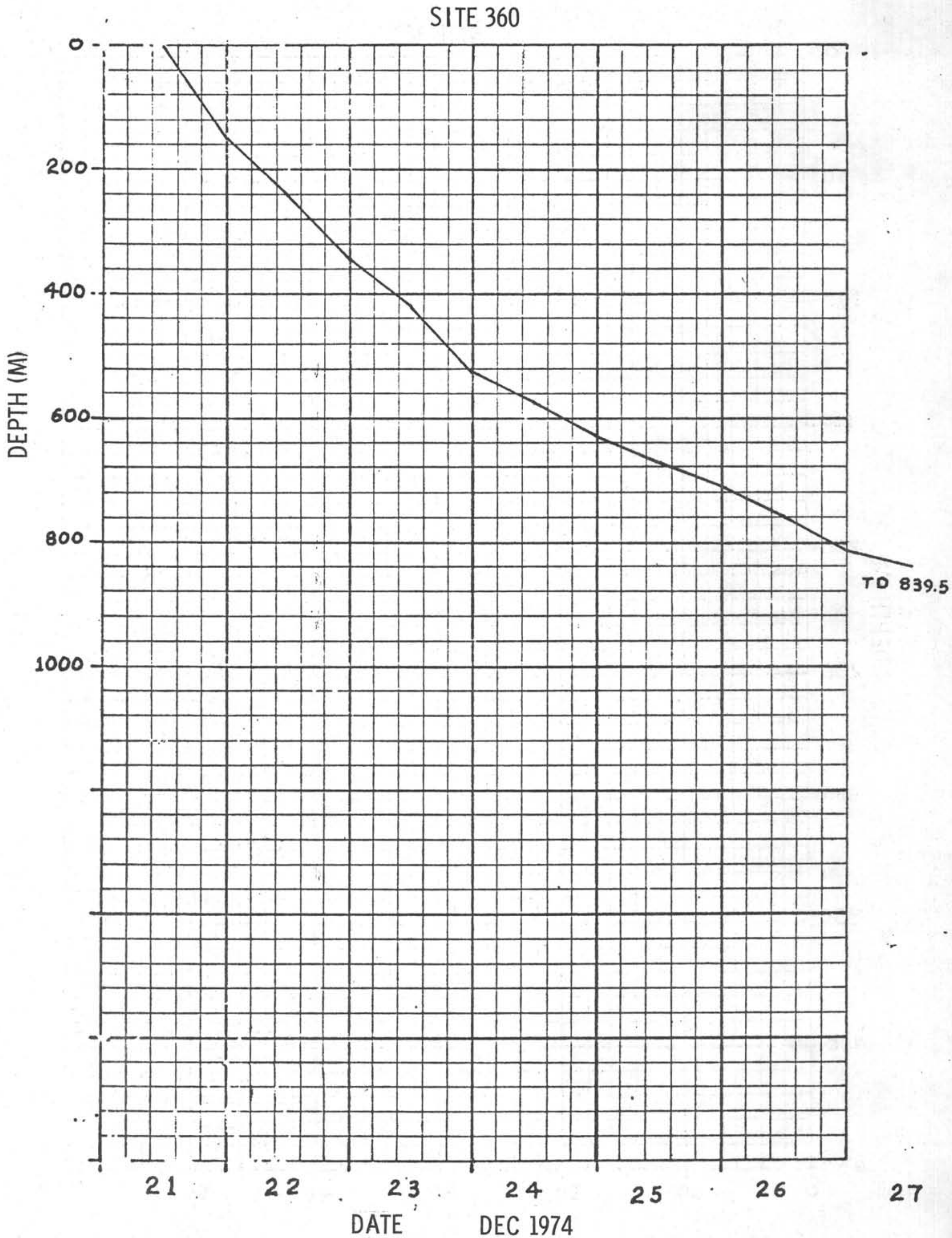
Date	Site Number	Cruise	Trips	Drill	Core	Stuck Pipe	Position Ship	Mechanical Repair	Port Time	Other	Total Time	Remarks
Dec 17-21		19.6							68.7	5.6	93.9	Adjust thrusters
Dec 21-27	360		17.3	37.1	96.8		1.5	4.3		9.0	166.0	Pos. system jam core barrel
Dec 27-Jan 05		53.5							137.4		190.9	Repair thruster
Jan 05-13	361		21.9	58.5	101.5		1.6	.5		10.0	194.0	
Jan 13-17		111.5								.2	111.7	Transfer at Capetown
Jan 17-20	362		9.2	13.8	41.7		.4	1.0		4.2	70.3	Bit seal failed
Jan 20-23	362A		9.0	38.5	25.5					2.0	75.0	Used center bit.
Jan 23-24			18.2	52.3	67.2		.4	1.0		6.2	145.3	Severing system
Jan 23-24		8.7									8.7	
Jan 24-28	363		11.7	24.8	50.7	.7	.8	1.5		1.5	91.7	
Jan 28-30		53.3									53.3	
Jan 30-Feb 6	364		10.0	64.0	90.8		1.0	5.5		5.7	177.0	Bowen elect. hydraulics
Feb 06		1.3									1.3	
Feb 06-08	365		13.6	22.2	12.5		.2			2.0	50.5	Magnaflux bottomhole assem
Feb 08-15		154.0						5.1			159.1	Propulsion Motor No. 5.
	Total	401.9	110.9	289.2	486.7	.7	5.9	18.9	206.1	46.4	1588.7	

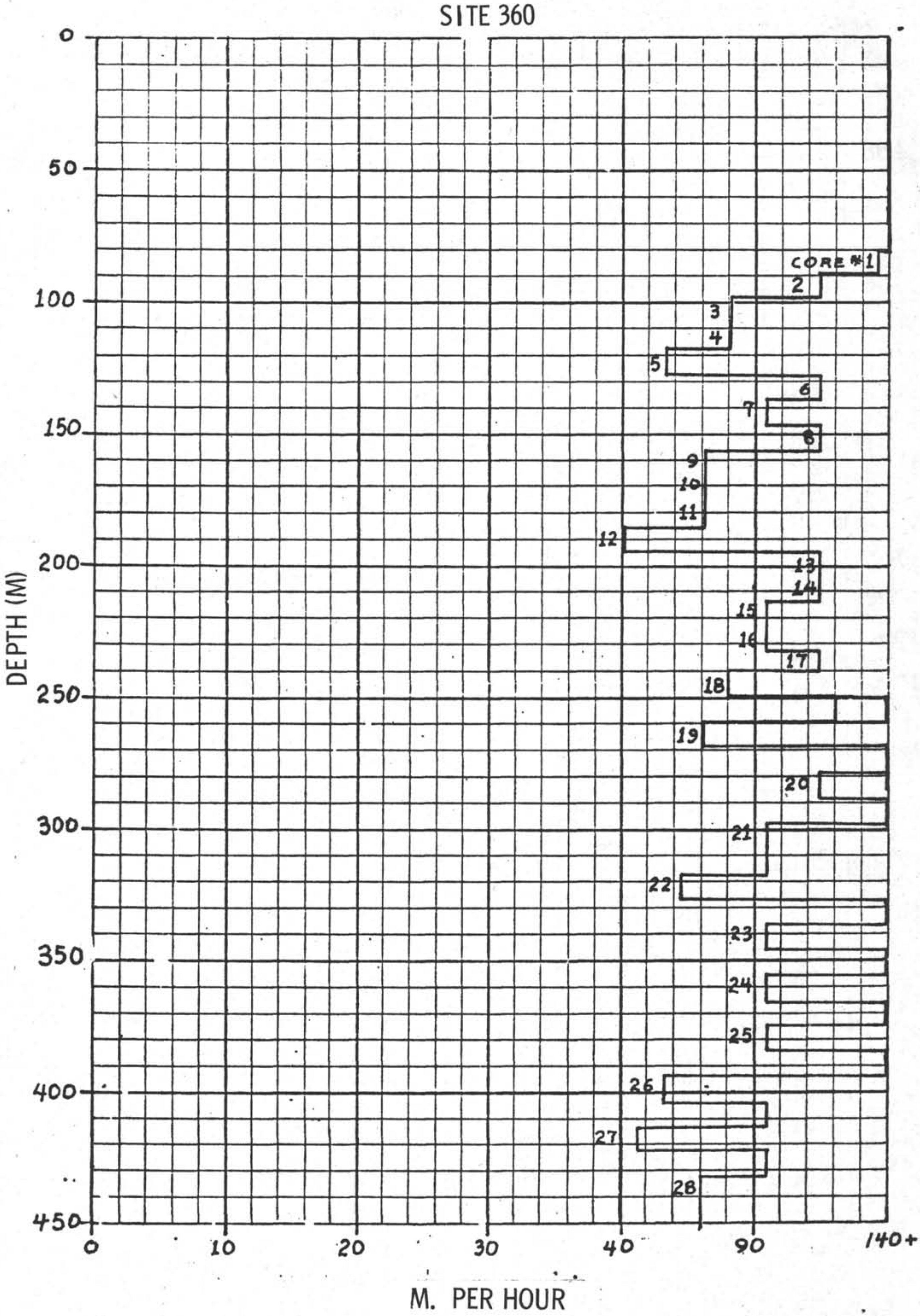
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 40

Hole	Mfg.	Size	Type	Serial Number	Meters Cored	Meters Drilled	Meters Total Penet.	Hours On Bit	Condition	Remarks
360	Smith	10-1/8"	F93C	KN148	475.0	364.5	839.5	62.5	T1, B1, SE	-
361	Smith	10-1/8"	93CJS	JK243	465.5	848.5	1314.0	70.0	T8, B8, OG	Three cones gone - fourth locked & flattened.
362	Smith	10-1/8"	F94C	PC157	418.0	387.5	805.5	17.7	T1, B1, SE	Bit seal failure - possible rerun.
362A	Smith	10-1/8"	F94CK	SZ083	109.5	971.5	1081.0	43.7	T1, B5	Seal gone & evidence of locking (one cone only)
363	Smith	10-1/8"	F94C	KN080	380.0	335.0	715.0	28.7	T8, B8, OG	Three-cone - all cones and shanks gone.
364	Smith	10-1/8"	F94CK	SZ092	427.5	658.5	1086.0	89.25	T8, B8, OG	All cones gone - shanks intact.
365	Smith	10-1/8"	F93CK	KN144	63.0	624.0	687.0	22.5	T1, B2, SI	Rerun - two seals gone.
					120.0	199.5	319.5	10.8		Run on Leg 38.
					183.0	823.5	1006.5	33.3		Total for bit.

DEEP SEA DRILLING PROJECT
DYNAMIC POSITIONING DATA
LEG

SITE No.	Avg. Head. °	Avg. Wind mph	Avg. Swell ft.	TIME OPERATED - PERCENT: Main Prop. RPM 0 - 75	75 - 100	100 +	Bow Thrusters RPM 0 - 200	200 - 300	300 +	Stern Thrusters RPM 0 - 200	200 - 300	300 +	Remarks
360	VARIOUS	25.9	6.8	39	49	12	54	24	22	42	43	15	
361	192.3	18.6	7.5	51	40	9	39	40	21	36	42	22	
362	148.6	16.1	6.5	95	5	0	68	31	1	58	40	2	
362A	156.4	11.9	4.8	100	0	0	53	44	3	46	51	3	
363	144.6	25.7	7.0	81	19	0	61	38	1	49	48	3	
364	180.0	15.6	5.2	92	8	0	60	39	1	59	39	2	
365	185.4	14.0	6.7	99	1	0	78	22	0	72	27	1	


SITE 360
DEPTH (M)
0
200
400
600
800
1000
TD 839.5
21
22
23
24
25
26
27
DATE
DEC 1974


SITE 360
DEPTH (M)
0
50
100
150
200
250
300
350
400
450
CORE #1
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5
6
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0
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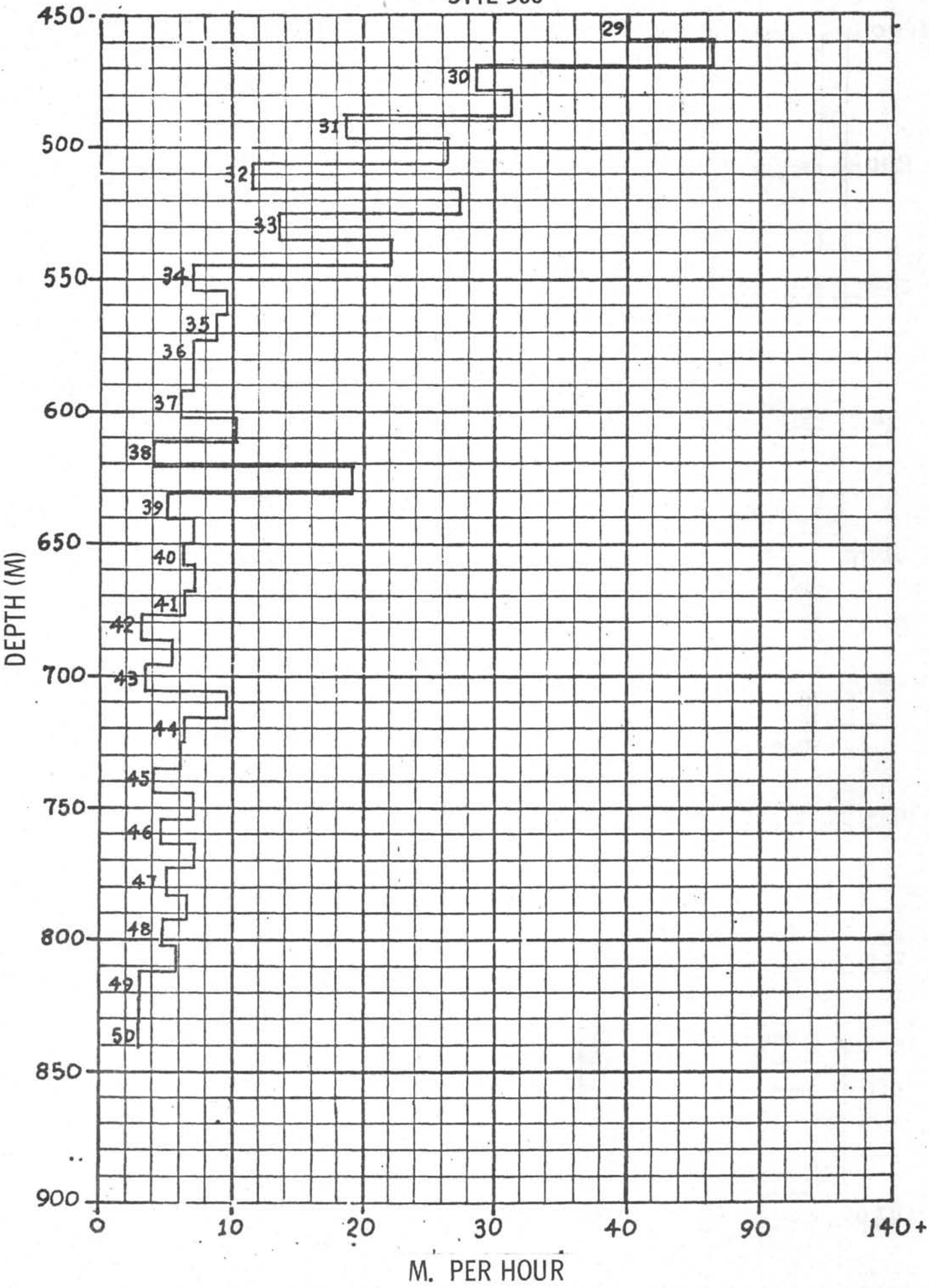
40
90
140+
M. PER HOUR

SITE 360


450
500
550
600
650
700
750
800
850
900
DEPTH (M)
0
10
20
30
40
90
140+
M. PER HOUR
29
30
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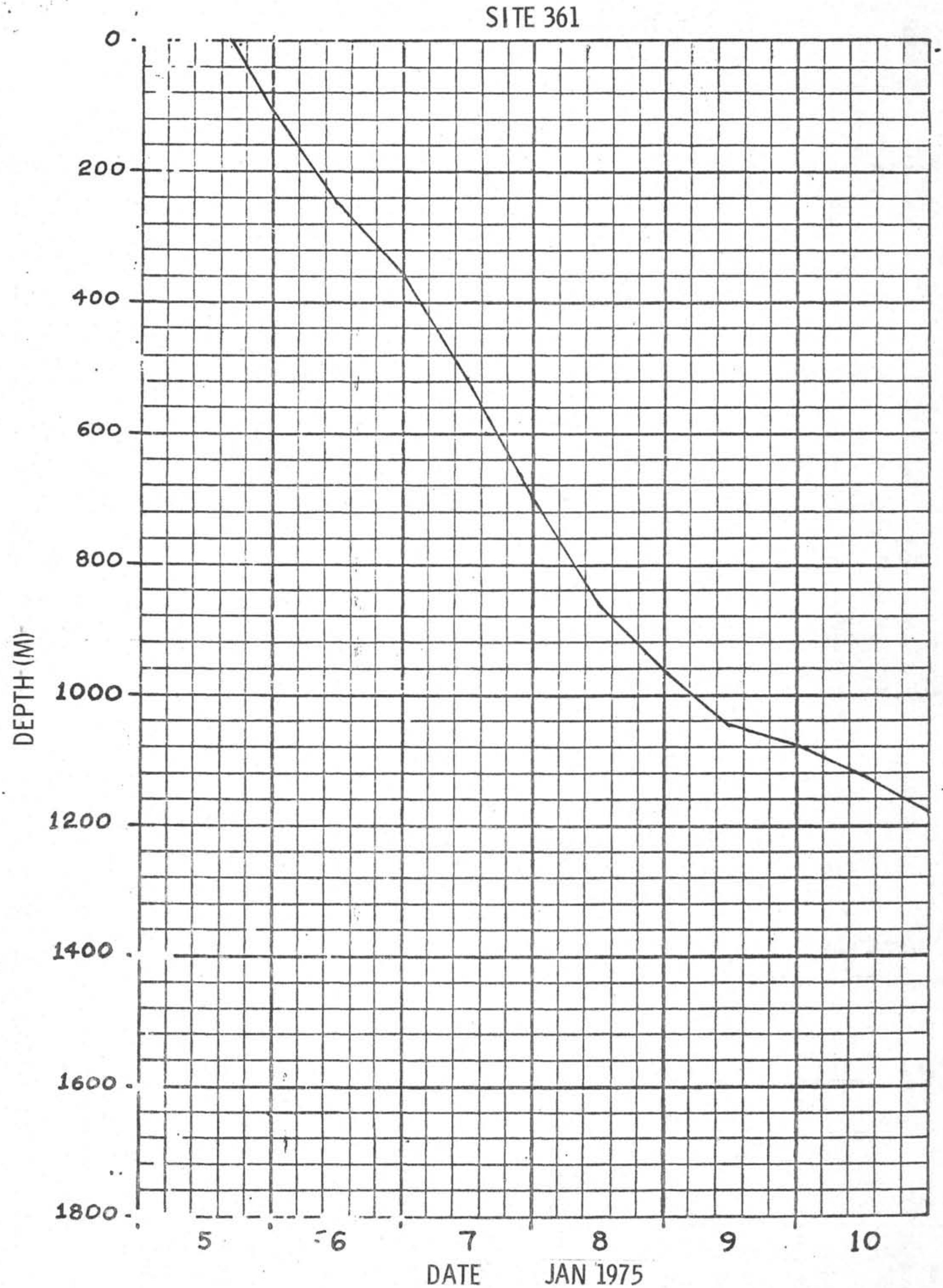

SITE 361
DEPTH (M)
0
200
400
600
800
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1200
1400
1600
1800
5
6
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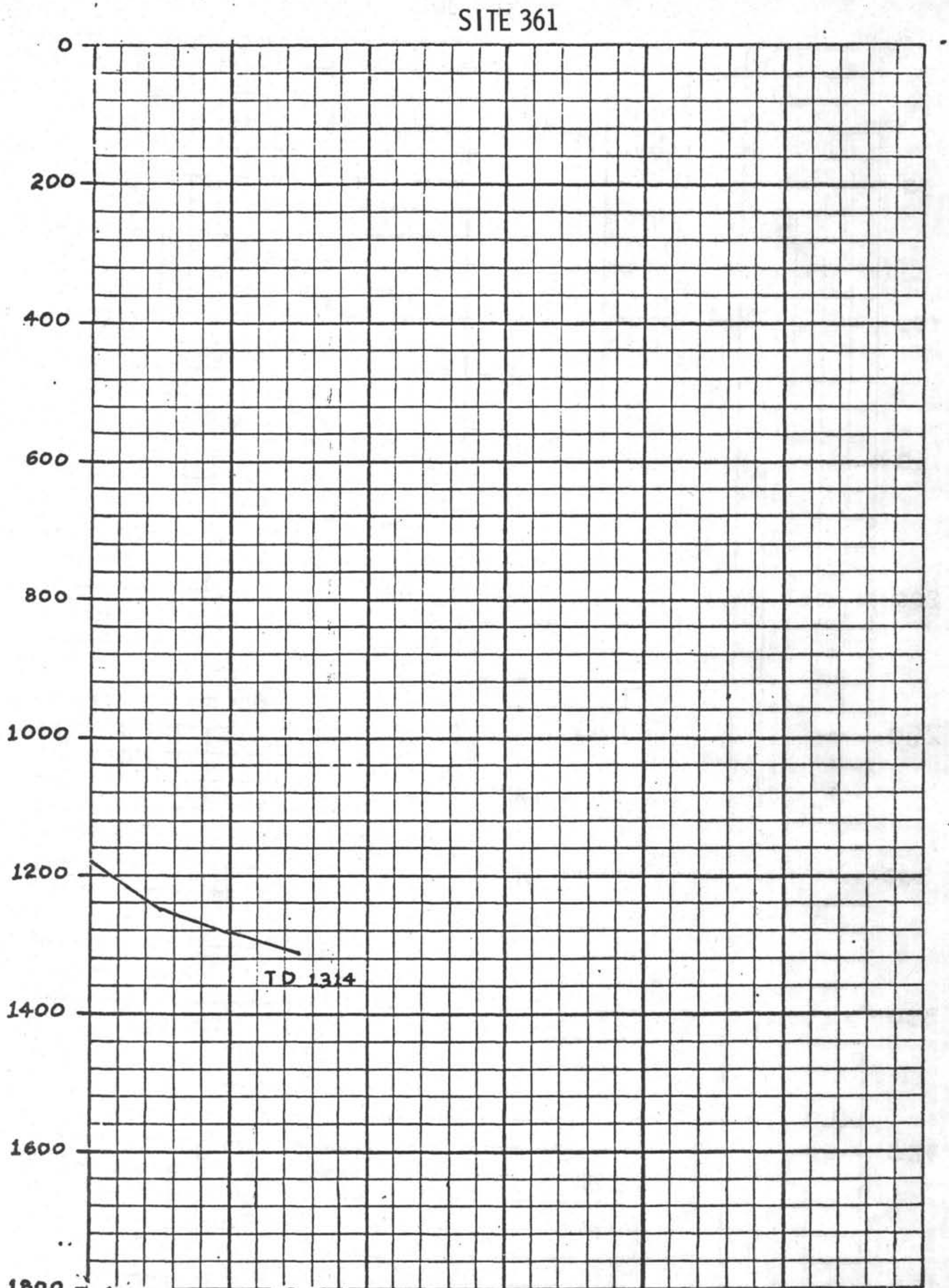
9
10
DATE JAN 1975



SITE 361
0
200
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1600
1800
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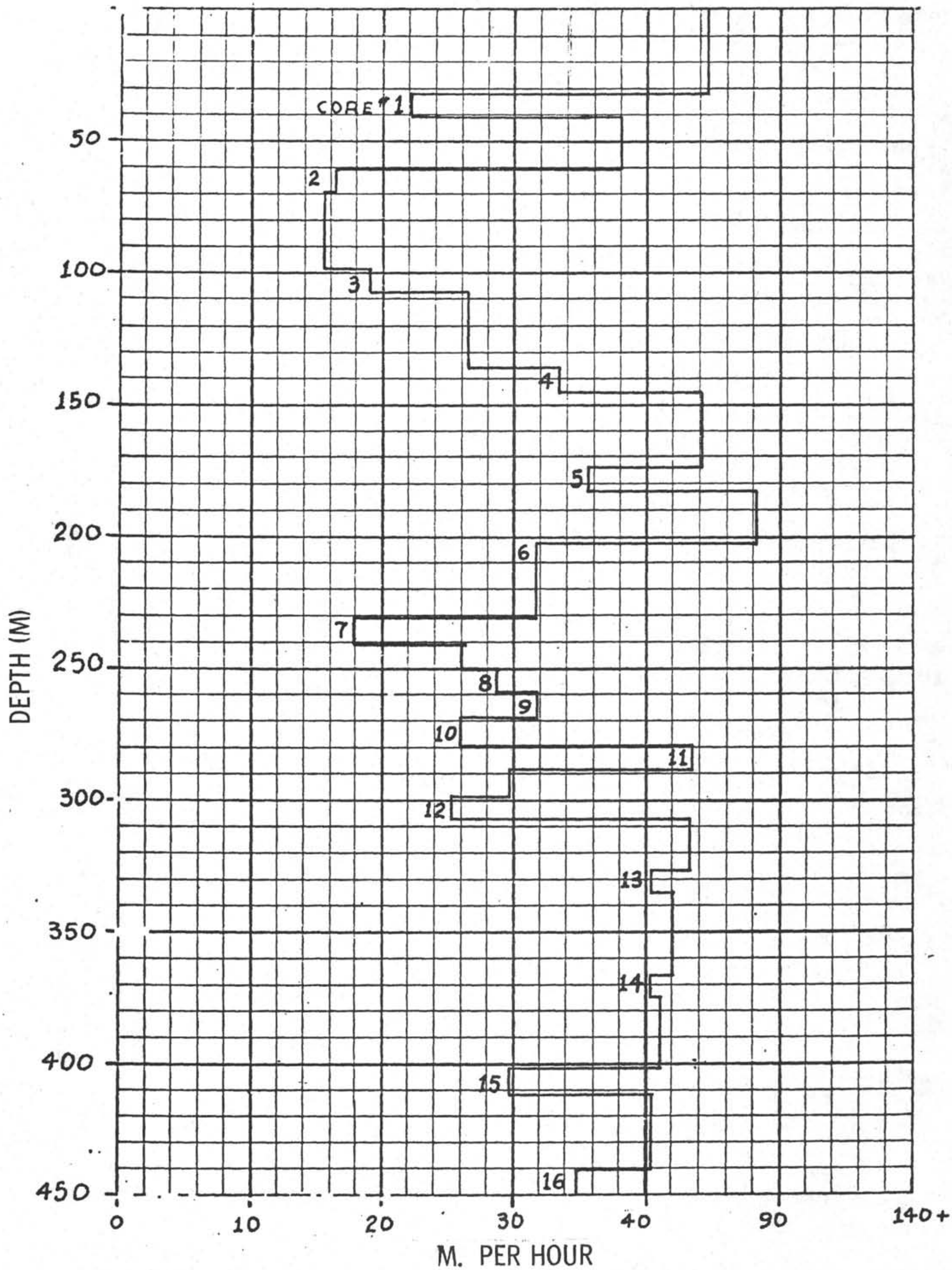
12
TD 1314

SITE 361



CORE #1
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14
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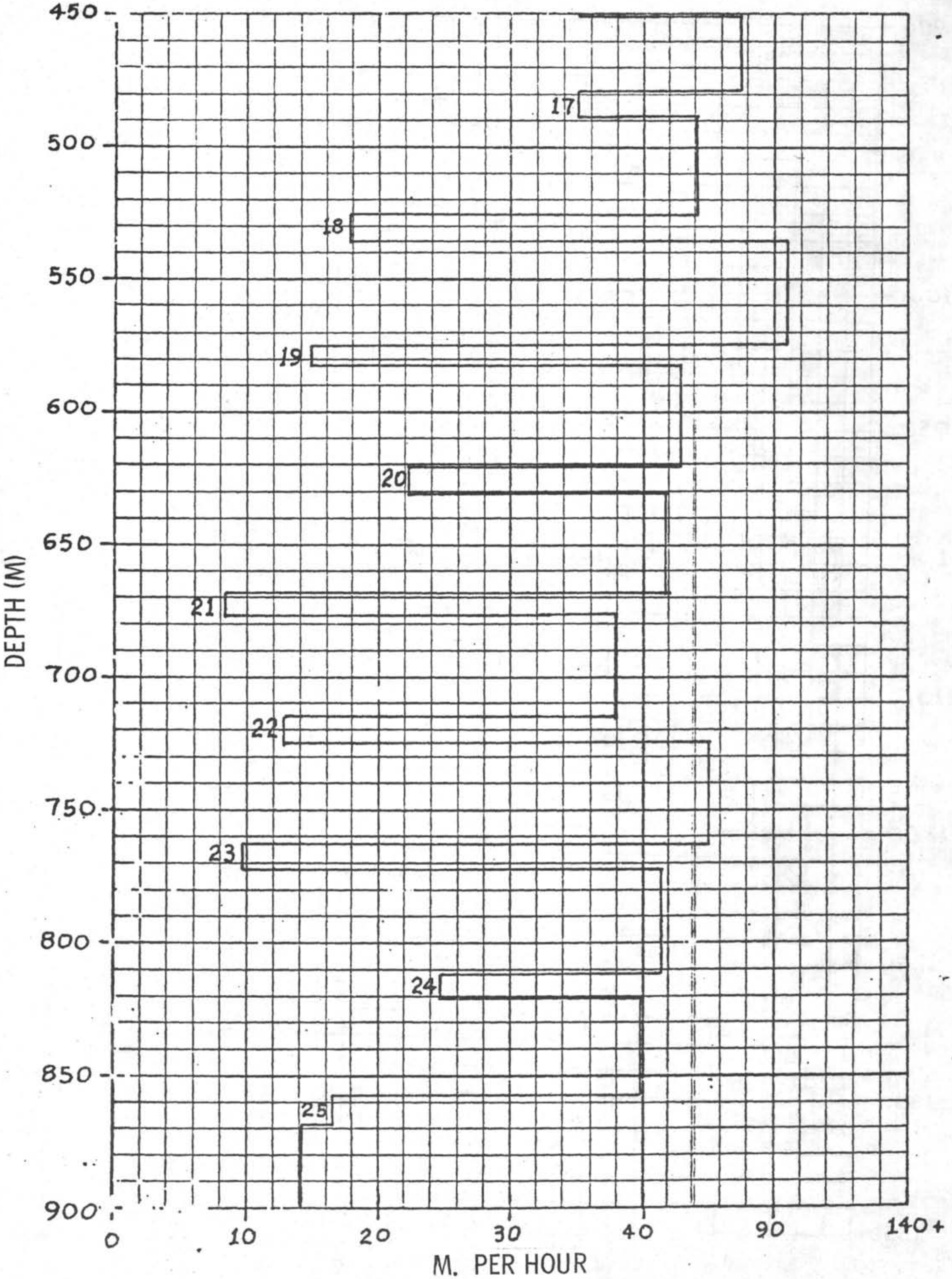
16
50
100
150
200
250
300
350
400
450
DEPTH (M)
0
10
20
30
40
90
140+
M. PER HOUR

SITE 361



450
500
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850
900
DEPTH (M)
17
18
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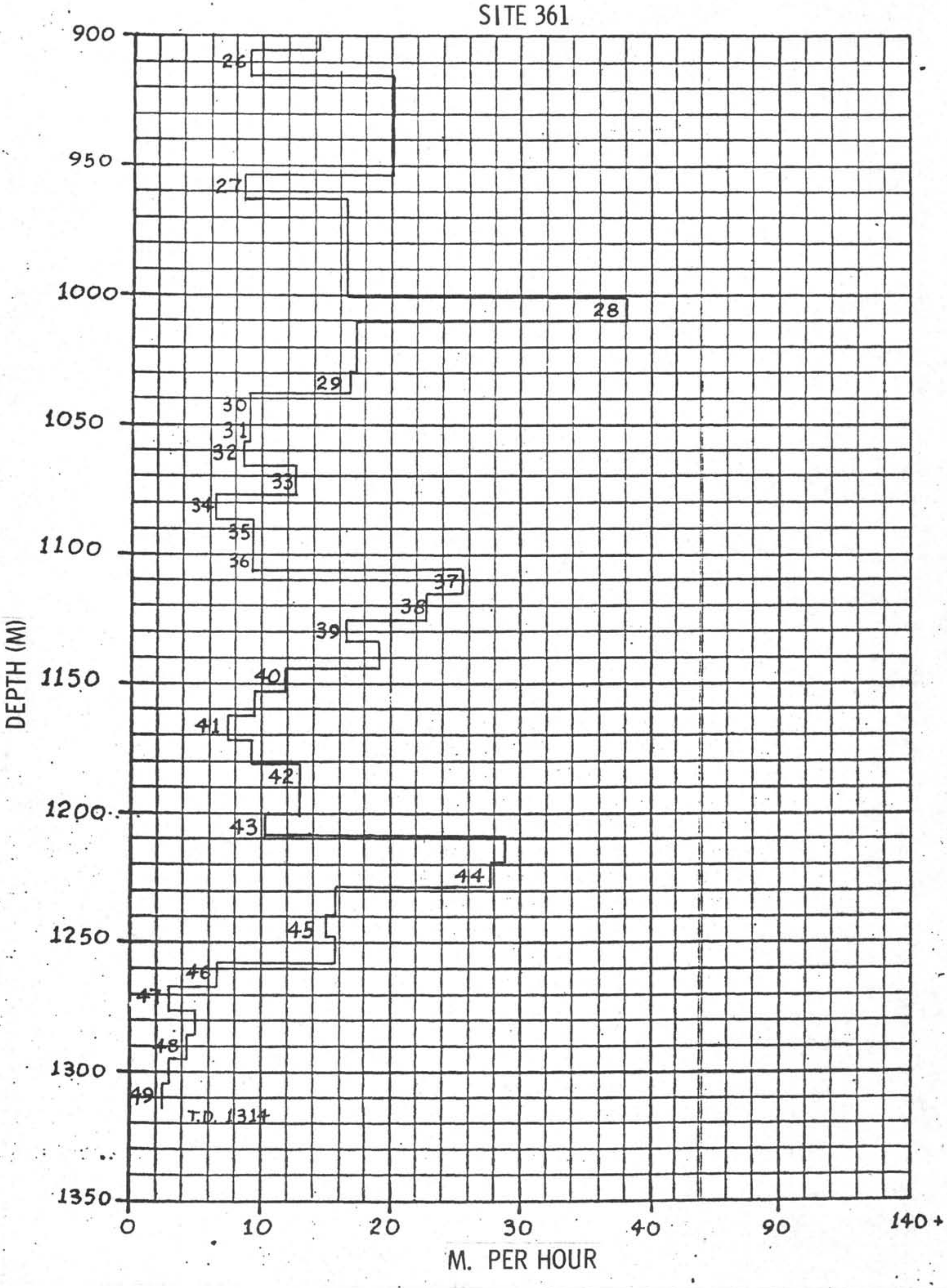
140+
M. PER HOUR



SITE 361
DEPTH (M)
900
950
1000
1050
1100
1150
1200
1250
1300
1350
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10
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40
90
140+
M. PER HOUR
26
27
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29
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31
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44
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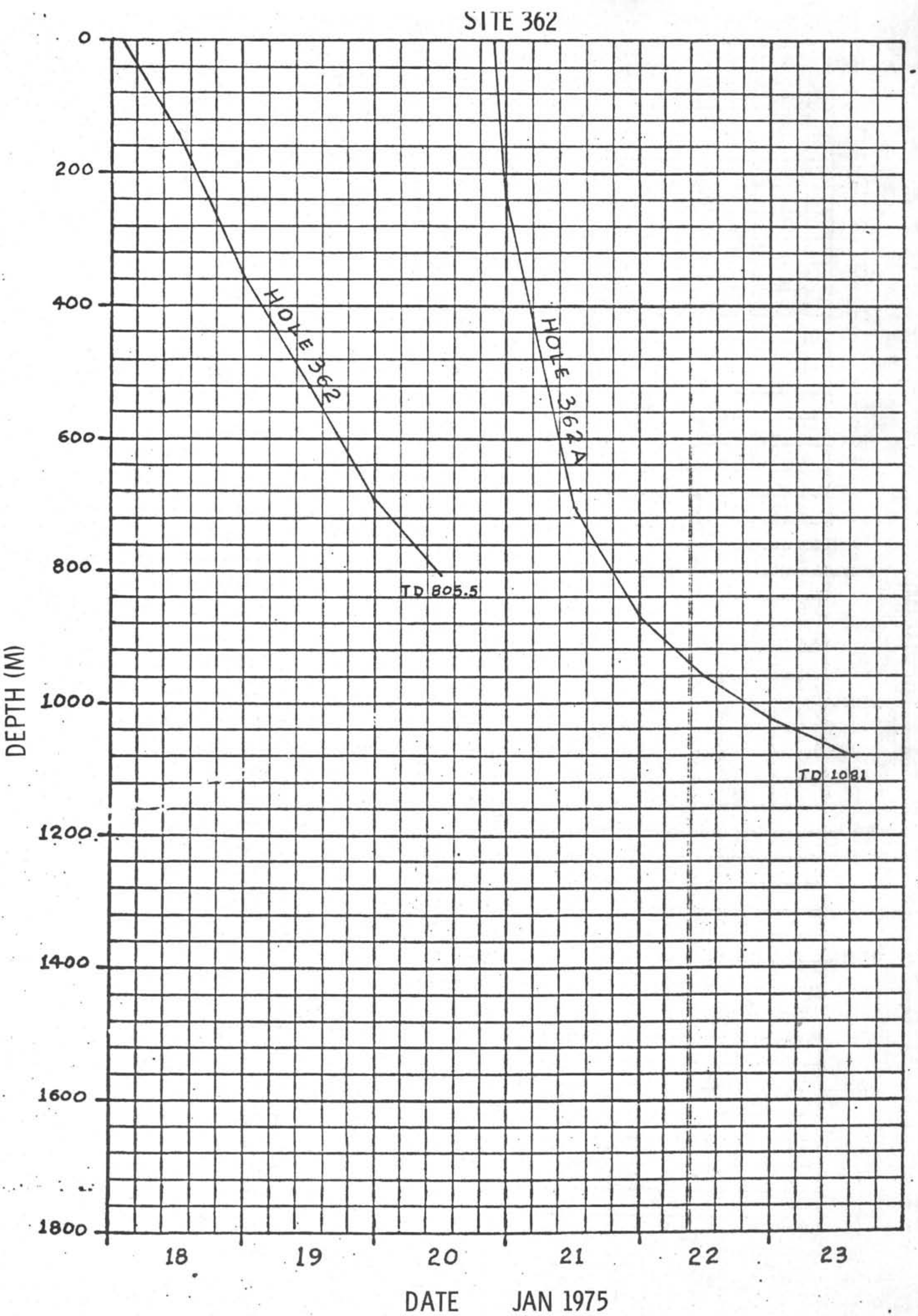
49
T.D. 1314


SITE 362
DEPTH (M)
0
200
400
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800
1000
1200
1400
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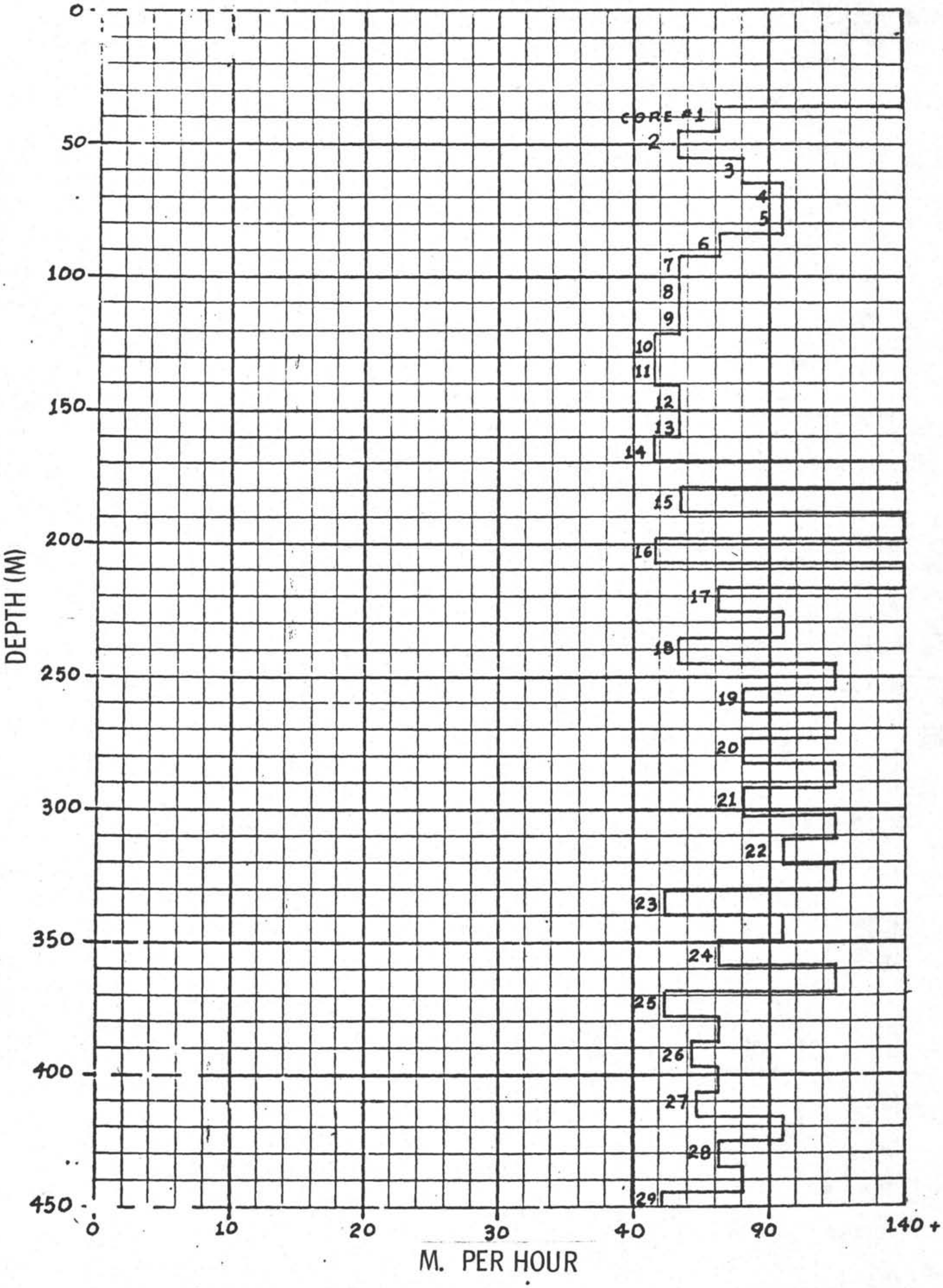
1800
HOLE 362
TD 805.5
HOLE 362A
TD 1081
18
19
20
21
22
23
DATE JAN 1975

HOLE 362



DEPTH (M)
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250
300
350
400
450
M. PER HOUR
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10
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40
90
140 +
CORE #1
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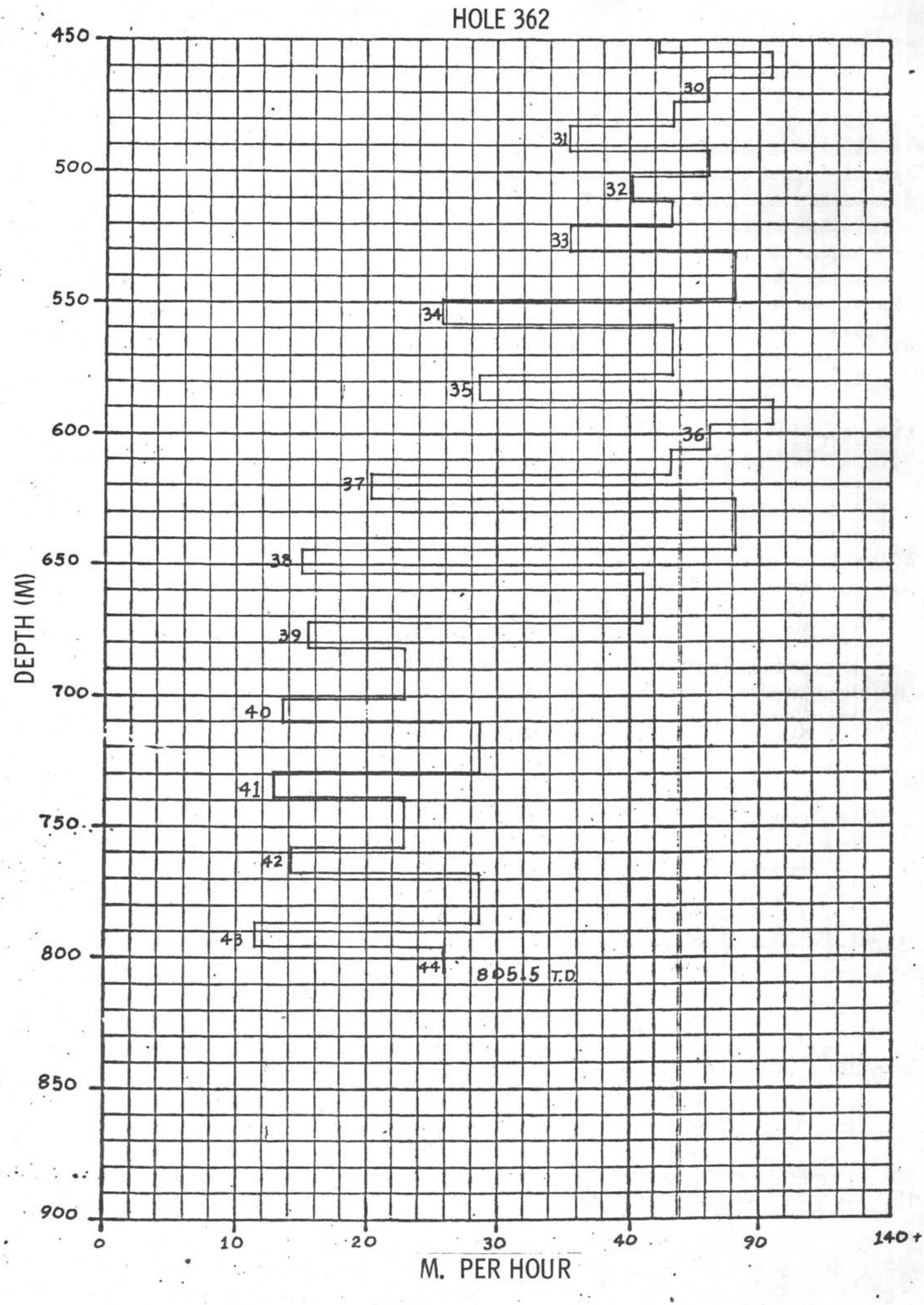

HOLE 362
DEPTH (M)
450
500
550
600
650
700
750
800
850
900
30
31
32
33
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35
36
37
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39
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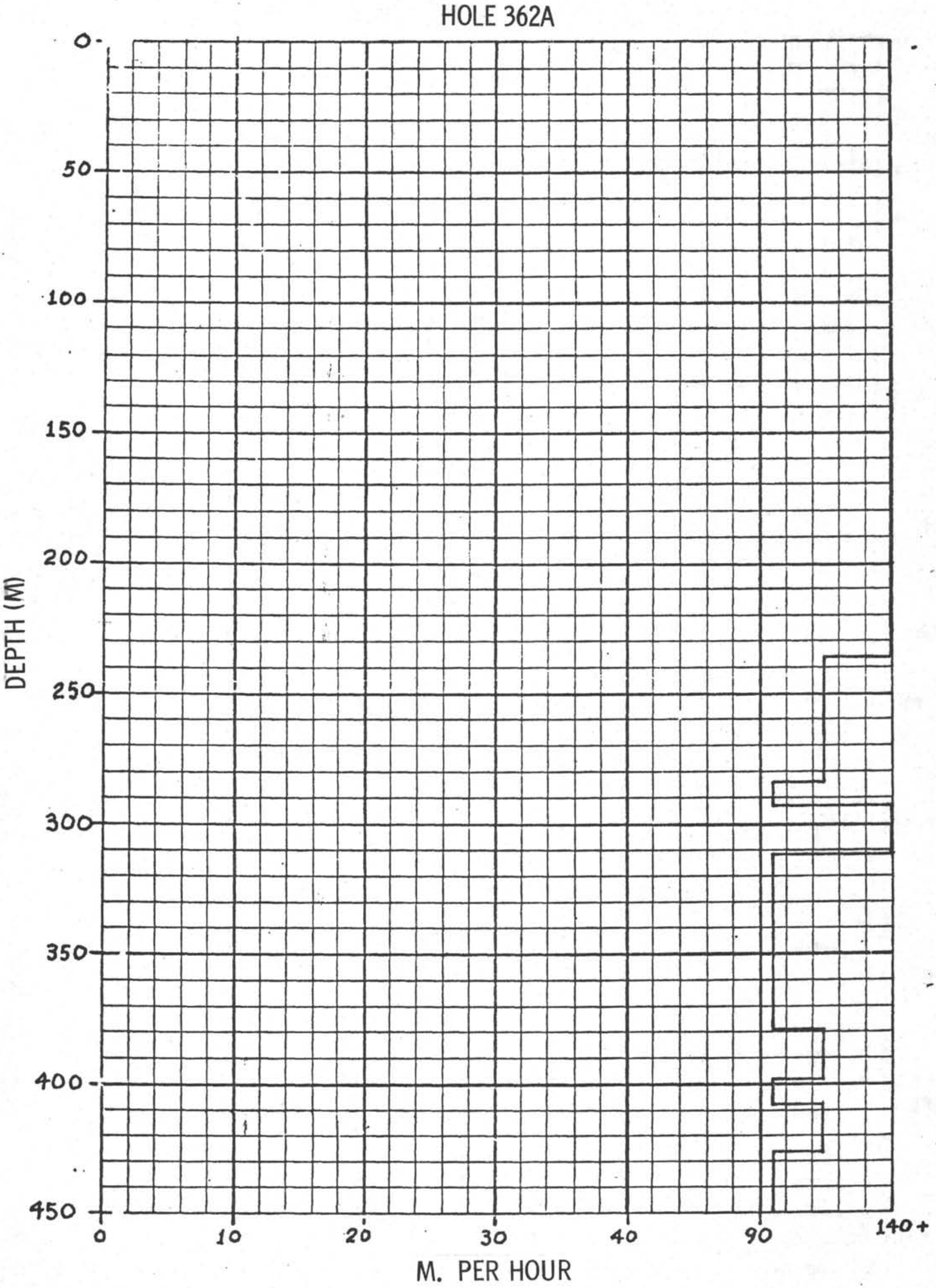
41
42
43
44
805.5 T.D
0
10
20
30
40
90
140+
M. PER HOUR


HOLE 362A
DEPTH (M)
0
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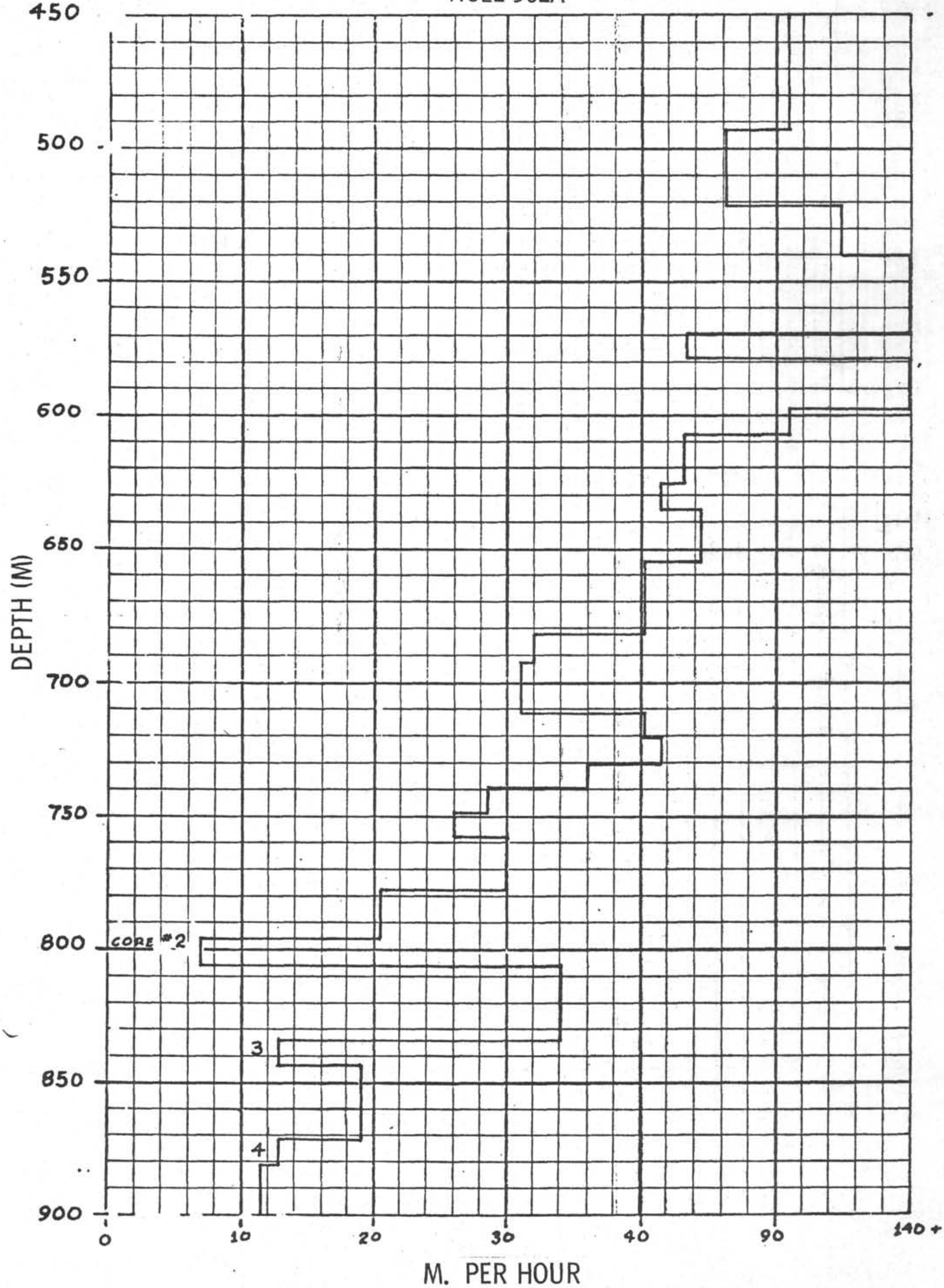
90
140+
M. PER HOUR

HOLE 362A


450
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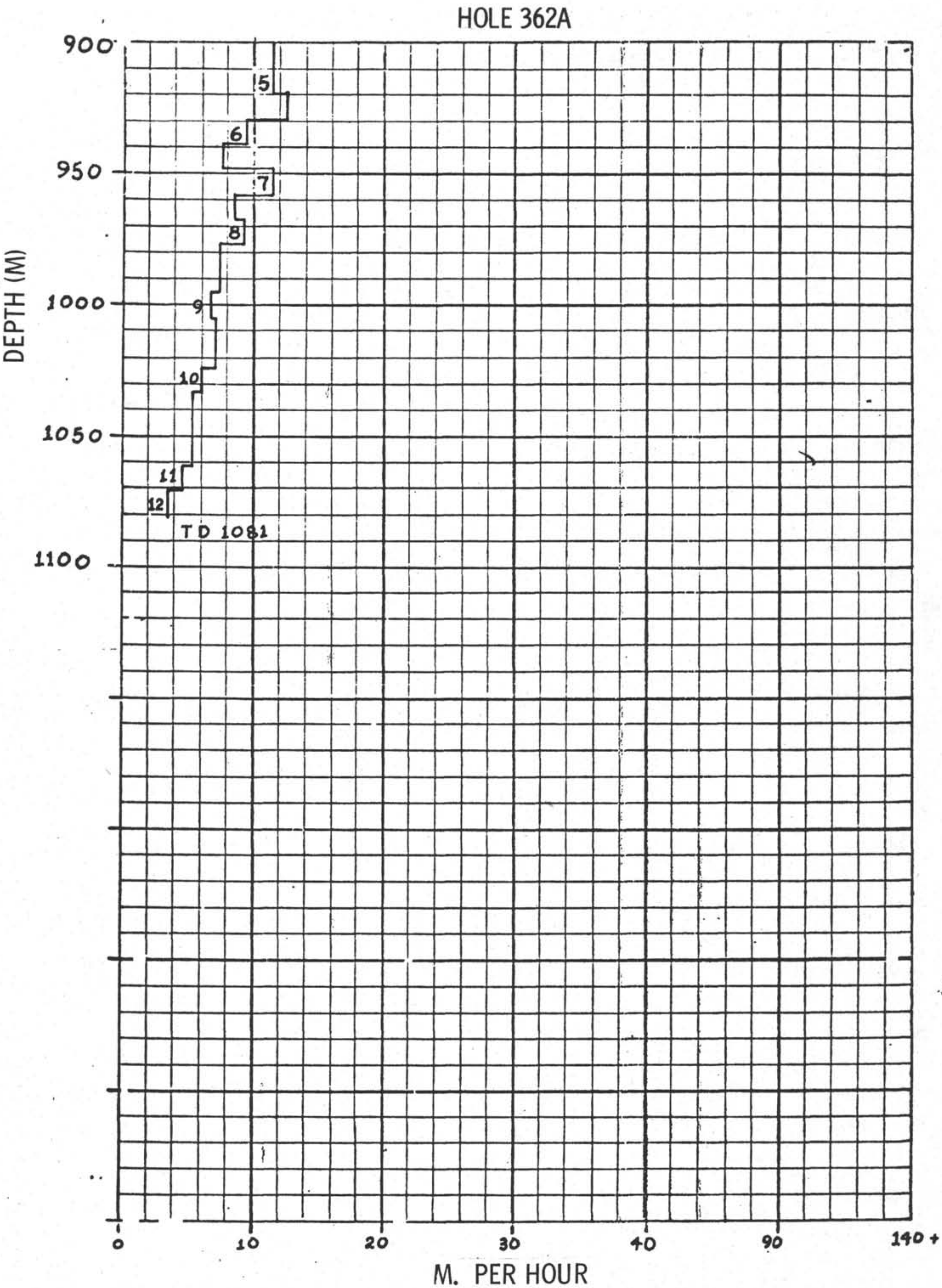
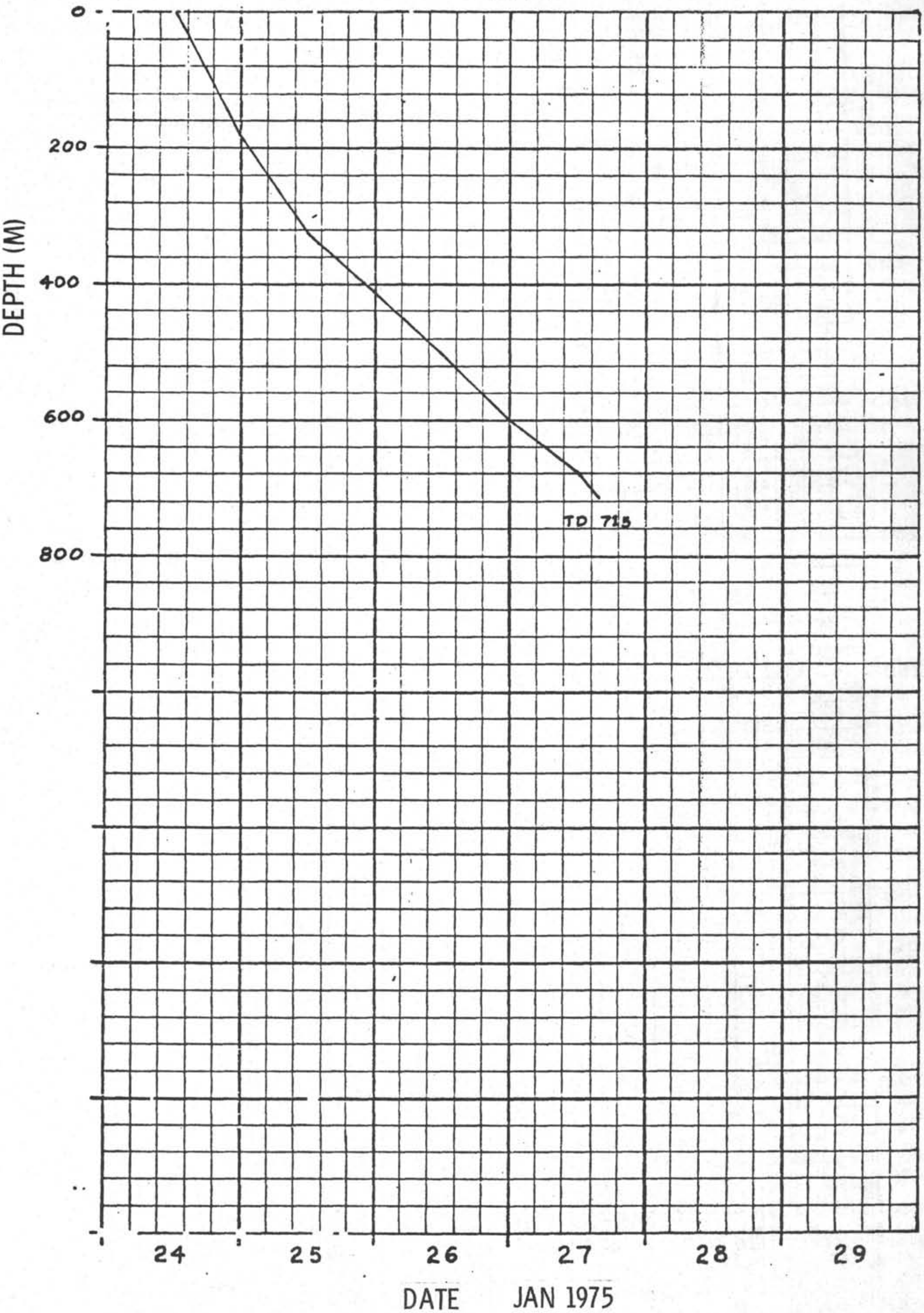
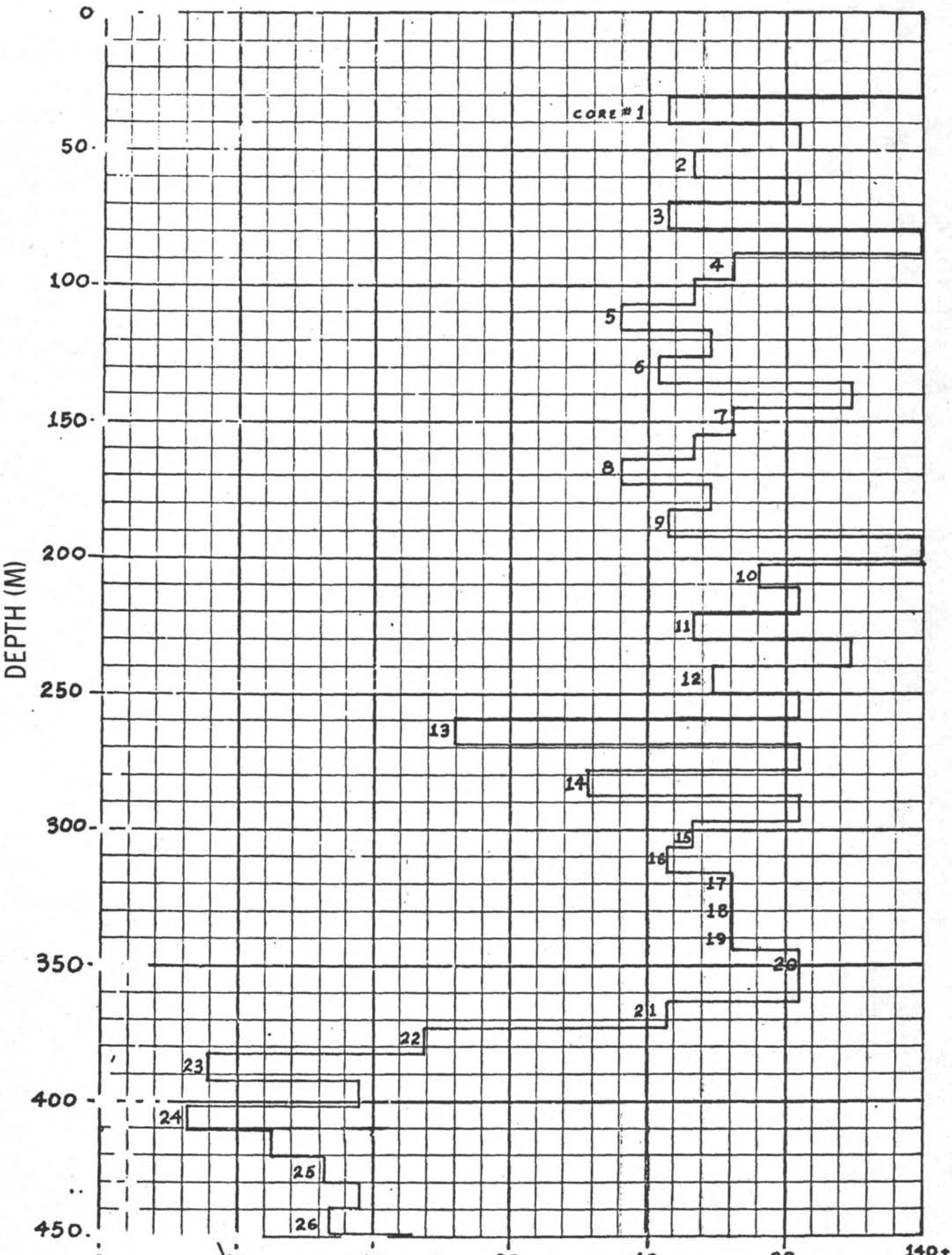
DEPTH (M)
CORE #2
3
4
0
10
20
30
40
90
140+
M. PER HOUR


HOLE 362A
DEPTH (M)
900
950
1000
1050
1100
5
6
7
8
9
10
11
12
TD 1081
0
10
20
30
40
90
140 +
M. PER HOUR

SITE 363



SITE 363



CORE # 1
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450
DEPTH (M)
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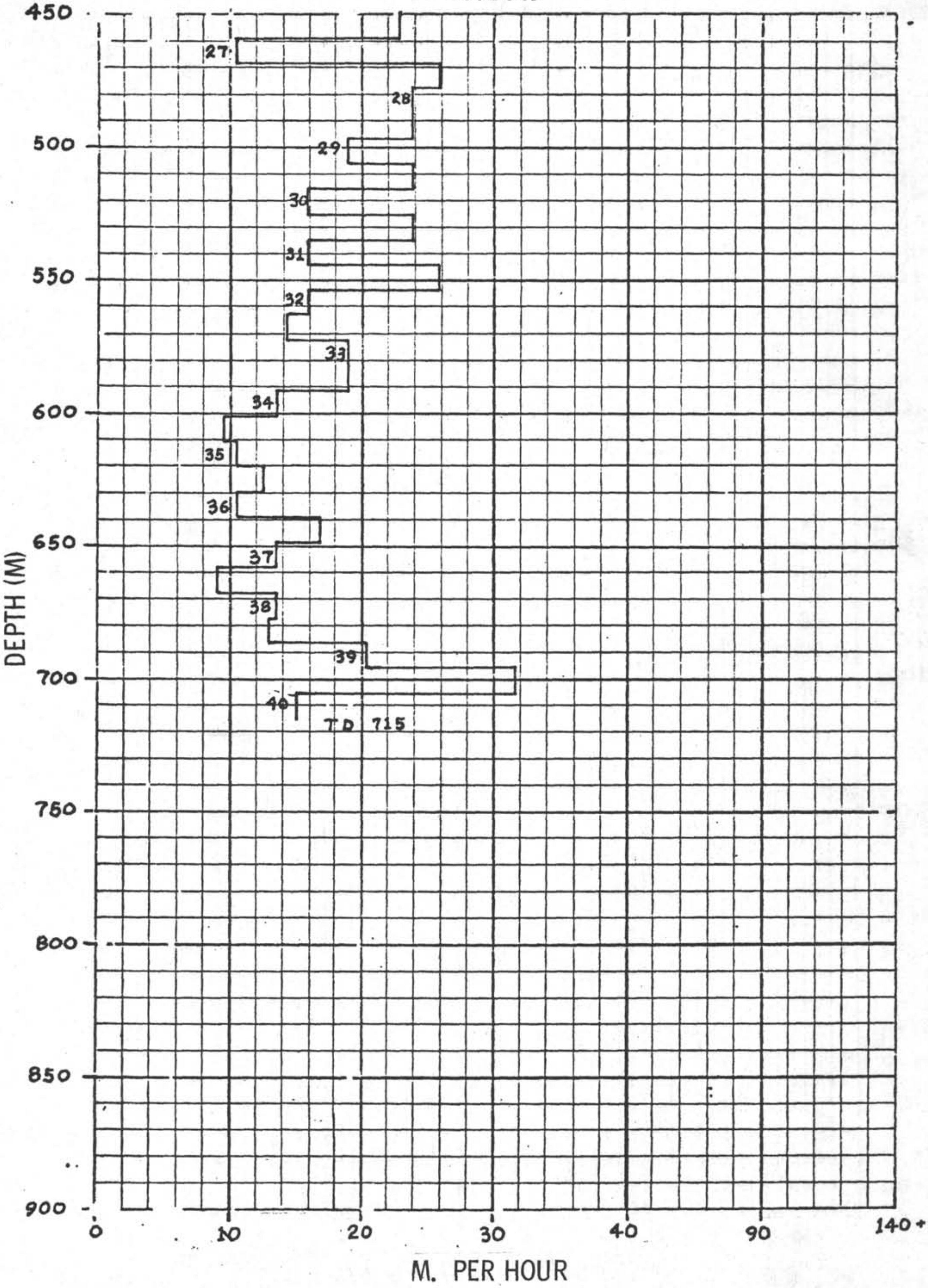
90
140+
M. PER HOUR

SITE 363



450
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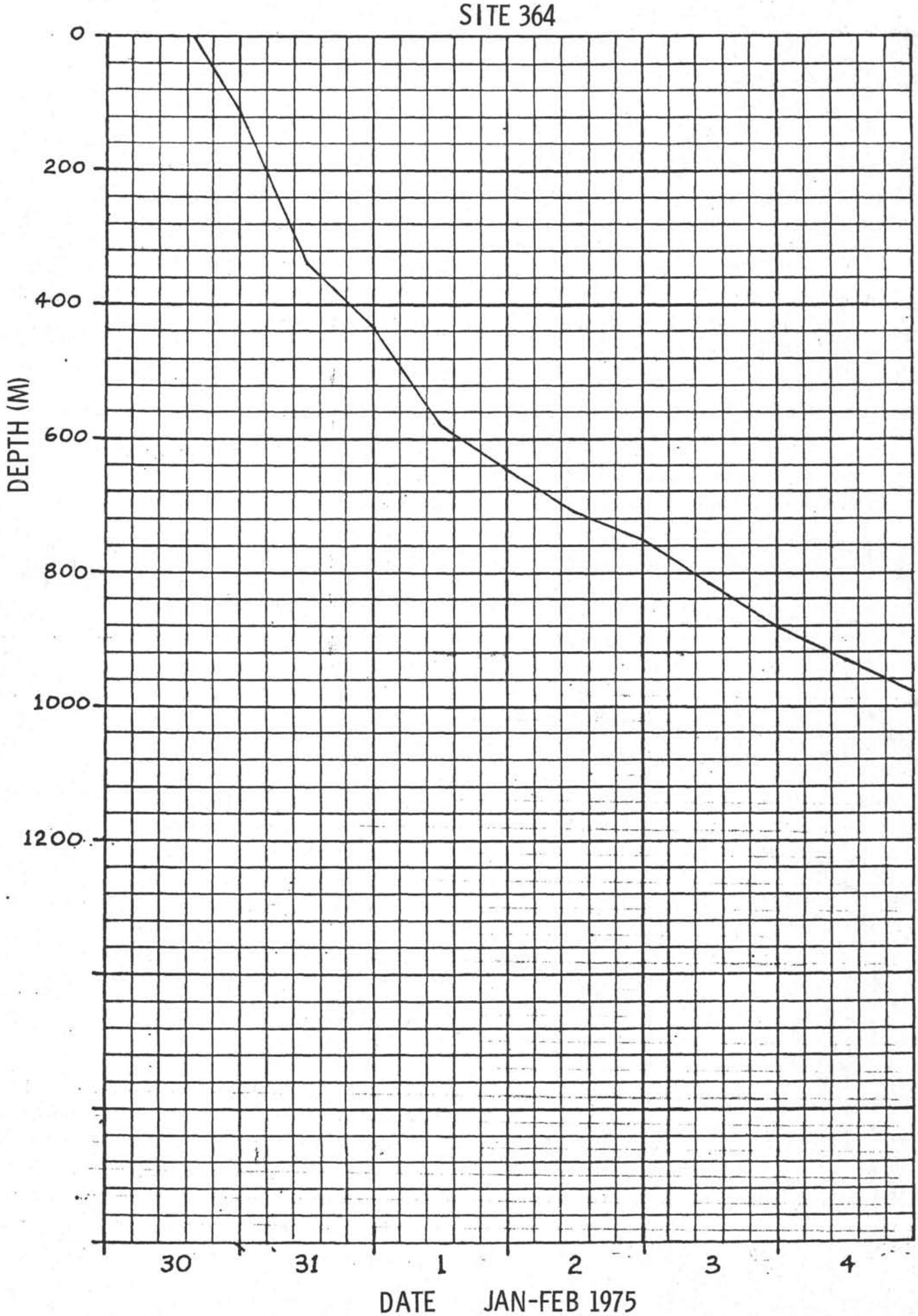
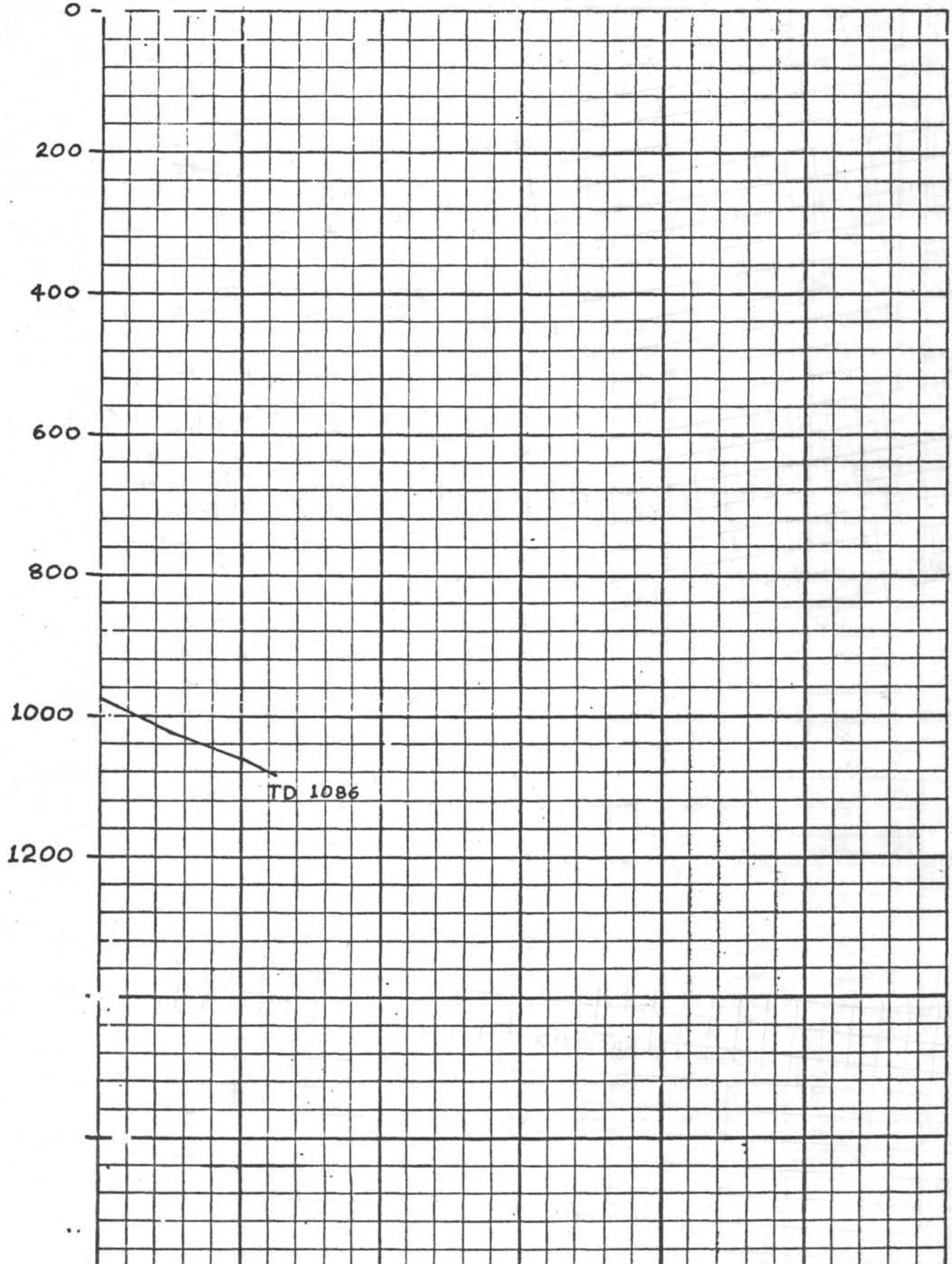
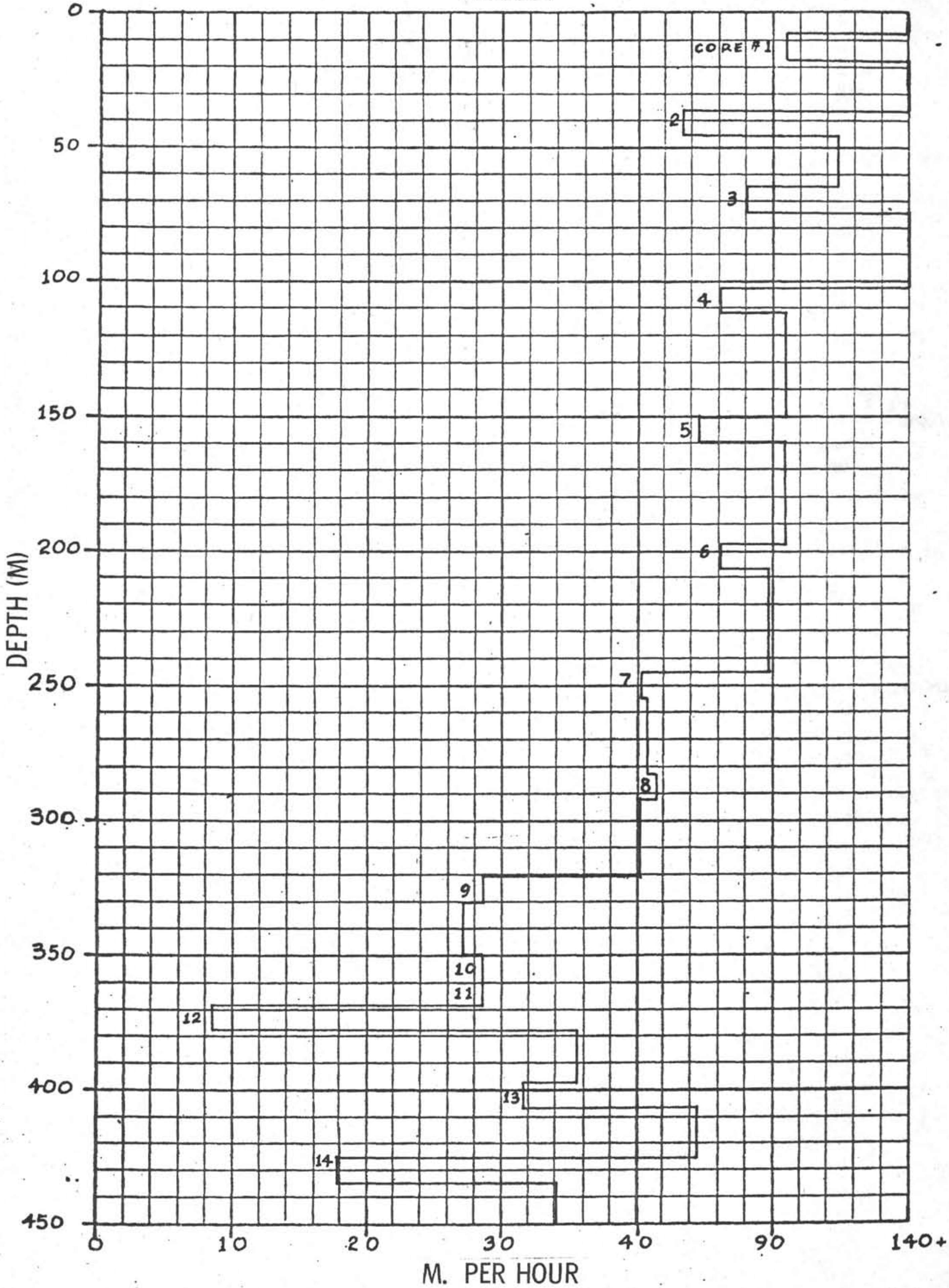
850
900
DEPTH (M)
27
28
29
30
31
32
33
34
35
36
37
38
39
40
TD 715
0
10
20
30
40
90
140+
M. PER HOUR


SITE 364
DEPTH (M)
0
200
400
600
800
1000
1200
30
31
1
2
3
4
DATE JAN-FEB 1975

SITE 364



SITE 364



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DEPTH (M)
CORE #1
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10
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30
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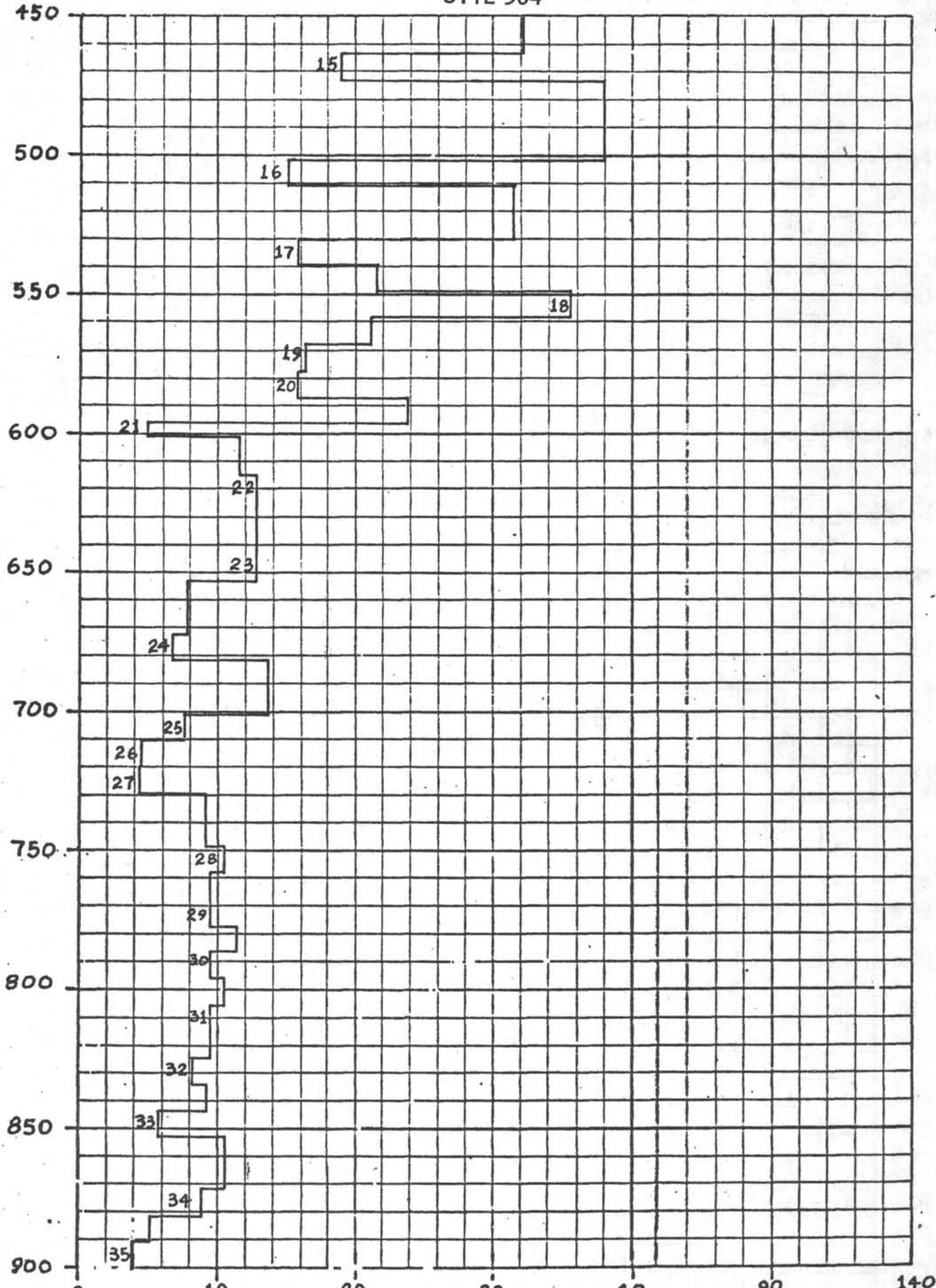
90
140+
M. PER HOUR

SITE 364



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140+
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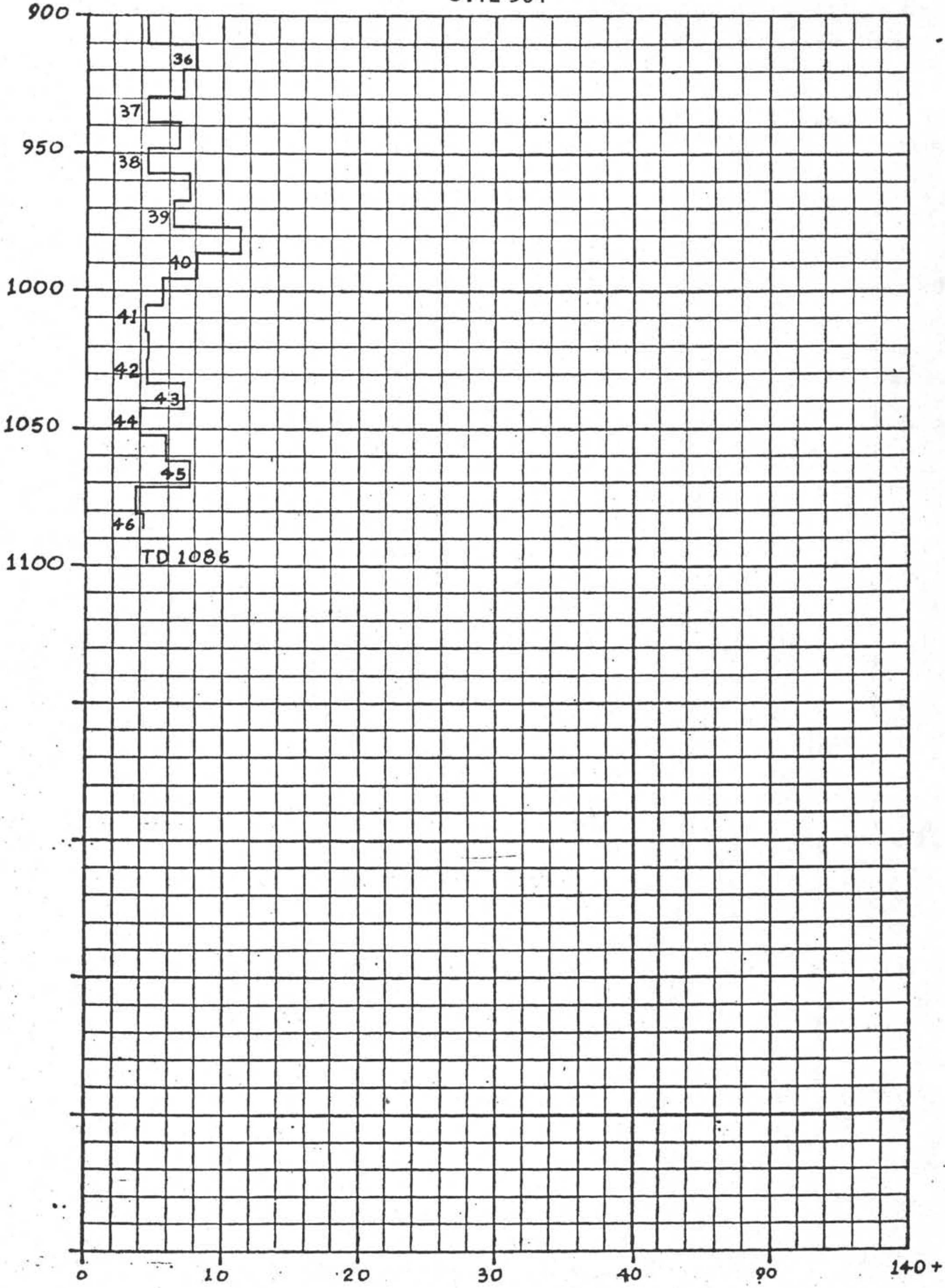
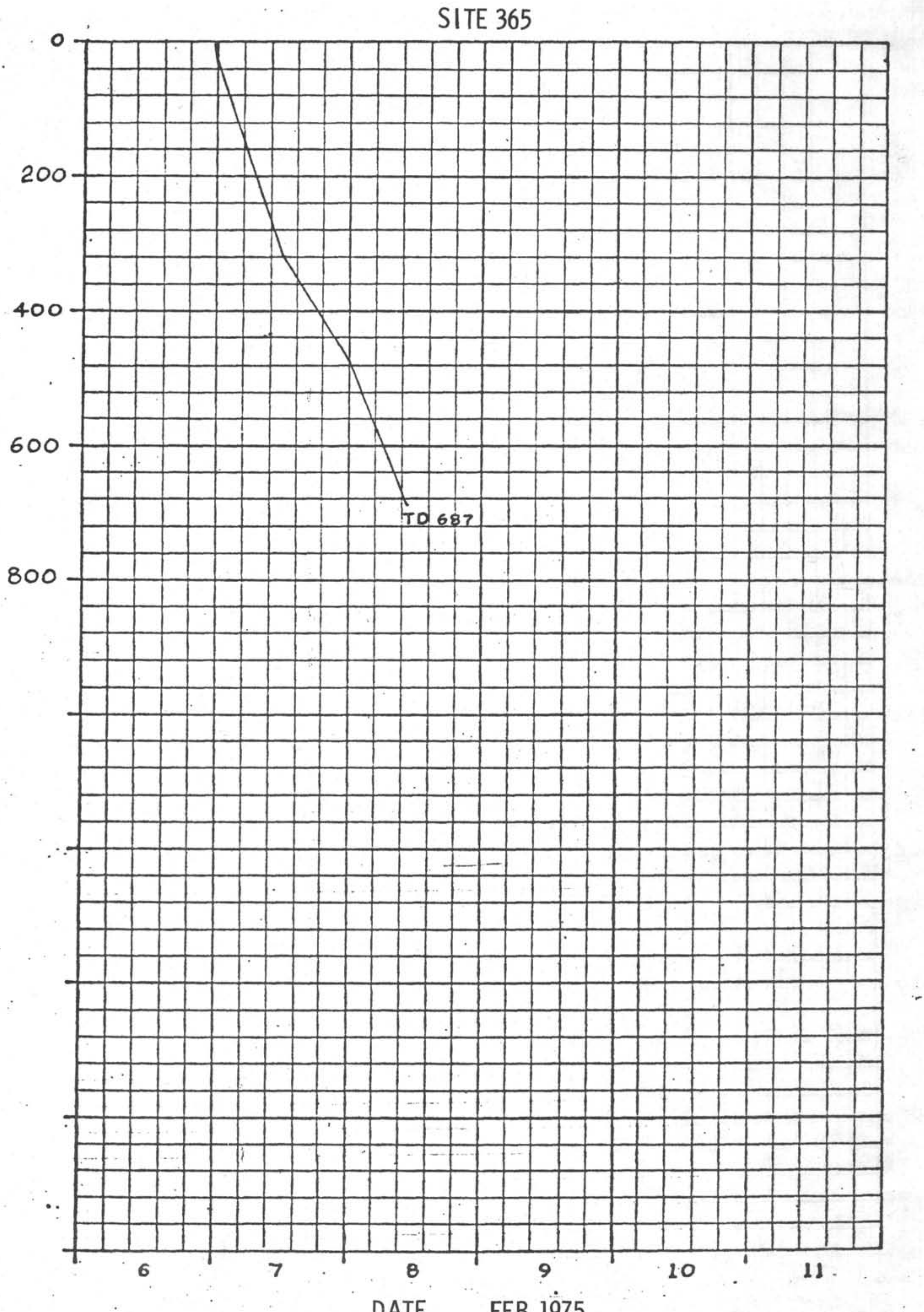
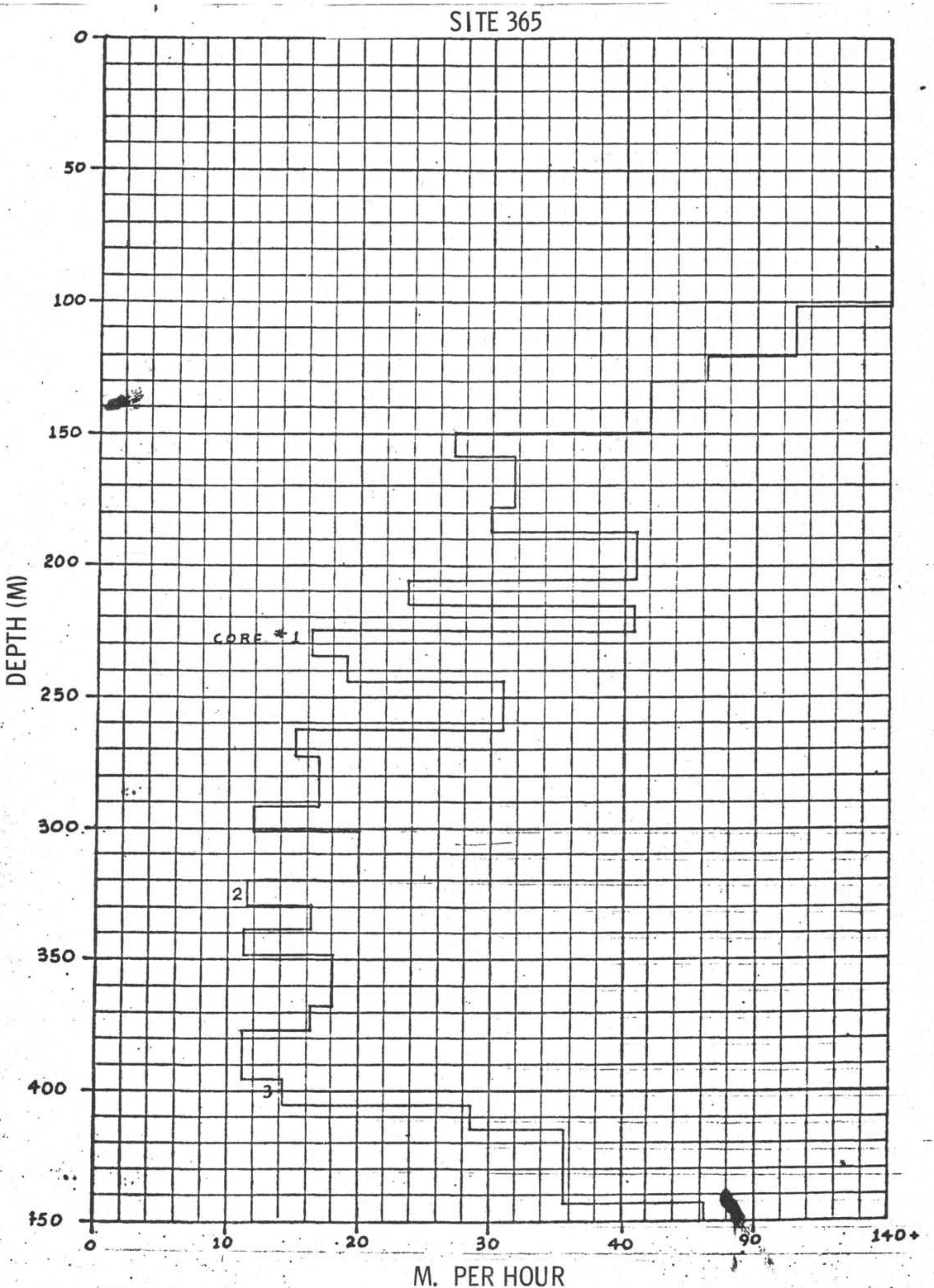
32
33
34
35

SITE 364



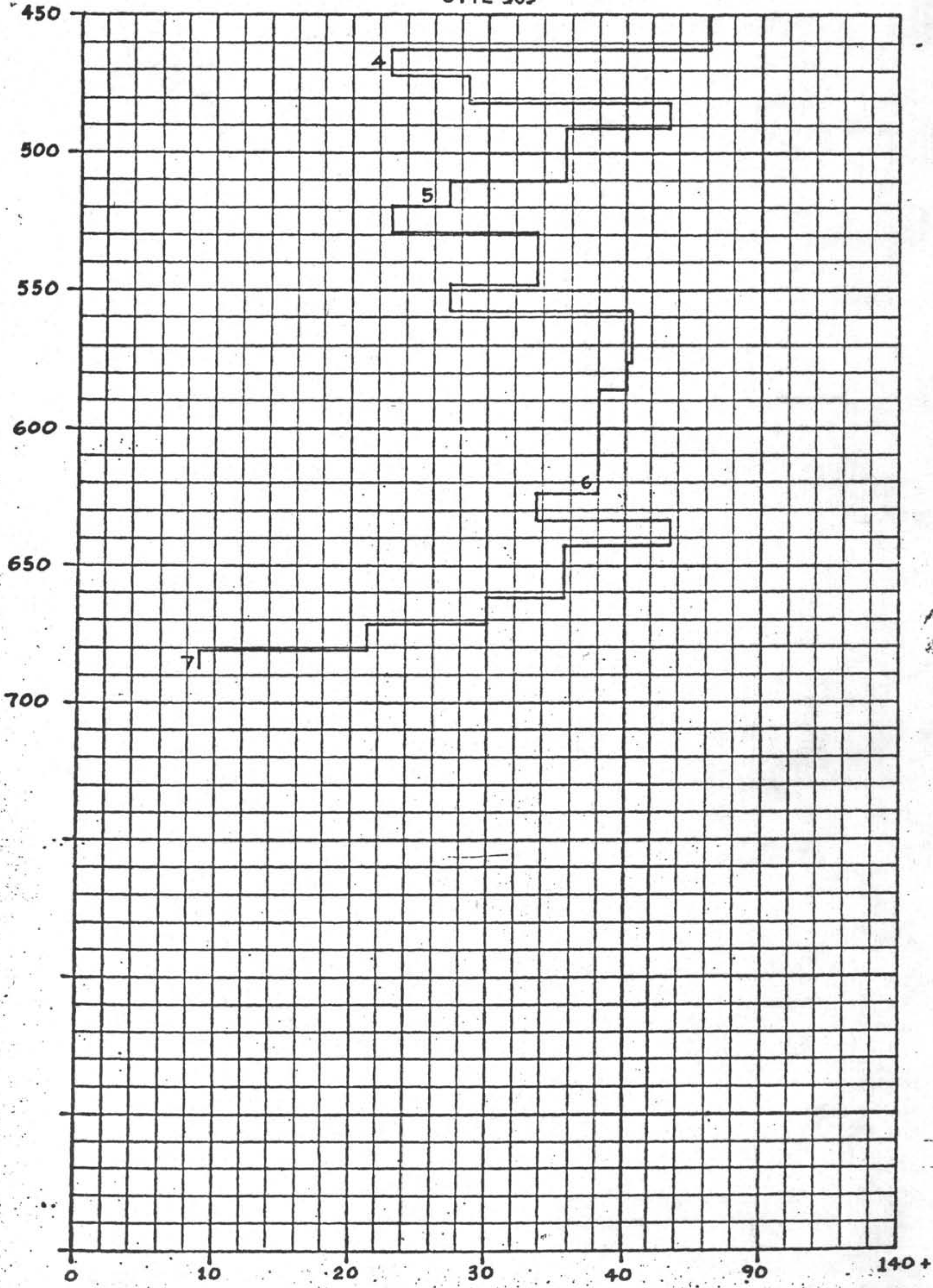
900
950
1000
1050
1100
36
37
38
39
40
41
42
43
44
45
46
TD 1086
0
10
20
30
40
90
140+


SITE 365
0
200
400
600
800
TD 687
6
7
8
9
10
11
DATE FEB 1975



SITE 365
DEPTH (M)
0
50
100
150
200
250
300
350
400
450
CORE #1
2
3
0
10
20
30
40
90
140+
M. PER HOUR

SITE 365



DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 41

SUMMARY

Leg 41 of the Deep Sea Drilling Project continued the historically significant investigation of the continental margin drilling begun on Leg 40. Although there were some disappointments in the failure to reach certain hoped for objectives, several of the holes revealed a number of geological surprises.

The leg started on February 15, 1975 in Abidjan, Ivory Coast and ended 53.9 days later in Malaga, Spain on April 10, 1975. The CHALLENGER traveled 3344.5 nautical miles and drilled seven holes at five sites along the northwest coast of Africa. Water depths averaged 3400 meters and varied between 1770 meters and 4758 meters. Hole depths averaged 836 meters and ranged from 42 meters to 1186.5 meters. A total of 2786 meters of coring was attempted with 1672.95 meters of core being recovered; for a percentage recovery of 60.04%.

Time distribution for the leg was 2.52 days in port, 16.56 days cruising, and 34.82 days on-site. The on-site time consisted of 3.72 days tripping, 5.7 days drilling, 22.97 days coring, 0.35 days positioning the ship, 0.18 days for mechanical downtime and 1.9 days for miscellaneous problems.

SITE 366 - SIERRA LEONE RISE

Our first site was located approximately 500 miles west of the seaport of Monrovia. The scientific objectives were threefold: (1) to study the subsidence history of the Sierra Leone Rise; (2) to determine the role of the Sierra Leone Rise in the paleocirculation of oceanic currents; and (3) to obtain a biostratigraphic record of the Mesozoic and Tertiary. Basement penetration was not anticipated at this location due to the contemplated thick sedimentary section.

The hole was spudded in 2870 meters of water after 4-1/2 days of travel from Abidjan. A surface core was cut and then several spot cores were taken in an attempt to core the reflectors recorded on the seismic records. Beginning at 366 meters subbottom, the hole was continuously cored to a total depth of 850.5 meters. This program was carried out with no problems until both Cores 52 and 53 had only recovery in the catcher. Believing that the bit was plugged, the center bit was dropped in an attempt to clear it. However, after pulling the center bit, Core 54 recovered nothing. At this time, drilling was stopped and the string pulled. Examination of the bit showed it to be completely plugged with some core material in the float sub below the flapper valve. The plugging had apparently been caused by the commencement of coring before the inner barrel had reached bottom. The bit seal was also examined and the teflon rings were found to be damaged. The upper plate was removed and the rings were replaced and a new upper plate tacked in place.

A second hole, 366A, was then spudded without offsetting the ship's position. This second hole was continuously cored from ocean bottom to 367 meters and then the location was abandoned. An hour and a half was lost on the second hole when a small valve in the Bowen unit system failed to operate and created back pressure which would not allow the unit to become operable.

Sea and weather conditions were ideal for drilling operations and it was frustrating to have the bit plug in Hole 366, when the top of the Cretaceous was anticipated within a few meters.

SITE 367 - CAPE VERDE BASIN

Located about 400 miles north of Site 366, this site was selected to determine the early history of the North Atlantic, particularly the nature of the lowermost reflectors believed to correspond with pre-middle Oxfordian sediments.

The hole was spudded in 4758 meters of water and coring and drilling began after the loss of an hour and a half to again repair the pressure valve in the Bowen unit pump. This problem had arisen on the previous hole and was thought to have been corrected.

At about 600 meters, methane gas was detected bubbling from black shale members. Some ethane gas as well as CO_2 and nitrogen were also detected. The cores were monitored closely, but by the time 850 meters had been drilled the gas had decreased to practically none and did not build again.

On the sixth day, three hours were lost when line tar plugged the overshot and prevented the recovery of the core barrel. A mud pill was spotted and circulated and the core barrel was retrieved. Following this, the string was pumped for five minutes after the recovery of a core barrel and before dropping a new barrel. This apparently solved the problem.

One other problem interrupted drilling for about 1-3/4 hours on the seventh day when a double life beacon stopped operating. A new beacon was dropped while the ship was held on position in the semi-automatic mode. This operation was successful and drilling continued with no damage to the drill string.

At a penetrated depth of 1144 meters, basalt was unexpectedly cored and shortly afterward, at 1153 meters, the drill string could not be operated on bottom and the hole was abandoned. When the bit was recovered, it was found to have one cone broken and another cracked. The teeth on the other two cones were in good condition. The bit had drilled a total of 81.2 hours when pulled. The bit seal was intact except for the teflon packing, which was badly worn and broken. This packing was replaced by a new type at the next location.

Again, while drilling at this site, the weather and seas remained ideal for the operation of the equipment.

SITE 368 - CAPE VERDE LOWER CONTINENTAL RISE

This site is located approximately 275 miles northwest of Dakar and was selected to determine the Late Cretaceous and Tertiary evolution of the eastern North Atlantic.

The hole was spudded in 3377 meters of water. On the second day of drilling, an hour and a half was again lost when the Bowen unit pressure valve required repairs. Additional work was required while moving from this site to Site 369.

Drilling and coring continued with methane and some ethane in Cores 25 and 26 or after 370 meters of penetration. The methane persisted but the ethane dropped out after Core No. 26 and was not recorded again until Cores No. 46 and 47, but with only traces in these cores. Beginning with Core No. 58 (921-930.5 meters), ethane was logged continuously to total depth. When the methane/ethane ratio decreased to 325, the hole was abandoned. Due to the gas and in compliance with instructions of the JOIDES Panel on Pollution Prevention and Safety, the bottom 100 meters of hole were plugged with cement and then plugged with mud to about 300 meters below the ocean floor.

One other problem developed. This was a plugged bit following the cutting of Core 47. The bit was unplugged after dropping the center bit (chisel) and pumping in a mud pill. About two hours were lost in this operation.

When the bit was pulled to the surface after 81.2 hours of drilling, it showed relatively little wear on the inserts and only one cone was loose due to bearing wear. It undoubtedly could have been run a number of hours longer. The new teflon packing (fiberglass reinforced) in the bit seal on this hole showed some wear, but appeared to be a definite improvement over the type used previously.

The bottomhole assembly was magnafluxed as the tools were broken down and no defects were found.

SITE 369 - SPANISH SAHARA CONTINENTAL SLOPE

This site was located approximately 40 miles northwest of Cape Bojador on the Spanish Sahara coast. It was selected (1) to determine the nature of the reflectors; and (2) to attempt to determine the recent subsidence history of the African margin. The geological results were apparently somewhat different than had been anticipated but were enthusiastically received.

The hole was spudded in 1770 meters of water. After five cores had been cut to a total penetration of 42 meters, hydrophone No. 4 blanked out for unknown reasons. The hydrophone array was changed and positioning was continued. The problem with hydrophone No. 4 disappeared immediately and caused no further disturbance. However, the drill string had been pulled above the mudline so a new hole, 369A, was begun.

This second hole was drilled to 42 meters and then continuously cored to a total depth of 488.5 meters. The only mechanical problem encountered while coring was the apparent rotation of the inner barrel beginning at about Core No. 10 (137 meters) and persisting until total depth. It was thought that the bit seal had caused the problem; but when the bit was retrieved, there was no visible evidence to substantiate the idea.

Methane gas was detected in Core No. 23 (251-260.5 meters) and continued to total depth. Ethane gas appeared in Core No. 40 (412.5-422 meters) and also continued to total depth. The methane/ethane ratio was watched carefully and after obtaining the results from Core No. 47, it was decided that further drilling could be hazardous and the hole was abandoned. The hole was plugged with cement as recommended by the JOIDES Safety Panel.

When the string was pulled, the bit showed little wear and the bearings appeared to be in good condition. The bit could be used later as a rerun.

The Schlumberger unit was tested at this site. The cap failed to fire, apparently due to a broken connector pin in the plug and socket assembly. There was also a distinct vibration while the unit was operating that had not been noticed before. It should be checked further when the ship goes to drydock.

SITE 370 - MOROCCAN CONTINENTAL MARGIN

The last site on Leg 41 was located approximately 150 miles southwest of Casablanca and 76 miles west of the coast line. Again, the objectives were to determine the nature of the old reflectors and the early history of the North Atlantic, specifically the reflectors believed to correlate with pre-Middle Oxfordian reflectors.

The hole was spudded in 4226 meters of water after waiting 18-1/2 hours on the weather. Before the hole could be spudded, it was necessary to wait for about 1-1/2 hours while an open circuit breaker could be temporarily repaired. This same problem occurred again the next day, but it was unnecessary to pull the string because the ship remained on position in the semi-automatic mode. Drilling was slow due to the nature of the sediments and it was necessary to make a wiper run on the fifth day in an attempt to improve core recovery.

Only minor shows of methane were detected during drilling and the hole was abandoned without cementing. A mud pill, however, was placed on bottom before coming out of the hole.

It was necessary to abandon the hole before the final objectives had been reached because of the short time remaining to reach Malaga, Spain on April 10th. The bit used established a new rotating record with a total of 121.50 hours when retrieved. At the surface all cones were intact, but the bearings showed considerable wear. The metal plates of the bit seal were intact but all of the teflon rings had broken and were gone.

DRILLING AND CORING ASSEMBLY

The bottomhole assembly, which was used on this leg, was a variation of the standard DSDP assembly used on other legs. It was different in that only three bumper subs were used rather than four and seemed to work most satisfactorily. The assembly consisted of a bit, bit sub (with float valve), core barrel, three 8-1/4" drill collars, one 5 foot stroke Baash-Ross bumper sub, three 8-1/4" drill collars, two 5 foot stroke bumper subs, two 8-1/4" drill collars, one 7-1/4" drill collar and one joint of 5-1/2" heavy wall drill pipe.

No problem developed with the drilling assembly during the leg and no tools were lost. The assembly was magnafluxed at Site 368 and no defects were detected.

CORING AND DRILLING EQUIPMENT

The standard DSDP core barrel assembly was used on all sites. Core recovery was quite good and an overall average of 60% was achieved. Recovery was lower in those holes which had fairly long sections of tough clays; for example, those encountered in Site 370.

Core barrel jamming occurred frequently, but with most of the jamming concentrated in the catcher area. This could be a function of the weight on the bit and the particular nature of the clayey sediments being cored.

One problem that seemed to occur on and off for no apparent reason was the rotation of the inner barrel. This rotation showed up as spiraling marks on the core and in some instances, quite deep grooving. It was suggested that possibly the bit seal might be contributing to the problem, however, this could not be proven. The incidence of inner barrel rotation is an area to be investigated.

BITS

With the exception of the one site where a F94C bit was run, all of the other bits were F94CK and proved to be very durable. The five bits used had an average rotating time of 71.4 hours and the last bit run on Site 370 set a new record of 121.59 rotating hours. The Type 94 bit was used because of anticipated cherts and limestones, in preference to a longer toothed bit which would have probably drilled faster in the shales, mudstones and clays encountered. The average penetration rate for the leg was 26.7 meters per hour.

POSITIONING

Positioning on this leg could be rated as good to excellent for the whole leg. Only minor problems developed and these were so minor that the drill string was never in danger. The worst situation developed on the last few days on Site 368, when variations in wind speed and direction caused excursions to a maximum of 120 feet but still within the prescribed limits for the depth at this site. The only other problem which might be considered serious occurred when the double life beacon on Site 367 began to fade after the fifth day and a new beacon was dropped. Offsets were put in 100' north and 1000' east) to compensate for drift of the new beacon while dropping and then normal positioning was resumed.

Power losses were experienced twice at Site 370, but were of such short duration that no problem developed. A more reliable power supply is needed, particularly in the area of the circuit breaker that was added after the initial installation of the positioning equipment.

BEACONS

The performance of five of the six ORE beacons used on this leg were excellent. One double life beacon, which was dropped on Site 367, gave indications of failing and a new single life beacon was dropped and the hole was completed with no complications. The other double life beacon that was dropped on Site 370, performed as expected. The possible cause of the failure of the first double life is the length of time it had been on board the vessel. A testing kit from the manufacturer to determine the condition of the batteries before dropping should be considered.

TEFLON BIT SEAL

The teflon bit seal was used on every site and appeared to be working successfully. A new type of teflon rings were used on Sites 368, 369, and 370. They were in good condition on Sites 368 and 369 when the bit was retrieved, however, on Site 370 they were completely gone indicating that they may also be too brittle. However, the bit in Site 370 set a drilling time record of 121 hours and 36 minutes, which could account for the wearing out of the seals.

HEAVE COMPENSATOR

Due to the unusually good weather and excellent sea conditions enjoyed on this leg, it was not necessary to use the heave compensator. This good weather was reflected in the long bit life average logged without the use of the compensator.

HYDROCARBONS

Methane gas was detected in cores recovered from Sites 367, 368, 369, and 370. Ethane gas was also observed in the cores from Sites 367, 368, and 369.

At Site 367, after both methane and ethane were detected, the cores were monitored carefully, but the methane/ethane remained about the same value until the hole was abandoned.

At Site 368, the methane/ethane ratio was satisfactory at Core No. 25 and then the ethane dropped out until Core No. 47. The ratio decreased from 610 in Core No. 62 to 325 in Core No. 63. Drilling was discontinued at this point and the hole abandoned with cement in accordance with JOIDES Safety Committee recommendations. Another factor that influenced abandonment was a cut fluorescence obtained from a shale sample in Core No. 63 even though no fluorescence was observed when looking at the shale under ultraviolet light. As a result of these observed values, a minimum methane/ethane ratio value of 500 was established as a cut off point for the remaining sites. This ratio was observed in Site No. 369 and the hole was cemented and abandoned. Site 370 logged only methane gas and therefore, no decision was necessary.

Further evaluation of the methane/ethane ration cut off value of 500 or less should be made, particularly since additional margin sites have been planned for IPOD.

WEATHER

As stated earlier in this summary, the weather enjoyed on this leg was ideal for the successful operation of the equipment. The only unfavorable weather encountered was on the approach to Site 370 and for 19-1/2 hours after dropping the beacon.

COMMUNICATIONS

No real problem developed in contacting radio station WWD on the 17 MHZ band; the only useful band with their limited working hours. The band was open for about two hours, which was ample time for any communications. This time corresponded to West Coast time from 1:00 to 3:00 p.m. Any traffic arriving later had to wait until the next day. When band conditions did change, arrangements were made with the Navy to handle outgoing traffic via the Mercast System. All incoming traffic was received directly from WWD. Much of the outgoing traffic was sent via various Navy stations which could be contacted. These stations included NST Londonderry, Northern Ireland, NGR in Greece and an occasional message sent through the station at Guam. The Project's traffic was light as compared with other legs. Few commercial calls were made, but conditions were good if they had been necessary. Some commercial calls were made to Germany by the scientific personnel. Many personal calls were made via the shipboard amateur station with very satisfying results. No equipment problems developed on this leg.

PERSONNEL

As has been stated many times before, the Global Marine personnel have to be commended for not only making this leg a success, but also for their skill in operating the equipment as efficiently as possible.

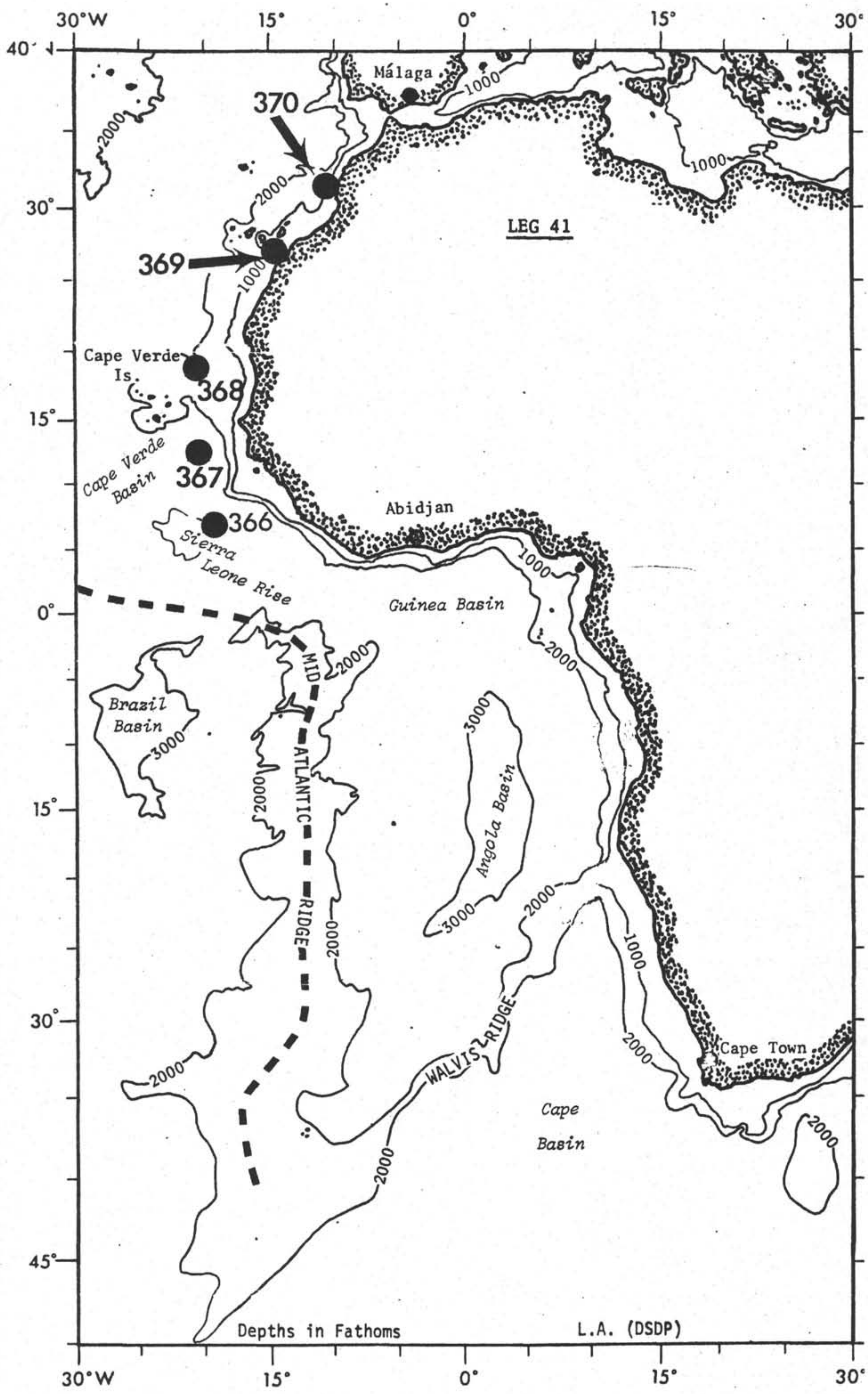
The SIO personnel also demonstrated their enthusiasm in trying to help achieve the necessary scientific goals.

The scientific party representing Germany, Russia, Canada and the United States retained their enthusiasm throughout the leg despite the disappointment of not quite achieving the anticipated goals in every case. There was a great deal of pleasure derived from their dedication and sense of humor.

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

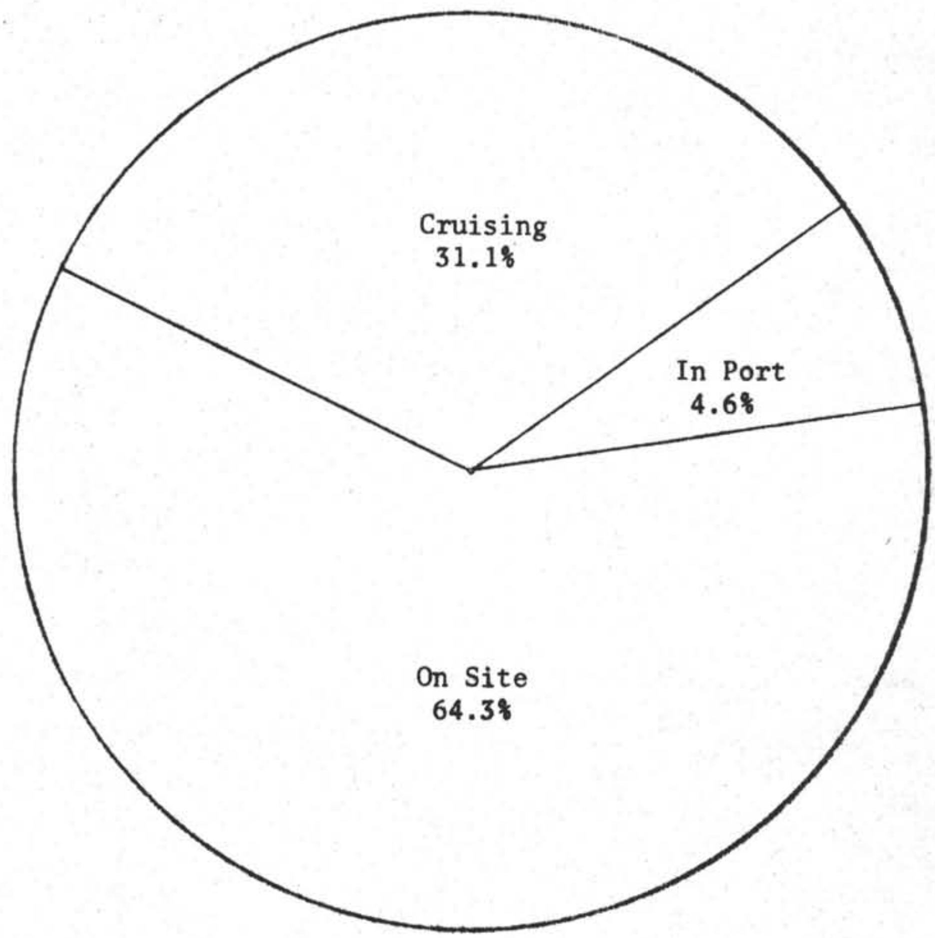
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 41

Total Days (February 15, 1975 - April 10, 1975)		53.9
Total Days In Port		2.52
Total Days Cruising Including Site Survey		16.56
Total Days On Site		34.82
Trip Time	3.72	
Drilling Time	5.7	
Coring Time	22.97	
Position Ship	.35	
Mechanical Downtime	.18	
Waiting On Weather	.77	
Other	1.13	
Total Distance Traveled Including Survey (Nauticial Miles)		3344.5
Average Speed (Knots)		8.5
Number of Sites		5
Number of Holes Drilled		7
Number of Cores Attempted		300
Number of Cores With Recovery		295
Percent of Cores With Recovery		98.3
Total Meters Cored		2786
Total Meters Recovered		1672.95
Percent Recovery		60.04
Total Meters Drilled		2276
Total Meters of Penetration		5062
Percent of Penetration Cored		55.03
Maximum Penetration (Meters)		1176.5
Minimum Penetration (Meters)		42
Maximum Water Depth (Meters)		4758
Minimum Water Depth (Meters)		1770



30°W
15°
0°
15°
30°
40°
30°
15°
0°
15°
30°
45°
Málaga
1000
370
2000
LEG 41
369
1000
1000
Cape Verde
Is.
368
15°
Cape Verde
Basin
367
Abidjan
366
Sierra
Leone Rise
1000
Guinea Basin
MID
2000
2000
Brazil
Basin
3000
3000
ATLANTIC
2000
Angola Basin
RIDGE
3000
2000
2000
1000
WALVIS
RIDGE
2000
Cape Town
2000
Cape
Basin
2000
2000
Depths in Fathoms
L.A. (DSDP)

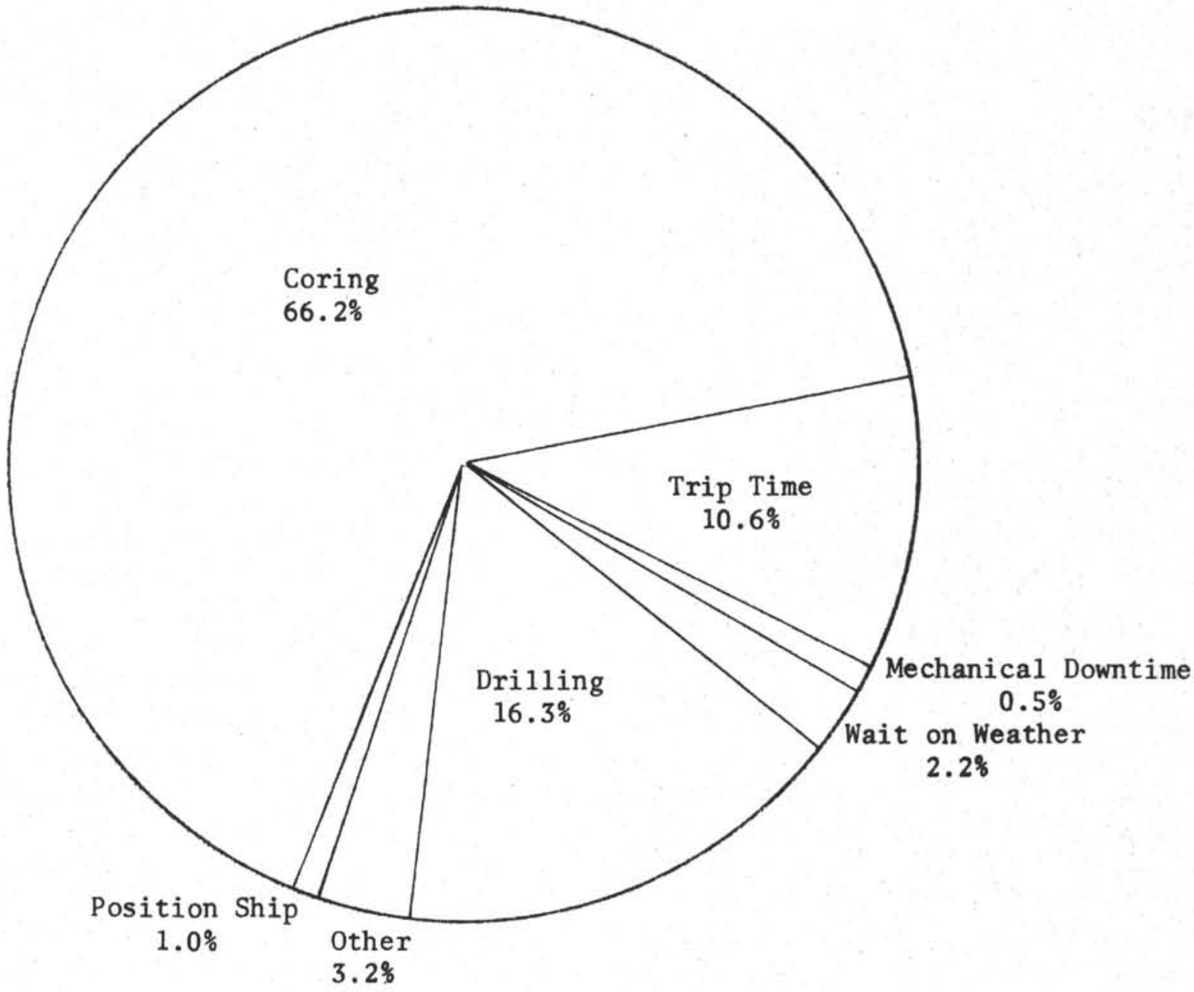
TOTAL TIME DISTRIBUTION



DEEP SEA DRILLING PROJECT

LEG 41

ON SITE TIME BREAKDOWN



DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG 41

Date	Site Number	Cruise	Trips	Drill	Core	Stuck Pipe	Wait On Weather	Position Ship	Mechanical Downtime	In Port Time	Other	Total Time	Remarks
Feb 15-17										60.5		60.5	
Feb 17-22		108.7										108.7	
Feb 22-27	366		14.2	3.7	100.6			1.3			2.9	122.7	
Feb 27-Mar 01	366A		12.75		37.0				1.5		.5	51.75	Bowen Sub Valve
Mar 01-03		49.15										49.15	
Mar 03-11	367		20.6	42.7	106.05			2.85	1.5		3.5	177.2	Bowen Sub Valve
Mar 11-15		50.0									3.0	53.0	
Mar 13-20	368		11.5	29.5	120.75			1.25	1.5		6.5	171.0	Bower Sub Valve
Mar 20-23		85.1										85.1	
Mar 23-24	369		4.9		4.5			1.0				11.4	
Mar 24-26	369A		3.8	.5	49.0						5.5	58.8	
Mar 26-29		50.3										50.3	
Mar 29-Apr 08	370		21.55	60.5	133.5		18.5	.9			6.15	241.1	
Apr 08-10		53.3										53.3	
		396.55	89.3	136.9	551.4		18.5	7.3	4.5	60.5	28.05	1294.0	

DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 41

Hole	Latitude	Longitude	Water Depth Meters	Number Of Cores	Cores With Recovery	% Of Cores W/Rec.	Meters Cored	Meters Recovered	Percent Recovered	Meters Drilled	Total Penet. Meters	Avg. Rate Penet.	Time On Hole	Time On Site
366	05° 40.68'N	19° 51.08'W	2870	55	53	96.4	518.0	304.0	58.7	332.5	850.5	17.9	120.8	
366A	05° 40.70'N	19° 51.10'W	2869	39	38	97.4	367.0	278.0	75.9	0.0	367.0	78.1	51.8	172.6
367	12° 29.21'N	20° 02.83'W	4758	40	40	100.0	347.0	174.2	50.2	806.0	1153.0	14.1	177.2	177.2
368	17° 30.43'N	21° 21.23'W	3377	63	61	96.8	582.5	327.7	56.2	402.0	984.5	12.1	171.0	171.0
369	26° 35.55'N	14° 59.92'W	1770	5	5	100.0	42.0	36.1	85.9	0.0	42.0	29.6	11.4	
369A	26° 35.55'N	14° 59.96'W	1770	47	47	100.0	446.5	350.25	78.4	42.0	488.5	25.2	58.8	70.2
370	32° 50.25'N	10° 46.56'W	4226	51	51	100.0	483.0	202.7	41.97	693.5	1176.5	9.68	241.1	241.1
	Totals			300	295	98.3	2786.0	1672.95	60.04	2276.0	5062.0	26.7		

DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 41

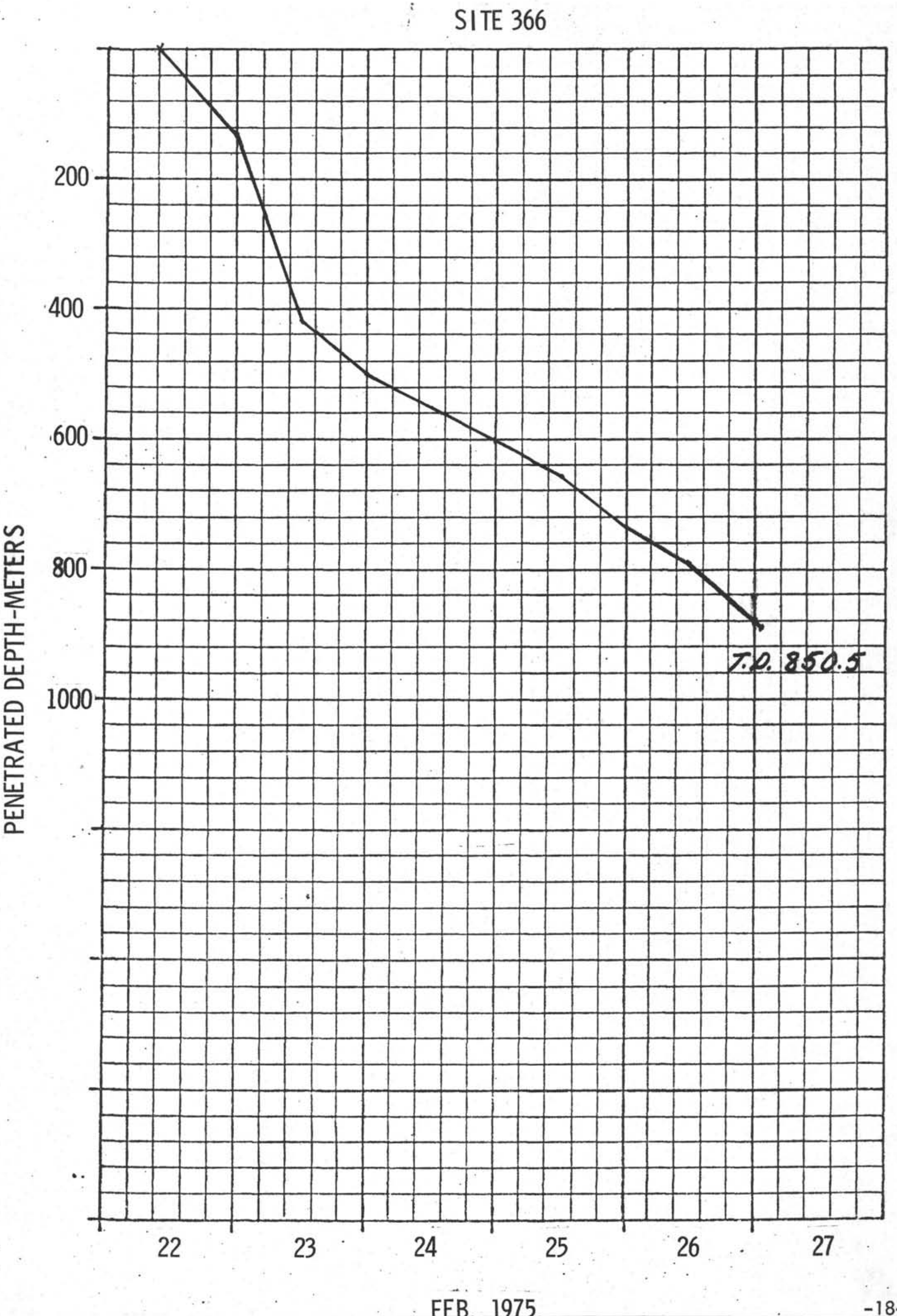
Hole	Mfg.	Size	Type	Serial Number	Meters Cored	Meters Drilled	Meters Total Penet.	Hours On Bit	Condition	Remarks
366	Smith	10-1/8"	F94CK	RC-897	518.0	332.5	850.5	47.36		total time 52.12 hr
366A	Smith	10-1/8"	F94CK	RC-897	367.0	0.0	367.0	4.76		
367	Smith	10-1/8"	F94CK	SZ-095	347.0	806.0	1153.0	81.27		
368	Smith	10-1/8"	F94C	PC-155	582.5	402.0	984.5	81.23		
369	Smith	10-1/8"	F94CK	SZ-155	42.0	0.0	42.0	1.4		total time 20.75 hr
369A	Smith	10-1/8"	F94CK	SZ-155	446.5	42.0	488.5	19.35	can be rerun	
370	Smith	10-1/8"	F94CK	SZ-156	483.0	693.5	1176.5	121.59		new rotating record

DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 41

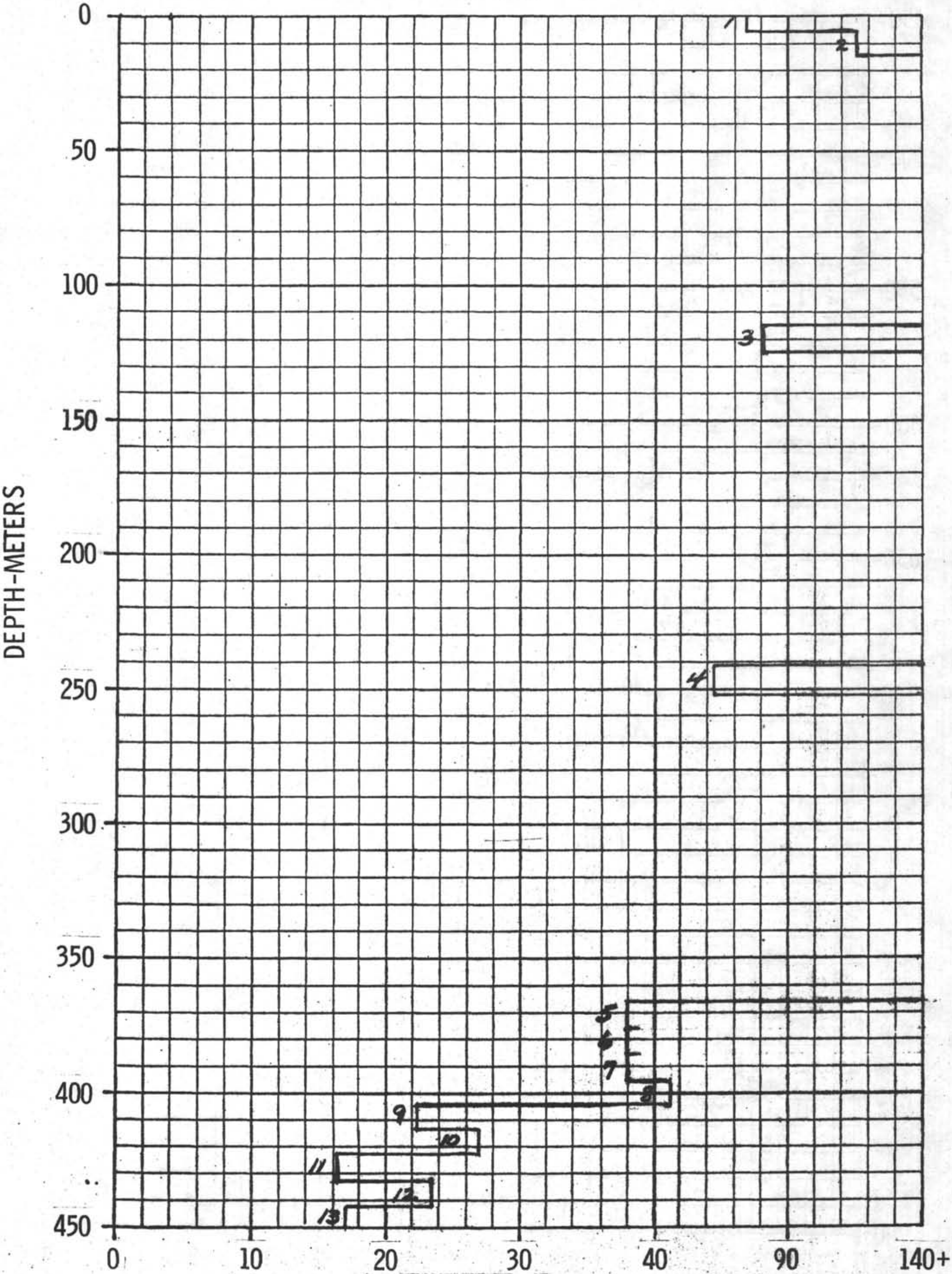
Site No.	Make	Freq. kHz	Serial Number	Site Time Hours	Remarks		
366 366A	ORE	13.5	326	172.55	Dropped 1040 2/22/75	2870 meters	Single Life
367	ORE	16.0	301	131.6	Dropped 1624 3/3/75	4758 meters	Double Life
367	ORE	13.5	323	45.25	Dropped 0415 3/9/75	4758 meters	Single Life
368	ORE	16.0	292	171.0	Dropped 0635 3/13/75	3377 meters	Single Life
369 369A	ORE	13.5	328	11.4 58.8	Dropped 2235 3/23/75	1762 meters	Single Life
370	ORE	16.0	297	241.1	Dropped 0006 3/29/75	4226 meters	Double Life

DEEP SEA DRILLING PROJECT
DYNAMIC POSITIONING DATA
LEG 41

Site No.	Avg. Head	Avg. Wind MPH	Avg. Swell Ft.	TIME OPERATED - PERCENT								
				Main Prop. RPM			Bow Thrusters RPM			Stern Thrusters RPM		
				0-75	75-100	100+	0-200	200-300	300+	0-200	200-300	300+
366	330	7 NNW	3	98.9	1.1	0.0	56.9	35.2	7.9	49.4	38.4	12.2
366A	325	14 NNW	4	100.0	0.0	0.0	78.2	21.8	0.0	77.7	22.3	0.0
367	013	24 NNE	6	92.9	7.1	0.0	49.7	42.6	7.7	40.4	46.2	13.4
368	015	26 NNE	5	73.8	24.9	1.3	48.4	41.9	9.7	33.4	52.6	14.0
369	009	28 NNE	6	22.2	66.7	11.1	0.0	52.8	47.2	0.0	41.7	58.3
369A	015	30 NNE	6	57.4	39.5	3.1	7.5	68.9	23.6	7.9	73.2	18.9
370	355	6-30 Varied	4	92.3	7.4	0.3	37.5	47.4	15.1	35.5	45.9	18.6

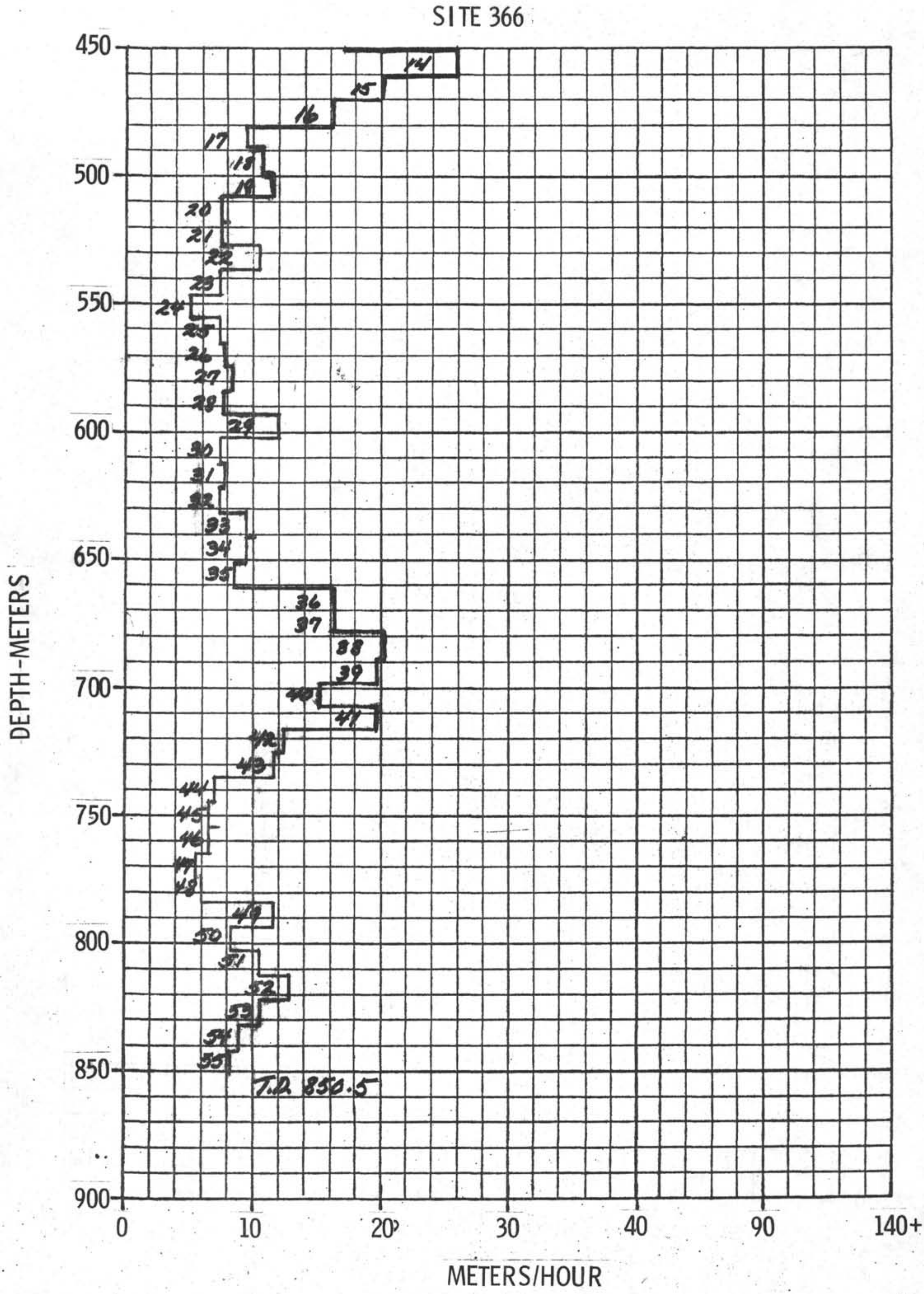

SITE 366
PENETRATED DEPTH-METERS
200
400
600
800
1000
T.D. 850.5
22
23
24
25
26
27
FEB. 1975

SITE 366

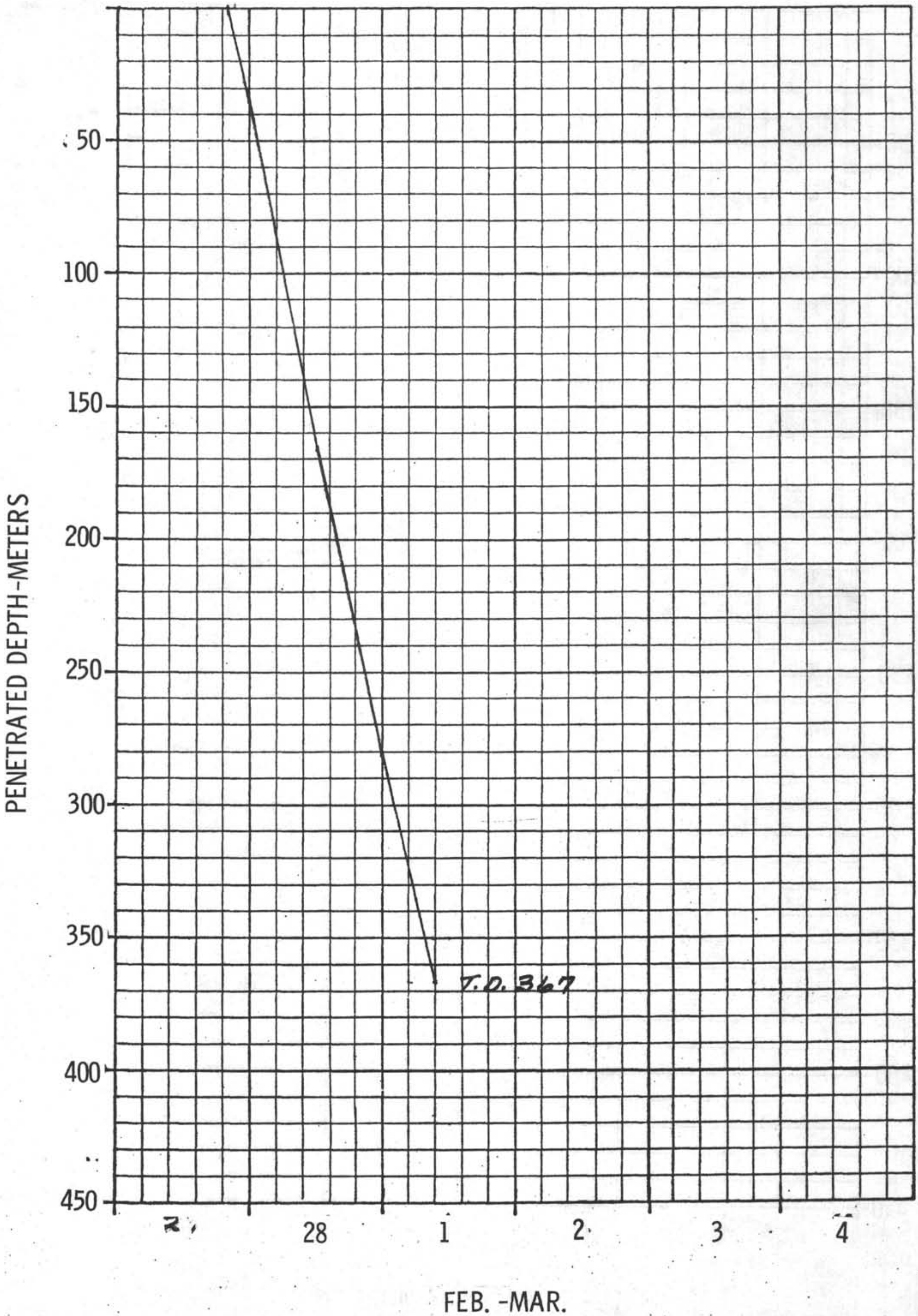


METERS/HOUR

CORED & DRILLED INTERVALS

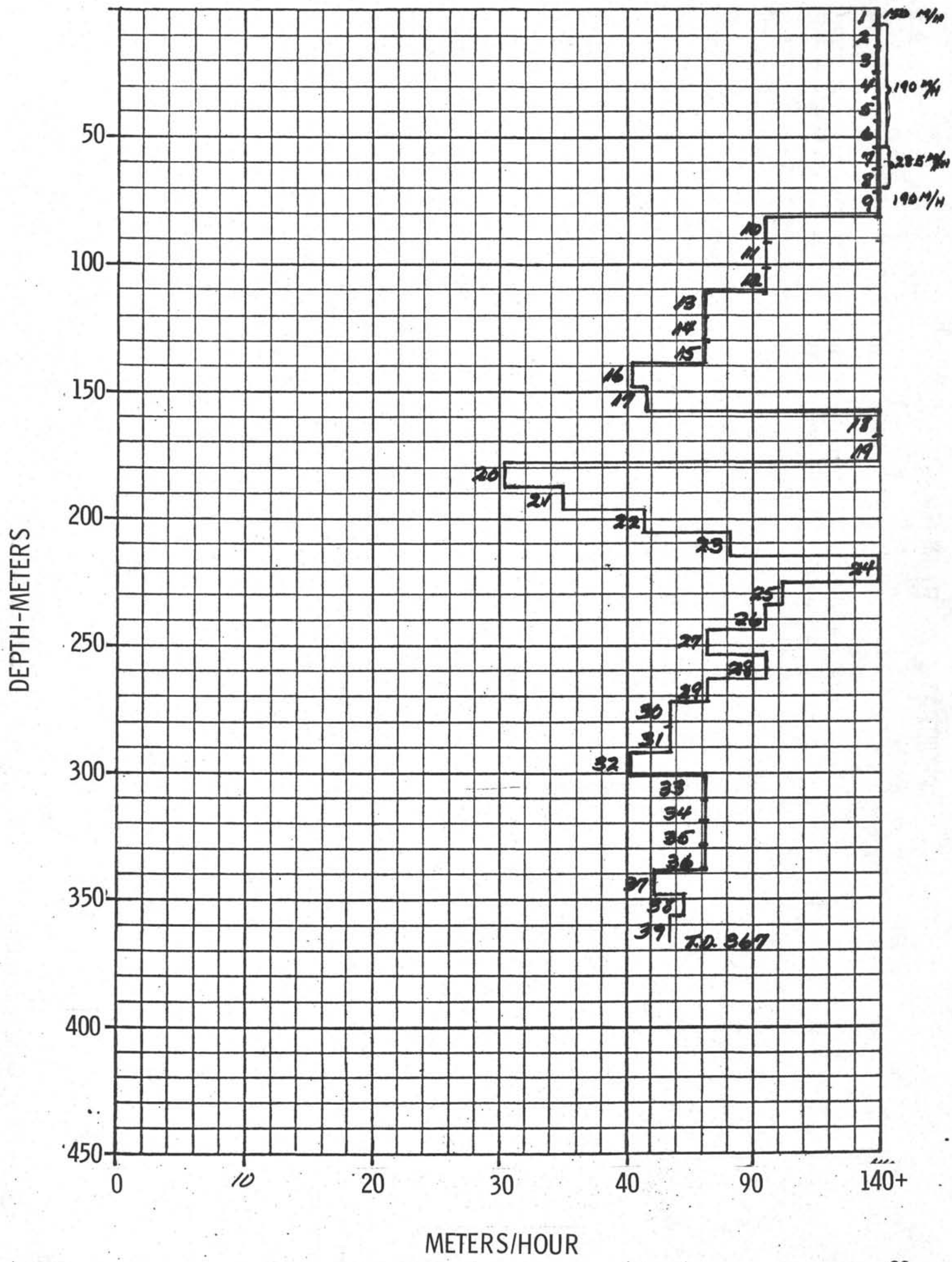

SITE 366
DEPTH-METERS
METERS/HOUR
450
500
550
600
650
700
750
800
850
900
0
10
20
30
40
90
140+
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
T.D. 850.5

SITE 366A

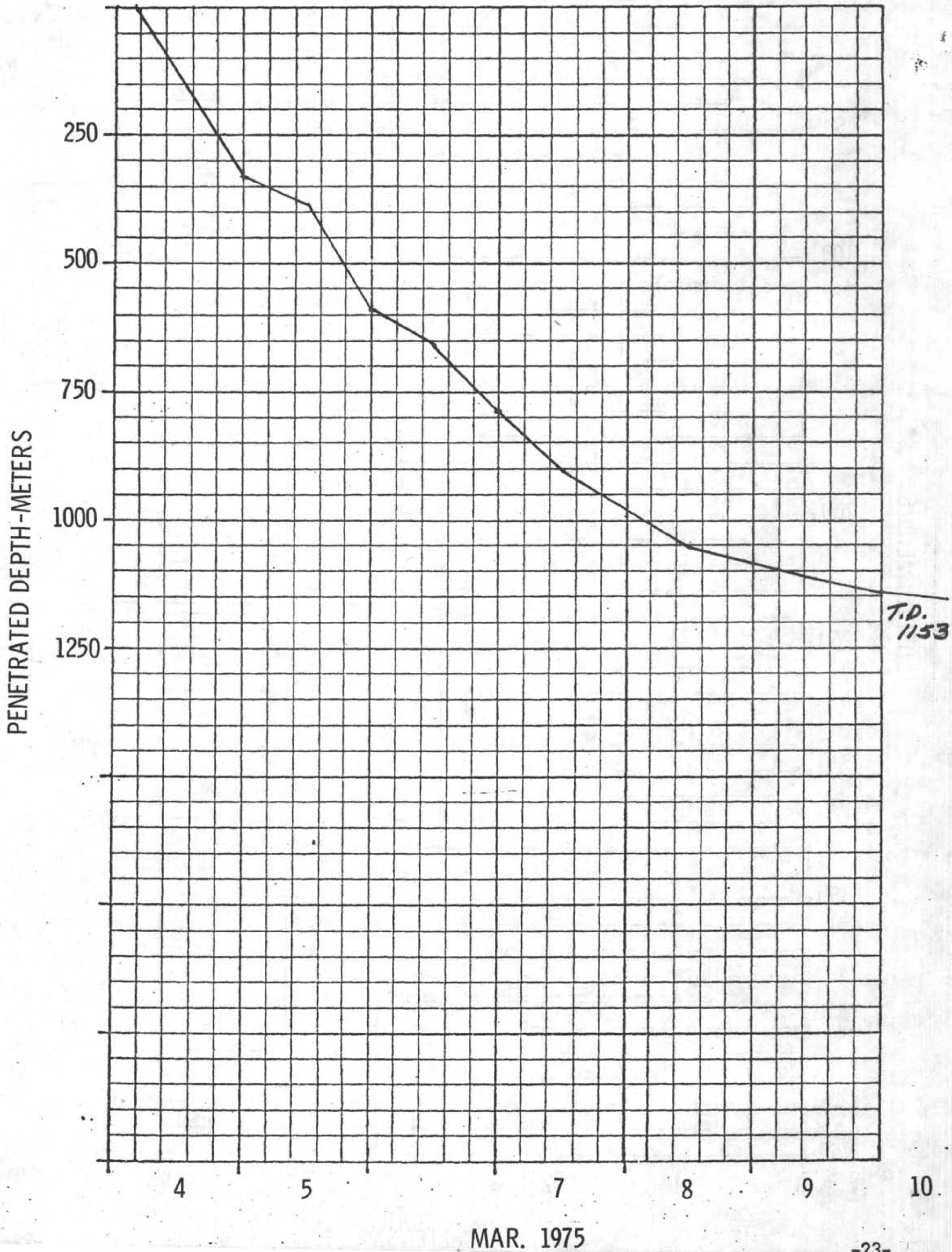


PENETRATED DEPTH-METERS
50
100
150
200
250
300
350
400
450
28
1
2
3
4
T.D. 367
FEB. -MAR.

SITE 366A

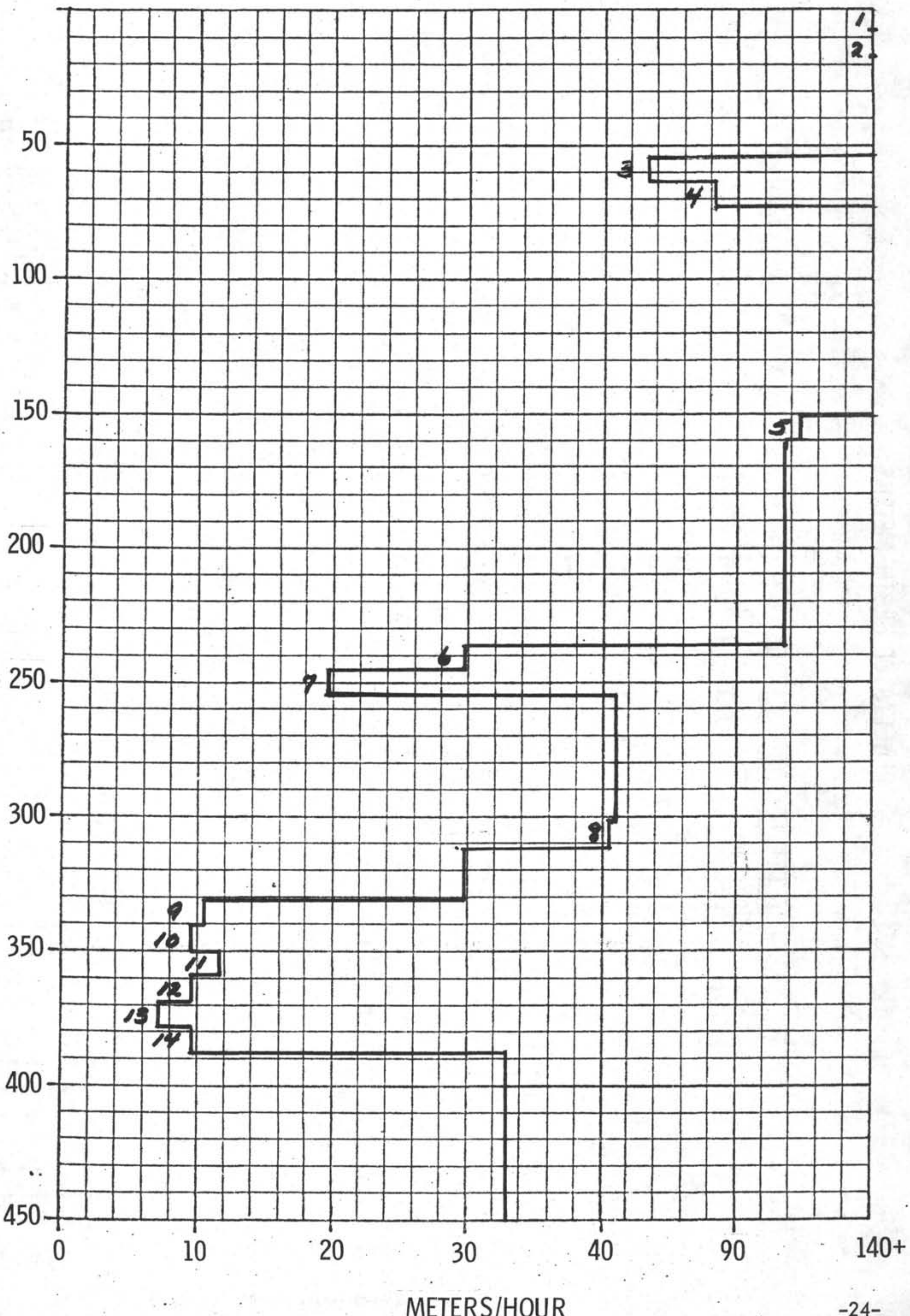

DEPTH-METERS
METERS/HOUR
50
100
150
200
250
300
350
400
450
0
10
20
30
40
90
140+
150 M/H
190 M/H
285 M/H
190 M/H
T.D. 367

SITE 367

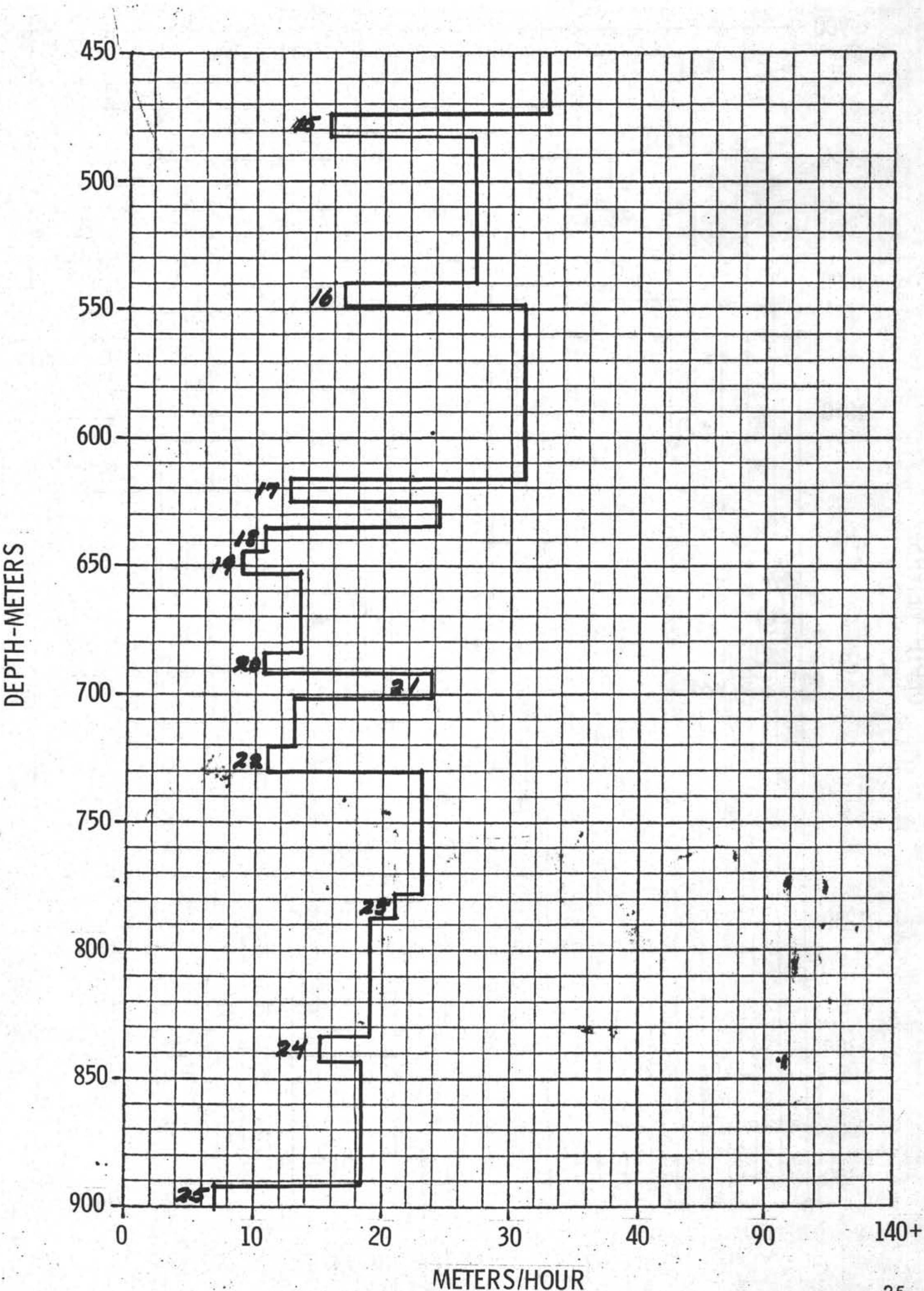


PENETRATED DEPTH-METERS
250
500
750
1000
1250
T.D.
1153
4
5
7
8
9
10
MAR. 1975

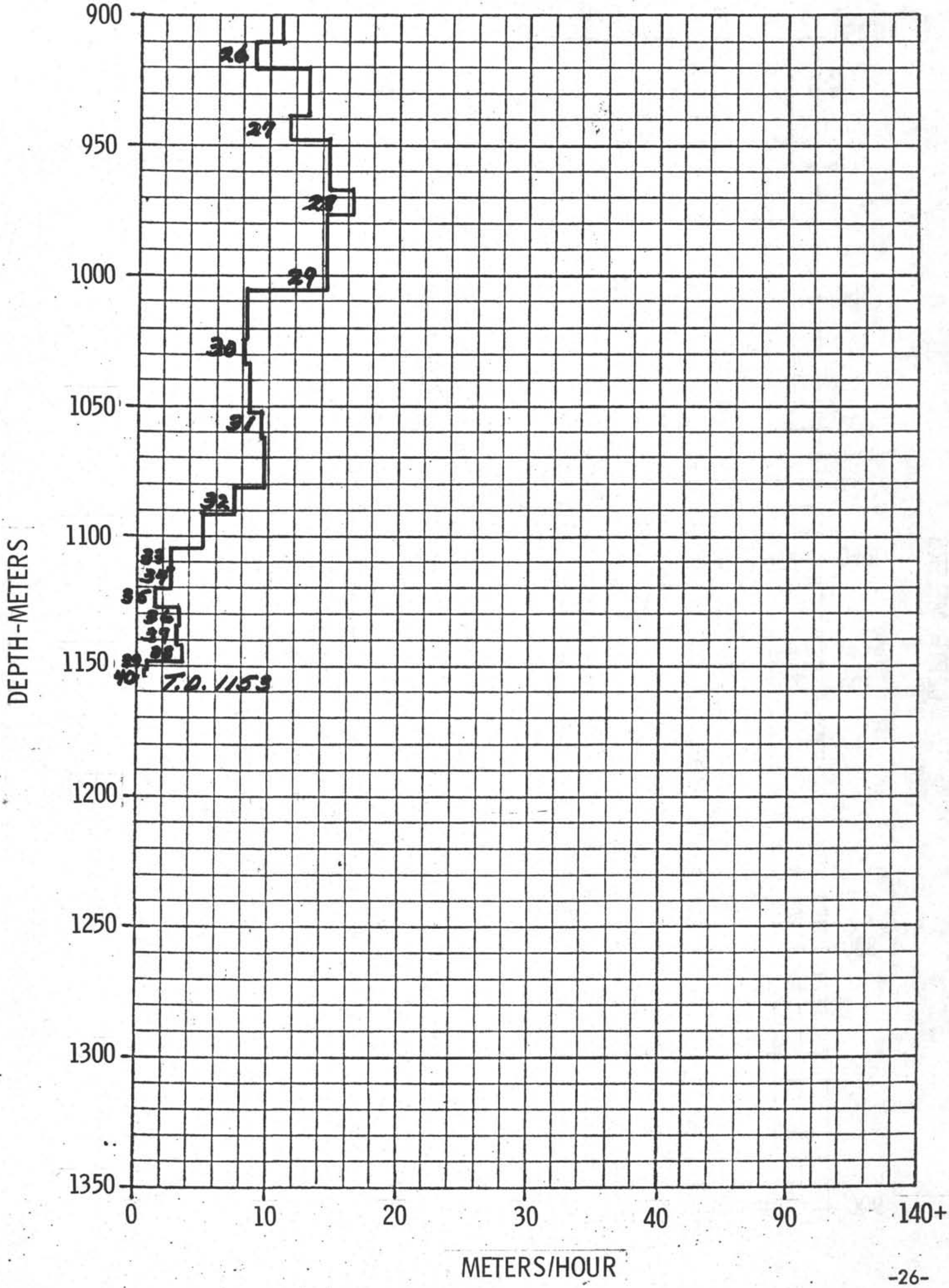
'TE 3(



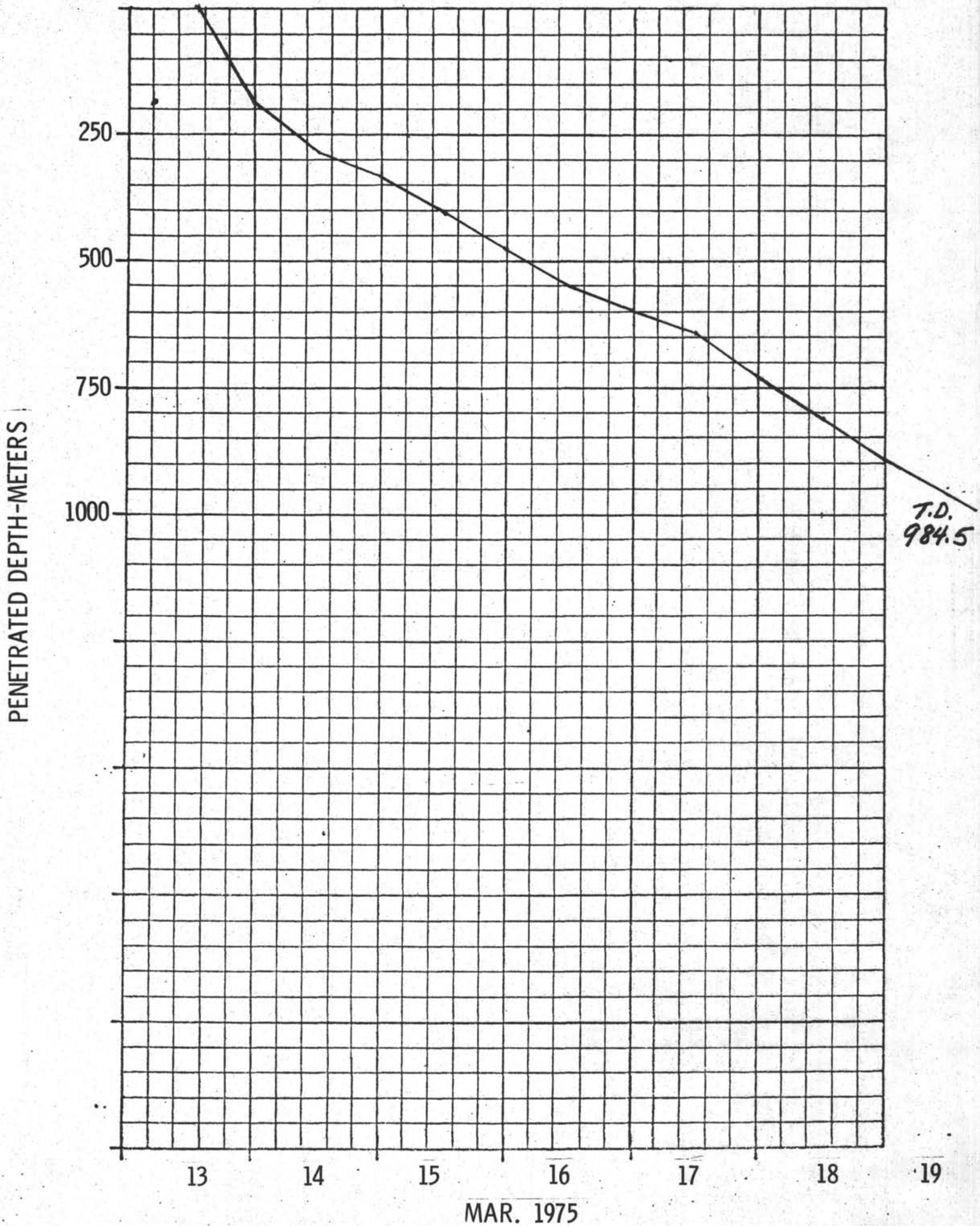
DEPTH-METERS
50
100
150
200
250
300
350
400
450
0
10
20
30
40
90
140+
METERS/HOUR
1
2
3
4
5
6
7
8
9
10
11
12
13
14



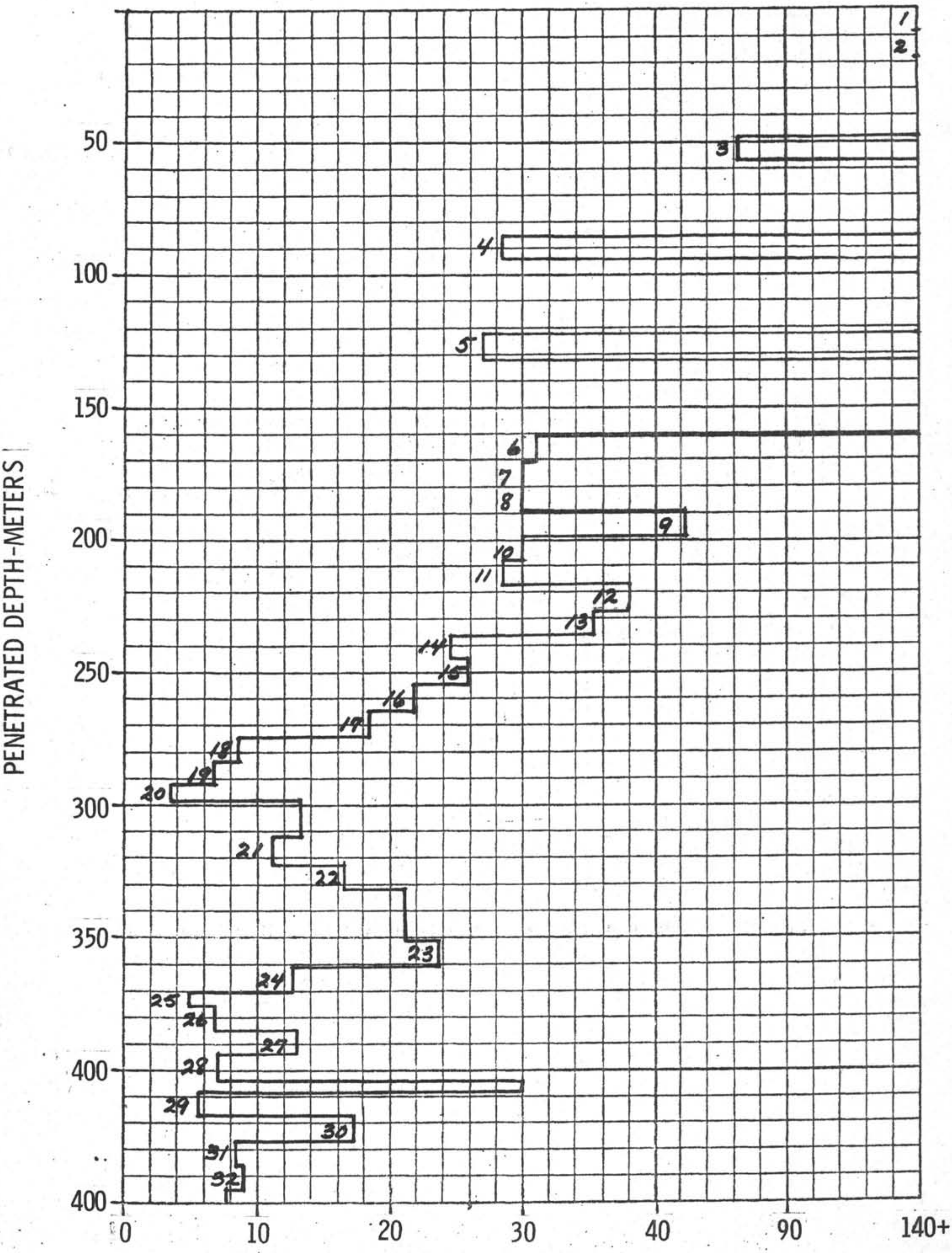
DEPTH-METERS
450
500
550
600
650
700
750
800
850
900
0
10
20
30
40
90
140+
METERS/HOUR
15
16
17
18
19
20
21
22
23
24
25


DEPTH-METERS
900
950
1000
1050
1100
1150
1200
1250
1300
1350
0
10
20
30
40
90
140+
METERS/HOUR
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
T.D. 1153

SITE 368


PENETRATED DEPTH-METERS
250
500
750
1000
T.D.
984.5
13
14
15
16
17
18
19
MAR. 1975

SITE 368


PENETRATED DEPTH-METERS
METERS/HOUR
50
100
150
200
250
300
350
400
400
0
10
20
30
40
90
140+
1
2
3
4
5
6
7
8
9
10
11
12
13
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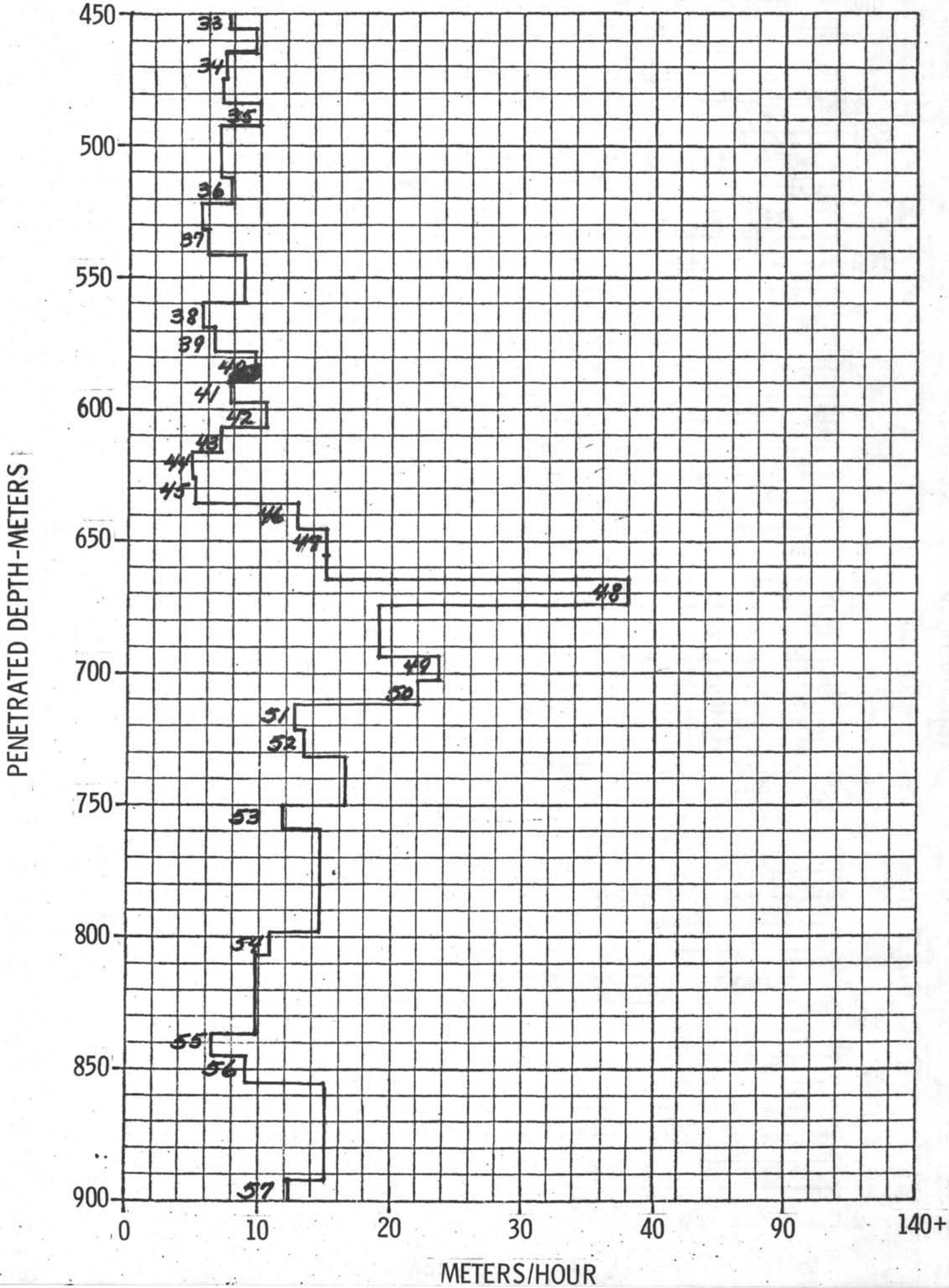
32

SITE 368



PENETRATED DEPTH-METERS
450
500
550
600
650
700
750
800
850
900
0
10
20
30
40
90
140+
METERS/HOUR
33
34
35
36
37
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53
54
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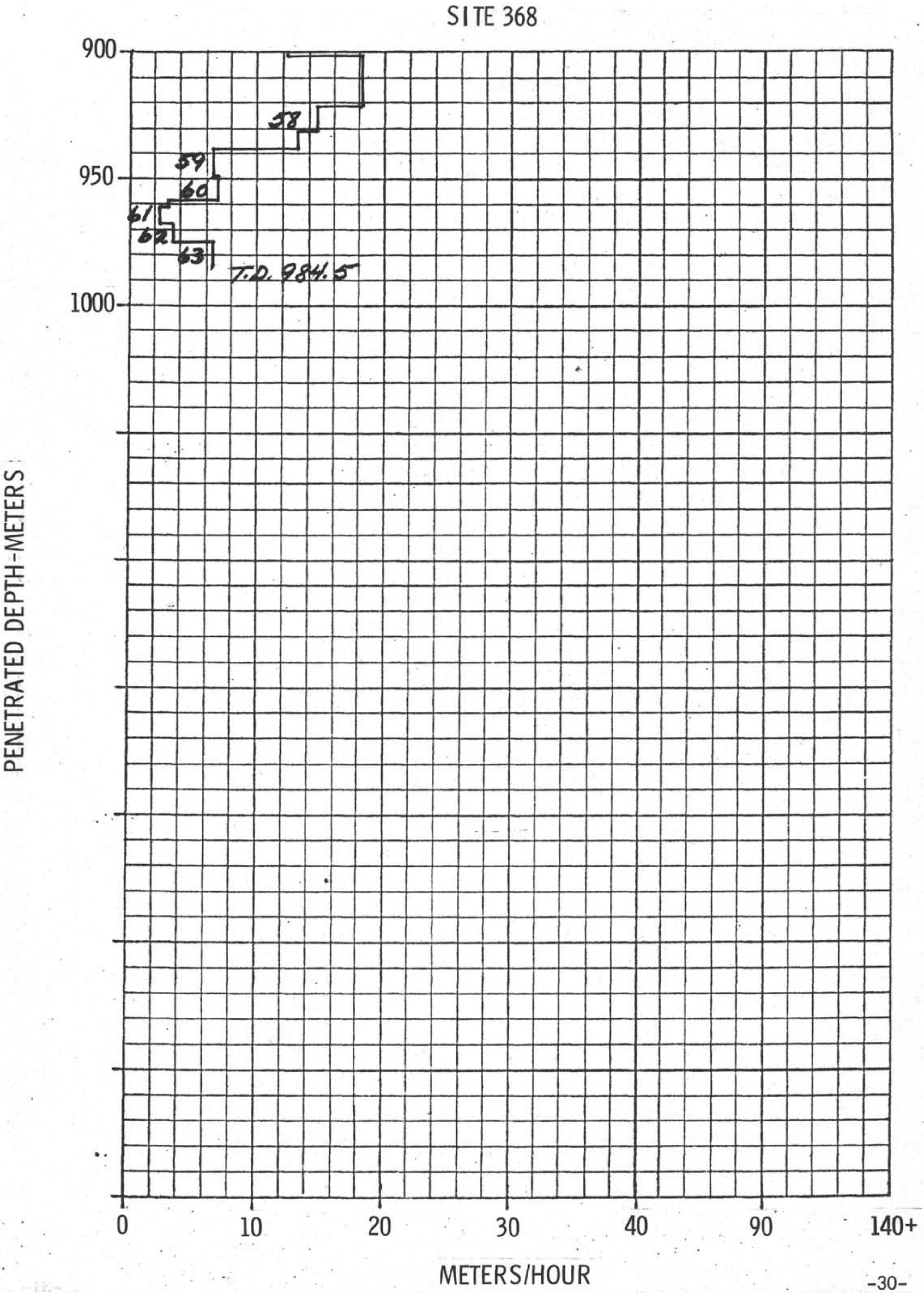
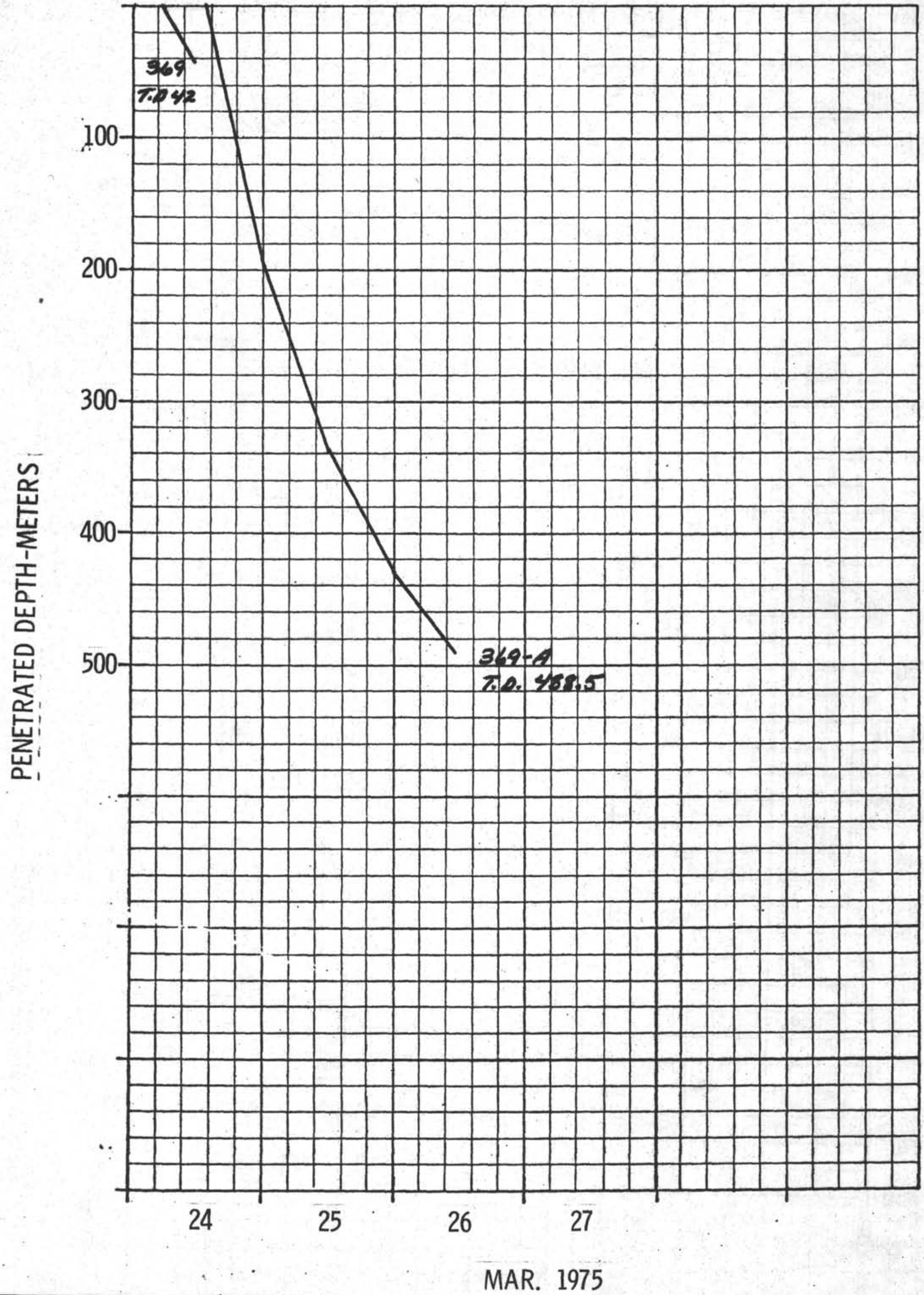
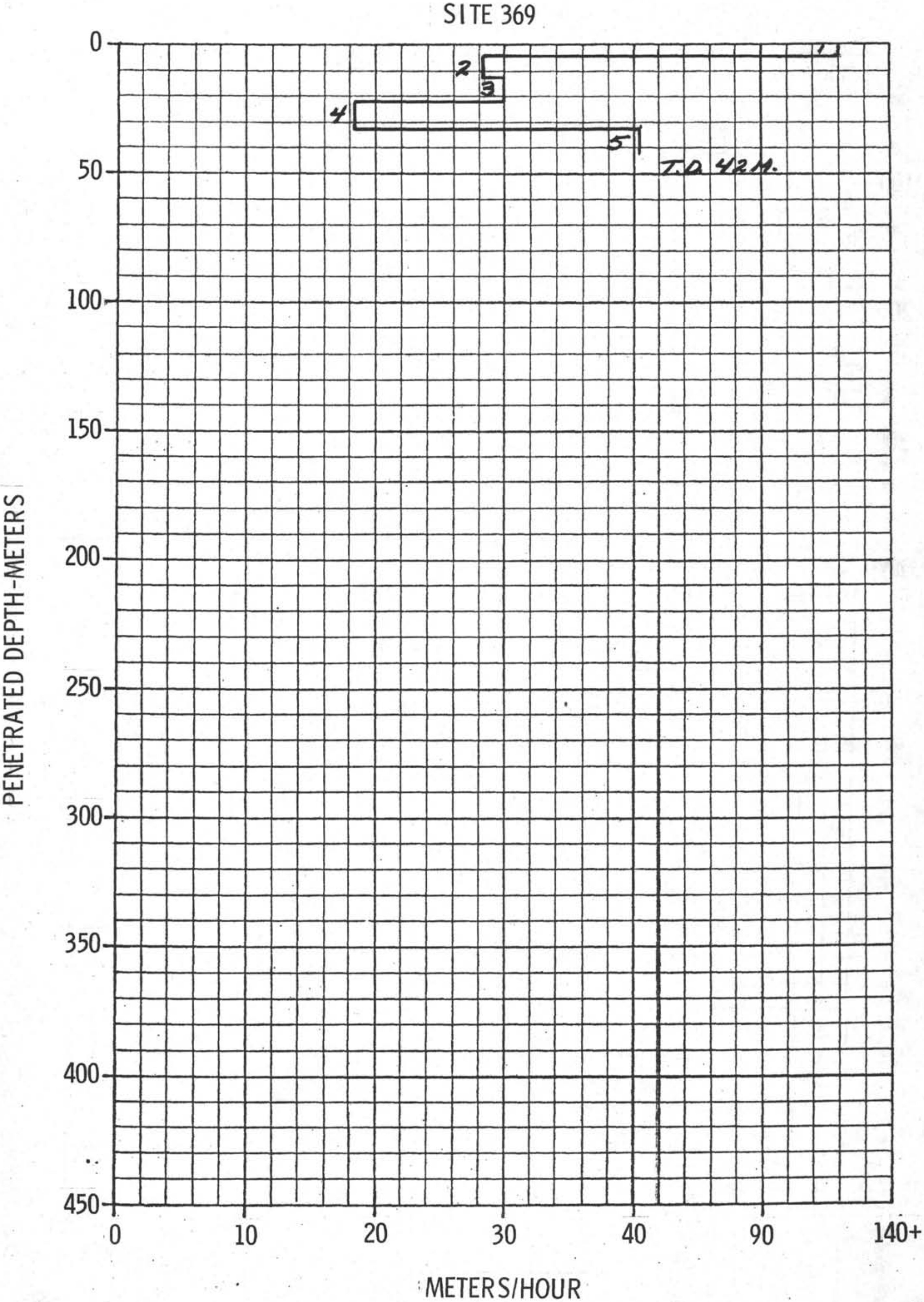
56
57

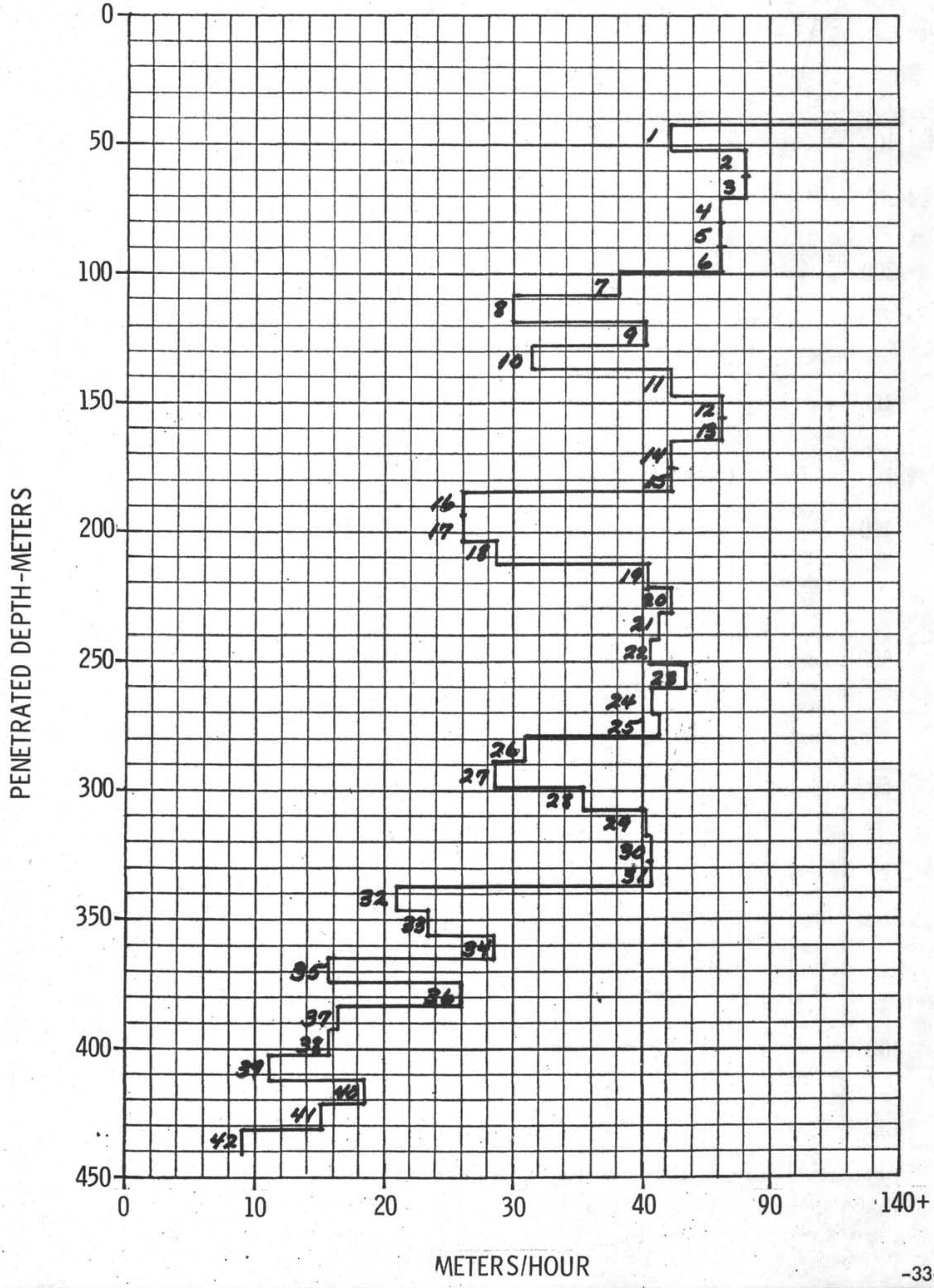

SITE 368
900
950
1000
PENETRATED DEPTH-METERS
58
59
60
61
62
63
T.D. 984.5
0
10
20
30
40
90
140+
METERS/HOUR

SITE 369 & 369A




SITE 369
PENETRATED DEPTH-METERS
METERS/HOUR
0
50
100
150
200
250
300
350
400
450
0
10
20
30
40
90
140+
1
2
3
4
5
T.D. 42M.

SITE 369A


PENETRATED DEPTH-METERS
0
50
100
150
200
250
300
350
400
450
0
10
20
30
40
90
140+
METERS/HOUR
1
2
3
4
5
6
7
8
9
10
11
12
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21
22
23
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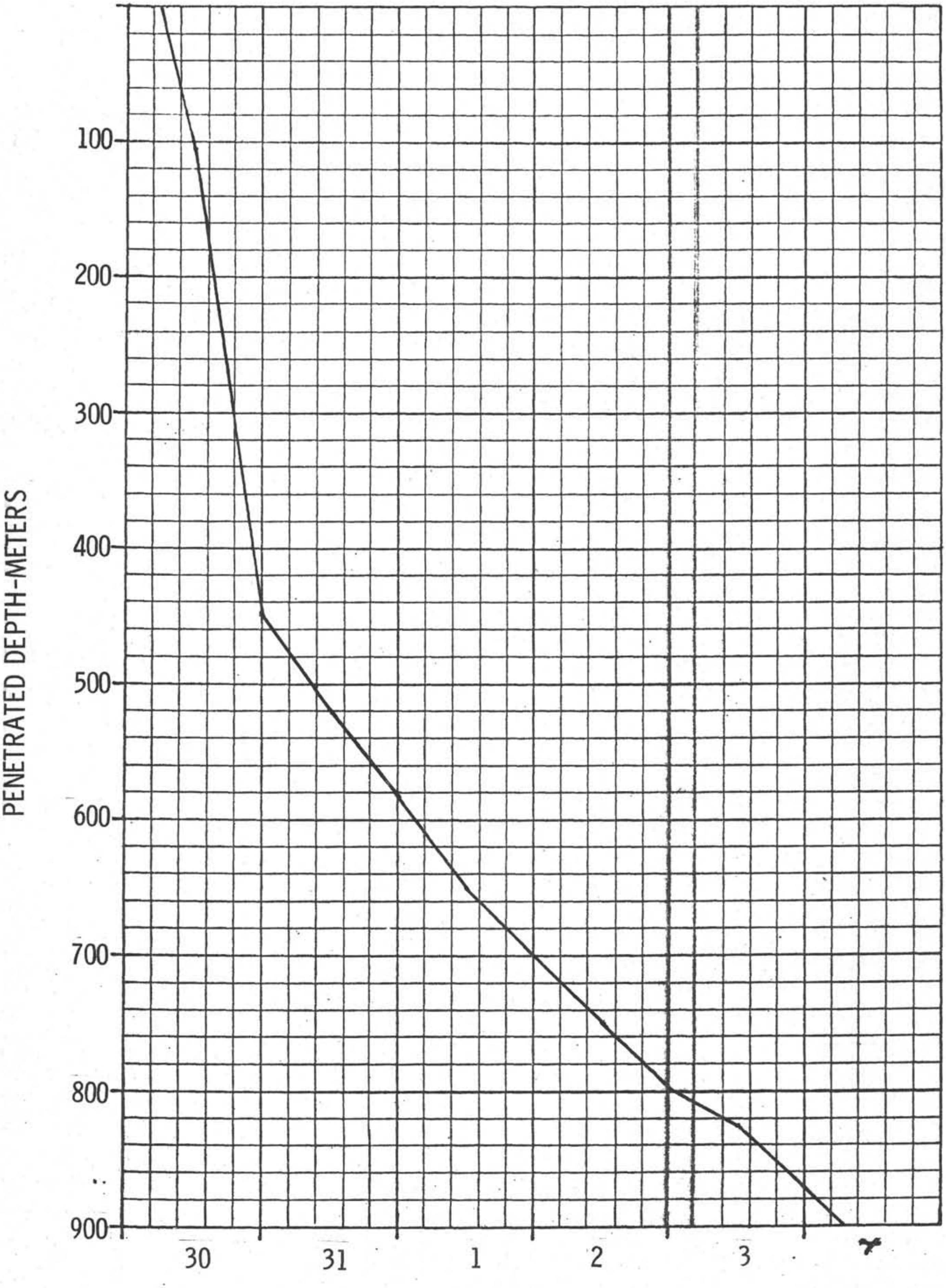
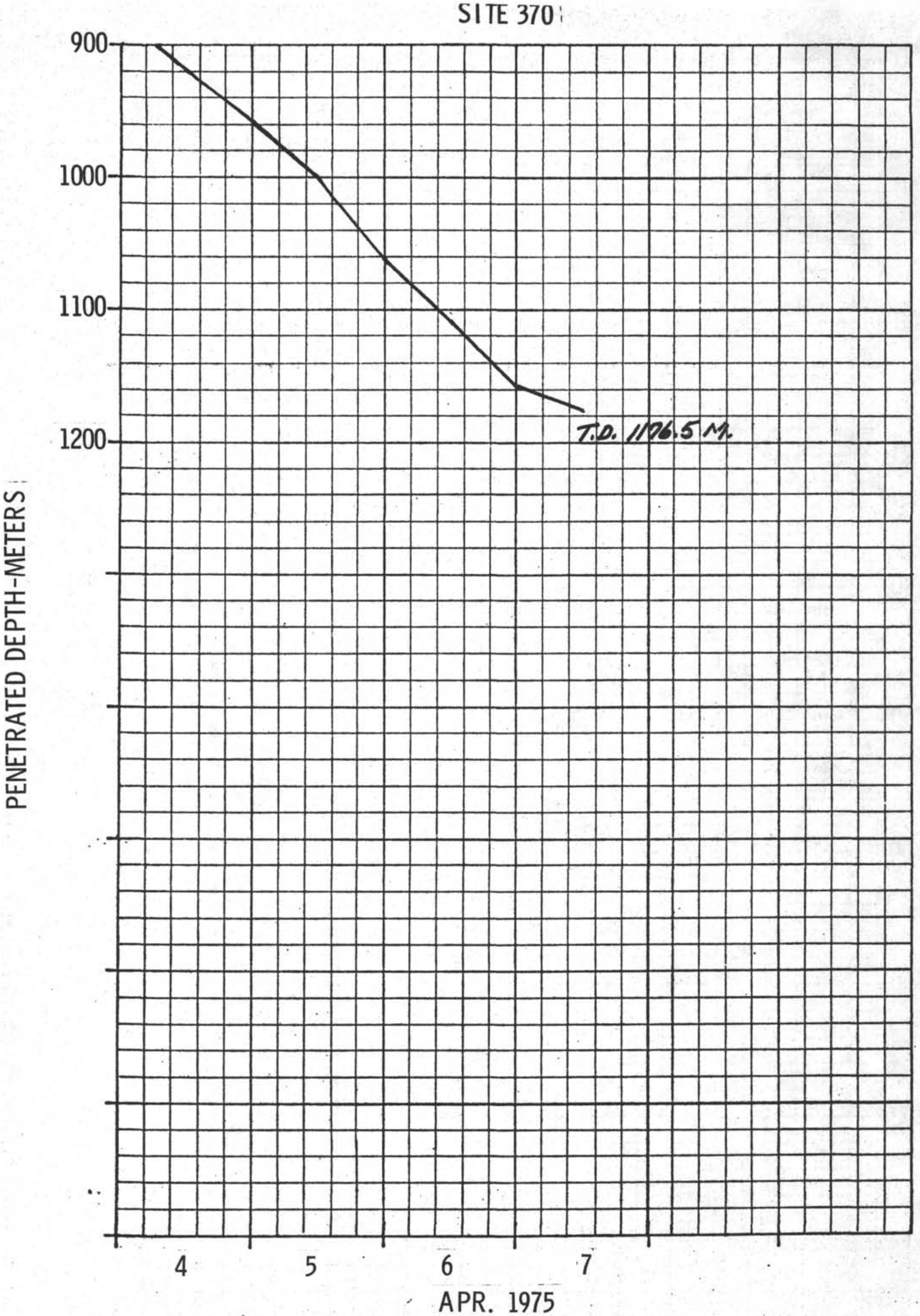
39
40
41
42

SITE 370

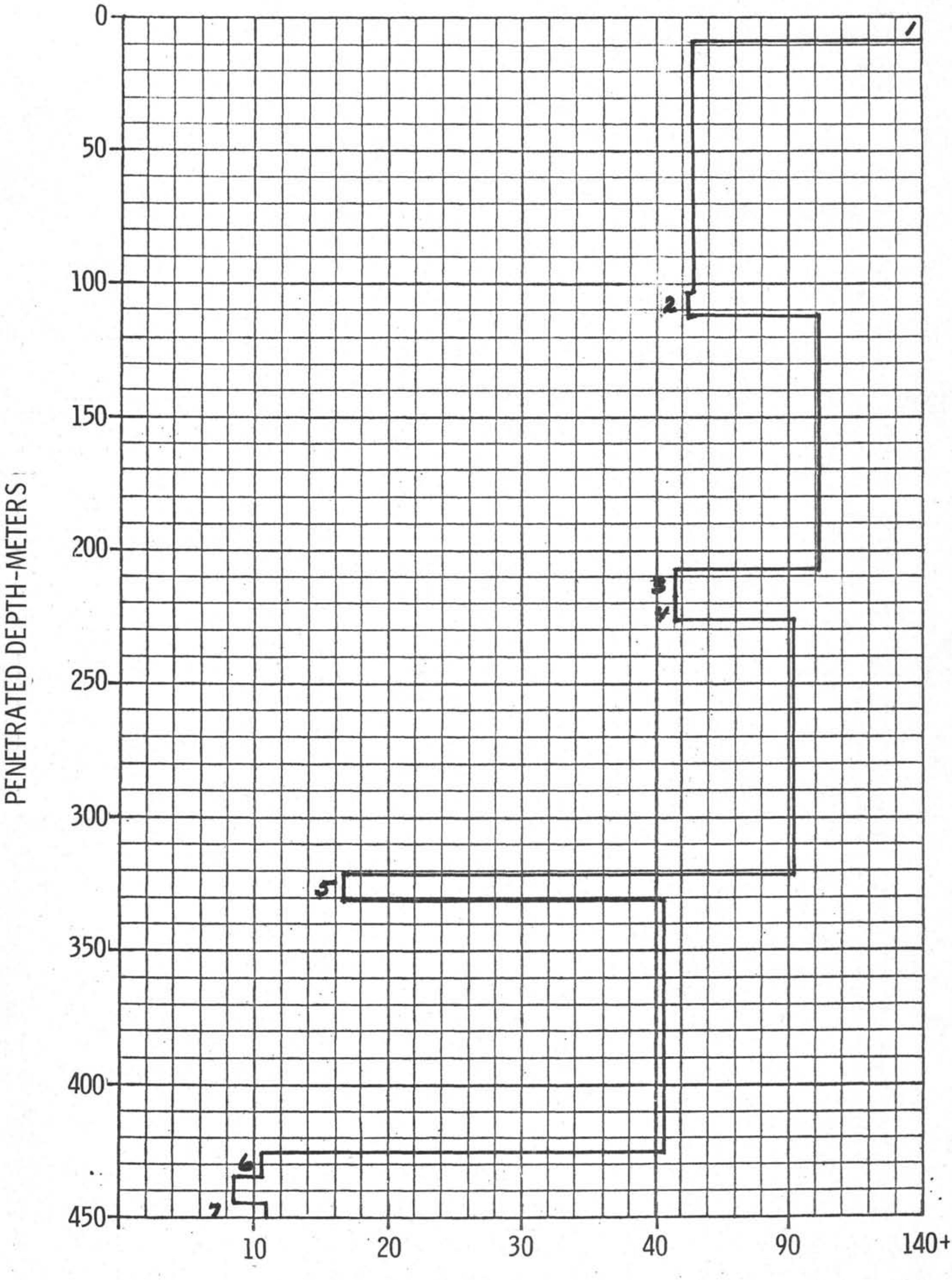


MAR./APR. 1975



SITE 370
900
1000
1100
1200
PENETRATED DEPTH-METERS
T.D. 1176.5 M.
4
5
6
7
APR. 1975

SITE 370



PENETRATED DEPTH-METERS
0
50
100
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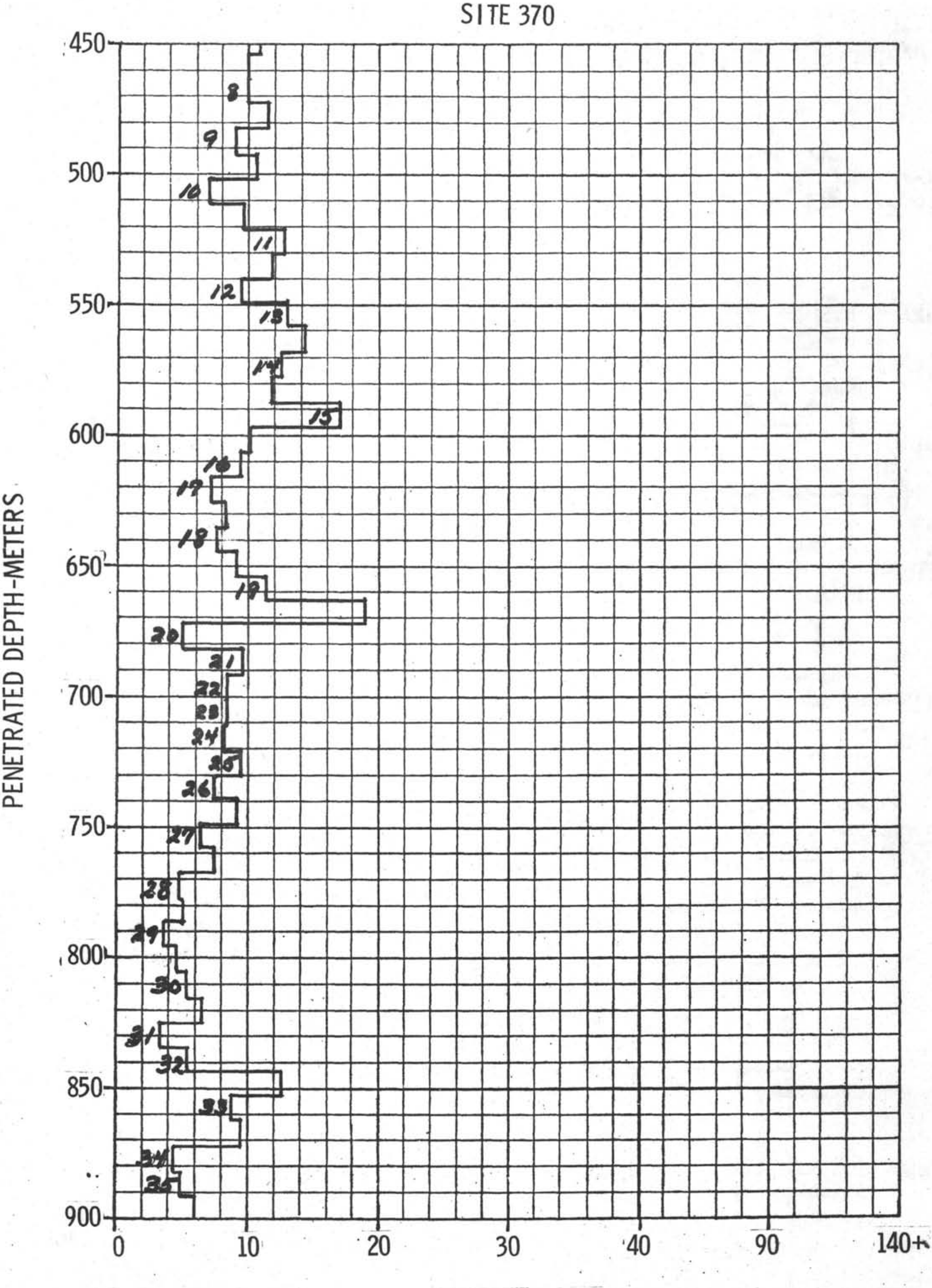
200
250
300
350
400
450
10
20
30
40
90
140+
1
2
3
4
5
6
7
METERS/HOUR


SITE 370
PENETRATED DEPTH-METERS
450
500
550
600
650
700
750
800
850
900
0
10
20
30
40
90
140+
METERS/HOUR
8
9
10
11
12
13
14
15
16
17
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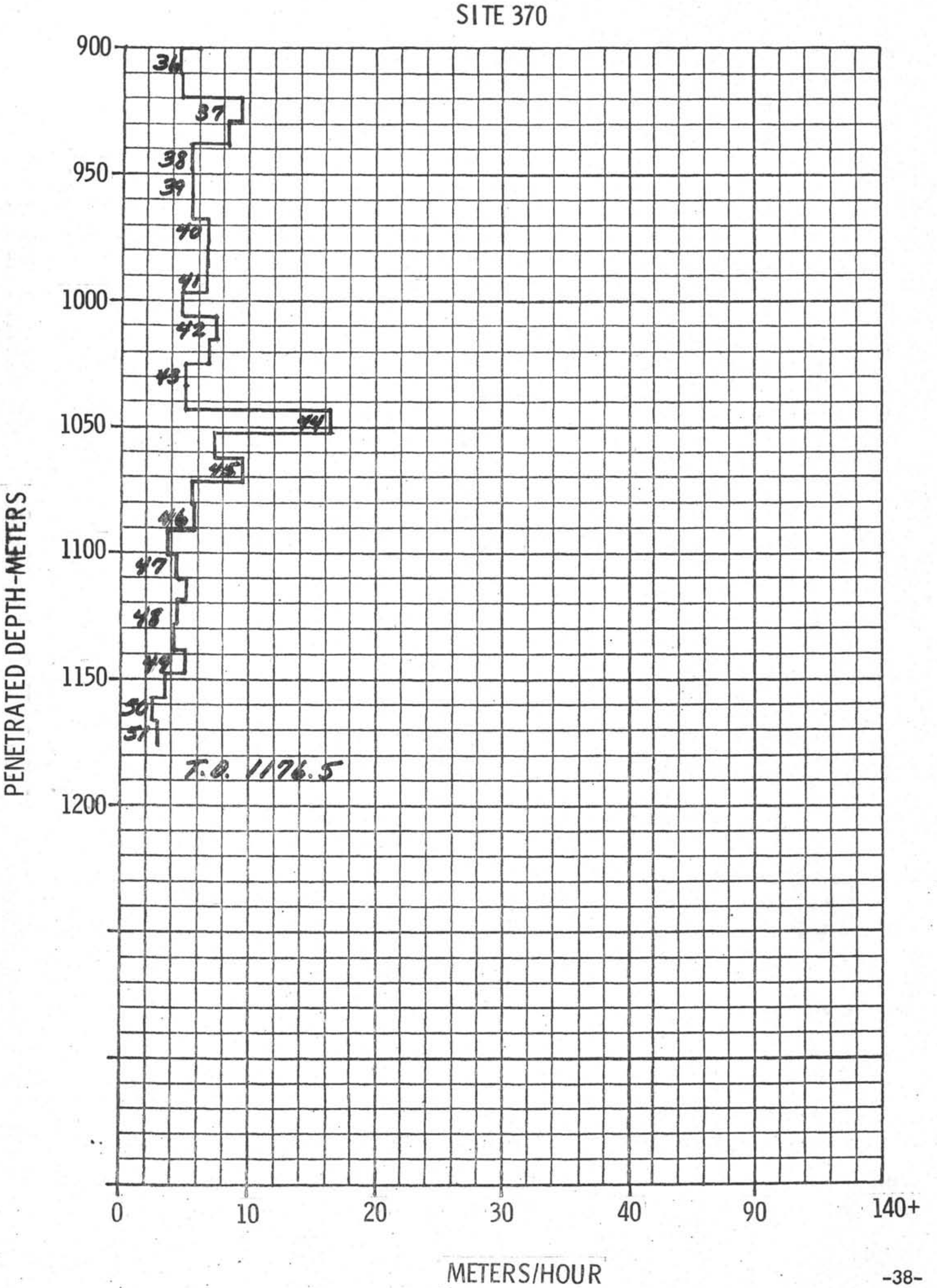

SITE 370
PENETRATED DEPTH-METERS
900
950
1000
1050
1100
1150
1200
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
T.D. 1176.5
0
10
20
30
40
90
140+
METERS/HOUR

DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 42

INTRODUCTION

Leg 42A Mediterranean Sea

Leg 42A comprised a return visit into the Mediterranean Sea to obtain a more comprehensive and detailed cross-section of scientfic data to further develop and resolve the profoundly interesting geological history of the region with its many ramifications.

The operation was significantly rewarding; the analysed and synthesized data will provide an additional incentive in resolving the contending concepts seeking to account for the origin of the evaporites, also known as the 'salinity crisis', and its integration into nature's grand scheme.

Principle results included the first hole to penetrate through the evaporites to confirm that a deep basin existed before the sudden deposition of the evaporites. Leg 13 findings were consolidated in scope, detail and better understanding. It was established that there may have been a significant difference during the Messinian stage between the east, with its great lakes; and west, with its arid deserts. Novel features included drilling into evaporite caverns and, incredibly, lost circulation conditions. An outstandingly successful suite of heat flow measurements also revealed an unexpected gradient change near the sea bed. Reputedly the toughest formation ever encountered during the project, selenitic gypsum, was penetrated.

At the request of the Leg Co-Chief Scientists, an extension of two days was granted, to compensate for a delayed start and reduction of maximum cruising speed (a major crack was found in the starboard main shaft and ground out). Often the sites selected were small seismic target areas, which were a specific feature of the region. This made the task of location pinpointing very arduous.

The exciting natural science of the area is complementary to its legendary classical history and its role in the evolution of civilization, a fact of which we were constantly reminded.

Leg 42B Black Sea

This was the first visit by the CHALLENGER to this unique, virtually land-locked sea with its history of alternating fresh, brackish and marine environments. It now has a variable salinity gradient and stagnant toxic lower water mass containing hydrogen sulphide.

The prime scientific objective was to obtain stratigraphic and biostratigraphic evidence of Pleistocene/Pliocene age with maximum continuity. Other objectives were to obtain evidence of the Paleo-oceanographic history in relation to sea level changes, detailed interactions with the Mediterranean, and identification of the Euxin Sea stagnation cycles.

The Black Sea was shown to contain a unique continuous sedimentary deposition of great value to scientific investigations. Very informative sedimentalogic, geochemical and climatic information was obtained including data on the variable and exceptionally high rate of sedimentation. Hitherto cores of the deepest youngest sediment yet obtained by the Project were recovered. Important geochemical evidence was obtained including assessment of salinity conditions and diffusion rates, and the geochemical evolution of shale gases. Major warm, cold, and three glacial periods were identified from sediment and pollen analyses. An outstandingly successful suite of heat flow measurements was obtained. An attempt at an important very deep hole (380A) was frustrated by active shales heaving and squeezing in on the drill string. Temporary bridging caused the circulating water to hydrofracture the formation and the hole had to be abandoned prematurely.

Leg 42A and 42B

No drilling equipment was lost on either part of the leg. A greater distance was cored on this voyage than ever before on the Project.

PORT CALL OPERATIONS

MALAGA

Principal work accomplished during the port call included:

*Top overhaul and recommissioning No. 12 prime mover.

*Inspection of No. 1 and 2 thruster tunnels, initially delayed by nonsealing muffs.

*Exchange of one circuit breaker.

*Simultaneous general inspections by ABS, USCG.

*Inspection of the motion compensator system and actuation by a service engineer. An assessment of the loss of chrome plating from the compensator main piston rod was made. It will adversely affect operating efficiency.

*A Tuboscope internal sonde inspection of the full drill pipe string produced 8 rejected joints and 9 joints downgraded as suitable only for the lower section of the string (these joints were segregated for inspection by external equipment).

*During a general GMI inspection on 13 May, an extensive well developed crack was discovered on the starboard propeller shaft in a relatively inaccessible position immediately inboard of the stern gland. Considerable effort was necessary to grind out and evaluate the degree of flaw propagation which was nearly 0.5 inches over the full periphery, and to suitably contour for stress relieving purposes. The unremitting efforts of GMI, ABS, USCG and Tuboscope personnel was commendable allowing the GLOMAR CHALLENGER to proceed with minimum delay. Expert advice was obtained to determine the operating stress limits that could be applied.

Efforts were made to locate a spare shaft as the one with which the ship had been originally fitted was no longer aboard. Finally arrangements were made to ship a spare from the United States to the next scheduled port of call.

The starboard propeller develops significantly more wake disturbance than the port one. This was noted during Leg 38 and possibly is caused by eccentricity which induces additional turbulence and cyclic stressing.

Refueling was accomplished at a comparatively low rate. Approximately 200,000 gallons were taken.

Total elapsed time was 94.5 hours (3.9 days), which unfortunately caused a delay in the commencement of Leg operations as three days had been originally scheduled.

ISTANBUL End Leg 42A Beginning Leg 42B

A pilot was taken aboard at the entrance to the Dardenelles for the navigationally difficult journey through the Dardenelles, Sea of Marmara, past Istanbul to the anchorage at Sar-iyer. The anchor was dropped at 1300 hours 21 May, 1975.

The scientific staff was quickly changed. Additional time was however required to clear essential equipment through customs and for the Global staff to handle compassionate matters and complete negotiations with the agents.

Considering that the Port Call arrangements and all other aspects of the matter, had not (after repeated requests) been made known to the Captain prior to arrival, the time required was less than expected.

After taking onboard a pilot, a night time entry was made into the Black Sea. Total elapsed time at Istanbul was 9 hours.

ISTANBUL - End of Leg 42B

The CHALLENGER returned to the Bospherus at 0530 hours on 11 June, collected a pilot and moored at Sar-iyer at 0600 hours.

CRUISING AND NAVIGATING

Cruising and navigating were conducted expeditiously with sound professionalism. There were occasions of exacting navigational requirements, often under relatively congested traffic conditions and with other traffic not adhering to international navigating procedures. These included negotiating the Straits of Messina (a pilot was not available) and threading a passage through the Aegean Islands. A pilot was taken aboard for the transit from the Dardenelles to Istanbul (where passing regulations are contrary to International standards) and also to and from the Black Sea entrance.

Cruising speed was only fractionally retarded due to the power transmitting limitation on the starboard propeller shaft. An engineering review by GMI showed no need to reduce the rating of the shaft.

WEATHER

The weather was excellent during Leg 42A and of ideal conditions for this type of operation.

Towards the end of Leg 42B the weather deteriorated and a moderate gale blew for some 2 1/2 days. Despite this, operations were not adversely affected.

DRILLING AND CORING ASSEMBLY

1. Bottom Hole Assembly (BHA)

   Because of the generally good weather conditions a BHA with 3 Long Stroke Bumper Subs (LSB) was employed to conserve equipment. It was considered satisfactory to leave magnaflux inspection of the connections until the protracted journey to the Azores.

2. Saver Subs

   The Saver Sub was changed twice and a recheck made to confirm hardness of the subs. Several soft subs (not to specifications) had been found in the recent past.

3. Long Stroke Bumper Subs (LSB)

   Routine maintenance was performed. On one sub there was an expected incipient small wash-out on the mandrel after a long period of circulating at 1600 psi. Otherwise performance was excellent.

   It was necessary to check the validity of the LSB thrust data prior to employing the higher pump pressure.

4. Drill Pipe

The drill pipe was internally inspected in Malaga and the downgraded joints segregated.

One joint of drill pipe was bent (approximately 10° chord) while coring at 167 m Below Sea Bottom (BSB) with the BHA buried with the joint of pipe at the mudline (Site 375). Initially this was believed to be due to a malfunction of the crown actuated Martin Decker weight indicator system, which presented the driller with erroneous visual weight information. At this time the positioning system was performing perfectly. Subsequent evidence from the next Site 376 indicated that the principle factor could well have been the sudden penetration of a cavern as the Geology at both sites revealed their presence. This factor, superimposed on a sluggish weight indicator system could well account for the incident as the driller would be virtually unaware of the conditions (The weight indicator system was inspected after the site and recalibrated. There was no significant fault found).

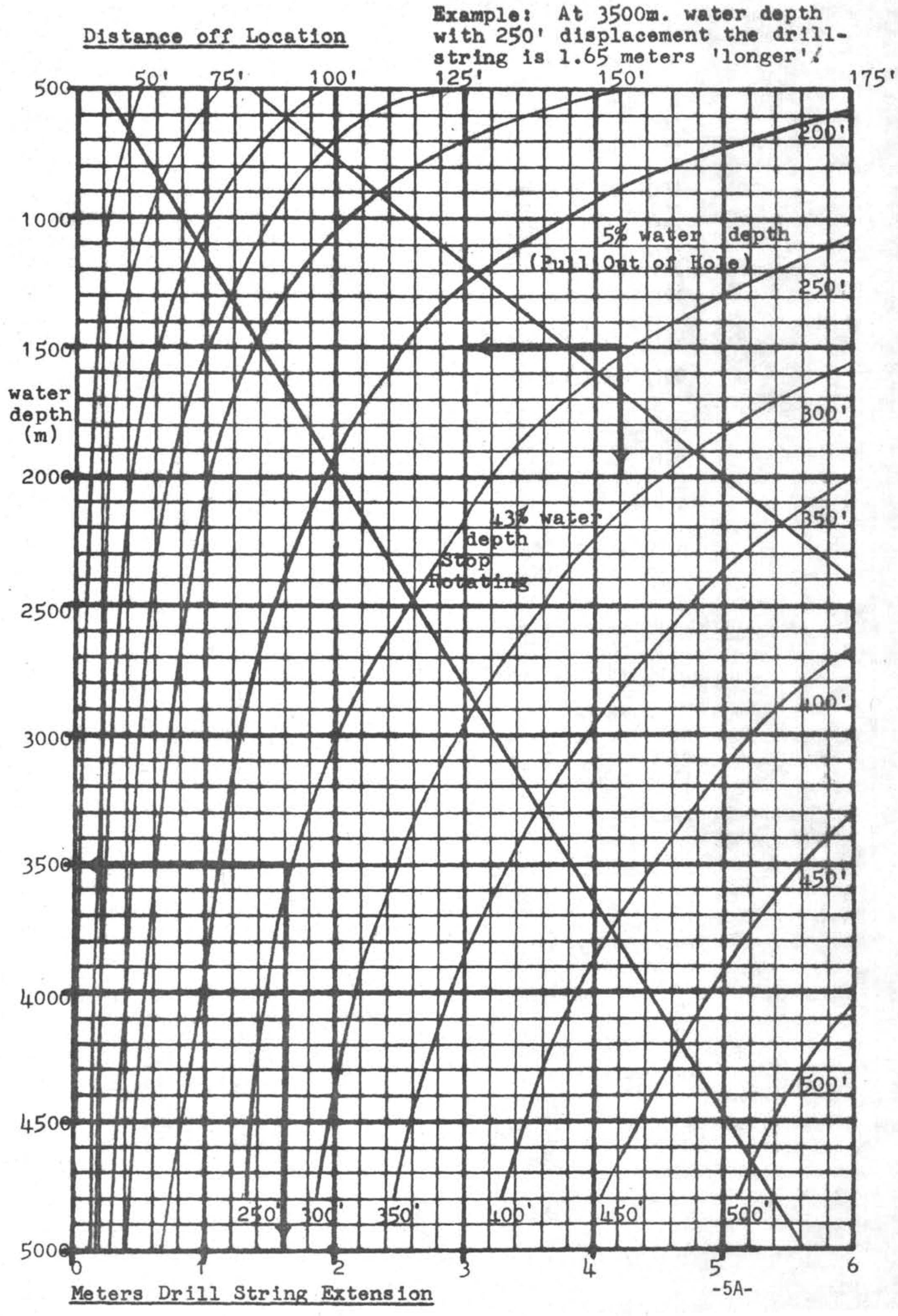
During the 350' off-hole translation at Site 374 the driller had to feed-off the pipe to keep the bit on bottom - some 3.0 m average (water depth 4090 m). This effect is particularly noticeable under slow penetration conditions and calm sea. The present method of estimating apparent increase in string length, by using the tangent angle, is clearly incorrect as the bit would have to be held down on bottom and the drill string tensioned at surface. Initial calculations show that the string configuration approaches a modified chordal angle and an initial graphical aid was prepared (attached). This aspect is not covered in the DSDP No. 4 Technical Report; yet it is important since a better understanding of string behavior is essential for efficiency and string integrity - refer correspondence. Importantly the effect becomes more serious in shallower water.

5. Effect of H_2S

The effect of H_2S in the Black Sea water was manifest in the usual manner by a distinguishing coating of black sulfide deposit on the pipe. Samples were taken for qualitative identification. The pipe 'in use' was rotated with that 'out of use' to provide recouperating time.

A more detailed investigation of the degree of stressing was undertaken and compared with the biaxial conditions covered in the DSDP study. This was considered necessary because triaxial stress values are more relevant to the deleterious effects of H_2S and also because the tension and torque are not static values in a dynamic system.

Superimposed on the deadweight string tension was a load of some 30% from string inertia and elasticity due to the use of LSB on a responsive ship under the sea conditions encountered. Superimposed on the tension is a torque arm tension developed by the eccentricity derived from relative ship movement, (i.e. mean displacement 40', peaks 60'+) this



Distance off Location
Example: At 3500m. water depth with 250' displacement the drill-string is 1.65 meters 'longer'.
50'
75'
100'
125'
150'
175'
200'
250'
300'
350'
400'
450'
500'
5% water depth (Pull Out of Hole)
43% water depth Stop Rotating
water depth (m)
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
250'
300'
350'
400'
450'
500'
0
1
2
3
4
5
6
Meters Drill String Extension

is produced as the string nutates in sympathy. Superimposed on both is the hoop stress from 1600 psi internal pressure; a modest stress but developing the triaxial condition. The majority of the cyclic bending due to roll/pitch is developed at the surface in the non H_2S environment.

Fortunately ships angular and displacement motions, also currents and tides, were of a moderate order and the water was relatively shallow; also there was little down hole H_2S. The maximum resolved stress was estimated at 46,700 psi at 1000 m below sea level in the maximum H_2S zone - which with safety could increase to 65,000 psi for short duration stuck pipe or moderate gale conditions of 5/6 June.

6. <u>Drill Pipe Restraint</u>

Only the horn was employed under the favorable donditions encountered.

7. <u>Severing Tool</u>

Only one correct pig tail electrical connector was available during Leg 42A and this one was retained for a real situation. A test was attempted using a spliced connection which failed.

A correct pig tail was employed on Leg 42B to successfully test the tool and system.

<u>CORING EQUIPMENT AND OPERATIONS</u>

1. <u>Standard Core Barrel</u>

The standard coring system performed well. Only one problem developed when the inner barrel apparently unlatched while coring due to peaning of the latch finger into a release contour. The axial tolerance was then reduced to lessen the impact generated by hard coring. Possibly the latch could be increased in strength for consistently hard coring operations.

2. <u>Coring and Recoveries</u>

Coring and recoveries were adversely affected by a number of different incidents which occurred in addition to the generally difficult donditions described under the site operations. These included loss of station keeping, penetrating caverns, lost circulation, milling up a thermal probe; the heterogeneous and often difficult laminates in particular on Leg 42A; extremely hard selenitic gypsum and sacrifice of recovery for penetration rate. Also on Leg 42B the presence of gas, which evacuated the liner by expansion on the way to surface by extruding the incohesive material through the sock, or propelled the liner contents onto the deck when the material was firmer.

A method of circulating at less than 5 SPM must be made available as recovery is lost with the stop/start pump technique where a small fluid movement is essential to prevent jamming.

3. <u>Side Wall Coring</u>

The equipment functioned well when two side wall cores were successfully cut at Site 374. The first was recovered on the wire line, but the second was not probably because heavy mud was emplaced between the two coring operations and entrained solids jammed the core barrel. In any case, it was free when the string was retrieved to surface.

4. <u>Pressure Core Barrel</u> (PCB)

An evaluation of the performance and suitability of the PCB resulting from the trial tests has been separately covered in detail by B. W. Adams with comments by the undersigned. The PCB was evaluated on 11 separate runs under a cross section of conditions absorbing approximately twelve hours.

By definition an economic tool to perform the twin functions of core and fluids recovery to the surface at ambient bottom hole pressure, and within the constraints imposed by the DSDP coring system, is a formidable engineering task.

An impressive effort has been made to achieve this by good basic design and very careful construction. The tests were effectively engineered, monitored and the equipment fastidiously assembled, operated and examined by Mr. B. W. Adams. In addition he commendably introduced onsite improvements and performed his own design and machining operations.

5. <u>Core Bits</u>

Bits were chosen from the two basically suitable types available, 3 cone long tooth or 4 cone medium tooth, depending upon expected formation conditions, intended penetration, and degree of drilling versus coring.

The 3 cone bits provided the expected superior ROP, but due to the inherent imbalance between tooth and bearing life, it is clear that the 4 cone is superior. Unfortunately the industry supply situation prevented the supply of four cone long tooth type which could have been used to great advantage in this area.

Formation lithification and induration varied widely and included compacted Miocene sediments, basalt, evaporites (tough and resilient) and selenitic gypsum which according to experienced opinion is the toughest material penetrated during the Project.

Due to completely unforeseen circumstances Leg 42A unfortunately terminated with two partially consumed F94CK bits. The first was planned to be rerun in a specific later site which unexpectedly was substituted by a site requiring a F93C bit. In the second instance a new bit was chosen to drill to its maximum limit, but the early penetration of halite enforced premature abandonment for safety reasons.

A special F940P bit was employed at Site 379/379A/379B to allow PCB evaluation tests and was partially consumed. Site 380 was programmed to penetrate to 1000 m, possibly the final Leg 42B hole; for this reason and for further PCB evaluation, it was necessary to use the other special F940P bit.

To prevent premature cone locking the core guides on the 4 cone bits were trimmed.

6. Bit Seal

Although there was an acute shortage of spare parts in the form of correct screws and only one wobble plate 'base plate' it was possible with ingenuity, to employ the seal at Sites 371, 374, 375, 376, 377, and 381, respective number of rotating hours and cores 15.03-8/15.7-24/33.63-13/14.3-23/22.5-24/12-54. At Sites 375 and 377 a pump pressure of 1600 psi was employed during washing and drilling operations for 28.2 and 9.6 hours respectively. Some fluid erosion of the teflon seals occurred.

The seal was not employed at Site 379 because the PCB was to be initially evaluated and it was considered unwise to have two incompletely developed devices employed at the same time.

At Site 380 a 1000 m continuously cored hole was planned requiring some 105 cores and corresponding impacts on the bit seal (previous highest 24 cores with failure of 50% of the securing bolts). Accordingly the seal was not employed to avert an expected failure requiring recovery of the bit. However at Site 387 54 cores were taken after high tensile bolting was installed.

The seal improves recoveries, although this is difficult to quantify, and definitely improves system hydraulics and bit life, particularly when washing and drilling. Some 200/500 psi additional pressure is developed according to pump rate. It can indicate its own state of efficiency by comparison of surface pressure/volume relationships. The upper weld-in plate should be inspected periodically to confirm integrity of the weld.

The advantages of recoveries and hydraulics outweigh the additional friction developed (tending to drive the barrel with the outer rotating barrel) but not always the possibility of mechanical failure, due to impact damage from the core barrel shearing the retaining screws preventing seating of the barrel. The latter can be considerably reduced with a few improvements.

The basic design is excellent; it is well made and it is effective. The improvements proposed are natural development from field experience.

DYNAMIC POSITIONING

1. Position Keeping

Some 2.5 hours were absorbed at the first site, prior to taking up final position, to balance and tune the dynamic positioning control system after the Malaga maintenance. This was a normal situation.

Automatic station keeping was generally good under the favorable weather conditions. Principal malfunctions and causes of control degradation were accounted for by a number of different faults, sometimes acting simultaneously. Some were isolated and corrected by duplicating the beacon. Problems included erroneous input signals, and on a number of occasions, a faulty or drifting reference gyrocompass. An intermittent ground on the hydrophone system electrical supply introduced noise and loss of control. The 16 kHz system also introduced a problem more than once.

At Site 374 a fault caused erratic excursions; a second beacon was dropped to eliminate the problem by a process of elimination. Part of the fault was due to the reference gyrocompass. Subsequently an off-hole translation of some 350' unknowingly developed from a combination of an excursion superimposed upon a displacement introduced during the period when changing beacons with no reference signal. This was reflected in an apparent change in drill pipe length required to keep the bit on bottom. It was observed that the quality of signal improved when the drill pipe was not rotating, possibly due to the close proximity of the beacon to the bore hole.

At Site 372A good positioning was held under a 3100' off-set condition in water depth of 8967'.

Generally the mean error was some 40', a good performance considering the vintage and system complexity and reflects the very good operating, maintenance and repair effort undertaken by GMI.

2. Beacons

More beacons were consumed than expected; the long life beacons were less dependable than the short life. The optimum situation would appear to be to use 16 kHz short life beacons, with 13 kHz back-up, for both short and long duration holes. The 16 kHz appears to provide the better reference cone with depth.

The initial beacon at Site 372 was launched at the wrong place due to a satellite navigation error. The replacement 16 kHz long life beacon failed after 69 hours when it developed an intermittent complete loss of signal for periods of 1 to 10 minutes; it was replaced by a 13.5 kHz beacon. The 16 kHz beacon subsequently recouperated and produced a good signal.

Two beacons were also used at Site 374. The initial 16 kHz beacon developed signal fluctuations.

The short life 16 kHz beacon at Site 380/380A continued to produce a good signal after 199 hours (8.3 days).

The beacons, particularly 16 kHz, appeared to produce a wider cone in the Black Sea possibly due to refraction under the conditions of salinity stratification. When returning to the Site 380 area the beacon was detected unexpectedly early.

HEAT FLOW MEASUREMENTS

A considerable number of successful heat flow measurements were made with indications, on Leg 42A, of unexpected temperature gradient changes adjacent to the sea bed. Due to sediment stability and resilience it was possible to obtain good heat flow record close to the sea bed. On one site a measurement was made at 30 m BSB. On Leg 42B an outstandingly successful suite of heat flow measurements was also obtained.

On three occasions the heat probe was lost and twice it was recovered in the subsequent core. The whole tool was lost in Site 379A and an effort to collect it with the core barrel failed. It was milled up and a section of the outer casing recovered within the core barrel which prevented any recovery, however there was no subsequent hole trouble.

A method to obviate the loss of the tool was devised whereby the catcher fingers were axially rotated 180° to increase the dogging effect. An improved technique was developed with the GMI crews for rapidly and accurately positioning the probe.

The Scripps electrical technician, R. Byrne, very rapidly familiarized himself with the function and operation of the tool to the significant advantage of the heat flow program.

MOTION COMPENSATOR

Due to the very favorable weather conditions the motion compensator was not employed during either Leg 42A or 42B.

SAFETY

1. Hole Safety

Hole safety measures and abandonment precautions are covered at the end of each individual site operations report.

The IMCO fluorescope, delivered at Malaga, proved to be a useful and dependable detecting device as to some extent did the chromatograph brought onboard at Istanbul.

All available methods of hydrocarbon detection and effective surveillance of core material were employed including ethane/methane ratios and means of distinguishing their origin, whether diagenic or otherwise.

For prudence, in the general interests of the Project and in view of the locale, abandonment plugging to a degree higher than that stipulated was emplaced, including a cement plug at Site 376.

The presence of geochemists was invaluable in the interpretation of the type and origin of evolved hydrocarbons, and their derivitives for control purposes. If possible, one should be assigned to every leg. A suitable rapid-acting chromatograph is needed and should be made available.

2. Personnel

The scientific and technical staff were introduced to, and familiarized with the ship's and other safety regulations and procedures.

Prior to the end of Leg 42A the special requirements, to meet the expected H_2S conditions on Leg 42B, were discussed and checked to ensure that a sufficient means of detection and safety equipment would be available, and to identify additional items for delivery to Istanbul prior to Leg 42B.

All personnel were made aware of the inherent dangers associated with H_2S detection, life saving and medical assistance. GMI and the ship's doctor kindly lectured and demonstrated the basics and arranged for breathing apparatus and other life saving equipment that was to be strategically deployed. Action was taken to reverse the direction of ventilation through the core laboratory, eliminate solitary working in potentially hazardous areas, and a check for perforated ear drums. A safety routine was organized, also a rehearsal of a casualty situation.

The degree of H_2S encountered was appreciably less than expected; the main threat became the sometimes violent expulsion of the core from the liner due to the natural expansion of methane on loss of confining pressure.

3. Accidents

There was an unfortunate accident at Site 379 on 25 May, when a newly hired rotary helper fractured his lower left leg. Fortunately it was a normal fracture very ably attended to by the ship's doctor. The cause of the accident was independent of the main drilling equipment and occurred when using hand tools on the inner core barrel. Since more appropriate care and attention was available in Istanbul, and the new Site 380 was within 60 miles, the patient was sent ashore by a small craft on 31 May to the American Hospital.

On 1 June another rotary helper suffered a serious injury to his right hand while stabbing in the wire line overshot. The ship's doctor undertook immediate surgery as necessary while urgent arrangements were made to transport the patient to a hospital in Istanbul. The hole (380) was prematurely abandoned and the drill string recovered so that the CHALLENGER could rendezvous with the Turkish Navy who very kindly on our behalf made the mercy dash to collect and deliver the injured to Istanbul with rewarding results.

4. Pollution

Special arrangements were made in the Black Sea to minimize the chance of coastal pollution due to the circular currents in a virtually land-locked sea. All combustible rubbish was incinerated.

This action was unanimously applauded on board as it is strongly felt that the Project has not met its responsibilities in this respect.

DELAYS

Superimposed on the delayed port call departure and reduced maximum cruising speed were a number of unavoidable equipment malfunctions and accidents. On all occasions diligent efforts were made to rectify problems and reduce delay to a minimum.

Actual down time was caused by a ground fault on a draw works electric motor, replacement of control valves on the Bowen prime mover (hydraulic pump), also power sub and welding of hydraulic pipe leaks. Also by failure of the block line spooler, burst rotary hose, and when the traveling block hit the core and sand line sheaves at the crown.

Other indirect delaying influences included two ruptured fuel lines on the main engines while underway, assignment of electrical power to the Bowen prime mover, activation of the audible warning at the drillers console, position keeping (refer separate section), and installation of power output monitoring devices on the main engines.

COMMUNICATIONS

The equipment performed very well and the main transmitter worked at full power throughout the trip with no difficulty (the corrective actions taken in December, plus the 5 minute delay in applying high voltage, have greatly improved the reliability of the equipment).

The bridge (2-3 MHz) voice radio, although of great value particularly in talking to Istanbul, which has no high frequency voice, was greatly handicapped by frequently being masked by the drilling derrick, thus indicating the need for a second, high powered antenna for 2.35 MHz. A request has been made for this.

Reception of messages by Mercast was particularly trying, due to poor receiving conditions, high transmission speeds by navy stations, poor keying by navy stations (Londonderry and Greece) and the continued failure of Londonderry to reply to requests for repeats. This system is highly unreliable. Commercial operation via radio Rome (IAR) was satisfactory, and Rome was easy to contact. Commercial radio telephone to European nations was good, through Radio Nordeicch (Germany). Commercial radio telephone to the USA, for personal messages, was passable during the early part of voyage but became impossible, due to interference from European stations, after the ship passed the Central Mediterranean. Sending outgoing traffic via the navy, except for the final day, was usually very good, however, many of the navy operators are new, resulting in numerous garbled communications.

It is considered essential that a VHF antenna, with preamplifier, be mounted forward of the derrick so that line of sight contact can be maintained as the vessel approaches a shore station. It is also considered essential that a booster or preamplifier be provided in the forward radar's video output, to overcome the considerable loss in the 400' (plus) run of coaxial cable from the transceiver to the display unit. It is also considered that the bridge display (relative bearing, ships head up) is not fully satisfactory from the standpoint of collision avoidance.

MISCELLANEOUS

The discovery that there was nitrogen in one of the carbon dioxide cylinders delivered at Istanbul fortunately did not cause a serious problem except for unique dispensation of Cola.

COMMENT

The shortness of time between the final site and the port call caused considerable hardship and was hardly necessary as anticipated in the advice to change the site sequence on cancellation of the Catania call.

There was wide diversity of different nationalities amongst the scientists - American, British, French, German, Italian, Lithuanian, Russian, Swiss and Turkish. All settled into their individual and team work with true dedicated professionalism.

There is difficulty adequately expressing the appropriate degree of respect and commendation for all personnel participating in the success of the whole leg. The effort was conscientious, continuous and unstinting; very good working relationships prevailed. This is especially applicable to the technicians who were short of time and to Global Marine who became short of personnel. It was a real and lasting honor to have been involved.

LEG 42A MEDITERRANEAN SEA

SITE 371 - SOUTH BALEARIC BASIN - OPERATIONS

There was no problem locating the site area, however, it was subsequently revealed, from geological evidence, that the beacon was positioned some 2 km from the optimum point. This was due to the relative smallness of the target area coupled with the compressed scale of the shipboard seismic print-outs; both factors probably make positioning most difficult. Accordingly the expected 400 m of sediments was expanded into some 572 m before an evaporite reflector was cored. Towards this point there was a pronounced increase in salinity reaching saturation in the reflector core.

A strategy of intermittent coring was adopted to supply optimum control. Core recoveries were good except for Core 6 (513/518 m) and 7 (522.5/527 m) each of which only recovered a full catcher section. No explanation other than the nature of the formation, coupled with consecutive washing and coring technique, could account for this.

In view of the additional time required to continuously core a minimum of 100 m below the evaporite reflector to reach the basalt; and in particular from the safety aspect; it was decided to terminate the hole.

The hole remained clean during the whole operation and all equipment functioned normally.

There was no indication of hydrocarbons and accordingly the hole was abandoned in the normal manner.

SITE 372 - MENORCA RISE - OPERATIONS

Considerable difficulty was experienced in finally reaching and identifying the site location due to navigating against adverse strong wind and currents.

Initially a 13.5 kHz long life beacon was dropped but subsequent satellite navigation checks revealed that it was necessary to reposition by some three miles, and drop a 16.0 kHz long life beacon. After additional satellite navigation checks, the CHALLENGER was precisely positioned by offsetting some 3100 feet from the second beacon to achieve the important exact geographic and seismic profile co-ordinates.

A long compact 3 cone bit was chosen to produce maximum penetration in the expected long section of progressively more compact sediments.

After running some 2000 meters of pipe, an attempt was made to test the severing tool system by running the tool some 1000 meters. An electrical discontinuity in the detonator connection frustrated the test.

After identifying sea bed at 2734 meters, the hole was washed to 2865.0 meters with control cores at 2846.0/2855.5 and 2865.0/2874.5 meters. The average modest core recoveries of 49.4% were probably due to the technique of washing prior to coring, in the soft sandy material of low cohesive strength.

Continuous coring was adopted from 2874.5 meter to identify the evaporite boundary at 2881 meters resulting in a series of very poor recoveries averaging 4%. Variation of all coring parameters, including proving the effective latching of the core barrel, conclusively revealed that it was a function of the formation. Initially it was due to interspersed bands of friable uncemented sands, and later to the inclusions of fragmentable large calcite crystals which disintegrated into irregular rubble. From the bottom of the evaporites, where interesting interbedded varve formation was encountered, recoveries improved.

After operating satisfactorily for 69 hours, the 16.0 kHz beacon failed and had to be replaced by a 13.5 kHz standard beacon. This accounted for 0.75 hours loss of operating time as rotation had to be stopped during the period of no reference signal for automatic station keeping.

Continuous coring continued from the bottom of the evaporites at 2931 meters to 3140.5 meters, an interval of 209 meters with 167.4 meters recovery (80%).

In the interests of maximum progress, the technique of washing and coring (38 meter intervals) was adopted from Core 30 at 3140 meters. Progress was generally as predicted in the mainly uniform consolidated and competent formation.

It became clear, as expected, that when employing a technique of washing followed immediately by coring in the competent type of formation, that the core was actually cut during the first wash. This was borne out by the relative penetration rates between the first and subsequent joint of pipe after commencing individual wash and core cycles, and corroborated when on one cycle penetration ceased after the first wash and a 100% core recovery was obtained. A slow penetration section at 3575/3595 meters was caused by an horizon of volcanic siltstone.

There were obvious signs of core diameter reduction after Core 44 at 3577.5 meters indicating accelerated bit wear. After Core 45, it was decided to cut a consecutive core during which the string torque requirements indicated incipient bit failure, having rotated in excess of 60 hours. Accordingly the hole was terminated after coring 3.5 meters at 3619.0 meters (in order not to jeopardize the heat flow operation programmed for the offset hole 372A by generating a restriction in the bit throat). Core 46 revealed a core diameter reduced from the normal 6.5 cm to 4.7 cm.

There were no indications of hydrocarbons and the hole was abandoned accordingly. Hole condition remained clean during the whole operation and all drilling equipment generally functioned normally. An electrical fault on one draw-works motor and a replacement valve on the Bowen Sub accounted for 1 3/4 hour delay. The bit was recovered above the mud line at 1430 hours 24 April.

SITE 372A - MENORCA RISE - OPERATIONS

After offsetting 1640 feet from Site 372, the bit was run down and encountered the sea bed at 2734.0 meters.

Hole was washed down to 2838.5 meters where the first of four heat probe measurements was made. Washing down, with subsequent heat flow measurements, was repeated at 2858.5, 2878.5 and finally at 2888.5 meters. The last interval was restricted to 10.0 meters to avoid the possibility of encountering the harder evaporite beds.

There were no indications of hydrocarbons and the hole was abandoned in the normal manner.

Two short delays totaling 1/2 hour were caused by the need to replace two valves on the Bowen prime mover (hydraulic pumps) which failed in rapid succession.

The heat probe operation was expeditiously accomplished and meaningful data was obtained.

SITE 373 - TYRRENIAN SITE M-6 - OPERATIONS

After locating the seismic reference, a 16 kHz beacon was dropped and the CHALLENGER precisely positioned.

A 4 cone medium compact bit was run for penetrating the expected basalt. Very hard sea bed was encountered at 3641 meters DPM - some 29 meters above the sea bed depth indicated by the PDR. No penetration was possible with full circulation and a static load of 10,000 lb. To attempt coring basalt under these conditions would have placed the BHA under unnecessary risk and developed into a protracted operation.

Accordingly the bit was pulled clear of the sea bed and the CHALLENGER was offset 2600 feet to position 373A in a section of sediments capable of completely enveloping the BHA.

There was a short delay after running the bit to bottom when assigning electrical power to the Bowen sub.

SITE 373A - TYRRENIAN SITE M-6 - OPERATIONS

After offsetting 2600 feet from Site 373 onto a location with an expected 140 meters of sediment the sea bed was confirmed with the bit at 3507 meters (PDR 3518 meters).

The hole was washed to 3603.5 meters before cutting an initial core prior to running the heat probe. The reduced recovery of 5.5 meters was due to a combination of washing and because the barrel was dressed with catchers for recovering basalt - the first intended core.

The heat probe runs were efficient and successful with a 19 meter washed interval in between.

Washing was resumed to 3779 meters where slower and rougher penetration indicated the basalt interface. Recovery from initial basalt cores averaged 40% - a recovery rate consistent with the frangible nature of the brecciated basaltic debris.

The technique of alternate drilling and coring was adopted from 3803 meters to 3926.5 to obtain more rapid penetration at the expense of core recovery. The combination of drilling and coring in continuous fragmented basalt with recrystallized sediments, interspersed with bands of very soft material, produced a very low recovery rate of some 10%. Recovery was sacrificed on one core in an effort to obtain a sample of the soft interval for dating purposes.

Also from surface appearances, the core barrel had unseated during Core 9, probably due to the pronounced drilling vibrations from the non-uniform formation oscillating the barrel and peening the release latch - resulting in a completely empty barrel.

It was apparent that the sections of the hard core were lodging and jamming in the core catcher area. The combined slip and finger catcher, employed on one core, produced only a few rounded pebbles.

Although the hole remained clean it was twice necessary to flush settled material from bottom by circulating gel mud.

After coring to 3964.5 meters and dropping the core barrel, it was not possible to regain circulation. This, coupled with some flow back during the connection (due to core material wedging in the float-valve), indicated a plugged BHA. Accordingly the hole was terminated after abortive attempts to clear the obstruction.

On recovery of the BHA to surface the whole of the outer core barrel section was full of reworked basalt cuttings with a smaller quantity of settlings. The bit had one collapsed bearing which allowed the cone to float and no doubt adversely affected true core cutting.

There were no indications of hydrocarbons and the hole was terminated accordingly.

SITE 374 - IONIAN BASIN - OPERATIONS

For this site emphasis was placed on obtaining maximum recovery of cored material from the sediment/evaporite transitional zone. Accordingly a F94CK 4 cone bit was chosen for optimum stability, and the seal unit, which had been conserved for this site, was employed.

The sea bed was contacted at 4090 meters DPM (4088 meters PDR) and the hole washed to 4190.5 meters (100.5 BSB) through sands, and possibly turbidites where Core 1 was cut prior to running the heat probe at 4200.0 meters.

Washing was continued to 4247.0 meters where instantaneous penetration rate indicated a suitable area for a heat flow measurement. A short confirmatory core was cut and the heat probe ran at 4251.5 meters. Subsequently alternate washing, with confirmatory coring, was continued in 47.5 meter cycles to 4394.5 meters (304.5 meters BSB) with heat flow measurements taken at the end of each cycle at 4299.0/4346.5/4394.5 meters. Thus cores were obtained without absorbing additional shiptime.

From 4420.5 meters continuous coring was adopted to evaluate the coring technique prior to coring the vitally required sediment/evaporite interface expected at 385 meters BSB. Core 10 (368.5/379.0 meters BSB) had a poor recovery due to alternate hard and soft banding - with probable incorrect circulation rate to suit the variable requirements including the presence of sands. On Core 11 surface indications did not confirm correct latching of the core barrel; accordingly a short core was cut (378.0/381.5 meters BSB) with 3.5 meters recovery including gypsum; slow penetration was related to lithology.

Short cores were cut as the occasion demanded to either improve recoveries or in an attempt to recover materials radically affecting rate of penetration. From Core 15 (406.5 meters BSB) recoveries significantly decreased in the harder gypsum/dolomite material, particularly in zones of friable large gypsum crystals.

During Core 18 (430 meters BSB) the core barrel check valve unfortunately backed out allowing circulating water to flush out the barrel. Penetration and coring efficiency was also impaired by station keeping problems with occasional off-hole excursions (causing apparent changes in hole depth and adversely affecting weight-on-bit control) culminating in the premature cutting of Core 19.

Core 22 recovered halite. Subsequent cores were cut, hopefully to recover additional halite, but even a short expedited core could not exceed the dissolving rate of the halites and other more soluble salts.

Side wall cores were taken at 4465.0 meters and 4460.5 meters (375.0/370.5 meters BSB), each with 100% recovery, to straddle the interval missed in Core 10.

There were traces of bituminous like materials in the transition zone which had a trace hydrocarbon and pronounced H_2S odor (with slight fluorescence); probably resulting from natural diagenetic processes. Because of this, and the unknown nature of the final two cores, coupled with the preset limit of penetration below the evaporite top, the hole was abandoned and filled with 10.7 lb/gal 90 second viscosity gel fluid.

To identify the cause of erratic station keeping, it became necessary to drop a 13.5 kHz beacon for comparison with the original 16.0 kHz beacon and by a process of elimination attempt to identify the malfunction.

SITE 375 - FLORENCE RISE - OPERATIONS

A long compact journal bearing bit was chosen, for the expected normal hardness sediments, to obtain the maximum rate of penetration for meeting the objective of some 1000 m BSB. If available the ideal choice would have been a 4 cone. The bit seal was used to concentrate the hydraulic power available from the paralleled pumps into jetting action and cleaning the cones and hole - and improving recoveries. At a circulation rate of some 610 USG/MIN the seal accounted for an increase in pressure through the nozzles of 400/500 psi. A surface pressure of 1600 psi provided 300/350 effective hydraulic horse power at the bit.

The sea bed was identified at 1914 meters (1916 PDR) and the bottom hole assembly was buried in relatively firm sediments before cutting Core 1 2051.5/2053.5 meters (137.5/139.5 meters BSB) to identify the unexpectedly hard interval consisting of evaporites which persisted for some 50 meters into the second core (189.5/194.5 BSB).

The subsequent core barrel would not seat and the extended barrel had to be dropped to clear an obstruction in the bit throat due to hard core remnants. An investigatory 3 meter core was immediately cut to confirm correct functioning.

Drilling and coring continued in generally unexpectedly hard and compact sediments; other sediments included volcanic sands and turbidites.

At 2707 meters (Core 12 792/793 meters BSB) hole fill was detected which was dispersed with gel mud. From 793.0 meters BSB to final depth at 821.5 meters the string was inclined to torque up due to a combination of hole fill and deterioration of the bit. A further two slugs of mud were necessary over this interval. A final 'snap' 3 meters core was cut which fortunately recovered 0.7 meters of material only 1 inch diameter.

Considering the unexpected hardness of the formation, from an early depth, the total penetration was greater than expected, probably the improved hydraulics and bit seal assisted in extending bit performance. Very good penetration rate was obtained in the near normal hardness material.

A small amount of natural methane and trace H_2S appeared and subsequently, disappeared over the expected, and previously experienced depth range, of 150/400 meters BSB. The ethane/methane ratio peak points were never less than 1:1000 and correspondingly increased with depth over the 150/400 meter interval. Under the prevailing conditions, and according to the safety panel's recommendation it was not necessary to emplace an abandonment plug. However, in the Project's general interests 100 barrels of heavy mud were emplaced from 100 to 400 meters BSB.

A delay of 4 1/2 hours was caused when replacing the kelly hose (which burst at 1600 psi, although rated at 5000 psi working pressure; an event consistent with its 3 1/2 years of service). The pipe was pulled back during the repair and the hole remained clean.

It was subsequently discovered after recovering the drillstring that a joint of drillpipe had been bent while coring at 167.0 meters BSB. At the time this was attributed either to a temporary malfunction of the crown actuated weight indicator, or off hole displacement, or some unexpected string/down hole condition. Subsequent investigations showed that station keeping had been excellent and the weight indicator system had no serious defect. Subsequent evidence from Site 376 revealed the very likely presence of caverns, which would also apply at Site 375, this could have been the unexpected disturbing influence causing apparent string length discrepancies and making conditions very difficult for the driller who would expect string length variations to only occur due to combinations of weight on bit, long stroke bumper sub travel, vessel heave, and off hole translation.

SITE 376 - EDGE ANTALYA BASIN - OPERATIONS

The short move from Site 375 was expeditiously accomplished. A F94CK bit was chosen, and a seal employed, for versatility and optimum recoveries.

The sea bed was encountered at 2117 meters DPM (2129.0 meters PDR); penetration was very slow through the exceptionally resistant sea bed crust. Continuous coring was adopted with heat flow measurements at 2143.5 and 2172.0 meters. The unusual resiliance of the near sea bed sediments allowed motionless heat flow measurements to be taken at this shallow depth of 26.5 and 55.0 meters BSB with correct down weight and without bit movement.

Coring continued with further heat flow measurements at 2191.0/2219.5 and 2248.9 meters (83.5/102.5/131.0 meters BSB). All were successful; and the last three had the unique distinction of apparently revealing a reversing function affecting the normal temperature gradient.

Core recoveries were disappointing and were directly caused by the heterogeneous 'banded' sediments which alternately required no circulation or continuous circulation. The result was either core jamming in the catcher, preventing recovery, or complete dispersion of the sandlike incohesive material.

From 134 meters BSB where evaporites (gypsum) were identified, recoveries were again disappointing due to the granulated material collapsing when disturbed and wetted. At 181.0 meters BSB progress, coring or washing, abruptly stopped irrespective of a combination of weight, rotation or circulation; this was attributed to extremely tough selenitic gypsum. By eventually finding a specific weight and circulation rate it was possible to make progress with the bumper subs at the almost collapsed point generating a safe resonnance jarring impact on the bit. This section was more difficult to penetrate than the toughest basalt hitherto encountered. A slug of viscous mud was circulated to clear tough cuttings and core remnants. (Washing was not undertaken for more than 7.5 consecutive meters without obtaining control core data).

From 192.0 meters BSB halite was unexpectedly encountered and fortunately recovered. Shortly after this depth, the pump output (20/25 SPM) and surface pressure indicated that there was little or no pressure drop in the system. Checks were made to decide whether an extensive wash-out was occurring, but there was no evidence to support this. Other mechanisms accounting for this behavior could have been the very unlikely upward flow of fluid in the annulus originating from bottom; or a loss of fluid into leached halite caverns (considered very likely by the geologists), which were linked allowing lateral movement of fluid at a lower pressure than the annulus back pressure. This effect coupled with normal head of circulating fluid between the stand pipe and sea level (some 40 psi) probably accounted for observed reduction in the normal 75/100 psi pumping pressure.

The hole was abandoned at 2333.5 meters (216.5 meters BSB) due to the radical change to halite.

There was a faint odor of hydrocarbon masked by a pungent acrid odor (not previously encountered) in the final core, but with only pin points of flourescence - possibly emanating from coarse gypsum crystals in the halite. Tests were made by the CHN Analyser which, detected organic carbon tentatively assessed at 1% by weight.

There was no evidence of the normal quantities of natural methane from any of the cores.

It was considered prudent to emplace a neat 40 barrel cement plug from 2303.0 meters to 2187.0 meters and heavy mud to the sea bed for the following reasons: the unexpected geological sequences encountered; the reduction in degree of control by lack of recoveries; because halite or other salts were penetrated (with little recovery including one complete core which indicated dissolution) to a distance approaching the implicit limit imposed by the Safety Panel; the unexplained reduction in circulating pressure requirements; and the shallowness of the hole.

Inspection of the recovered drillstring revealed the beginning of a small natural wash-out on one long stroke bumper sub and some loss of sealing efficiency in the bit seal. Neither of these put together could explain the behavior in the circulating system, which included wire-drawing and pump hammer when chasing down the core barrel at normal pump rate (the water ends of both pumps were opened and found to be in efficient order). Thus all evidence confirms the suspected and unique condition of 'lost circulation' under 2117 meters of water which is corroborated by the geological prediction and subsequent evidence.

SITE 377 - CLEFT IN MEDITERRANEAN RIDGE - OPERATIONS

Site 377 was located in the area of Site 126 (Leg 13) with the object of penetrating the maximum depth into the formation beneath the unconsolidated sediments which filled the original canyon. Accordingly a long tooth F93C bit was chosen for maximum penetration rate, and the bit seal employed to improve bit life and hydraulics.

Soft sea bed was encountered at 3719 meters (3728 PDR) and hole washed to 161 meters BSB where there was a distinct change to a more consolidated formation. Washing, with short 'spot' coring, for geological control, was undertaken until the penetration rate, in the increasingly lithified and indurated formation, determined that the remaining leg time available could be absorbed more profitably at an alternative site.

A total depth of 3982.0 meters (263.0 meters BSB) was reached. There were no indications of methane or hydrocarbons and the hole was abandoned accordingly.

During the positioning operation one of the 16 kHz interface circuits between one hydrophone and the computer failed. The decision was taken to continue operations with three hydrophones in the knowledge that a 13.5 kHz beacon could be subsequently employed with four hydrophones available.

SITE 378/378A - CRETAN BASIN - OPERATIONS

Since this last site of Leg 42A was of a limited duration it was decided to re-run the long tooth bit and penetrate to the evaporite horizon as rapidly as possible with the object of redrilling and coring the upper section within the time limit available.

The sea bed was encountered at 1845 meters DPM (1851 meters PDR) and hole washed through soft sediments to 1929.0 meters. Thereafter rapid washing and coring was adopted to 2157.0 meters (312.0 meters BSB) where dolomitic evaporite was identified.

Recoveries were low due to the rapid wash/core technique and the adhesive waxy nature of the relatively soft sediments. On one occasion the fingers of a soft core catcher were bent backwards in the opposite direction to normal, and often the catcher dogs were plastered into the collapsed position. It was impossible to adjust the circulation rate to produce better recoveries.

Successful heat flows were run at 1967.0 and 2071.5 meters; the probe was lost on the second one without affecting operations.

Site 378A

The bit was recovered to sea bed and respudded without offsetting. Cores were cut at 1891.0 meters and at 2147.0 meters where a successful heat probe was run.

Washing and coring was adopted from this depth, for additional information until it became necessary to abandon the site for the cruise to Istanbul.

Coring was slow through the selenitic gypsum and recoveries were consistent with the frangible nature of the evaporites. There was positive indication of lost circulation over one interval in the gypsum.

There was no evidence of methane or hydrocarbons in either 378 or 378A. The site was abandoned in the normal manner. A 100 barrel heavy mud plug was emplaced in 378A because of the lost circulation condition.

LEG 42B BLACK SEA

SITE 379 - EUXINE ABYSSAL PLAIN - OPERATIONS

The special 10 inch F940P core bit designed for the pressure core barrel (PCB) was used. After running pipe to 880 meters the PCB was dropped for an initial evaluation and functional test which proved successful as fluid was recovered to surface at 1200 psi (hydrostatic pressure at this depth in a variable density gradient was estimated at 1271 psi).

Sea bed was encountered at 2171.0 meters (2175 PDR) and a 7 meter punch core taken with the PCB, 4 meter (57%) core was recovered. Pressure in the barrel was 1300 psi compared with the theoretical ambient hydrostatic of 3141 psi. Some pressure may have been lost because the PCB isolating ball valve was employed to cut the core - possibly leaving a trace of detritus on the sealing surfaces.

The core was left in the barrel for a suitable period while the pressure was sequentially bled down in stages to detect hydrates which did not appear to be present.

The hole was abandoned at 2178.0 meters, 7.0 meters BSB.

SITE 379A - EUXINE ABYSSAL PLAIN - OPERATIONS

Site 379A was spudded, without offsetting, and continuous coring was adopted from sea bed.

The first 60 meters of sediment was unconsolidated ooze which generally was extended and lost through the plastic sock enroute to surface as the entrained gas correspondingly expanded with reduction in constraining pressure. Liners showed evidence of having originally been filled with core.

Increased consolidation with depth allowed improved recoveries. From 300 meters expanding gas often ejected the core from the liner when breaking off the catcher sub - this accounted for a general loss of recovery although steps were taken to dampen the action, and for safety reasons, by the use of a canvas screen.

The pressure core barrel (PCB) was run on three occasions for evaluation purposes (covered in a separate report).

Heat flow measurements were made at 45.0/92.5/149.5/197.0/244.5/292.5/339.5/425.0/ and at TD 624.5 meters BSB with good results. On one occasion the probe was broken off and recovered in the subsequent core. During a run at 406.0 meters the whole unit became detached from the core catcher and was left in the hole. An attempt to retrieve it with the subsequent core failed and it had to be milled up. A portion of the case was recovered (zero core recovery).

Methane, with trace ethane (10,000:1 peak 2500:1) was generally present from the sea bed occasionally in volumes sufficient to propel the core from the liner. Continuous analyses of methane, and other checks, showed that there was no evidence of higher hydrocarbons. Heat flow measurements showed normal temperatures. There was a faint trace of H_2S in one core. The hole was abandoned and filled from TD to sea bed with heavy gel mud.

SITE 379B - EUXINE ABYSSAL PLAIN - OPERATIONS

The bit was pulled above the sea bed and the severing tool successfully tested while offsetting (200 feet, 105° true) from 379A.

Sea bed was encountered at 2171.0 meters, cores were cut at specific depths for geochemical reasons to a total depth of 2330.0 meters (159.0 meters BSB). Core recovery was lost due to gas expansion extruding the core through catcher and sock.

Heat probes were run at 2206.5 and 2330.0 meters.

Methane, with trace ethane was present from the sea bed. There was no evidence of higher hydrocarbons. The hole was abandoned and filled with heavy gel mud.

A delay of 5 1/2 hours was caused when the traveling block hit the core line fair-lead sheaves at the crown which had to be replaced and the core line resocketed.

SITE 380 - BASIN APRON OFF BOSPORUS - OPERATIONS

In view of the expected deep penetration (1000 meters plus) and for further PCB evaluation tests a new F94 special bit was employed. The bit seal was not used as continuous coring would require some 105 core barrels dropped which was considered to be beyond the capacity of the current design.

Sea bed was located at 2115.0 meters DPM (2117.0 meters PDR) and an initial 8 meter evaluation punch core taken with the PCB with 100% recovery of the sea bed interface material.

Continuous coring was undertaken from surface. Recoveries were poor, as expected, through the section where some circulation was required but at minimum pump strokes the core material disintegrated. Also expanding entrained gas ejected the core through the catcher and sock.

From 2362.0 meters (247.0 BSB) the quantity of core recovered was sacrificed in the interest of quality and to mitigate core disturbance and contamination for important geological analysis. The circulation rate was increased beyond the maximum necessary for optimum recovery to keep the bottom of the hole clear of cuttings (apparently the required low circulation rate and non-mud making characteristic of the sediment produced insufficient cutting clearing capability). The emphasis remained on quality not quantity of core.

At 0430 hours on 1 June, a decision was taken to cease operations forthwith so that an injured floor man could be taken to Istanbul for urgent medical attention to his right hand. The pipe pulled while concurrently attempting to arrange alternative emergency transport to Istanbul.

Good heat flow measurements were recorded at 2181.5/2257.5/2333.5/2409.5 meters.

The PCB was twice run for further evaluation testing which is separately reported.

Rotation was stopped for a short period on 30 May, when a displacement occurred while returning the CHALLENGER to the optimum heading for wind and sea after having held a broadside attitude to create a leeward calm area (for the small craft sent to collect the first injured floorman who broke his lower left leg).

There was diagenetic methane, with a high ratio of ethane, present from the outset. At 2466 meters there was a faint odor of bituminous material in the core with a faint trace of flourescence; this disappeared in the subsequent core. There was no evidence of higher hydrocarbons. Due to the circumstances and locale, the hole was filled with heavy gel mud.

The site was vacated at 0830 hours and the CHALLENGER made full speed to rendezvous with a Turkish naval MTB which kindly made the mercy trip on our behalf to rapidly transport the patient to a hospital in Istanbul.

SITE 380A - BASIN APRON OFF BOSPHORUS - OPERATIONS

The CHALLENGER returned to the vicinity of Site 380 and repositioned 100 feet S and 100 feet E of the original beacon.

The hole was washed and drilled with the same bit and BHA to 332.5 meters BSB with heat flows recorded at 2219.5 and 2286.0 meters.

Continuous coring was adopted from this depth to final depth at 3188.5 meters (1073.5 meters BSB) with heat flow measurements at 2485.5/2580.5 meters.

From 2870.0 meters it was occasionally necessary to circulate slugs of gel mud to purge the hole of sloughed and possibly heaving immature shales and cuttings. At approximately 3115 meters (1000 meters BSB) the circulating pressure, while coring, gradually increased - although the pump output remained relatively fixed; the hole was flushed with high volumes of sea water, and gel slugs, without any improvement. The surface pressure at high circulating rates, was only fractionally more than the pressure at low circulating rates; also a static pressure in excess of 500 psi developed when the pump was stopped. These two factors, plus extra torque requirements, and surface evidence that the uphole shales could be expanding, due to both hydration and osmosis, indicated that the hole was becoming grossly under-gauged over a significant interval and that the circulating fluid was being pumped into the low fracture strength formation. Accordingly, it was decided to discontinue operations forthwith because of the risk of stuck pipe (the very highly polished state of the recovered pipe confirmed the down hole conditions).

The pressure core barrel was twice run at 2703.5/3017.5 meters with low recoveries at low pressures (separately reported).

The methane/ethane ratios fluctuated continuously occasionally reaching a low value of 570/600:1. There was no evidence of heavy hydrocarbons. The hole was completely filled, in stages, with heavy gel mud.

Rotation was stopped twice due to off-hole excursions in blustery weather. There was a short delay prior to spudding-in due to a fault in the positioning system. On the 4th it was necessary to change the ship's heading 180° to face into a moderate gale condition.

SITE 381 - BASIN APRON OFF BOSPHORUS - OPERATIONS

The partially used special F94 bit was employed to allow further testing of the PCB.

Sea bed was located at 1750.5 meters (1738.0 PDR) and hole was continuously cored from sea bed to final depth at 2254.0 meters (503.5 meters BSB).

From 1995.0 meters there were positive indications of uphole formation squeezing in on the drill string inducing fluid to be hydrofractured into the formation between this point and the bit. A back pressure developed with the pump shut down, torque increased and pipe drag persisted until the undispersed cuttings could be cleared away. Gel mud slugs and copius flushings cleared away cuttings and hole conditions improved. Providing the cuttings could be converted into a 'suspension' the hole remained clean - providing the pipe was frequently reciprocated.

Between 2102.0 and 2187.0 meters (351.5/437.0 meters BSB) the average rate of recovery dropped from 62.5% to 10% as interbedded sands and lithified formation was penetrated. It became necessary to employ the center bit to clear bottom hole rubble. Core was also lost above and below this interval due to gaseous extrusion of cored material from the liner.

Heat flows were recorded at 1836.0/1931.0/1950.0/2225.5; the PCB was employed to cut a 4.5 meter core at 1945.5 meters with 0.15 meter recovery at negligible pressure.

Since the location was not one scrutinized by the safety panel, all safety controls were rigidly applied. Methane/ethane ratios remained above 1250:1; there was no evidence of higher hydrocarbons. The hole was abandoned by filling with heavy gel mud.

DEEP SEA DRILLING PROJECT

SUMMARY OF OPERATIONS

LEGS 42A AND 42B

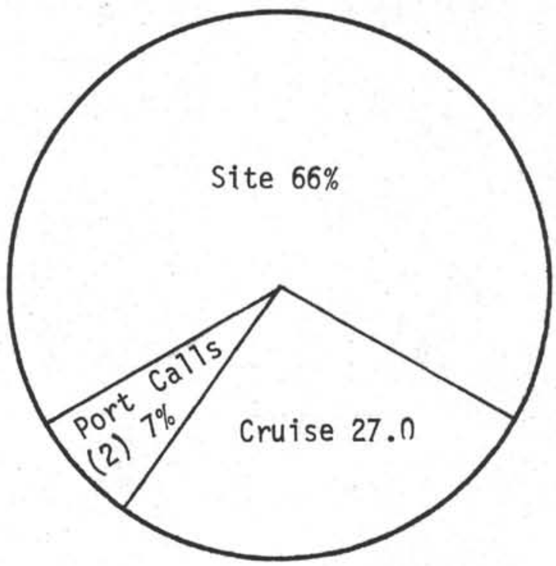
	42A	42B	42A/B
Total Days On Leg	41.15	20.75	61.90
Total Days In Port	3.94	0.37	4.31
Total Days Cruising*	12.73	4.00	16.73

	42A	42B	42A/B
Trip Time	7.29	1.55	88.40
Drilling Time	6.03	2.15	8.18
Coring Time	8.78	10.42	19.20
Mechanical Downtime	0.30	0.23	0.53
Waiting on Weather	-	-	-
Other Miscellaneous Time	2.07	2.02	4.09

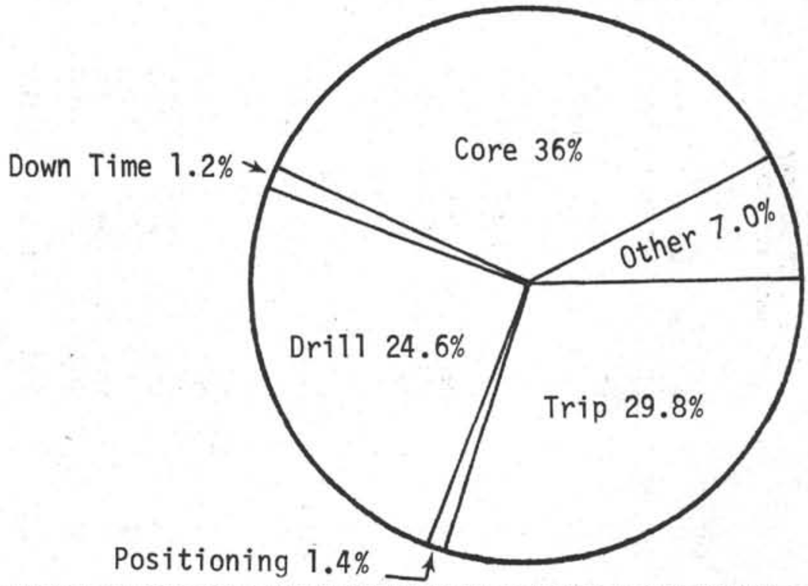
	42A	42B	42A/B
Total Distance Traveled (Nautical Miles)	3217.00	793.00	4010.00
Average Speed (Knots)	8.78	8 29	8.53
Sites Drilled	8.00	3.00	11.00
Holes Drilled	11.00	6.00	17.00
Number of Cores Attempted	150.00	251.00	401.00
Number of Cores With Recovery	144.00	242.00	386.00
Percent of Cores With Recovery	96.00	96.40	96.20
Total Meters Cored	1192.20	2318.00	3510.20
Total Meters Recovered	670.20	1274.80	1945.00
Percent Recovery	56.20	55.00	55.40
Total Meters Drilled	3269.30	420.00	3689.30
Total Meters Penetration	4461.50	2738.00	7199.50
Percent of Penetration Cored	26.72	84.70	48.80
Maximum Penetration Meters	885.00	1073.50	1073.50
Minimum Penetration Meters	154.50	0.00	0.00
Maximum Water Depth Meters	4090.00	2171.00	4090.00
Minimum Water Depth Meters	1845.00	1750.50	1750.50

*Total cruising days includes surveys before dropping beacon and 5 hr. mercy trip.

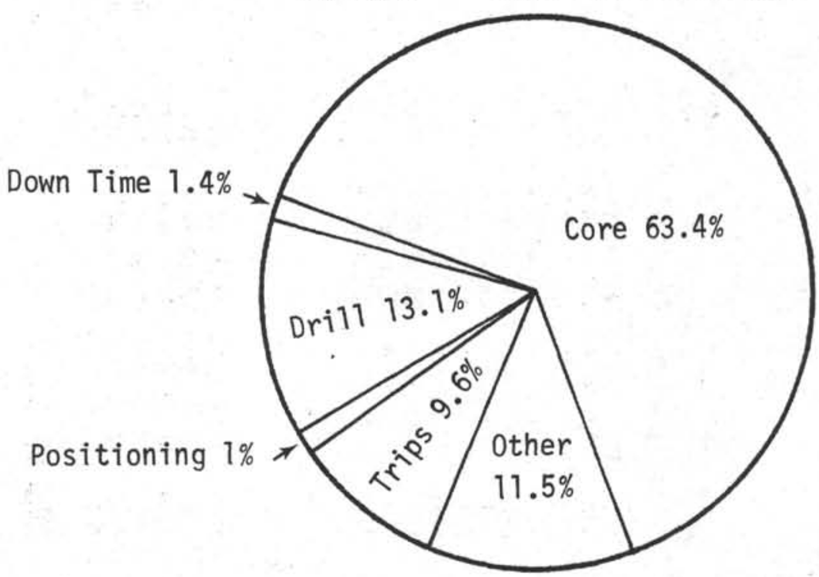
LEG 42A/B TOTAL TIME BREAKDOWN



LEG 42A SITE TIME BREAKDOWN



LEG 42B SITE TIME BREAKDOWN



DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEGS 42A AND 42B

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 hr.	Time on Site hr.
371	37°35.88'N	05°15.55'E	2808	8	8	100.0	62.0	43.3	69.8	489.0	551.0	36.6	46.0	46.0
372	40°01.86'N	04°47.79'E	2734	46	46	100.0	431.0	315.9	73.3	454.0	885.0	14.7	125.5	-
372A	40°01.90'N	04°47.79'E	2734	-	-	-	-	-	-	154.5	154.5	142.6	14.0	139.5
373	39°43.67'N	12°59.00'E	3461	-	-	-	-	-	-	-	-	-	8.0	-
373A	39°43.68'N	12°59.56'E	3507	12	11	92.0	114.0	27.5	24.1	343.5	457.5	35.7	43.5	51.5
374	35°50.87'N	18°11.78'E	4090	24	22	92.0	153.5	77.2	50.3	303.5	457.0	29.1	76.0	76.0
375	34°45.74'N	31°45.58'E	1914	13	13	100.0	73.0	66.9	91.6	748.5	821.0	24.4	74.0	74.0
376	34°52.32'N	31°48.45'E	2117	23	22	95.6	202.5	76.4	37.7	14.0	216.5	15.1	50.0	50.0
377	35°09.24'N	21°25.85'E	3719	4	4	100.0	10.0	8.2	82.0	253.0	263.0	21.0	32.5	32.5
378	35°56.67'N	25°06.97'E	1845	11	11	100.0	99.7	33.5	33.6	212.3	312.0	117.7	18.5	-
378A	35°56.67'N	25°06.97'E	1845	9	7	78.0	46.5	21.3	45.8	297.0	343.5	45.3	20.0	38.5
TOTAL END 42A				150.0	144.0	96.0	1192.2	670.2	56.2	3269.3	4461.5	25.4		
379	43°00.29'N	36°00.68'E	2171	1	1	100.0	7.0	4.0	57.0	-	7.0	140.0	7.0	-
379A	43°00.29'N	36°00.68'E	2171	68	64	94.1	622.0	381.0	61.3	2.5	624.5	36.7	89.0	-
379B	43°00.29'N	36°00.68'E	2171	9	8	89.0	80.5	29.3	36.4	78.5	159.0	73.9	23.5	119.5
380	42°05.98'N	29°36.90'E	2115	40	39	97.5	370.5	169.5	45.7	-	370.5	42.8	57.8	-
380A	42°05.94'N	29°36.82'E	2115	79	77	97.5	734.5	421.5	57.4	339.0	1073.5	27.7	141.5	199.0
381	41°40.25'N	29°24.96'E	1750.5	54	53	98.1	503.5	269.5	53.5	-	503.5	42.1	74.5	74.5
TOTAL END 42B				251.0	242.0	96.4	2318.0	1274.8	55.0	420.0	2738.0	34.9	-	393.0
TOTAL 42A and 42B				401.0	386.0	96.2	3510.2	1945.0	55.4	3689.3	7199.5	28.35	-	901.0

DEEP SEA DRILLING PROJECT

BIT SUMMARY

LEGS 42A/B

HOLE	MFG.	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET.	HOURS ON BIT	CONDITION	REMARKS
371	Smith	10-1/8	F94CK	SZ096	62.0	489.0	551.0	15.03	T1 B1	
373	Smith	10-1/8	F94CK	SZ096	Nil	Nil	Nil	Nil	T1 B1	
373A	Smith	10-1/8	F94CK	SZ096	114.0	343.5	457.5	12.8		
TOTALS					176.0	832.6	1008.5	27.83	TF B8	Scrap
372	Smith	10-1/8	93CJS	JK193	431.0	454.0	885.0	60.32		
372A	Smith	10-1/8	93CJS	JK193	-	154.5	154.5	1.08		
TOTALS					431.0	608.5	1039.5	61.4	Cones Missing	Scrap
374	Smith	10-1/8	F94CK	SZ082	153.5	303.5	457.0	15.7	T2 B2	Reuse
375	Smith	10-1/8	F93C	KN305	73.5	748.5	821.5	33.64	T3 B8	Scrap
376	Smith	10-1/8	F94CK	SZ081	202.5	14.0	216.5	14.34	T1 B2	Reuse
377	Smith	10-1/8	F93CK	KN307	10.0	253.0	263.0	12.6		
378	Smith	10-1/8	F93CK	KN307	99.7	212.3	312.0	2.65		
378A	Smith	10-1/8	F93CK	KN307	46.5	297.0	343.5	7.27		
TOTALS					156.2	762.3	918.0	22.52	T3 B8	Scrap

DEEP SEA DRILLING PROJECT

BIT SUMMARY

LEGS 42A/B

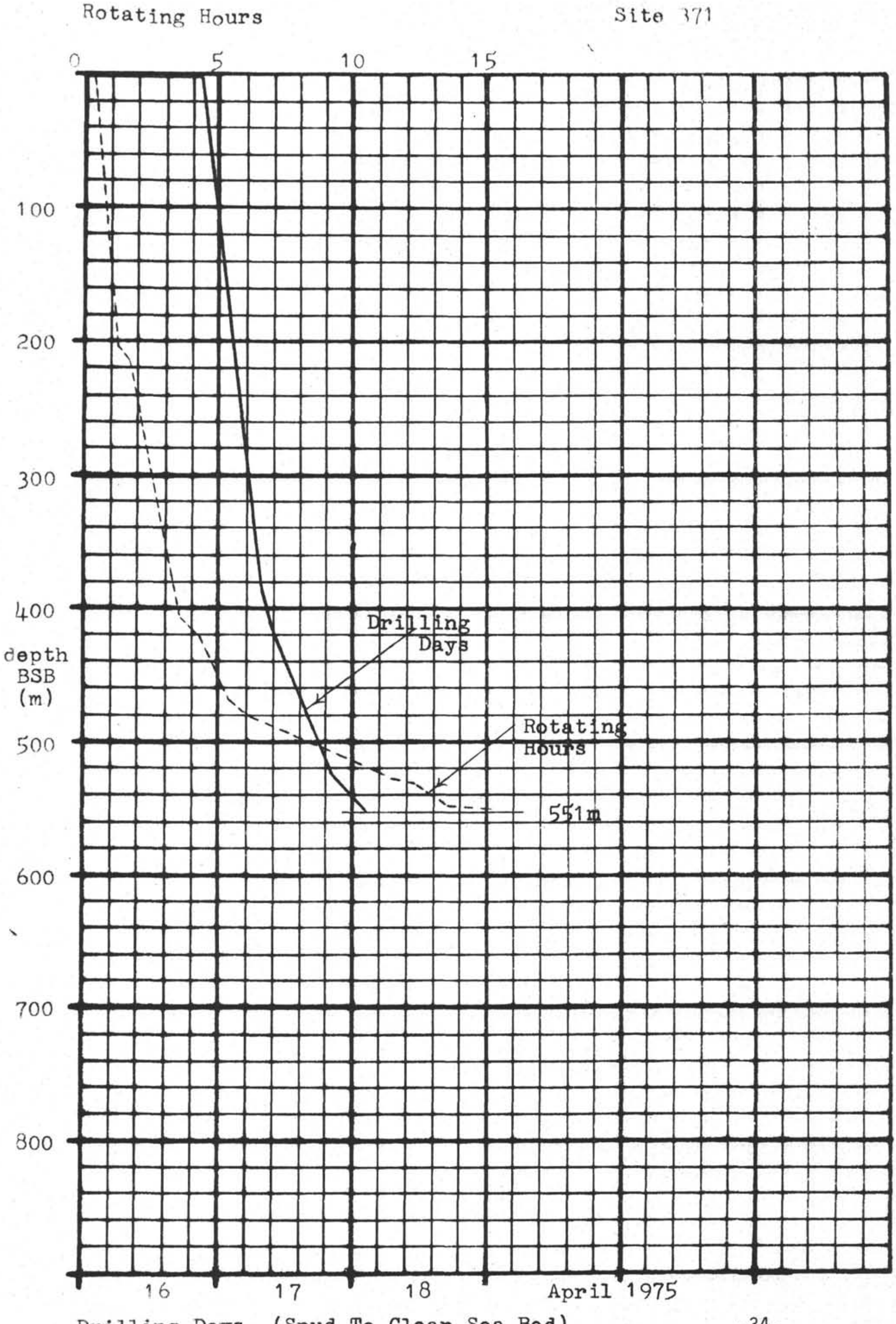
HOLE	MFG.	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET.	HOURS ON BIT	CONDITION	REMARKS
379	Smith	10"	F940P	BV054	7.0	-	7.0	0.05		(Special PCB Bit)
379A	Smith	10"	F940P	BV054	622.0	2.5	624.5	17.03		
379B	Smith	10"	F940P	BV054	80.5	78.5	159.0	2.10	T2 B2	
381	Smith	10"	F940P	BV054	503.5	-	503.5	12.0		
TOTALS					1213.0	81.0	1294.0	31.18	T3 B2	Reuse
380	Smith	10"	F940P	BS688	378.5	-	378.5	8.6		(Special PCB Bit)
380A	Smith	10"	F940P	BS688	734.5	339.0	1073.5	38.7		
TOTALS					1113.0	339.0	1452.0	47.3	T4 B6 Shirt Tail Wear	Rebuild? (refer letter)

DEEP SEA DRILLING PROJECT

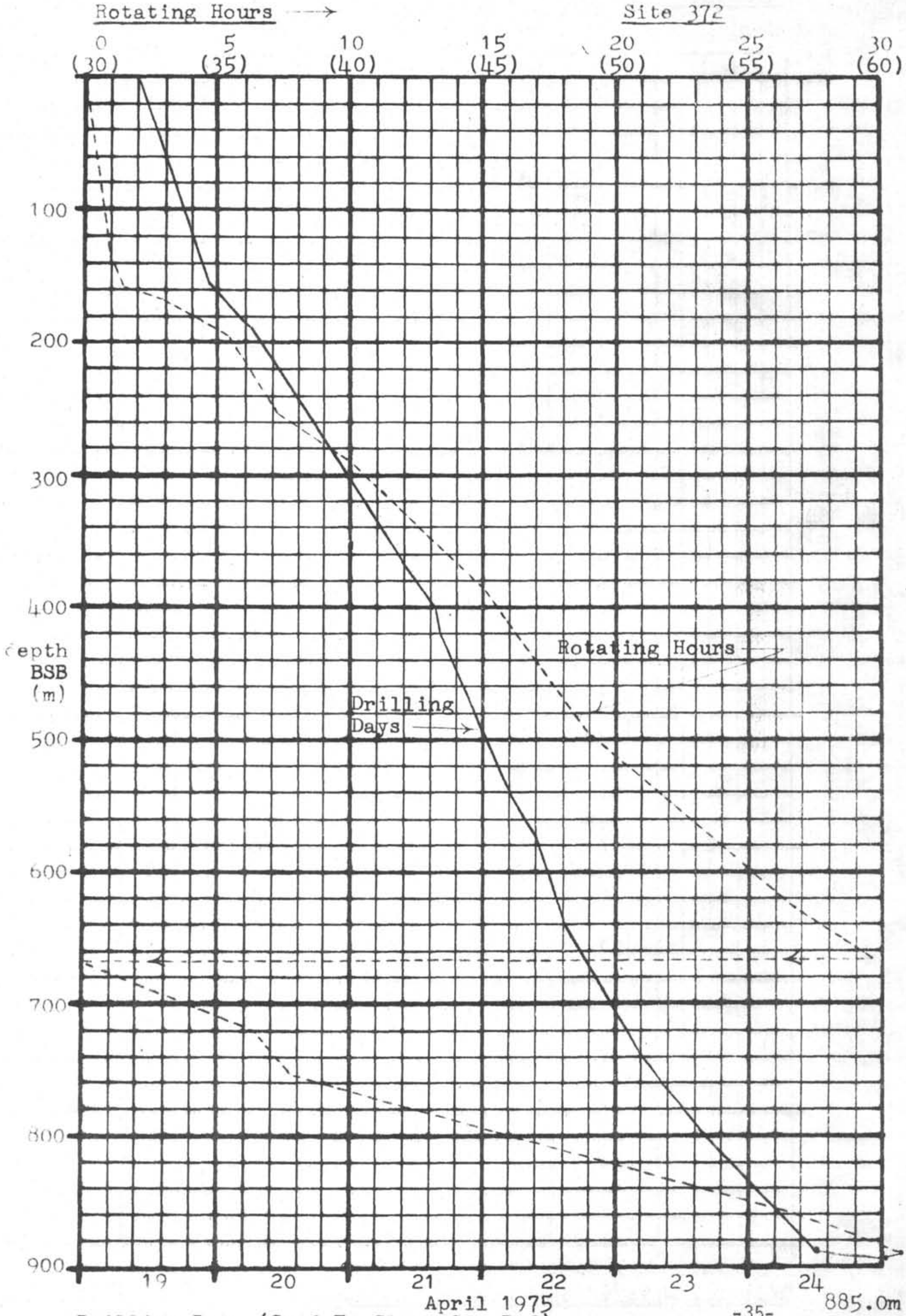
BEACON SUMMARY

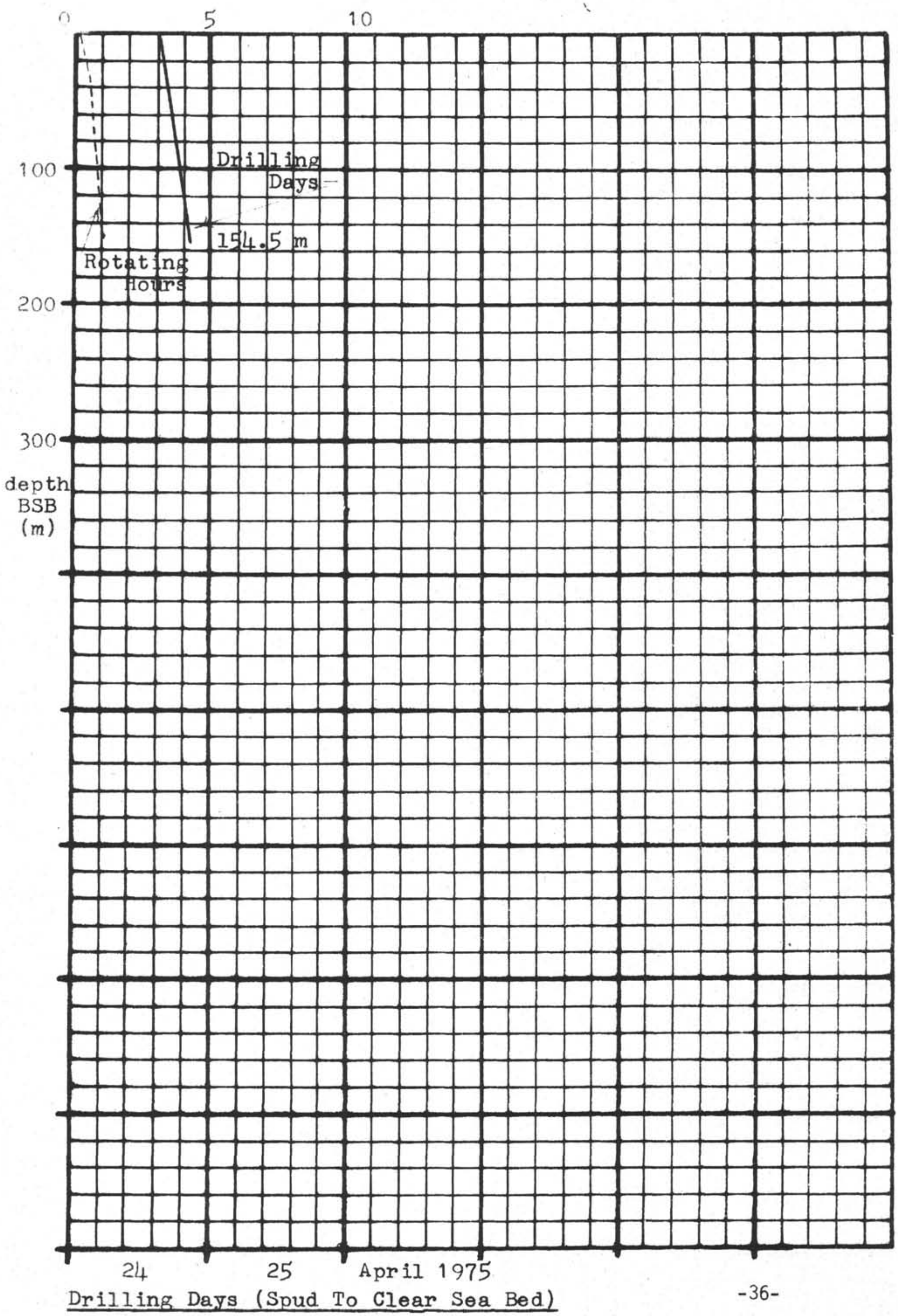
LEGS 42A/B

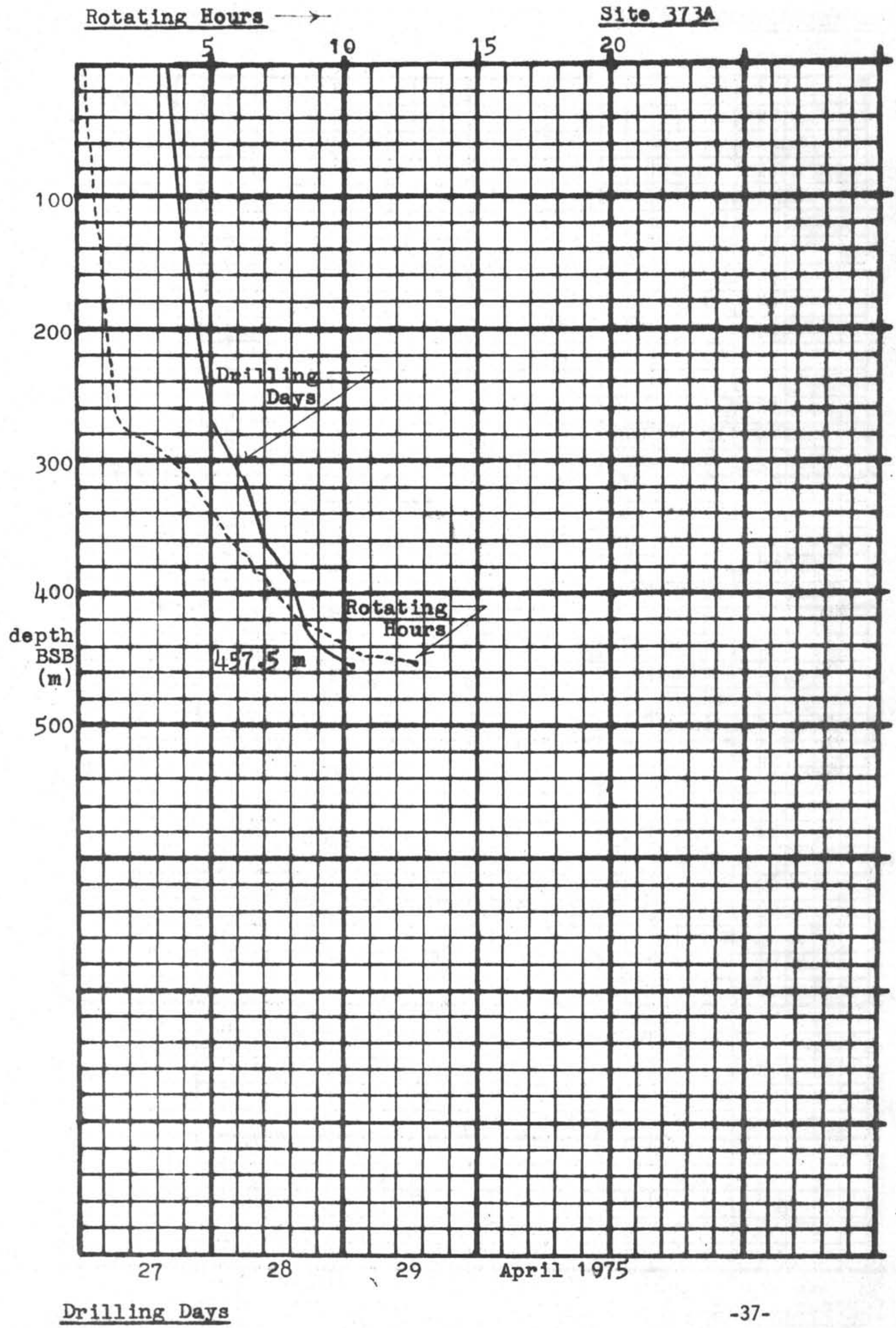
SITE NO.	MAKE	FREQ. kHz	SERIAL NUMBER	HOURS SITE TIME		
371	ORE	13.5	317		1.9	Satisfactory - (Some signal strength attenuation initially)
372	ORE*	13.5	312		-	Satisfactory - Repositioned Ship
372	ORE*	16.0	298		69.0	Unsatisfactory - Intermittent after 69.0 hr.
372	ORE	13.5	319	56.5	} 70.5	Satisfactory
372	ORE	13.5	319	14.0		
373	ORE	16.0	307	8.0	} 51.5	Satisfactory - (2600' offset)
373A	ORE	16.0	307	43.5		
374	ORE	16.0	294		28.7	Satisfactory - But initially in doubt.
374	ORE	13.5	311		47.3	Satisfactory
375	ORE	16.0	310		74.0	Satisfactory
376	ORE	13.5	330		50.0	Satisfactory
377	ORE	16.0	255		32.5	Satisfactory
378	ORE	13.5	327	18.5	} 38.5	Satisfactory
378A				20.0		
379	ORE	16.0	308	7.0		
379A	ORE	16.0	308	89.0	}119.5	Satisfactory
379B	ORE	16.0	308	23.5		
380	ORE	13.5	324	57.5	}199.0	Satisfactory - Good signal after 8.3 days.
380A	ORE	13.5	324	141.5		
381	ORE	16.0	293		74.5	Satisfactory



Rotating Hours
Site 371
0
5
10
15
100
200
300
400
depth
BSB
(m)
500
600
700
800
Drilling
Days
Rotating
Hours
551m
16
17
18
April 1975
Drilling Days (Spud To Clear Sea Bed)

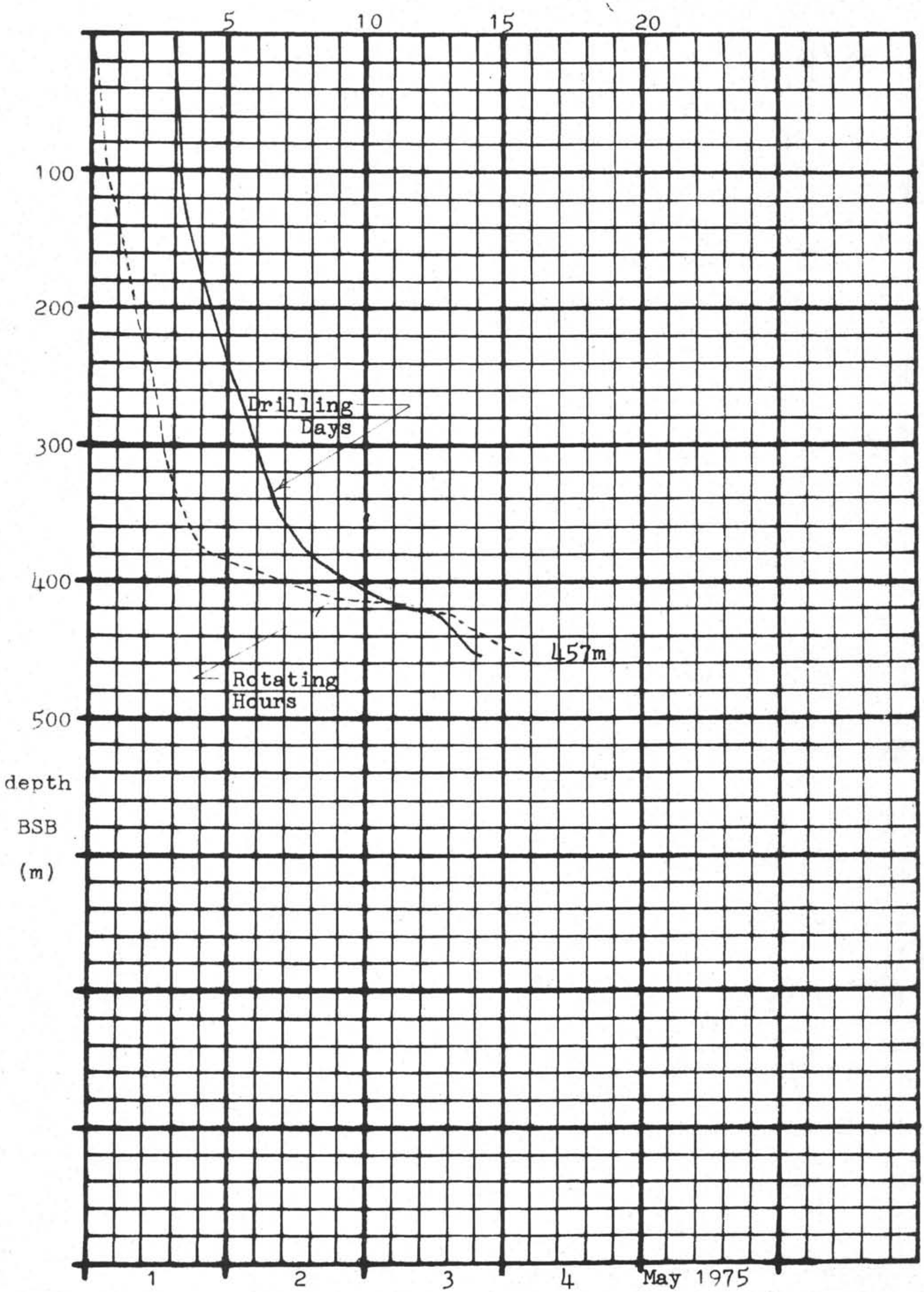

Rotating Hours
Site 372
0
(30)
5
(35)
10
(40)
15
(45)
20
(50)
25
(55)
30
(60)
100
200
300
400
Depth
BSB
(m)
500
600
700
800
900
Rotating Hours
Drilling
Days
19
20
21
22
23
24
April 1975
885.0m
Drilling Days (Spud To Clear Sea Bed)


Rotating Hours
0
5
10
100
200
300
depth
BSB
(m)
Drilling
Days
154.5 m
Rotating
Hours
24
25
April 1975
Drilling Days (Spud To Clear Sea Bed)

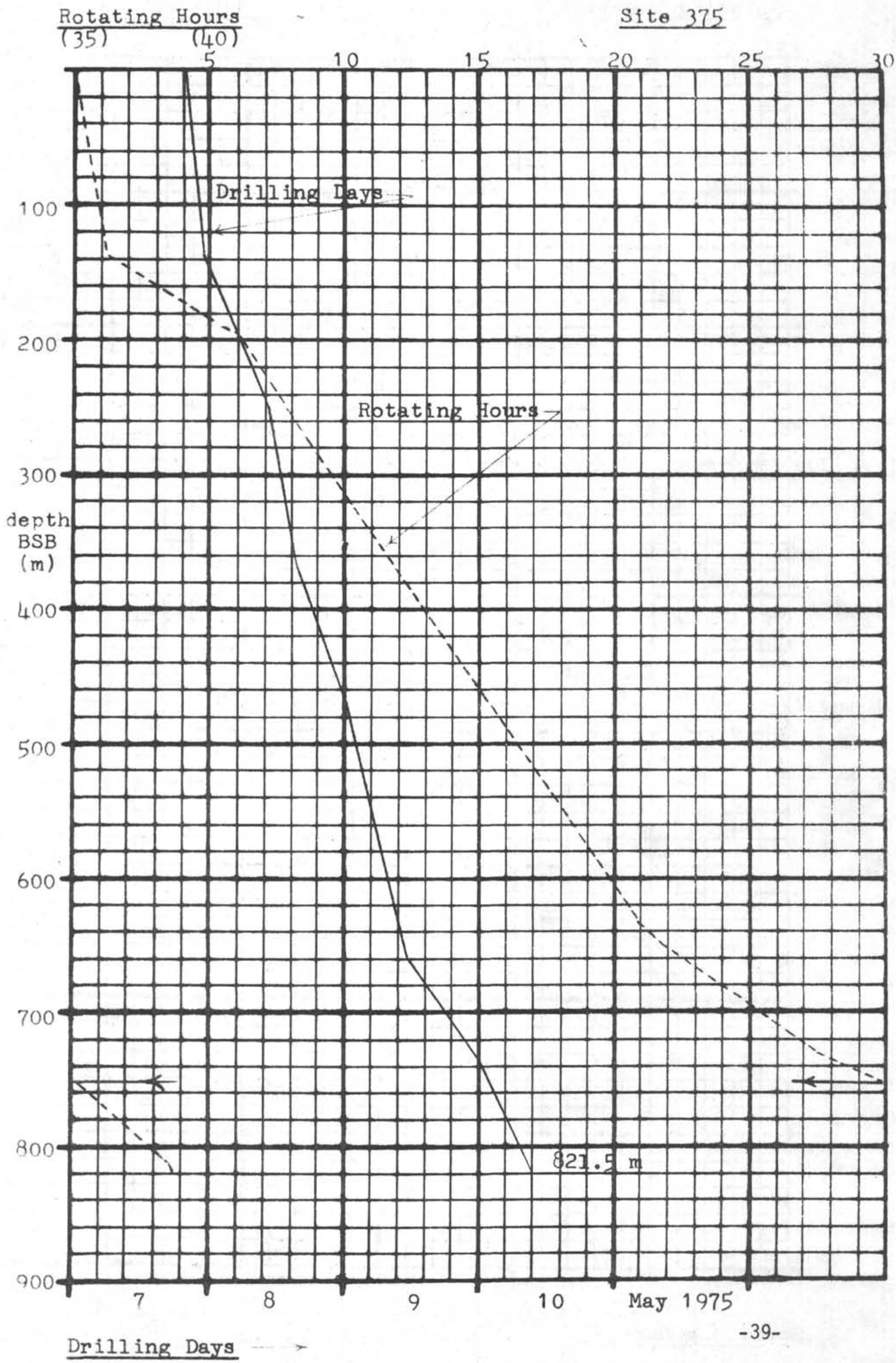

Rotating Hours
Site 373A
5
10
15
20
100
200
300
400
500
depth BSB (m)
Drilling Days
Rotating Hours
457.5 m
27
28
29
April 1975
Drilling Days

Rotating Hours →

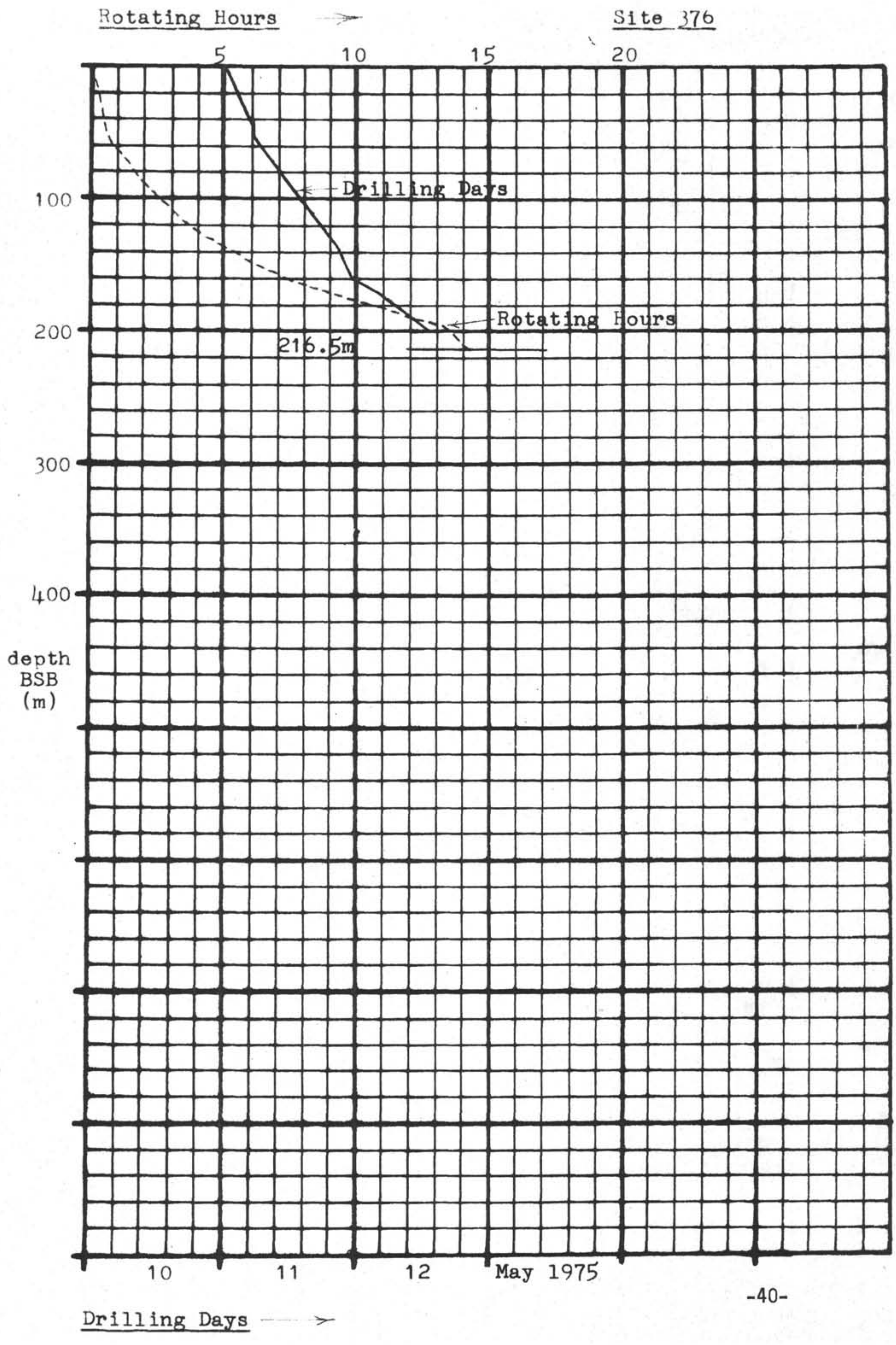
Site 374



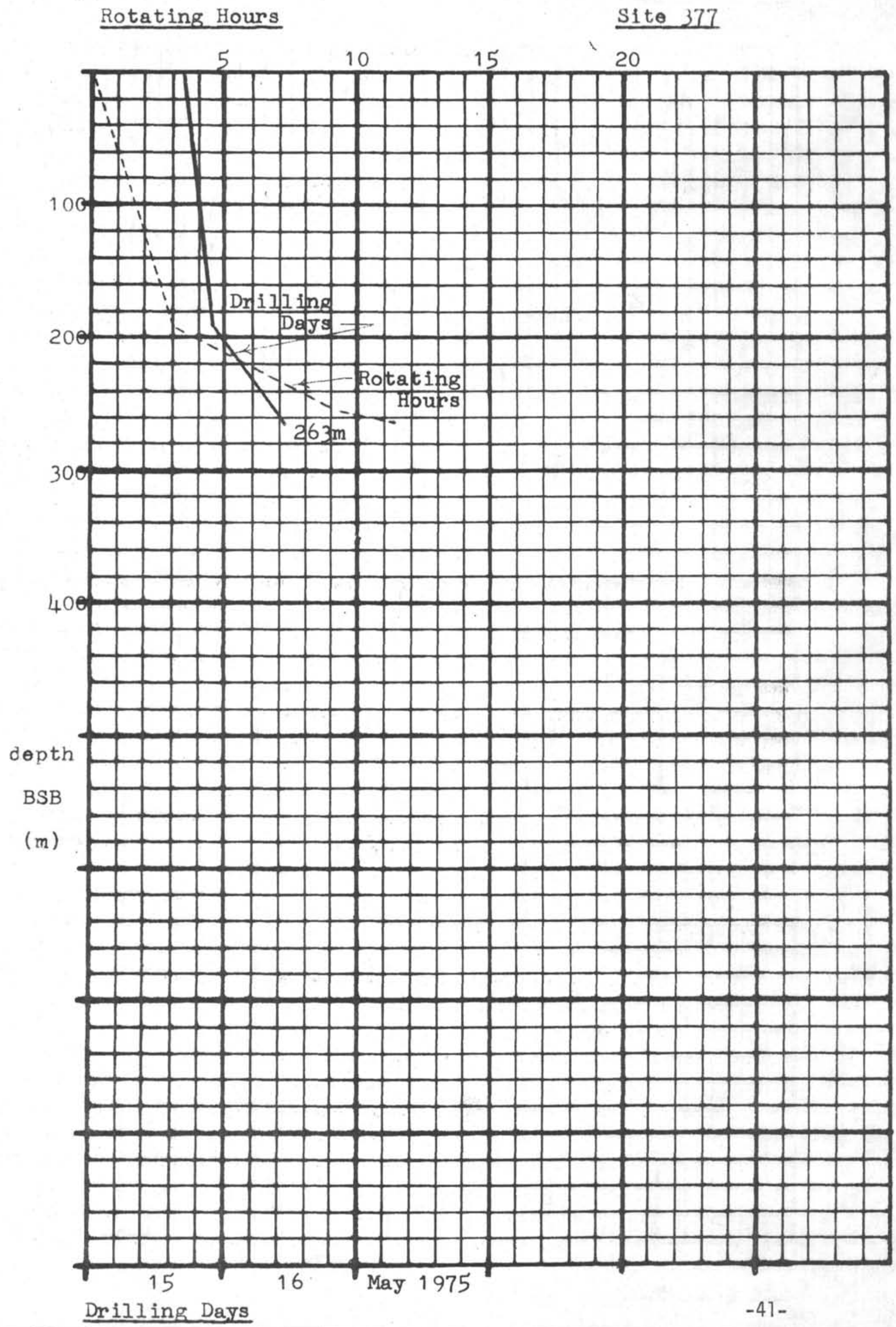
Drilling Days →



Rotating Hours
(35)
(40)
Site 375
5
10
15
20
25
30
Drilling Days
Rotating Hours
100
200
300
depth BSB (m)
400
500
600
700
800
900
821.5 m
7
8
9
10
May 1975
Drilling Days

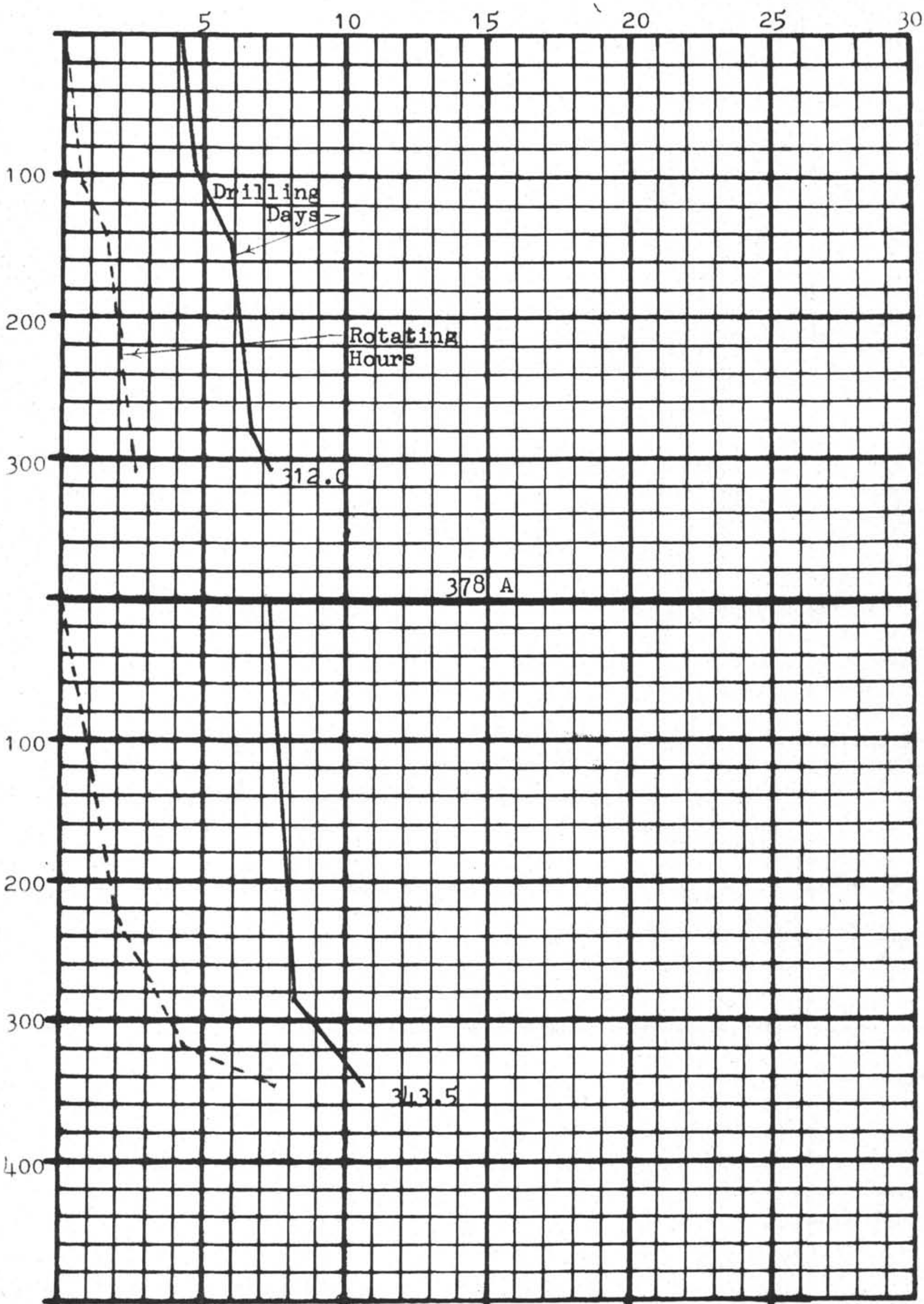


Rotating Hours
Site 376
5
10
15
20
100
200
300
400
depth
BSB
(m)
Drilling Days
Rotating Hours
216.5m
10
11
12
May 1975
Drilling Days

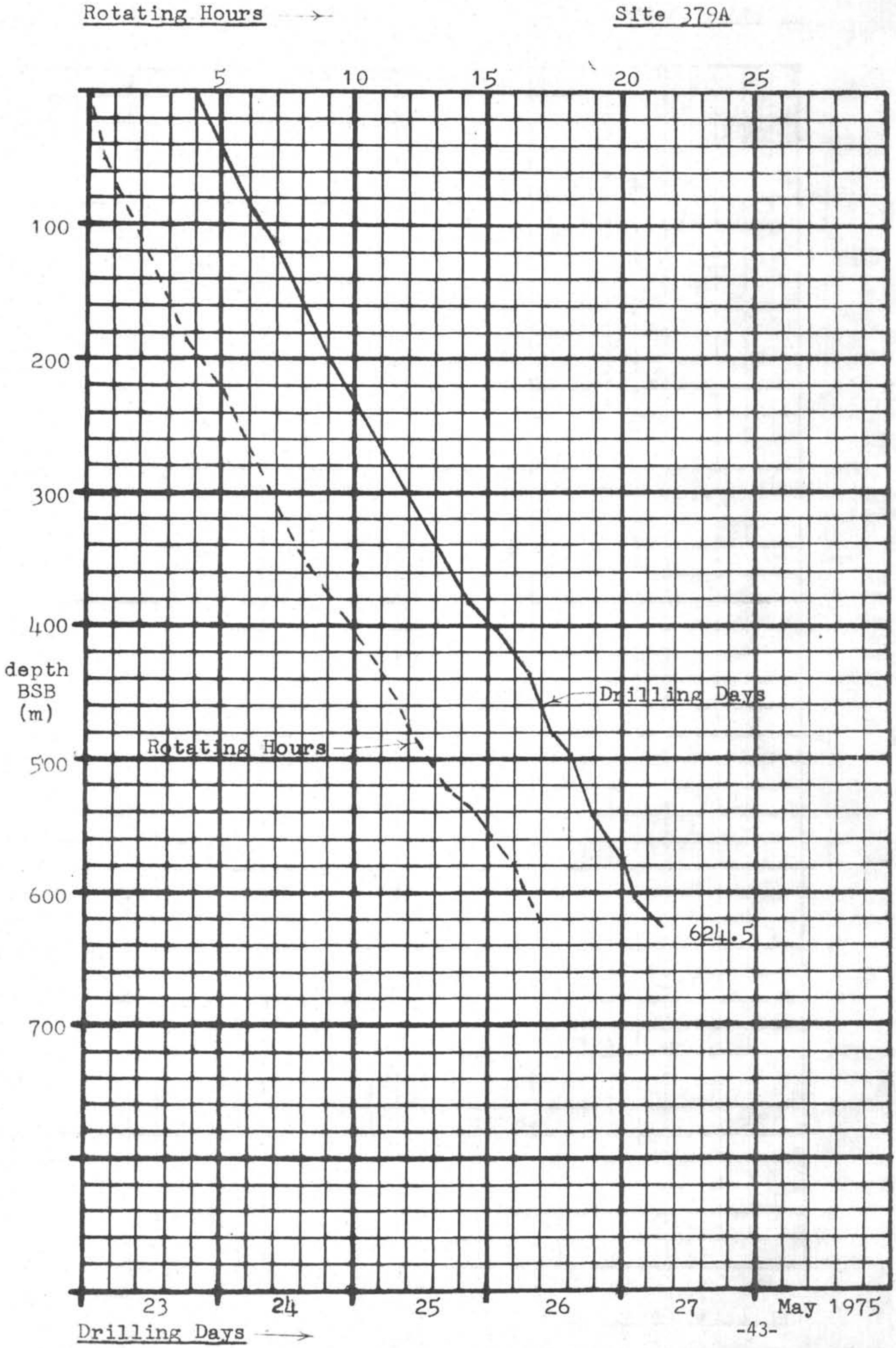

Rotating Hours
Site 377
5
10
15
20
100
200
300
400
depth
BSB
(m)
Drilling
Days
Rotating
Hours
263m
15
16
May 1975
Drilling Days

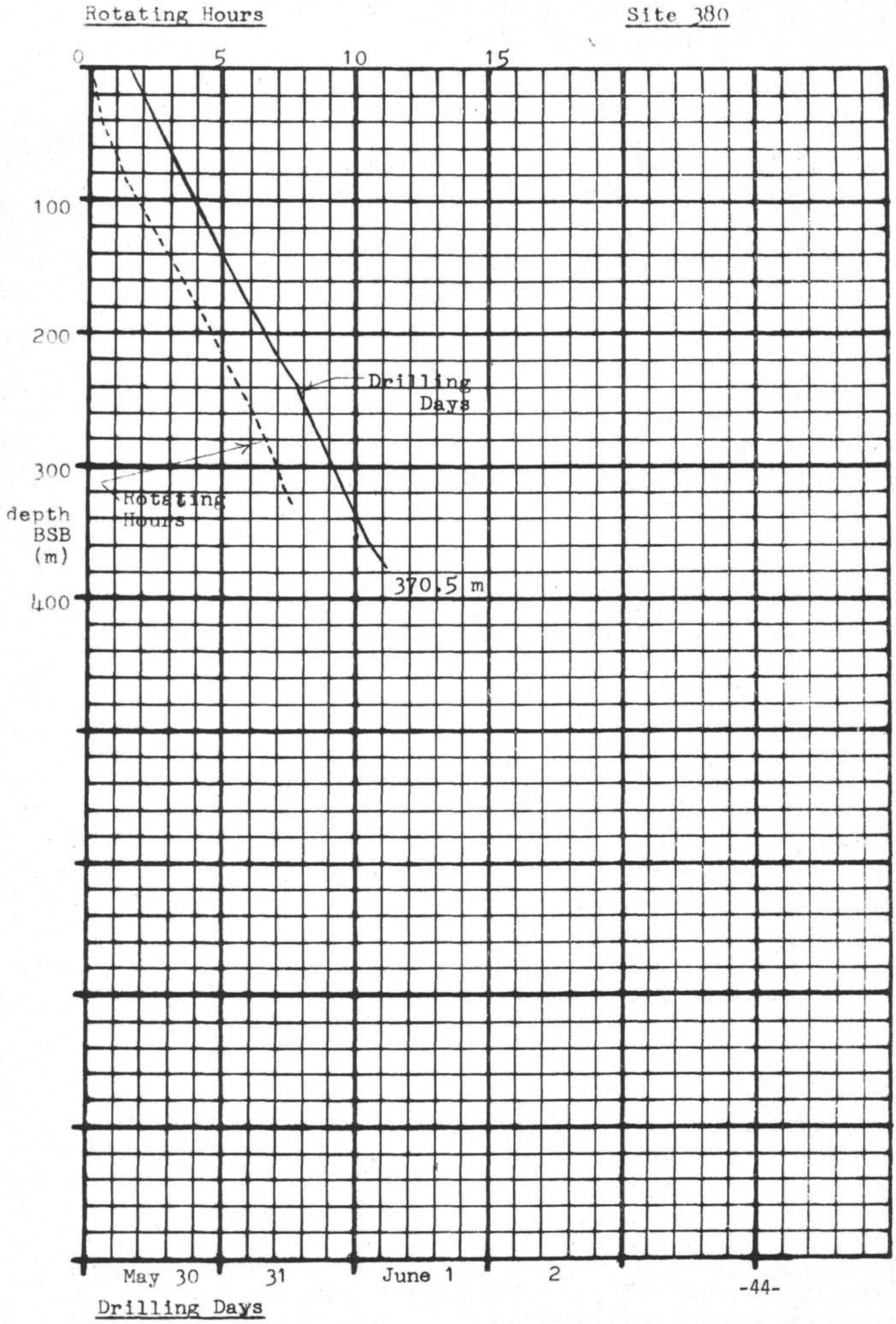
Rotating Hours

Sites 378/378A

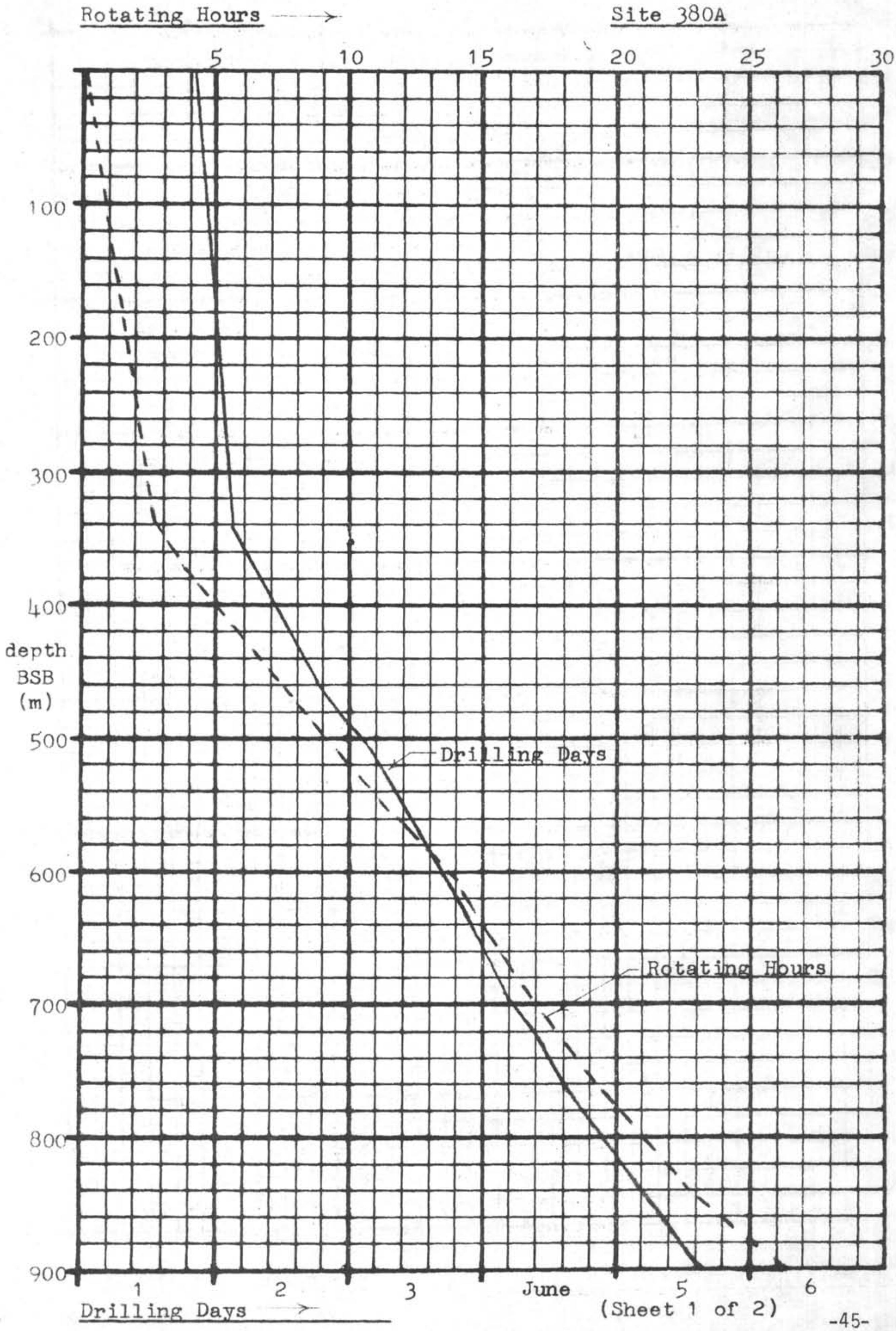


Drilling Days

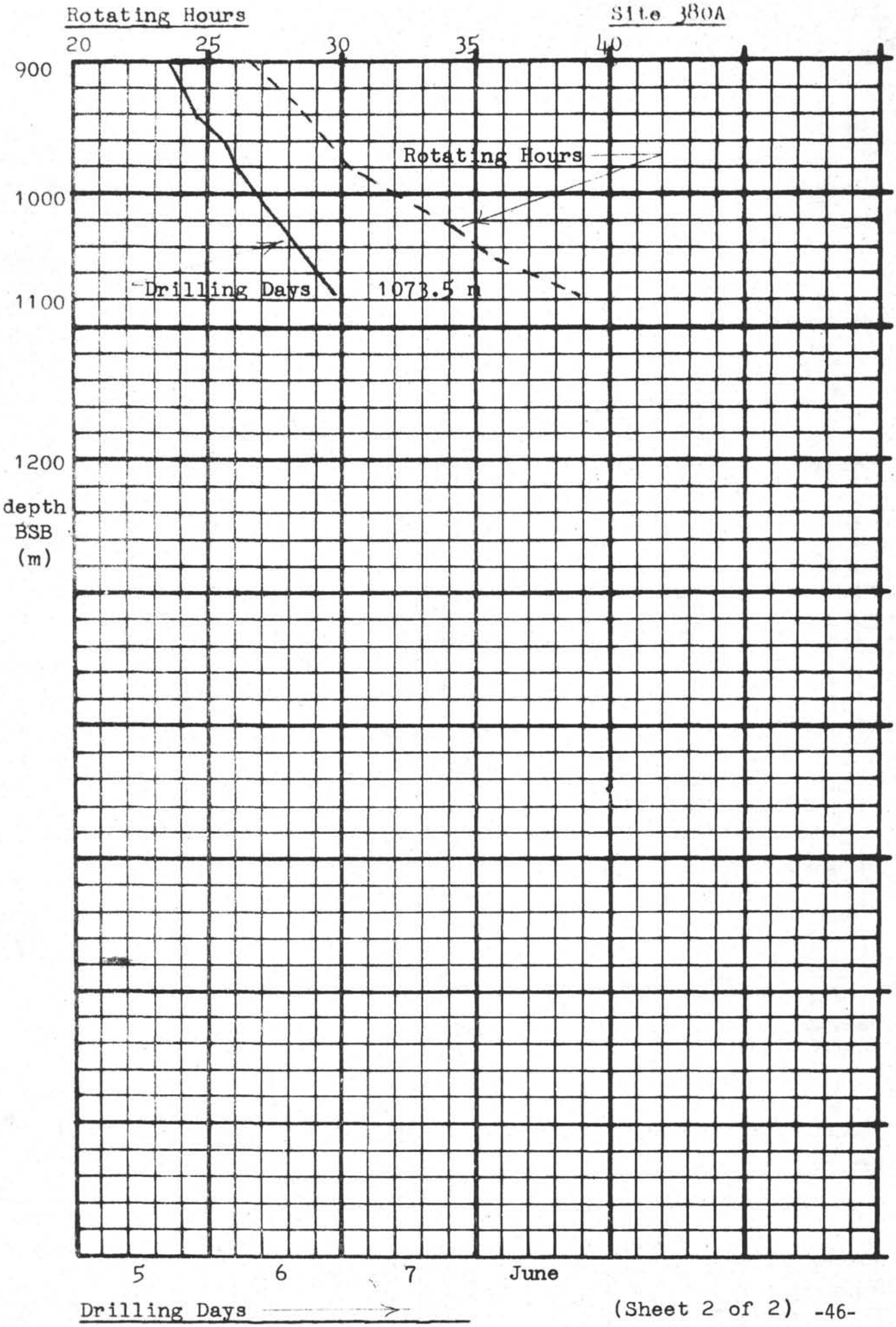

Rotating Hours →
5
10
15
20
25
100
200
300
400
500
600
700
depth
BSB
(m)
Drilling Days
Rotating Hours
624.5
23
24
25
26
27
May 1975
Drilling Days →



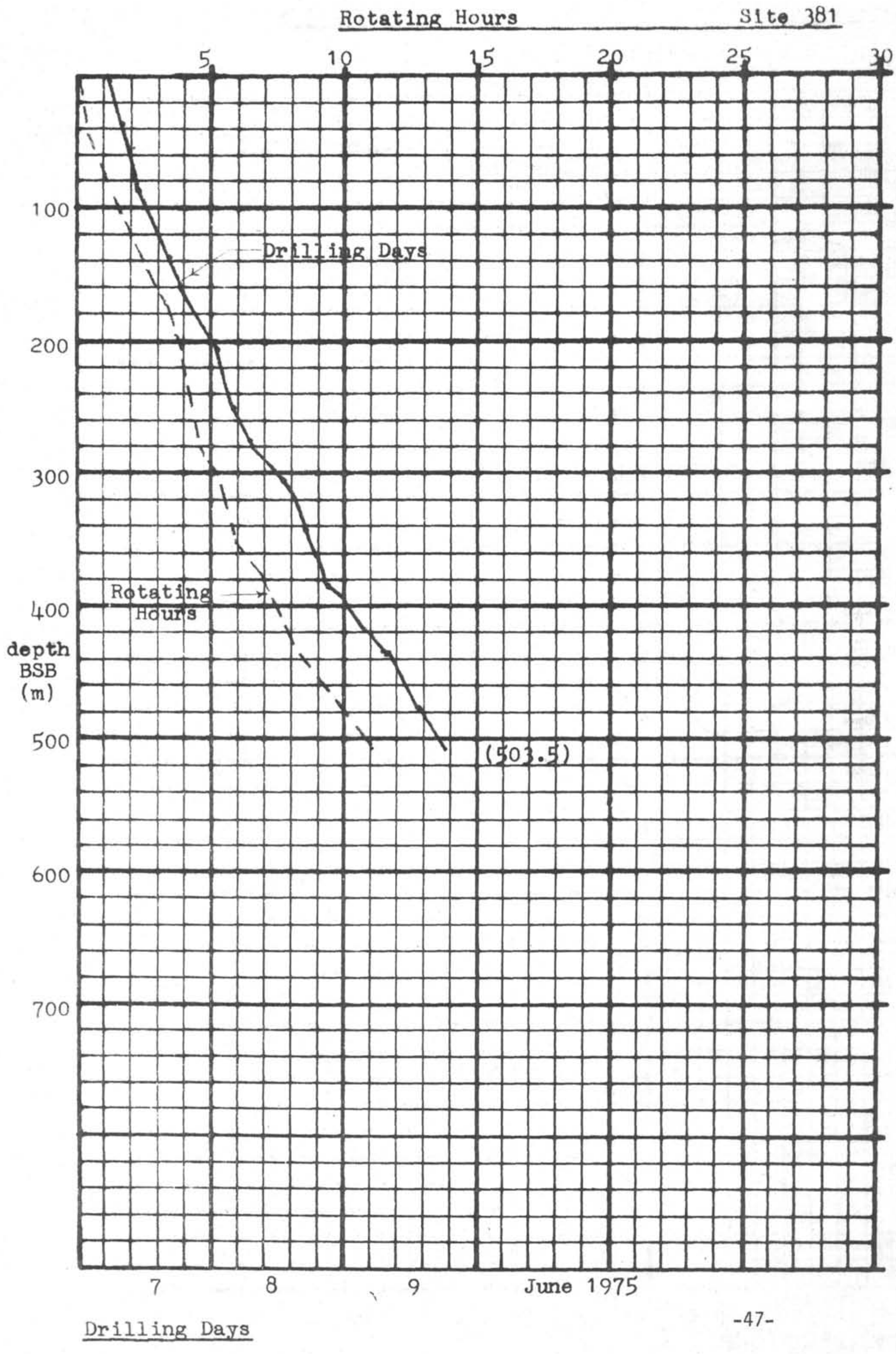
Rotating Hours
Site 380
0
5
10
15
100
200
300
400
depth BSB (m)
Drilling Days
Rotating Hours
370.5 m
May 30
31
June 1
2
Drilling Days



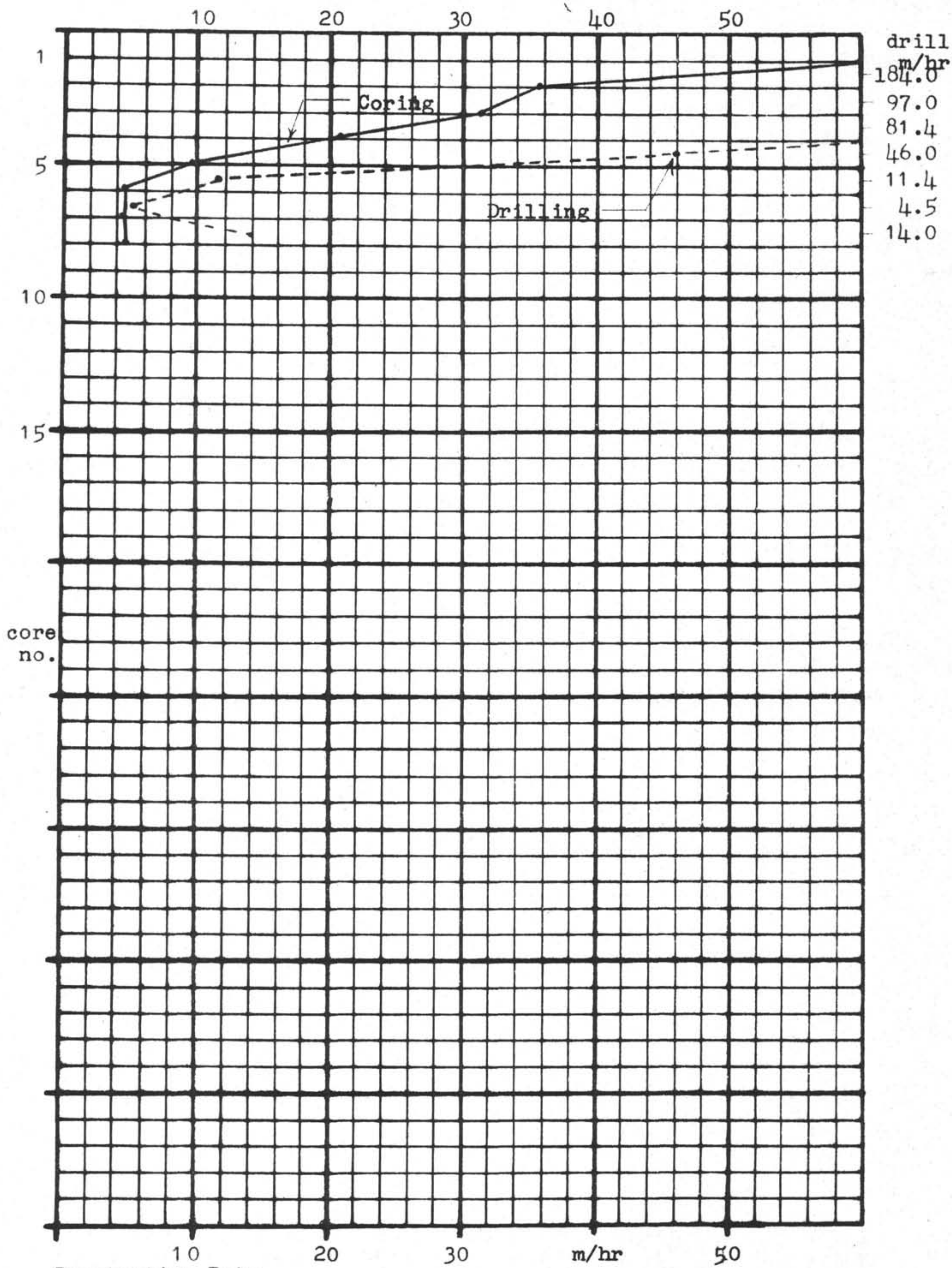
Rotating Hours
Site 380A
5
10
15
20
25
30
100
200
300
400
depth BSB (m)
500
600
700
800
900
Drilling Days
Rotating Hours
1
2
3
June
5
6
Drilling Days
(Sheet 1 of 2)

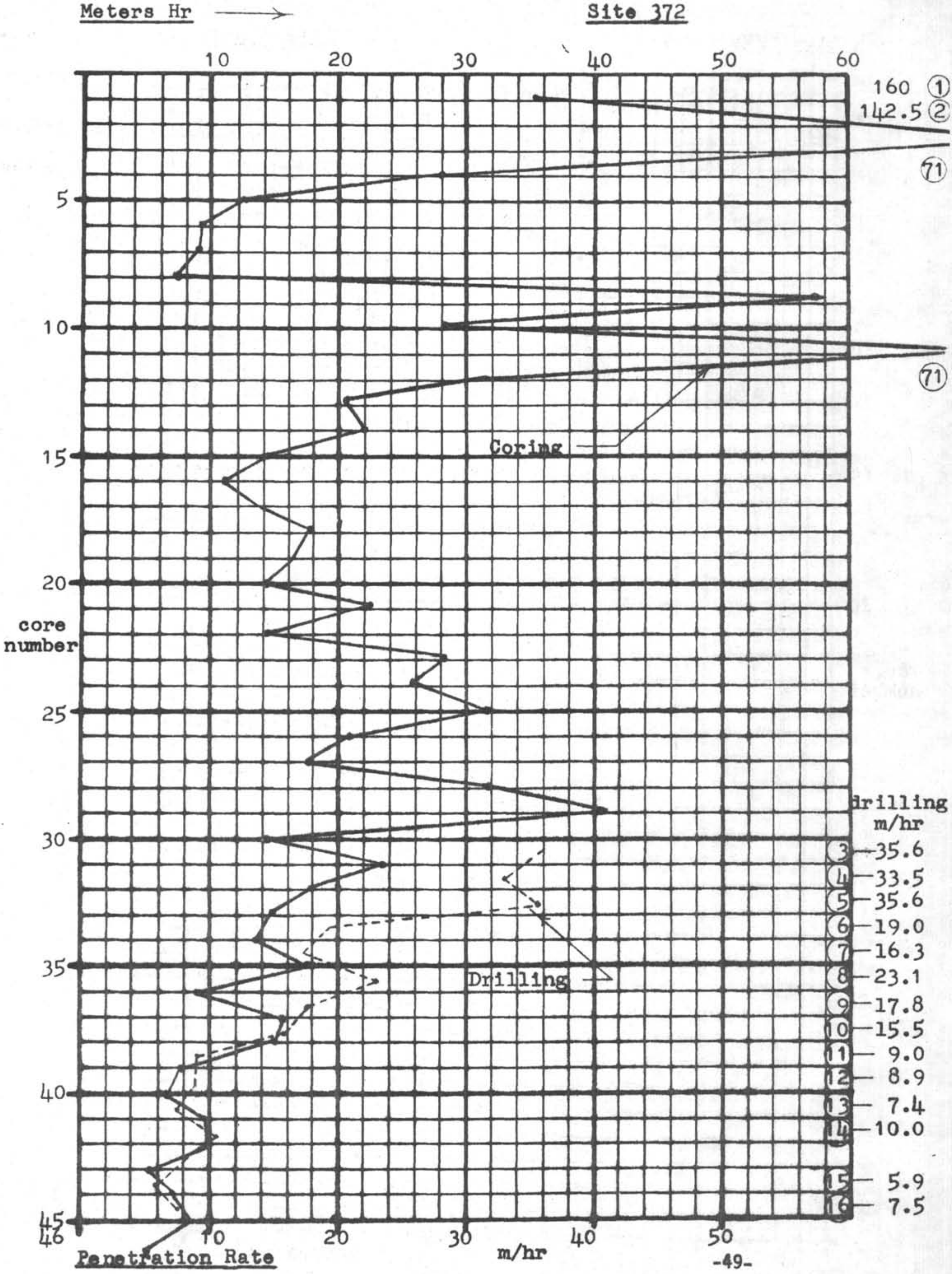

Rotating Hours
Site 380A
20
25
30
35
40
900
1000
1100
1200
depth BSB (m)
Rotating Hours
Drilling Days
1073.5 m
5
6
7
June
Drilling Days

(Sheet 2 of 2)



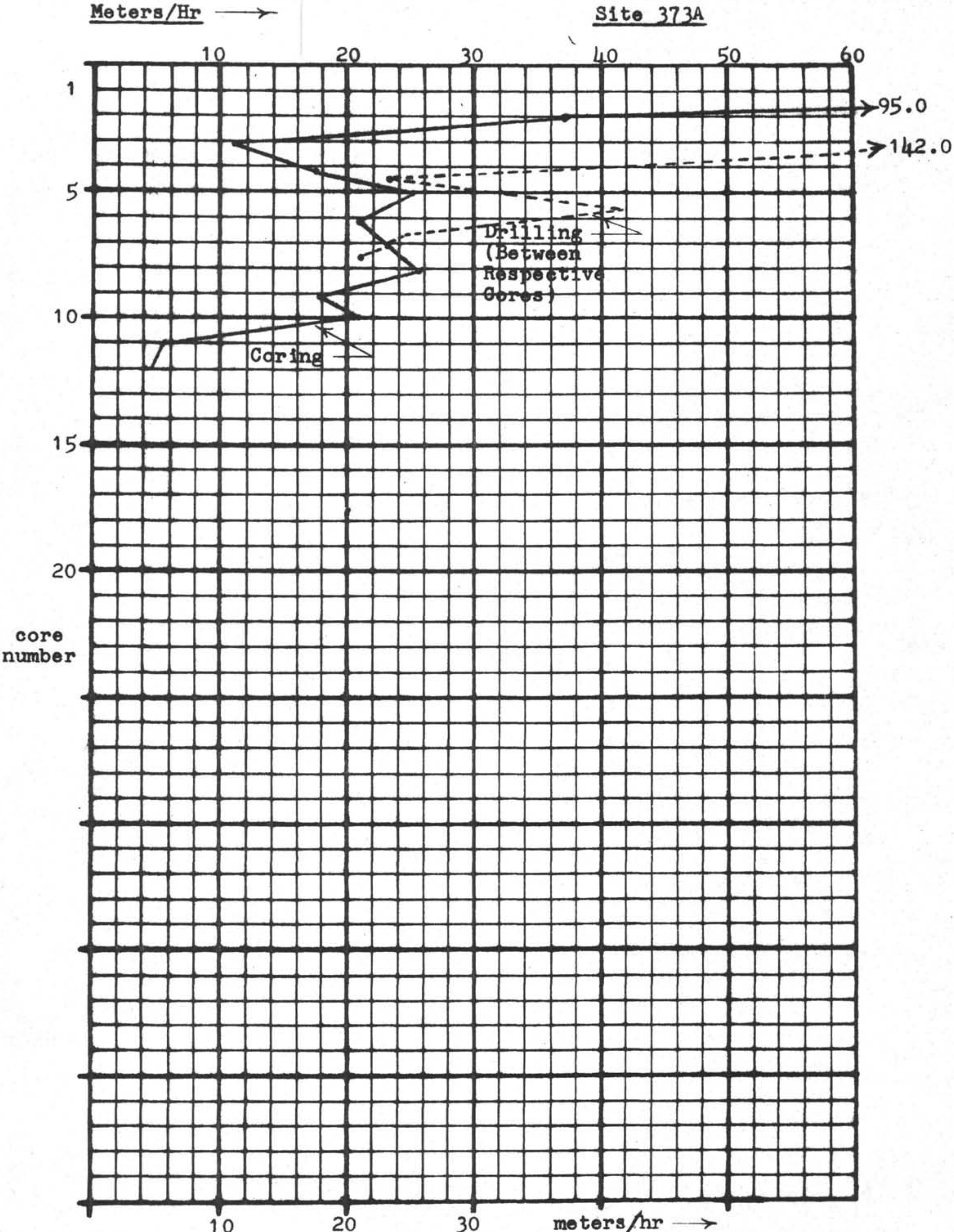
Rotating Hours
Site 381
5
10
15
20
25
30
100
200
300
400
500
600
700
depth
BSB
(m)
Drilling Days
Rotating
Hours
(503.5)
7
8
9
June 1975
Drilling Days


10
20
30
40
50
drill
m/hr
184.0
97.0
81.4
46.0
11.4
4.5
14.0
Coring
Drilling
1
5
10
15
core
no.
10
20
30
m/hr
50
Penetration Rate

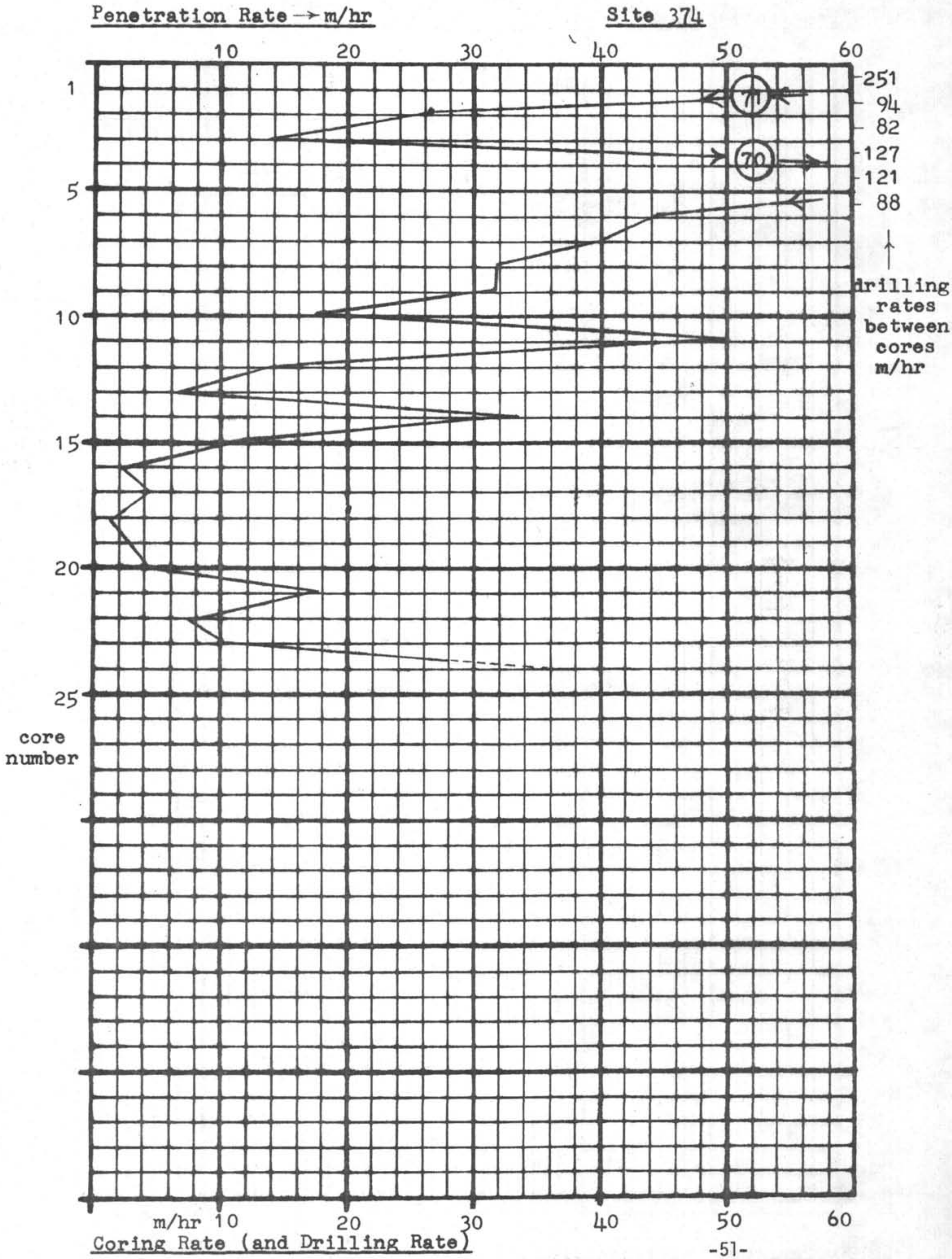


Meters Hr
Site 372
10
20
30
40
50
60
160 1
142.5 2
71
71
Coring
Drilling
core number
5
10
15
20
25
30
35
40
45
46
drilling m/hr
3 35.6
4 33.5
5 35.6
6 19.0
7 16.3
8 23.1
9 17.8
10 15.5
11 9.0
12 8.9
13 7.4
14 10.0
15 5.9
16 7.5
Penetration Rate
m/hr

Site 373A

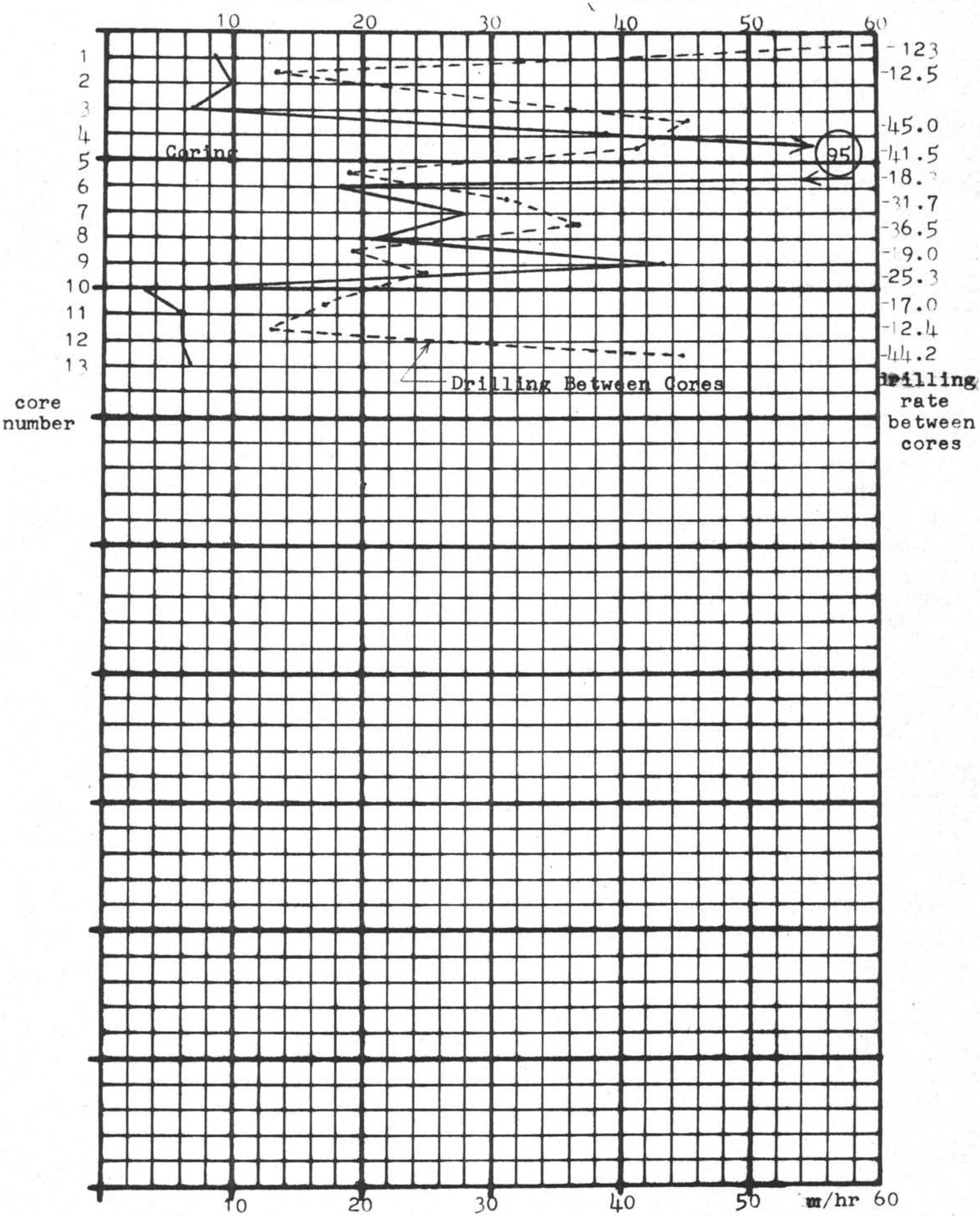


Coring and Drilling Rates



Penetration Rate → m/hr
Site 374
10
20
30
40
50
60
1
5
10
15
20
25
core
number
71
70
251
94
82
127
121
88
drilling
rates
between
cores
m/hr
m/hr 10
20
30
40
50
60
Coring Rate (and Drilling Rate)

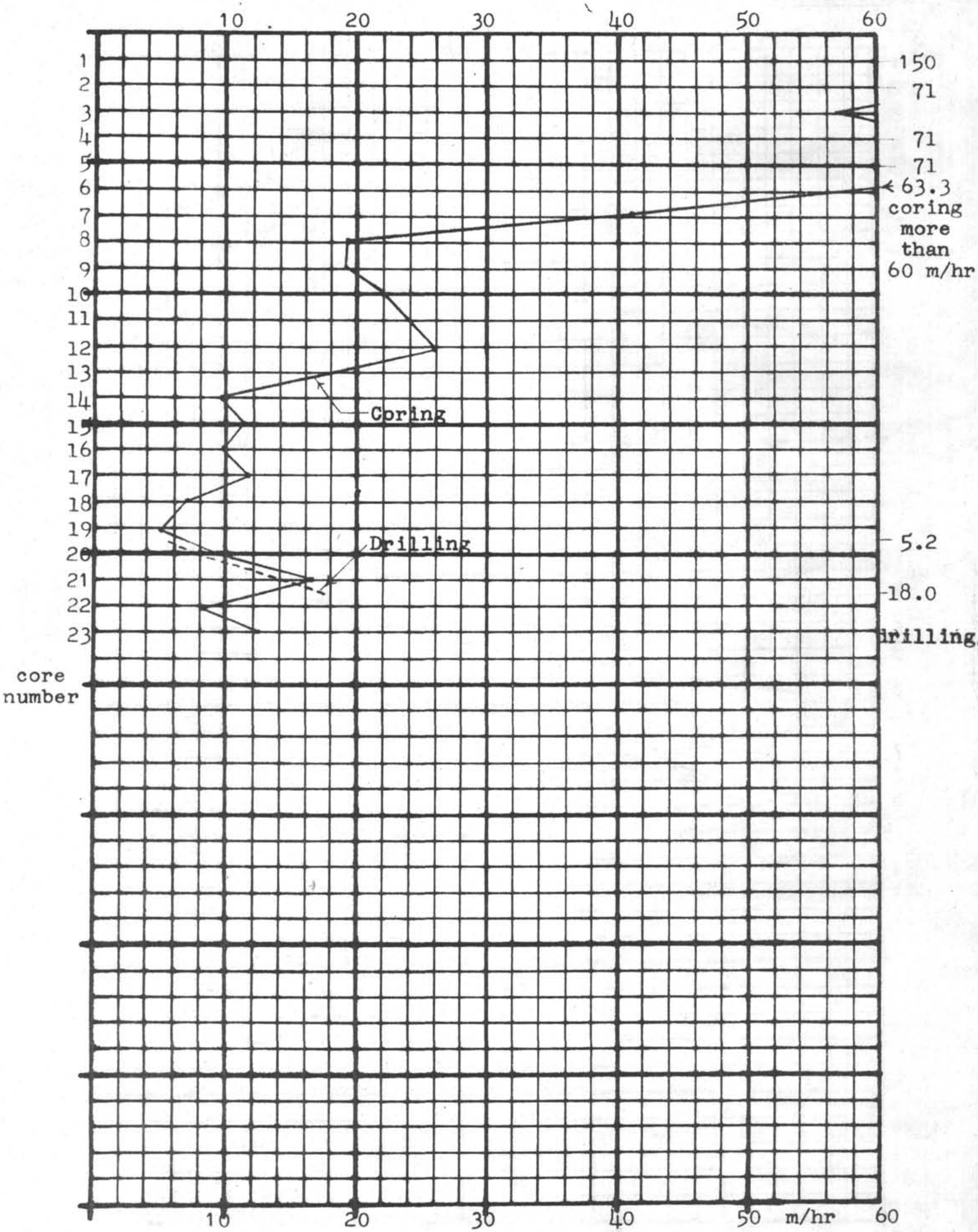
Penetration Rate m/hr Site 375



Coring And Drilling Rates

Penetration Rate m/hr

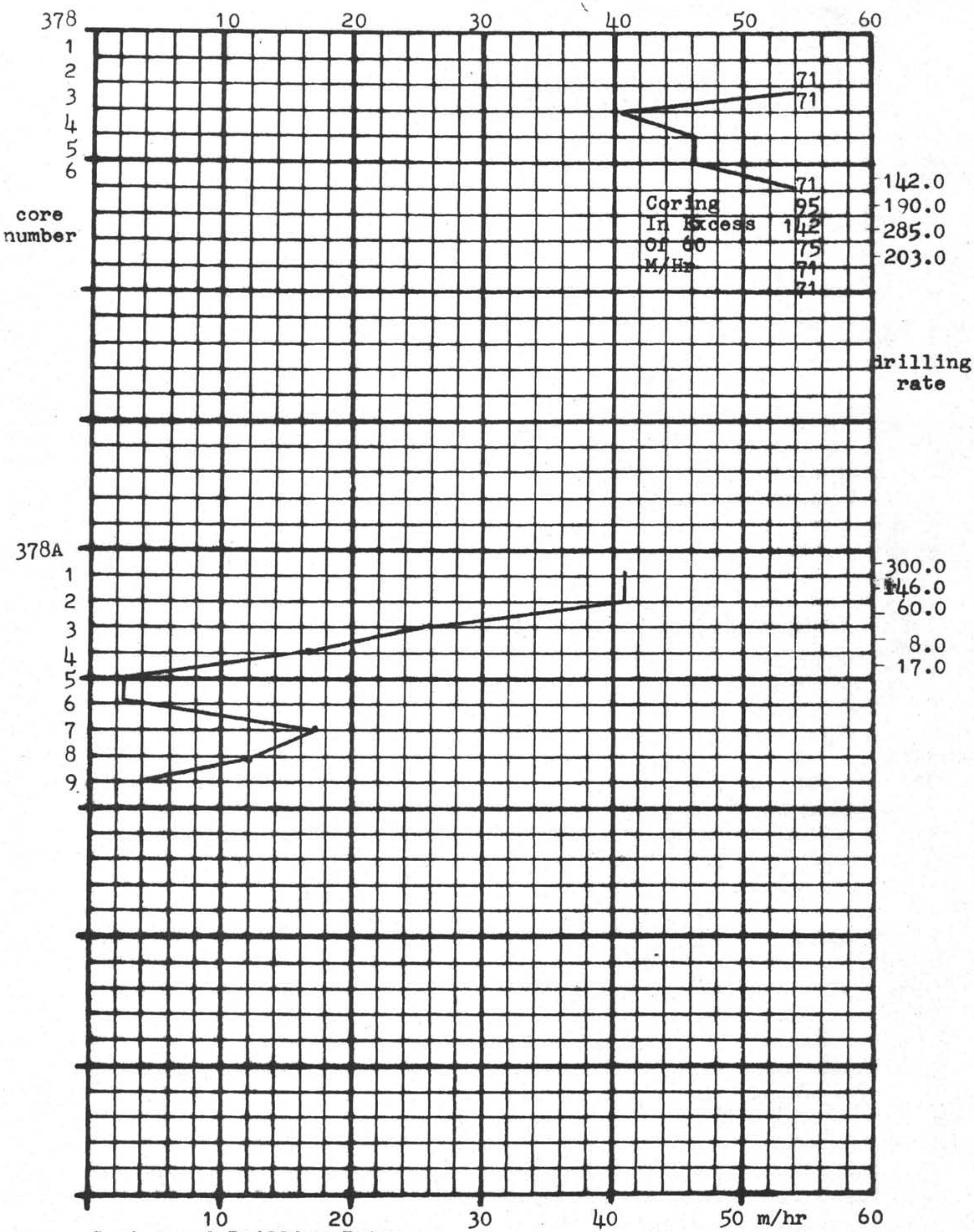
Site 376



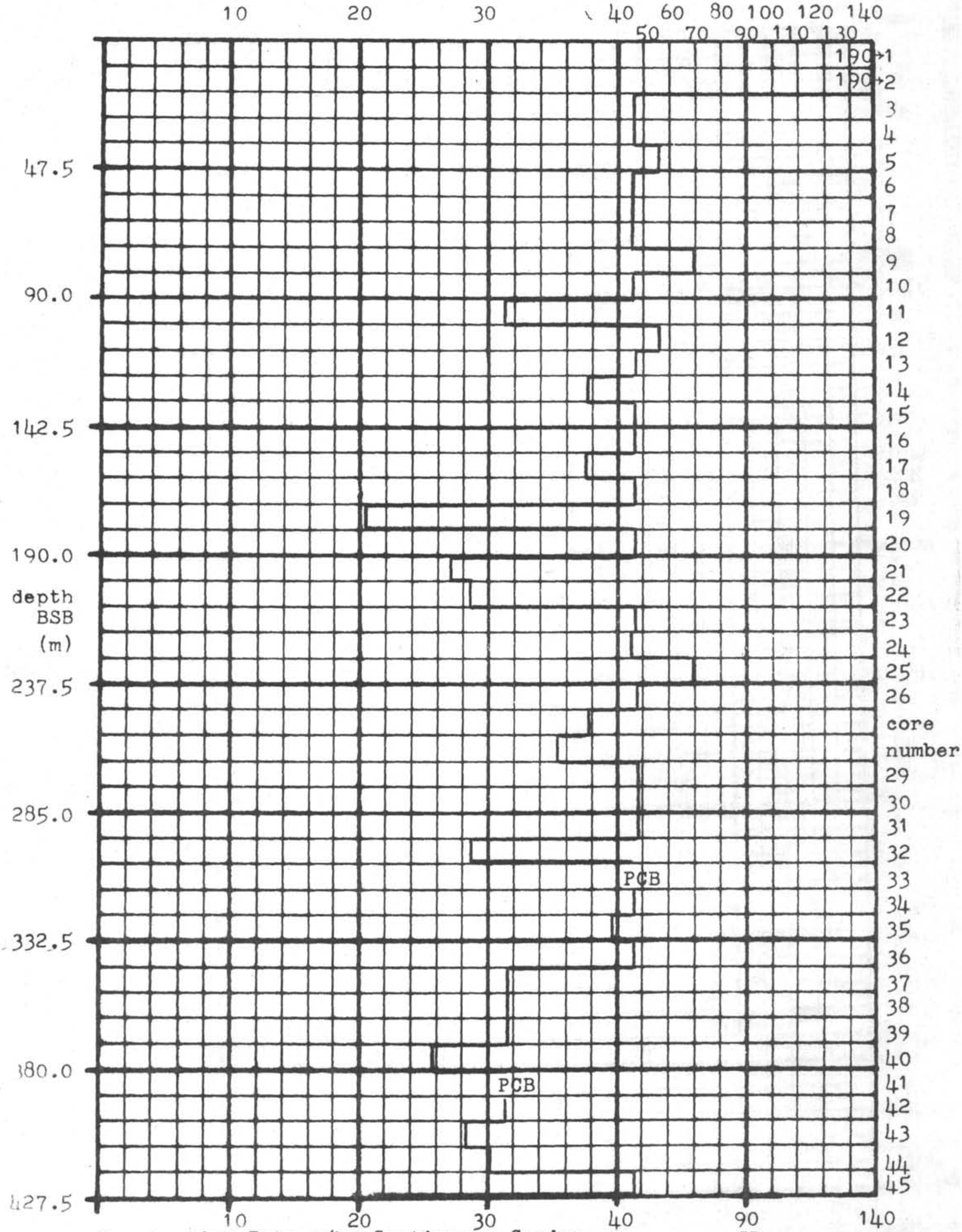
Coring and Drilling Rates

Penetration Rate m/hr

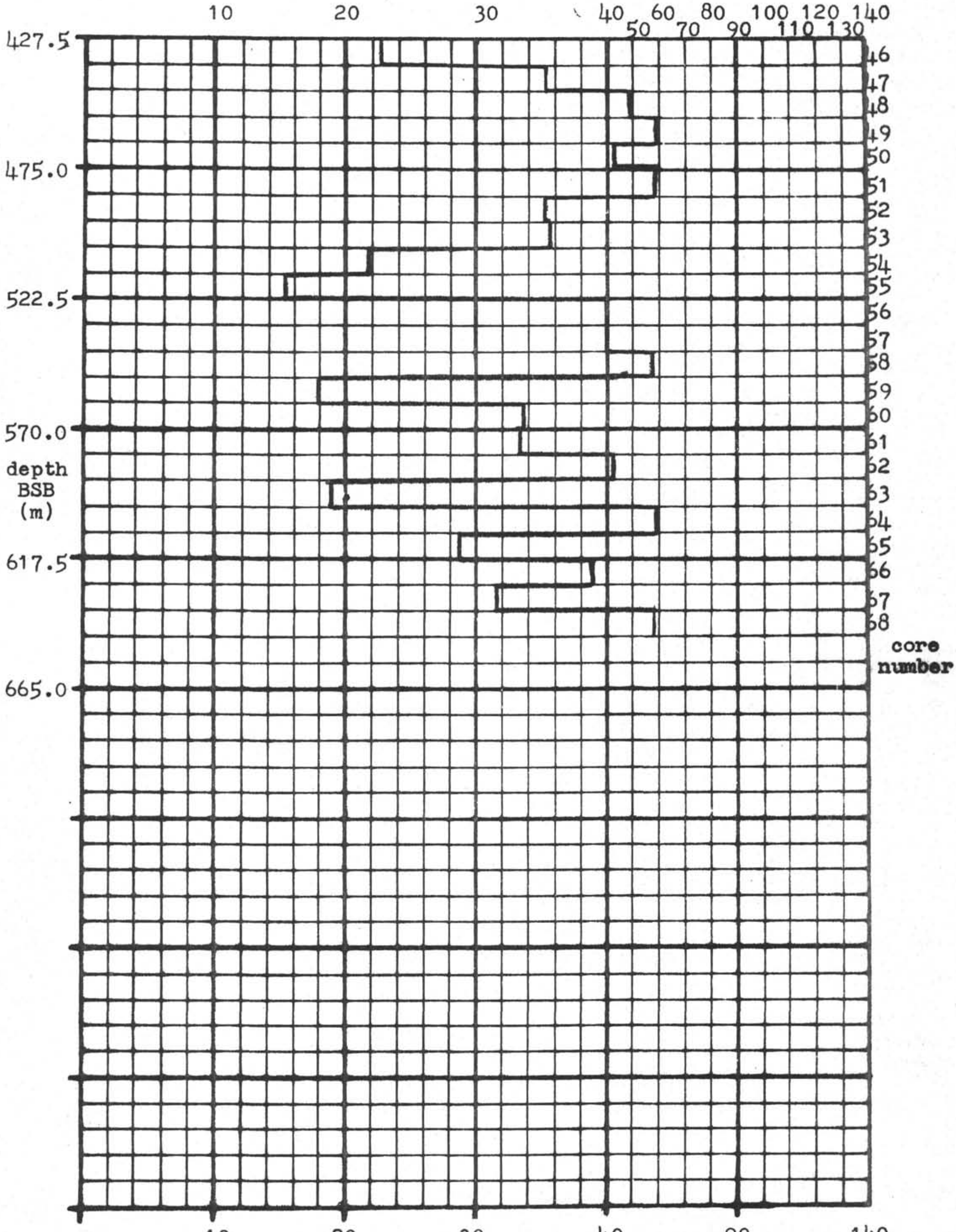
Site 378/378A



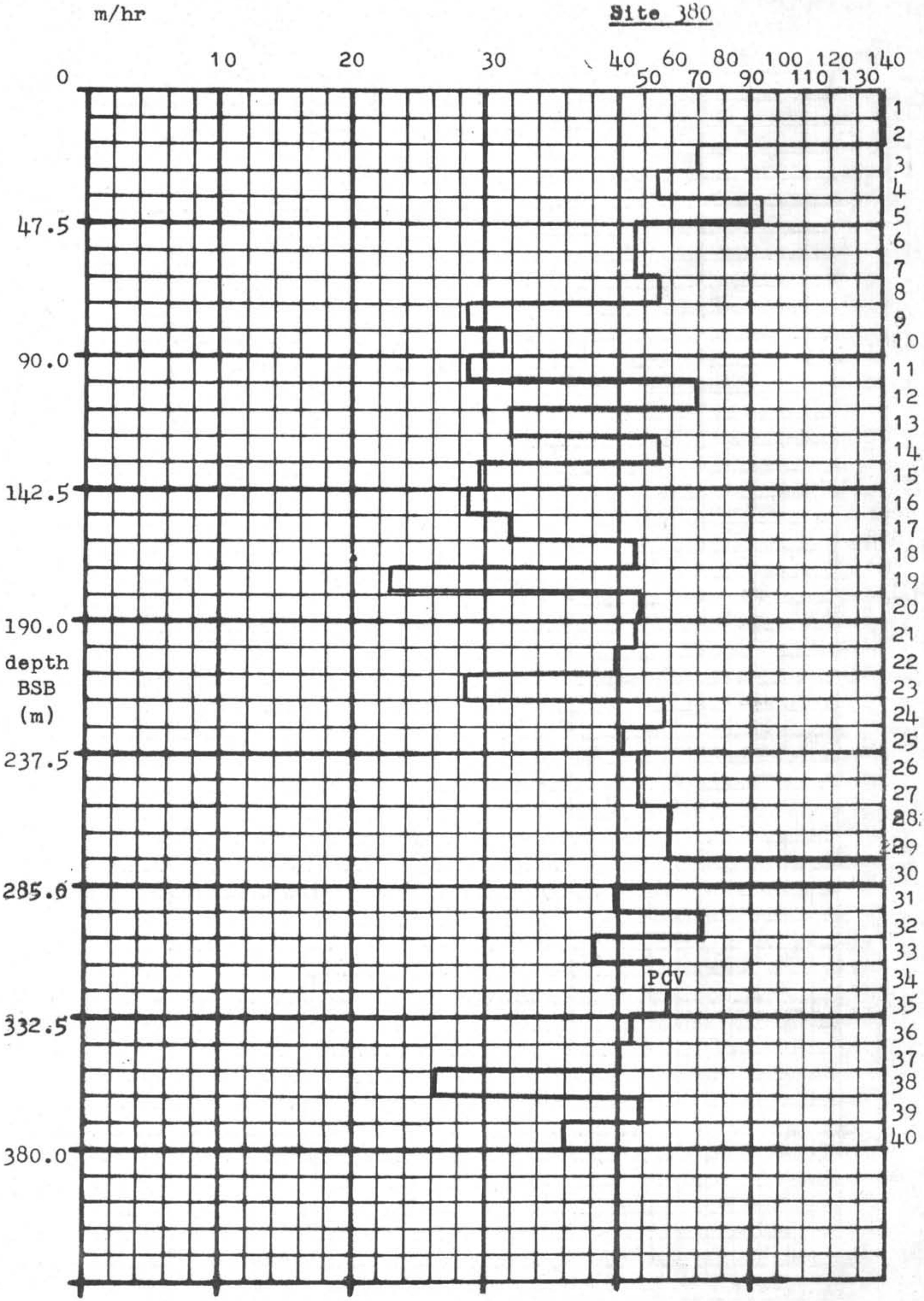
Coring and Drilling Rates



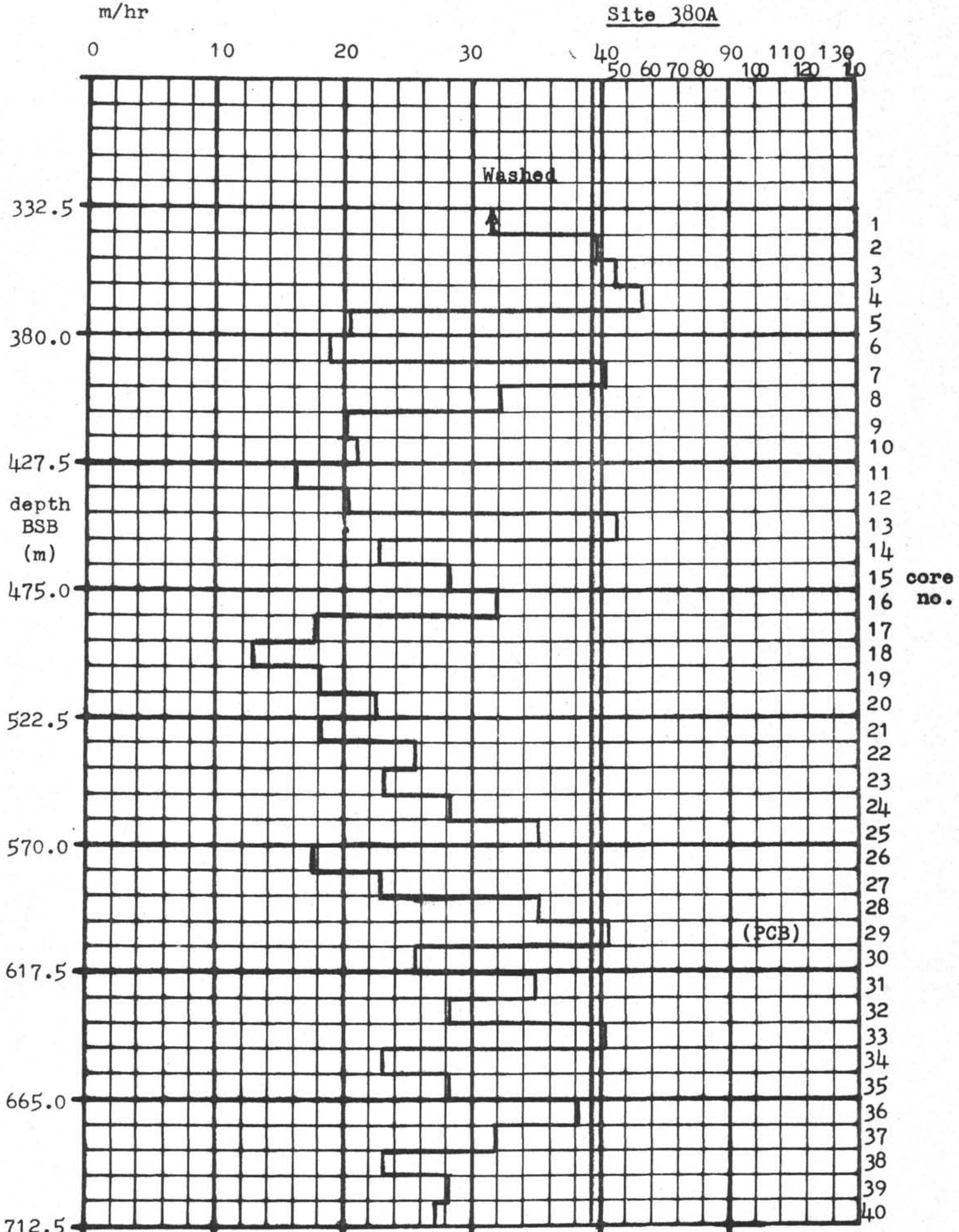
Penetration Rate m/hr Continuous Coring



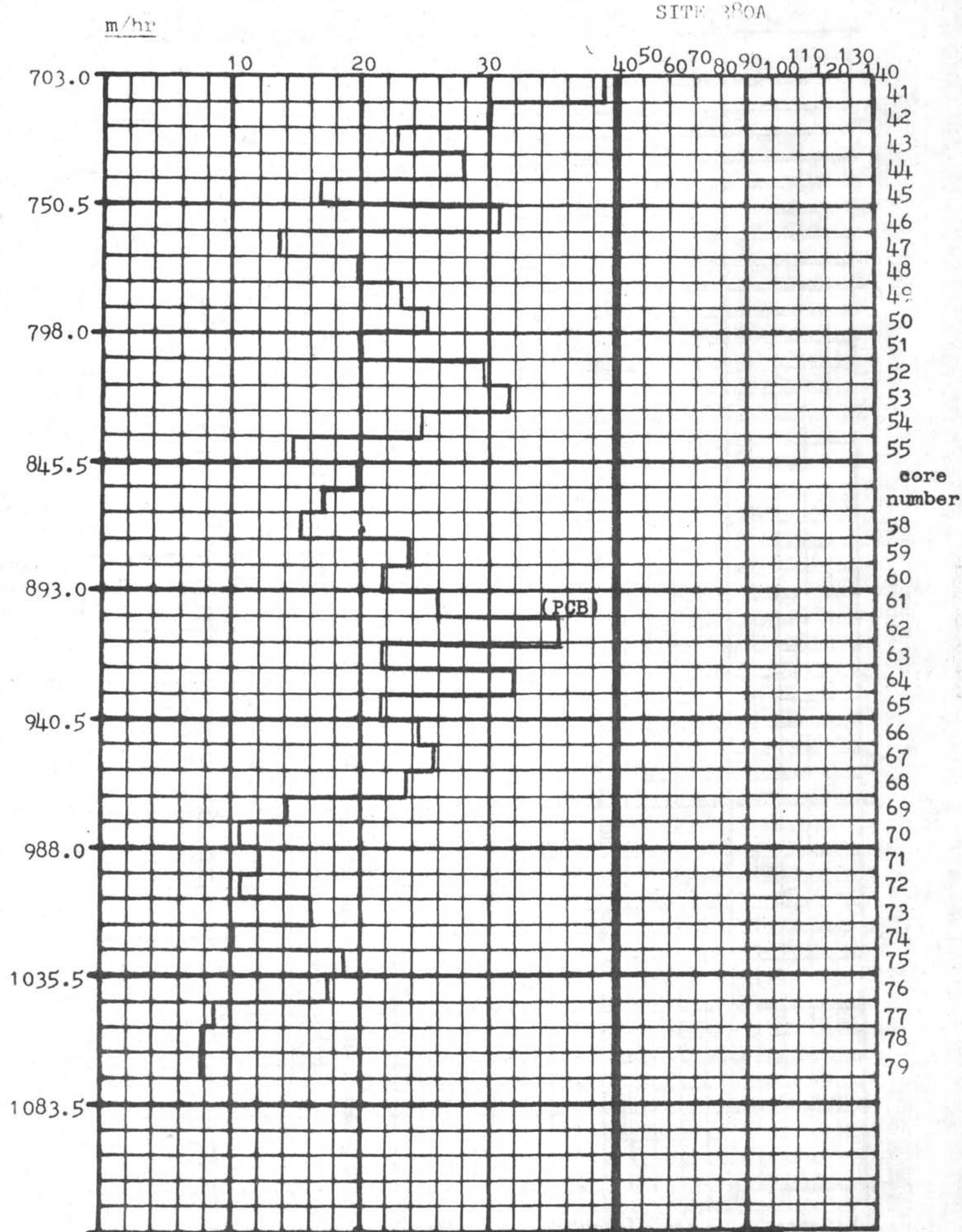
Penetration Rate (Continuous Coring) m/hr



Penetration Rate m/hr Continuous Coring

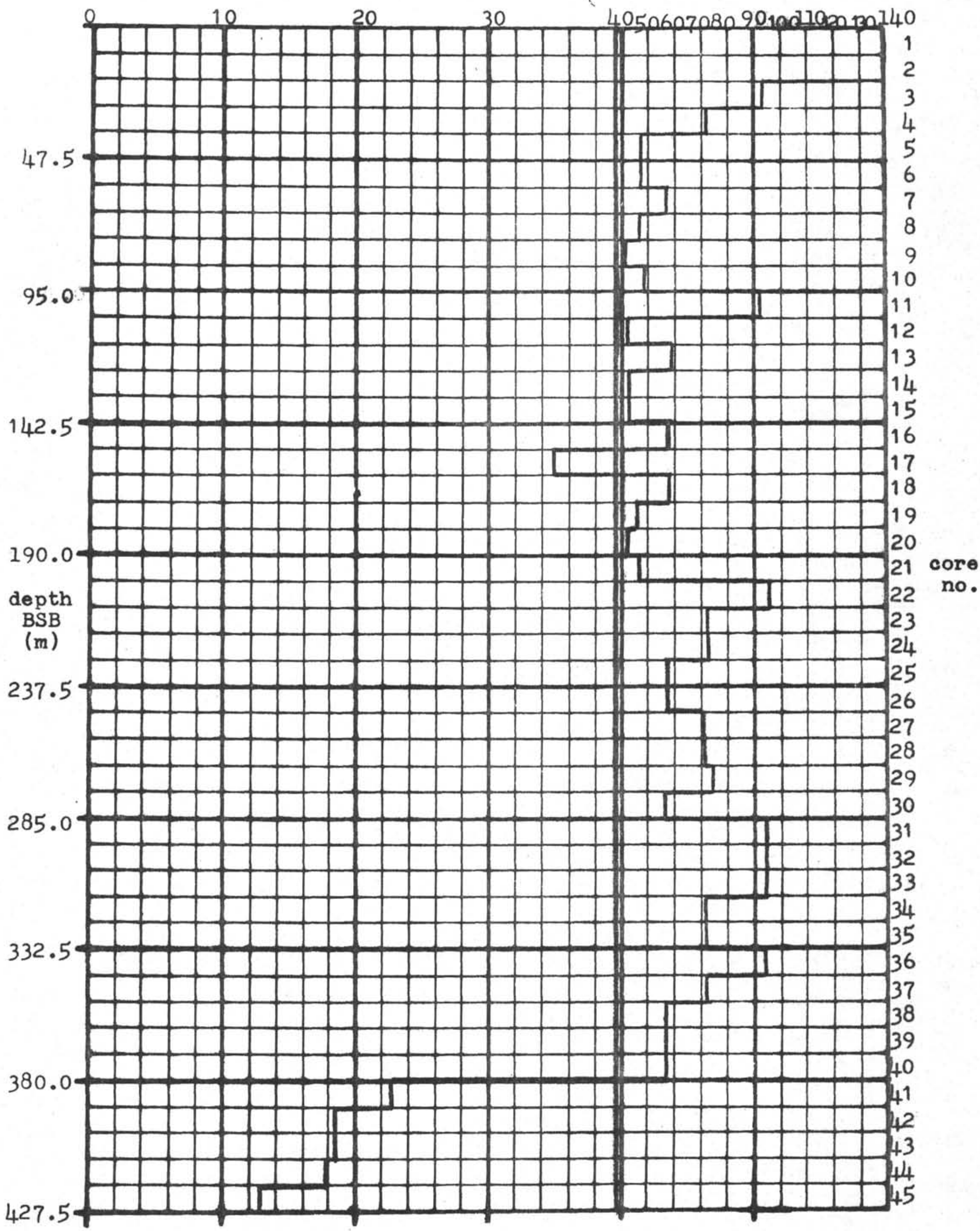


Penetration Rate m/hr Continuous Coring Sheet 1

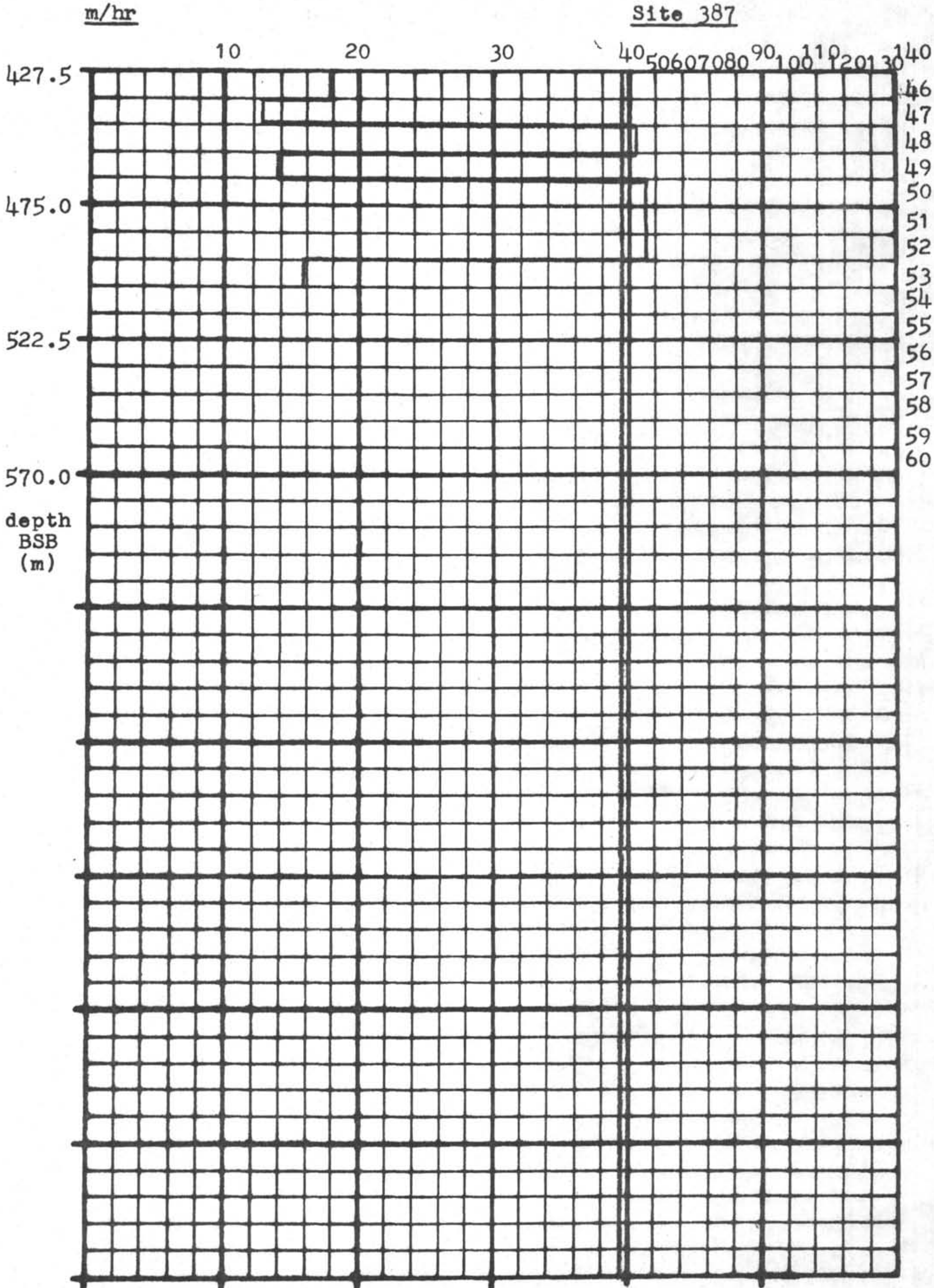


Penetration Rate m/hr Continuous Coring   Sheet 2 of 2 m/hr

Site 381



Penetration Rate (Continuous Coring)



m/hr
Site 387
10
20
30
40
50
60
70
80
90
100
110
120
130
140
427.5
475.0
522.5
570.0
depth
BSB
(m)
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 43

The 43rd scientific voyage of the GLOMAR CHALLENGER marked the contractual culmination of Phase III of the highly successful seven year Deep Sea Drilling Project. It was also a homecoming voyage after more than five years away from the continental United States. Despite nearly 35 days spent cruising and two major mechanical failures, six deep water Atlantic sites were drilled and cored. An extensive coring program was carried out in a variety of lithologies ranging from thick hemipelagic sediment sections to various volcanogenic rock typed, including basalt.

The leg commenced on June 11, 1975 at Istanbul, Turkey and terminated on August 12, 1975 at Norfolk, Virginia, U.S.A. A very brief stop was made at Ponta Delgada, Azores to embark scientific personnel and a two day unscheduled port call was made at Bermuda for emergency repairs. Of 3131.7 meters total penetration, 1768.5 meters of core was attempted with recovery of 957.9 meters.

Total length of the leg was 61.4 days of which 34.7 were spent under way. The ship was on site for 22.9 days and in port for 3.8 days.

ISTANBUL PORT CALL

Due to a high degree of port congestion, the CHALLENGER was assigned an anchorage at Büjük Dere. The anchorage, located near the northérn end of the Bosporus, was several kilometers from the main port of Istanbul. Inconvenient location and inadequate communications caused considerable difficulty and delay in customs and immigration formalities and in the movement of freight and personnel to and from the ship.

Major accomplishments of the port call included Global Marine and Scripps crew changes; inspection of the starboard tail shaft by representatives of GMI, the American Bureau of Shipping and the U.S. Coast Guard; on loading of fresh water and lube oil; onloading of GMI and SIO air and surface freight (including a spare tail shaft and 800 sacks of bentonite) and the onloading of consumable provisions.

Sailing from Istanbul was delayed for approximately six hours in anticipation of the arrival of two members of the scientific party. When it was learned that they would not be embarking in Istanbul, the anchor was raised and the cruise began after 48 hours and 50 minutes in port.

ISTANBUL TO PONTA DELGADA

The first 14 days of the leg were spent in steaming from Istanbul to the scheduled rendezvous at Ponta Delgada, Azores, Excellent weather prevailed for the duration and an average speed of 8.2 knots was made good. A geophysicist was on board for this portion of the cruise only and approximately three operating hours were spent in obtaining sonobuoy profiles for sound velocity measurements.

PONTA DELGADA PORT CALL

A total of 3.8 hours was spent at anchor while embarking and disembarking personnel. The total scientific staff for the drilling leg came aboard at this point and the geophysicist disembarked. In addition, two Scripps and two GMI crew members embarked while one of each departed. Fresh provisions were taken aboard and a small shipment was dispatched for SIO. Again, customs and other formalities were the time controlling factors.

AZORES TO SITE 382

Upon departing Ponta Delgada on June 27, course was set for the first proposed drilling site. The good weather continued to hold but attention was focused on the erratic progress of tropical storm Amy, the first of the season. About one day before the CHALLENGER's projected arrival at Site 43-1, it became evident that Amy would arrive at the same location shortly thereafter. As the storm rendered the scheduled occupation of Site 43-1 out of the question, the course was altered to the southwest to evade the storm. The storm remained in the area of Site 43-1 and it was necessary to proceed to Site 43-2. An estimated 30 hours of operating time were spent in additional steaming as a result of tropical storm Amy.

SITE 382 - NASHVILLE SEAMOUNT

On July 6, Site 382 was spudded in 5537 meters of water about one mile east of the base of the most easterly of the New England seamounts. Scientific objectives included determination of the time of seamount volcanism and sampling of both the sedimentary section and the basement.

While running drill pipe to the sea floor, difficulty was encountered in assigning power from the engine room to the "B" motor of the drawworks. Malfunctioning control components in the electric brake caused lack of positive control in braking. These problems were rectified and accounted for a total of three hours lost time.

The bottomhole assembly was magnafluxed as it was assembled and found free of defects.

Drilling and coring operations proceeded smoothly, although two extra wireline runs were necessary. The first was due to a buildup of line tar which prevented the overshot from latching onto the pulling neck. The second extra trip was necessary to free a stuck inner core barrel after shearing the pin in the overshot on the first attempt. The sticking was attributed to fragments of the volcanic breccia that was being penetrated at the time. Drilling was terminated after successful recovery of the breccia which was of a type not previously known to exist in the oceans.

The trip out of the hole was interrupted for a test of the drill pipe severing system. A blasting cap (dummy charge) was run down the drill pipe to a depth of 1500 meters and fired successfully, confirming the physical and electrical integrity of the system.

SITE 383 - SOHM ABYSSAL PLAIN

Upon completion of Site 382, the CHALLENGER steamed back northeast to the location which had been bypassed due to unfavorable weather. Objectives of the hole were to penetrate and sample the sedimentary section and to sample the basement for an indication of the nature of the J magnetic anomaly.

Some swell persisted on arrival at site and it was decided to perform an operational test of the heave compensator during the drilling operation. The heave compensator and power sub were picked up without incident, but during final adjustment of the compensator, the blocks were lowered too quickly. A joint of drill pipe and the pup joint below the power sub were bent. About six hours were required to set back the power sub and replace the pup joint and possibly damaged subs. As the heave compensator was also slightly damaged, it was set back for underway repair.

While washing down at about 35 meters subbottom, sloughing formation was encountered which tended to plug the annulus. The first core recovered coarse loose sand from about sixty meters. Sloughing and attendant hole problems continued intermittently in spite of mud flushes as drilling continued. A second core was attempted at 110-120 meters subbottom without recovery. At this point sticking tendencies increased and the danger to the drilling assembly was considered too great to warrant further efforts. The location was abandoned after a total of one and one half days on site.

SITE 384 - "TWO-BIT RIDGE"

A second attempt to drill the J anomaly was made about 95 miles northeast of Site 383 in an area where seismic profiles indicated that turbidites were absent.

A current estimated at 1.5 to 2 knots complicated initial positioning somewhat but was not considered strong enough to hamper operations. As operations proceeded, however, the force of the current appeared to increase.

The wind, which remained nearly at right angles to the current, increased to about thirty miles per hour. This combination of forces taxed the positioning system to the limit and utilized all available shaft and thruster horsepower to maintain station. On the final drilling day, winds increased briefly to about forty miles per hour, resulting in a 400 foot excursion and intermittent loss of acoustic signal. Although this situation forced a decision to pull the drill string, the wind force abated before the sea floor was cleared and drilling operations recommenced.

The drag of the current on the drill string resulted in considerable stress on the drill pipe at the keel line accompanied by strong vibration. Due to the near absence of swell those stresses normally associated with vessel roll/pitch were minimal at the time.

Two attempts to retrieve the final core resulted in sheared pins in the retrieval tool. It was therefore necessary to pull the entire drill string to recover the inner core barrel. Limited time precluded another round trip to drill a desired offset hole for sampling shallow sediments. When the coring assembly had been recovered, it was found that the core barrel had been jammed upward so tightly by material in the bit that the latch could not release. A lump of hard basalt was wedged in the core throat with soft, weathered basalt packed around it, completely plugging the throat.

SITE 385 - VOGEL SEAMOUNT

The revised schedule called for drilling a second seamount site near the Gosnold Seamount, (Site 43-6) but again the elements changed the schedule. When the CHALLENGER had approached to within about eighty miles of Site 43-6, her speed of advance at full shaft RPM had decreased to less than four knots. In nearly flat calm wind and seas, this indicated she was stemming a four to five knot current. In view of the current related problems at the previous site, it was considered highly unlikely that operations would be feasible at the proposed location. An alternate site was selected at Vogel Seamount, which lies outside the path of the Gulf Stream and course was altered southward toward the new destination. Delay due to the indirect route and reduced headway was approximately 18 hours.

After arrival on site, operations progressed quite smoothly with the only problem being very low core recovery in poorly consolidated volcanoclastic material.

On the final day on site, while pipe was being pulled, a serious leak developed in the gear box of No. 2 (forward) bow thruster. Seawater was replacing the oil at an untenable rate and it was decided that further use of the thruster could be justified only in emergency situations.

BERMUDA PORT CALL

Fortunately the ship's track from Site 385 to Site 386 passed very close to the island of Bermuda and Global Marine was able to secure a docking assignment for the CHALLENGER on extremely short notice. As a result the ship was berthed in Hamilton, Bermuda for emergency thruster repairs less than forty hours after departing Site 385.

GMI's Ship Manager, Robert Rakestraw and Port Engineer, Neville Motts, had flown to Bermuda to greet the CHALLENGER and to take charge of the repair operation. Local divers and a large mobile crane were standing by to assist ship's company in installing the "earmuff" thruster tunnel covers. This operation was completed in a record time of four hours.

When the thruster tunnel had been pumped dry and entered, it was discovered that eight of the sixteen bolts joining the base of the thruster's right angle gear drive to the skeg were sheared off or loosened. Although the cause of the failure was not determined, the bolts were replaced, all bolts in the tunnel were tightened and epoxy was applied to the heads to prevent loosening by vibration.

In addition to the emergency repair work, fresh commissary supplies were taken aboard and the xerox copy machine was serviced.

Despite a concentrated effort, repairs were not completed in time to leave port on July 23. A delay of about eleven hours was occasioned by port regulations prohibiting night departures. At 0610 local time on July 24, the CHALLENGER was again under way after a total of 38 hours in port. Total operational time lost due to thruster breakdown is estimated to be 48 hours.

SITE 386 - SOUTHEAST OF BERMUDA

Site 386 was located about eighty miles from Bermuda and the beacon was dropped less than thirteen hours after departure from port. Scientific aims included a fairly continuous coring program through the sedimentary section with a final basement objective. Three major seismic reflecting horizons were to be sampled to determine their age and nature.

Operations proceeded smoothly until early on the fifth day when rising winds, coupled with a current about twenty degrees on the bow, began to cause frequent loss of acoustics and threatened to overload the propulsion machinery. Coring operations were suspended for thirty minutes until conditions stabilized.

Coring then continued through a thick section comprised mostly of fairly homogeneous claystone. This accounted for a core recovery of over seventy percent. Basement was reached and basalt was recovered.

SITE 387 - SOUTHWEST BERMUDA RISE

Located about 190 miles northwest of the previous drill site, Site 387 was drilled with basically the same scientific objectives as Site 386.

After early delays to set back the heave compensator and to replace the swivel wash pipe and packing assembly, drilling and coring proceeded without delay. Core recovery was below average through the entire sediment section. This is at least partially attributable to the presence of chert in the sediments and to a considerable interval of hard limestone interbedded with rather soft clay. Basement was again reached and the rate of penetration slowed to less than one meter per hour in massive basalt. Fortunately the full 2.9 meters of basalt cored was recovered.

It was discovered after drilling had been completed that the main bearing of the swivel was severely damaged. As repair was beyond shipboard capabilities and a spare swivel is not as yet carried aboard the CHALLENGER, drilling operations were effectively terminated for the leg.

SITE 387 TO NORFOLK

A seventh site had been scheduled for drilling prior to entering port, but loss of drilling capability forced another schedule change. As the ship was only two days steaming time from Norfolk, last minute arrangements for early entry into port were necessary. To make the most efficient use of remaining operating time, post-site geophysical surveys were conducted between Sites 387 and 386. At 1312 on August 9, after 53.7 hours of surveying, the CHALLENGER departed Site 387 for Norfolk. Leg 43 ended officially at 0945 on August 12 when the first mooring line was put over at Lambert Point Docks, Norfolk, Virginia.

DRILLING AND CORING EQUIPMENT

A standard DSDP bottomhole assembly was used at all sites. This consisted of a bit, bit sub (with float valve), core barrel, three 8-1/4" drill collars, one five foot stroke Baash-Ross bumper sub, three 8-1/4" drill collars, two five foot stroke bumper subs, two 8-1/4" drill collars, one 7-1/4" drill collar and one joint 5-1/2" heavy wall drill pipe. No drilling tools were lost.

Initial problems with power to a drawworks motor and the functioning of the pipe racker skate were traced to the engine room switchboard and to a faulty control air valve, respectively and corrected.

Considerable concern was generated when, on two occasions, malfunctions in the control components of the ELMAGCO electric drawworks brake resulted in a loss of positive braking control at the driller's console. Satisfactory function was regained through the skill of the ship's electrician and the use of a non-standard rectifier. The reliability of the system remained doubtful, but no further problems occurred.

After drilling had been completed at Site 387 and just as the Bowen sub/swivel assembly was about to be set in the rat hole, the lower seal of the swivel failed, allowing the oil to escape from the housing. The oil was found to contain abundant metal fragments, indicating bearing failure in the swivel. The swivel was disassembled and the lower race of the main (thrust) bearing was found to be severely pocked with much of the facing metal lost. The upper race was gouged at one point. Some of the tapered rollers were severely worn at the small and while others were pitted. As neither a spare swivel nor spare bearing parts are carried on board, the casualty terminated drilling capabilities for the leg. It is felt that excess torque resulting from the early stage of this failure may have contributed to the apparent weakness in the heave compensator noted at the beginning of Site 387 operations. (See details under Heave Compensator Section)

On four occasions, extra core retrieval trips were required. In one case a buildup of line tar prevented the overshot from latching onto the pulling neck. Three overshot pins were sheared in attempts to retrieve stuck inner barrels. On one occasion the second retrieval attempt was successful and in the second instance the drill string was pulled after two pins were sheared. At other times considerable pull was required but the barrels released before the pin sheared. One shear pin failed during retrieval.

Five core barrels were retrieved with no recovery. In all cases but one this can be attributed at least partially to the unconsolidated or brecciated nature of the material being cored and not to mechanical failure of the coring equipment. The fifth empty barrel resulted when very sticky clay was being cored and all dogs of the dual core catcher were found to be "pasted" in the open position, leaving nothing to retain the core. The slip-type core catcher was employed unsuccessfully on two runs in basalt breccia. The first recovery was limited to a broken core fragment (apparently cut on the previous core) that had jammed across the catcher at the bottom of the slips and prevented further core entry. On the second run there was no recovery but the catcher appeared fully functional.

BITS

No bit failures occurred during the course of the leg. The F94CK sealed journal bearing roller cone bit was convincingly effective in penetrating highly variable lithologies at a generally satisfactory rate. All bits were recovered with bearing seals intact, indicating that all bearings remained in good condition. Cutting structures were unmarred except in the bit run at Site 387. Several tungsten carbide inserts were broken on this bit, probably as a result of drilling chert encountered at several points in the sediment section. This was undoubtedly a factor in the very slow rate of penetration in the basalt basement at this site.

HEAVE COMPENSATOR

The drill string heave compensator was incorporated in the drilling system on Sites 383 and 387 for purposes of performance evaluation and crew familiarization. Although a peripheral problem developed, the system was found to perform well without repetition of malfunctions noted on previous trials.

At Site 383, initial attempts to balance the cylinders found the accumulator piston stuck in the full down position. A relief valve opened when additional hydraulic pressure was applied to dislodge it. The main stand pipe valves were then closed and the pressure was raised sufficiently to break the piston loose.

During subsequent balancing procedures, the compensator was being closed by gravity with the drill string hung at the rotary table and one joint of drill pipe above the elevator. The travelling block was lowered too quickly due to a misinterpreted signal and everything between the blocks and the floor was placed in compression. The joint of drill pipe was bent severely and the twenty foot pup joint appeared to be bent slightly. In addition, the slider bar on the side of the compensator cylinder was badly bent and the bolts holding it to the lifting block had sheared, allowing the block to rotate out of position.

The drill pipe joint, pup joint, saver sub and kelly sub were all replaced. An attempt was made to straighten the slider bar, but the unit was set back when it was determined that excessive repair time would be required.

The slider was heated and straightened and the bolts were replaced while the ship was under way.

At Site 387 the compensator was picked up and balanced without incident. The system operated quite satisfactorily for sixty meters penetration (including one core), although the ship was heaving only slightly.

In the course of the drilling operation, it was noted that the lifting block was rotating ten to fifteen degrees when the compensator cylinder was open and the drill string was being turned. The torsional force was apparently the result of frictional drag generated in the swivel thrust bearing with a heavy drill string suspended and rotating. This resulted in repeated bending of the previously weakened slider bar and considerable shear stress on the bolts holding it to the block. Failure of the bolts or of the slider appeared imminent. This would have allowed the block to rotate to a position where the compensator cylinder could not be latched in the closed position and could have allowed the heavy slider bar to fall to the rig floor. It was therefore necessary to remove the compensator from the system before the failure could occur and until a replacement slider could be procured.

POSITIONING SYSTEM

With the exception of the major bow thruster casualty, the dynamic positioning system performed flawlessly within its capabilities. Near perfect weather experienced during site occupancy was a major factor in the excellent performance of the system. Temporary station keeping and acoustics loss difficulties were encountered on two occasions when wind/current conditions taxed the ship's available propulsion and thruster power to the limit.

BEACONS

The performance of the ORE acoustic beacons of both frequencies was without fault. Strong signal levels and good pulse characteristics were maintained for the duration of occupancy at all sites. The only problem encountered was a tendency for the plastic activating plugs to break as they are being removed. This made removal of the magnets difficult.

WEATHER AND CURRENTS

With the exception of several hours delay and two days of fairly rough seas involved in circumnavigating tropical storm Amy, excellent weather prevailed for the entire leg. At no time were on-site operations affected adversely by roll, pitch or heave. On the two occasions when some station keeping difficulty was experienced, wind and seas would have been no problem had they not been aggravated by strong currents.

The current factor has established itself as a fairly important operational consideration. There have been only a few holes drilled in areas of strong currents, but experience indicates that fairly fast moving surface currents can be handled by the CHALLENGER's positioning system if the weather is good. Deep running currents, such as the Gulf Stream encountered at Site 384, exert additional force as they act on a considerable length of drill pipe. The additional force which must be overcome by the positioning system is probably a less important factor than the stress exerted on the drill pipe at the ship.

COMMUNICATIONS

No major communications problems were encountered on Leg 43. Radio communications equipment performed well with only minor maintenance actions required.

During the early days of the cruise, while the ship was operating in Mediterranean and eastern Atlantic areas, outgoing messages were sent routinely through the U.S.

Navy Station, NGR, in Greece. Incoming traffic was received via the Navy's Mercast, a system in which the traffic is sent "blind" and each ship copies the messages addressed to itself.

The ship was in direct contact with SIO station WWD by July 1 and all incoming traffic for the remainder of the leg was received directly. The Navy circuit was utilized on two or three occasions for outgoing traffic when the CHALLENGER's signals were too weak to be read by WWD.

Several commercial radio telephone calls were made for business and personal reasons with good results. Many amateur radio telephone patches were made with satisfactory results.

In addition to the ship's traffic, the CHALLENGER routinely transmitted weather and hydrographic data to NOAA and the U.S. Navy. These data were the result of observations by the meteorologist and were transmitted several times daily.

NAVIGATION

During operations at Site 386, a mechanical problem in the teletypewriter printout of the satellite navigation system resulted in the loss of the system for the remainder of the leg. An attempt was made to utilize LORAN navigation, but the unit proved inaccurate and unreliable. Navigation for Site 387 and subsequent surveys and the final cruise to Norfolk was dependent on celestial fixes and dead reckoning. Due to hazy and foggy conditions at Site 387, final coordinates were based on a single star fix.

Though LORAN navigation is possible only within about 800 miles of land, it is recommended that the unit be maintained in a tuned and fully operational condition. It is the only backup for the SAT NAV system when celestial fixes cannot be obtained and a significant portion of IPOD operations are scheduled within LORAN range.

In areas where currents are a factor in station keeping and navigation, a properly calibrated pitometer log would be helpful in evaluating current direction and velocity. The CHALLENGER's pit log has been out of commission for some time and is located at the moonpool where it is affected by turbulence.

PERSONNEL

It is worthy of note that the staff endured one of the longest cruises in the history of the Project without serious morale problems, illnesses or injuries. The near absence of injury was no accident, as a high degree of safety consciousness was evident among GMI's drilling and marine personnel.

Global Marine personnel were conscientious and competent, especially in minimizing the operational downtime caused by major mechanical failures.

The SIO technical staff discharged their duties in a competent and reliable manner.

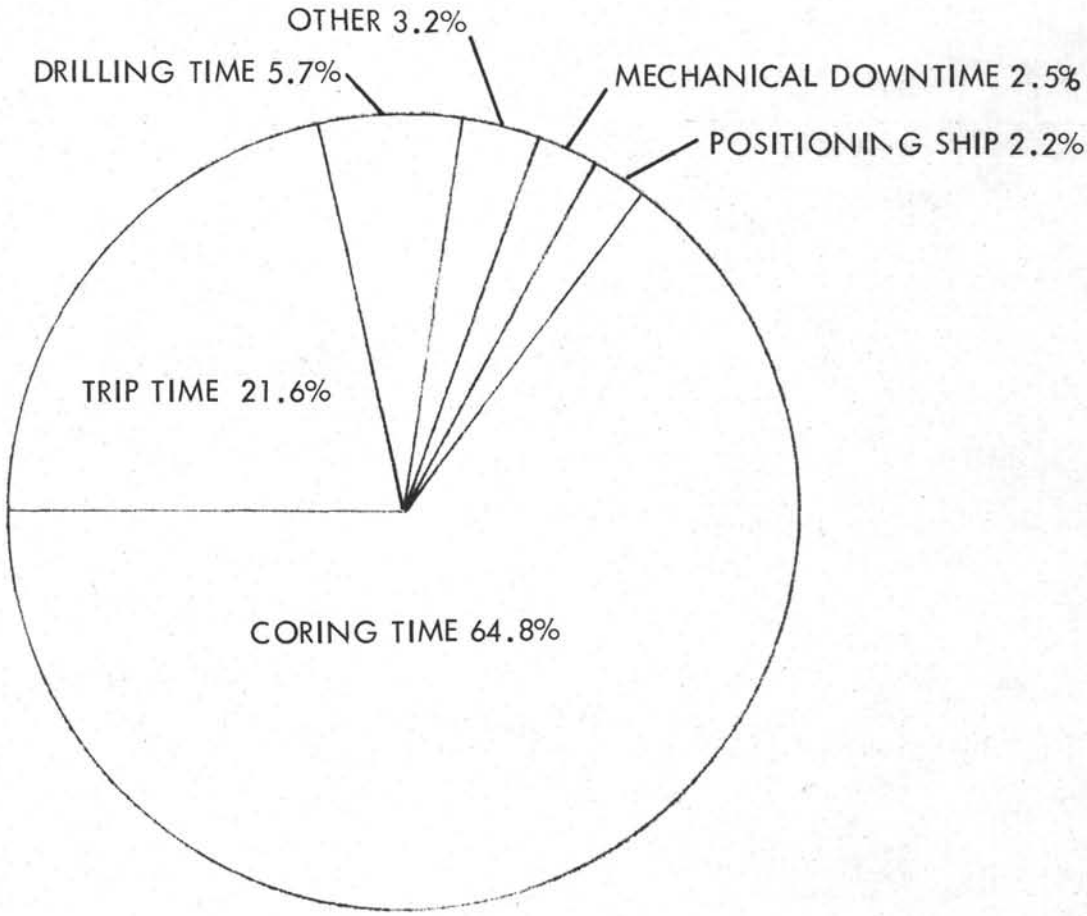
The multinational scientific group proved to be highly congenial and enjoyed an excellent working relationship with the technical and contractor's personnel. As drilling operations were concentrated near the end of the voyage, a truly impressive volume of work was accomplished under severe time and space limitations.

Glen N. Foss
Cruise Operations Manager
Deep Sea Drilling Project

DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 43

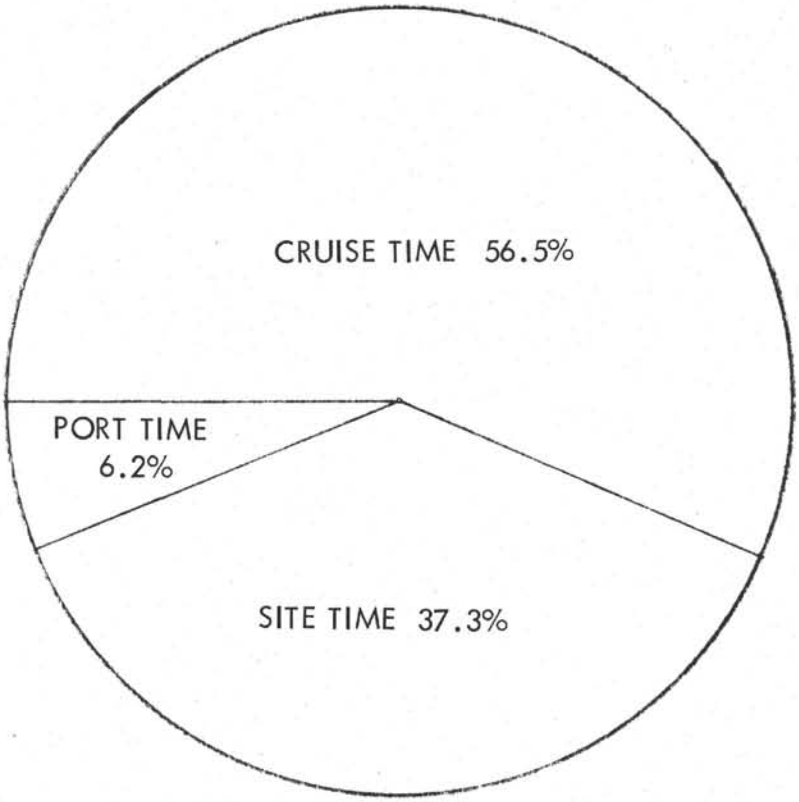
Total Days, Leg 43		61.4
Total Days In Port		3.8
Total Days Cruising		34.7
Total Days On Site		22.9
Trip Time	4.9	
Drilling Time	1.3	
Coring Time	14.9	
Mechanical Downtime	0.6	
Position Ship	0.5	
Other	0.7	
Total Distance Traveled (Nautical Miles)		7125
Average Speed (knots)		7.7
Sites Investigated		6
Holes Drilled		6
Number of Cores Attempted		189
Number of Cores With Recovery		184
Total Meters Cored		1768.5
Total Meters Recovered		957.9
Percent Recovery		54.2
Total Meters Drilled		1363.2
Total Meters of Penetration		3131.7
Percent of Penetration Cored		56.5
Maximum Penetration - Meters		973.8
Minimum Penetration		120.3
Maximum Water Depth - Meters		5537
Minimum Water Depth		3920

DEEP SEA DRILLING PROJECT
ON-SITE TIME DISTRIBUTION
LEG 43

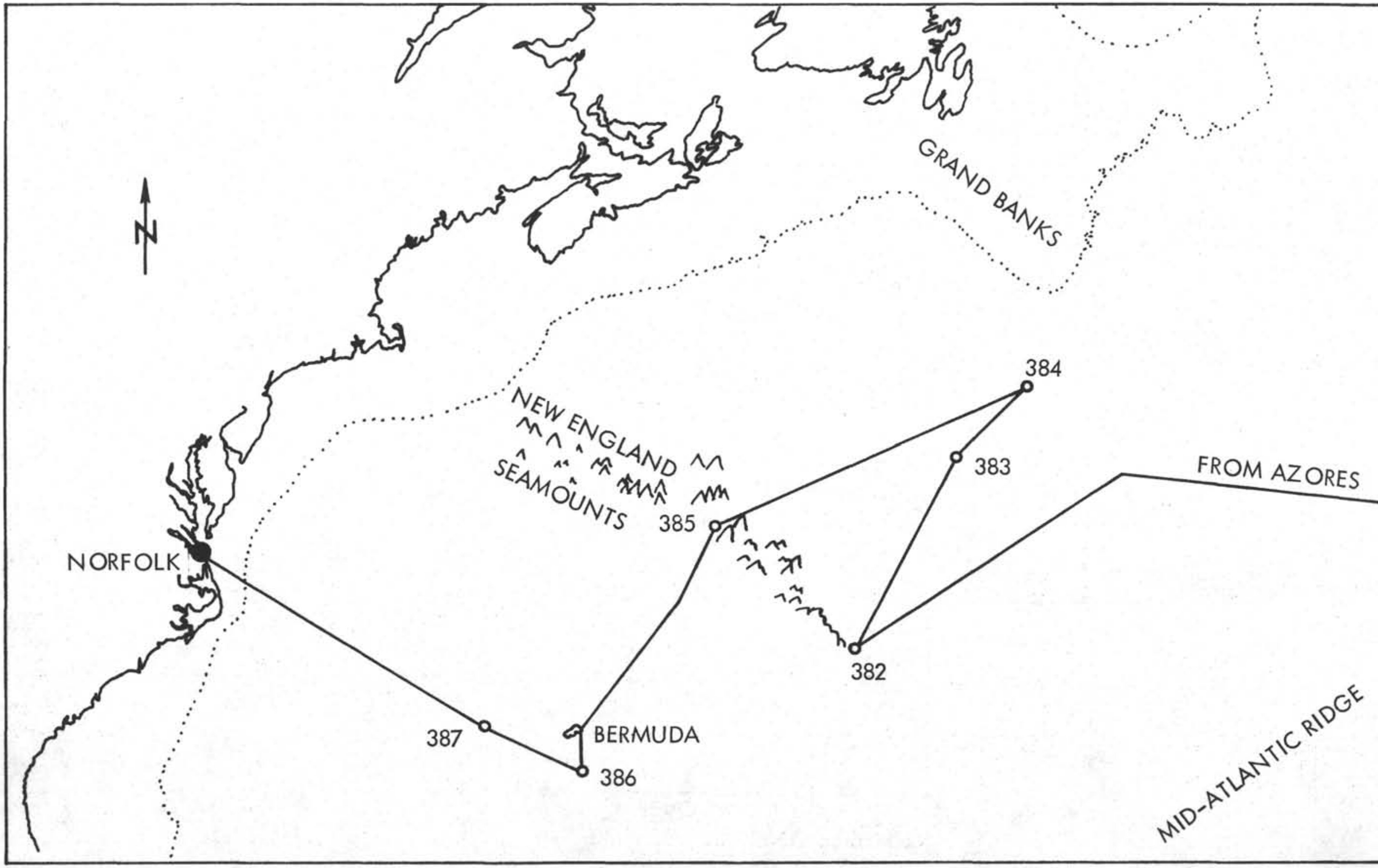


TOTAL TIME ON SITE: 22.93 Days
TOTAL SITES: 6
TOTAL HOLES: 6

DEEP SEA DRILLING PROJECT
TOTAL TIME DISTRIBUTION
LEG 43



START LEG: June 11, 1975
FINISH LEG: August 12, 1975
TOTAL TIME: 61.44 Days



LEG 43 DRILL SITES
ISTANBUL – NORFOLK

DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 43

Site No.	Make	Freq. kHz	Serial Number	Site Time Hours	
382	ORE	13.5	354	90.5	Strong for duration.
383	ORE	16.0	295	35.9	Strong for duration.
384	ORE	13.5	353	54.6	Strong for duration.
385	ORE	16.0	309	64.9	Strong for duration.
386	ORE	16.0	291	166.2	Strong for duration.
387	ORE	13.5	318	138.2	Strong for duration.

DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 43

Hole	Mfg.	Size	Type	Serial Number	Meters Cored	Meters Drilled	Meters Total Penet.	Hours On Bit	Condition	Remarks
382	Smith	10-1/8	F94CK	SZ218	232.2	288.3	520.5	11.8	T1, B1, SE	Drilled clay & volcanic breccia. Suitable for rerun.
383	Smith	10-1/8	F94CK	SZ217	19.0	101.3	120.3	0.8	T1, B1, SE	Drilled coarse, loose sand.
384	Smith	10-1/8	F94CK	SZ217	194.4	135.9	330.3	8.0	T1, B1, SE	About 3 hours in basalt. Total 8.8 hours.
385	Smith	10-1/8	F94CK	SZ217	227.9	164.7	392.6	10.9	T1, B1, SE	About 4 hours in basalt breccia. Total 19.7 hours.
386	Smith	10-1/8	F94CK	SZ087	626.8	347.0	973.8	61.1	T1, B?, SE	About 5 hours in basalt. Core guide somewhat bent.
387	Smith	10-1/8	F94CK	SZ096	468.2	326.0	794.2	45.4	T3, B?, SE	Several broken inserts. Drilled chert, lime and basalt.

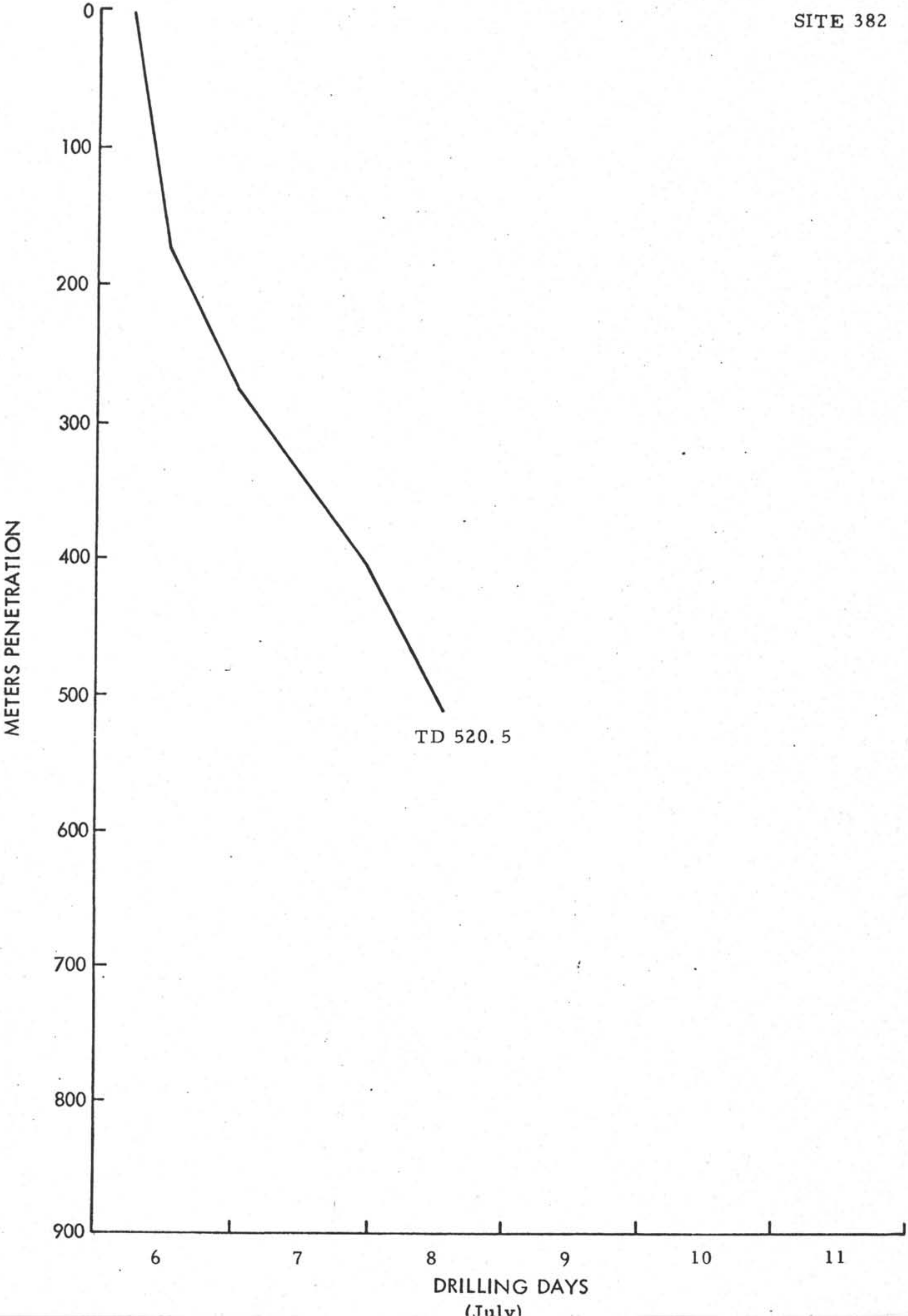
DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG 43

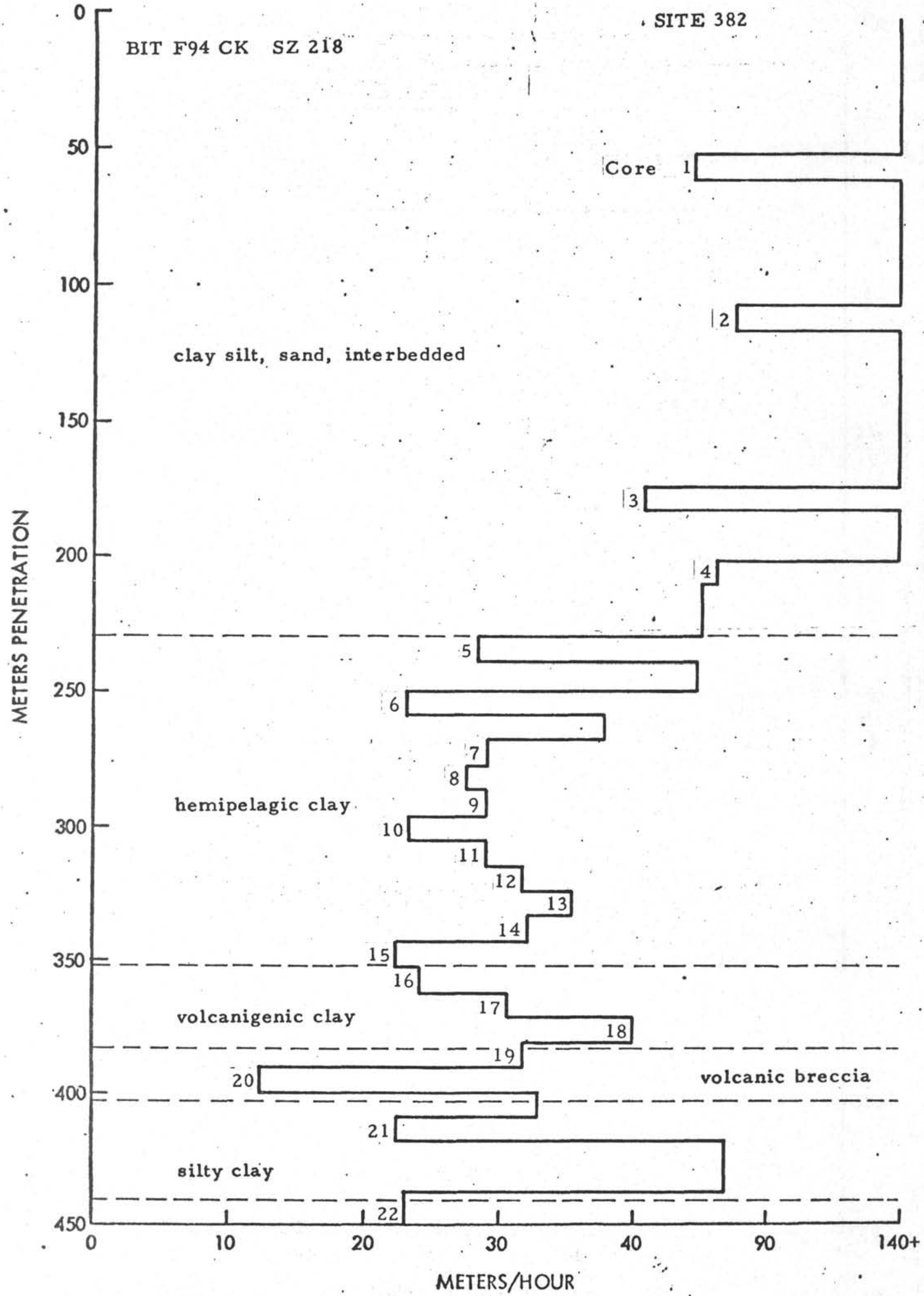
Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	Position Ship	Mech. Repair	Port Time	Other	Total Time	Remarks
6/11-27		340.8							48.8		389.6	Istanbul to Azores.
6/27-7/5		169.4							3.8		173.2	Azores to Site 382.
7/5-9	382		22.4	5.6	47.1		1.2	5.5		8.7	90.5	Severing system; magnaflux Mechanical problems.
7/9-10		38.0									38.0	
7/10-12	383		22.6	1.0	3.4	1.2	1.2	6.5			35.9	Heave compensator. Hole trouble.
7/12		12.0									12.0	
7/12-15	384		16.4	1.6	29.5		4.9	0.5		1.7	54.6	Bowen hose.
7/15-18		73.3									73.3	
7/18-20	385		19.6	1.6	41.1		2.1			0.5	64.9	
7/20-22		44.0									44.0	Site 385 to Bermuda.
7/22-24		12.8							38.0		50.8	Bermuda to Site 386.
7/24-31	386		18.4	8.6	136.8		1.1			1.3	166.2	
7/31-8/1		21.1									21.1	
8/1-7	387		19.3	12.8	98.6		1.7	1.5		4.3	138.2	Heave Comp - swivel down.
8/7-12		122.3									122.3	Site 387 to Norfolk.
	Total	833.7	118.7	31.2	356.5	1.2	12.2	14.0	90.6	16.5	1474.6	

DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 43

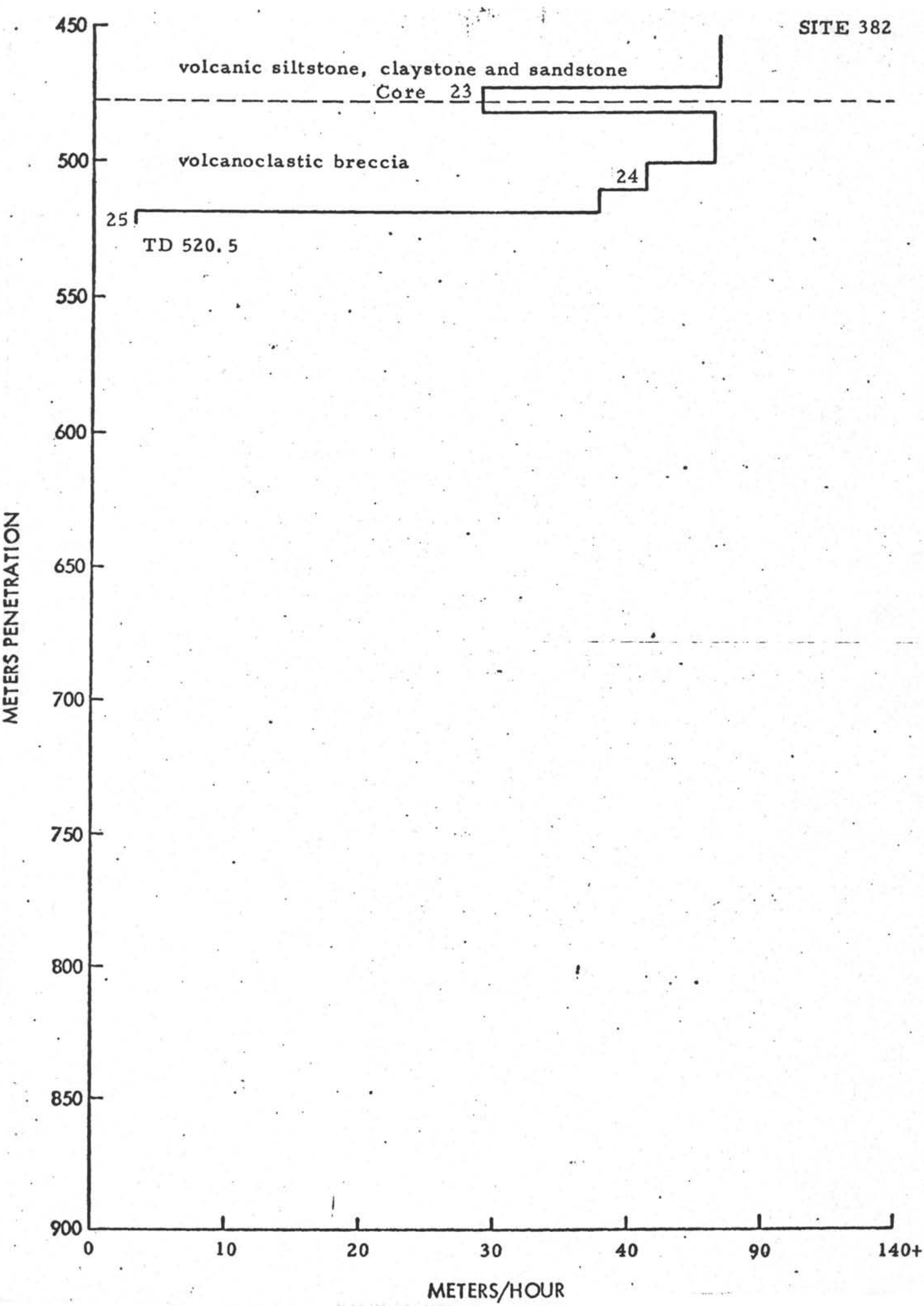
Hole	Latitude	Longitude	Water Depth Meters	Number Of Cores	Cores With Recovery	Percent Of Cores With Recovery	Meters Cored	Meters Recovered	Percent Recovered	Meters Drilled	Total Penet. Meters	Avg. Rate Penet.	Time On Hole	Time On Site
382	34° 25.04'N	56° 32.25'W	5537	25	25	100.0	232.2	162.4	69.9	288.3	520.5	44.1	90.5	90.5
383	39° 14.88'N	53° 21.18'W	5277	2	1	50.0	19.0	4.9	25.7	101.3	120.3	144.4	35.9	35.9
384	40° 21.65'N	51° 39.80'W	3920	22	20	90.9	194.4	110.5	56.8	135.9	330.3	41.2	54.6	54.6
385	37° 22.17'N	60° 09.45'W	4966	24	23	95.8	227.9	63.3	27.8	164.7	392.6	36.1	64.9	64.9
386	31° 11.21'N	64° 14.94'W	4793	66	65	98.5	626.8	439.5	70.1	347.0	973.8	15.9	166.2	166.2
387	32° 19.2'N*	67° 40.0'W*	5128	50	50	100.0	468.2	177.3	37.9	326.0	794.2	17.5	138.2	138.2
				189	184	97.4	1768.5	957.9	54.2	1363.2	3131.7	22.7		550.3

* Based on celestial navigation

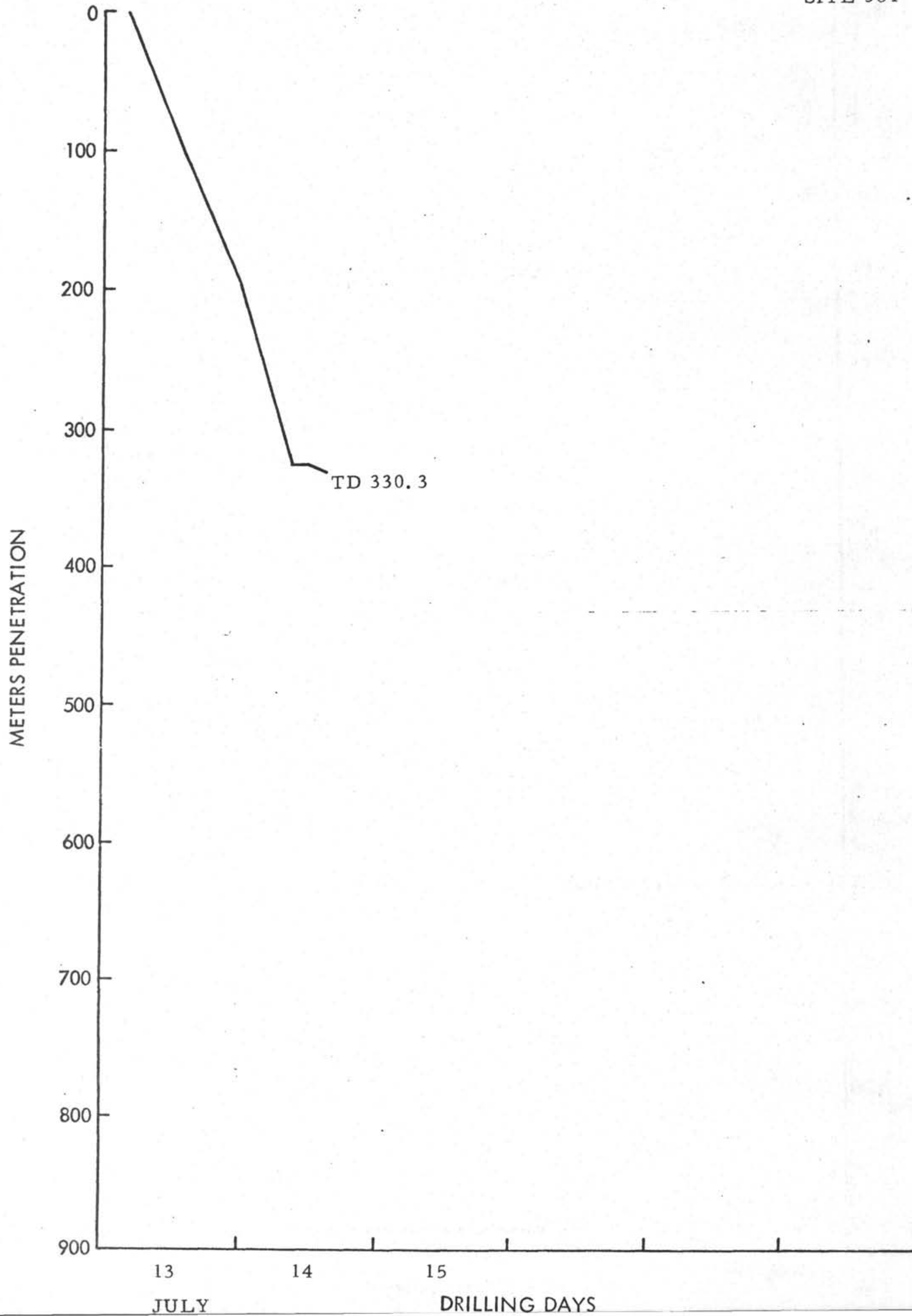

SITE 382
METERS PENETRATION
0
100
200
300
400
500
600
700
800
900
TD 520.5
6
7
8
9
10
11
DRILLING DAYS
(July)

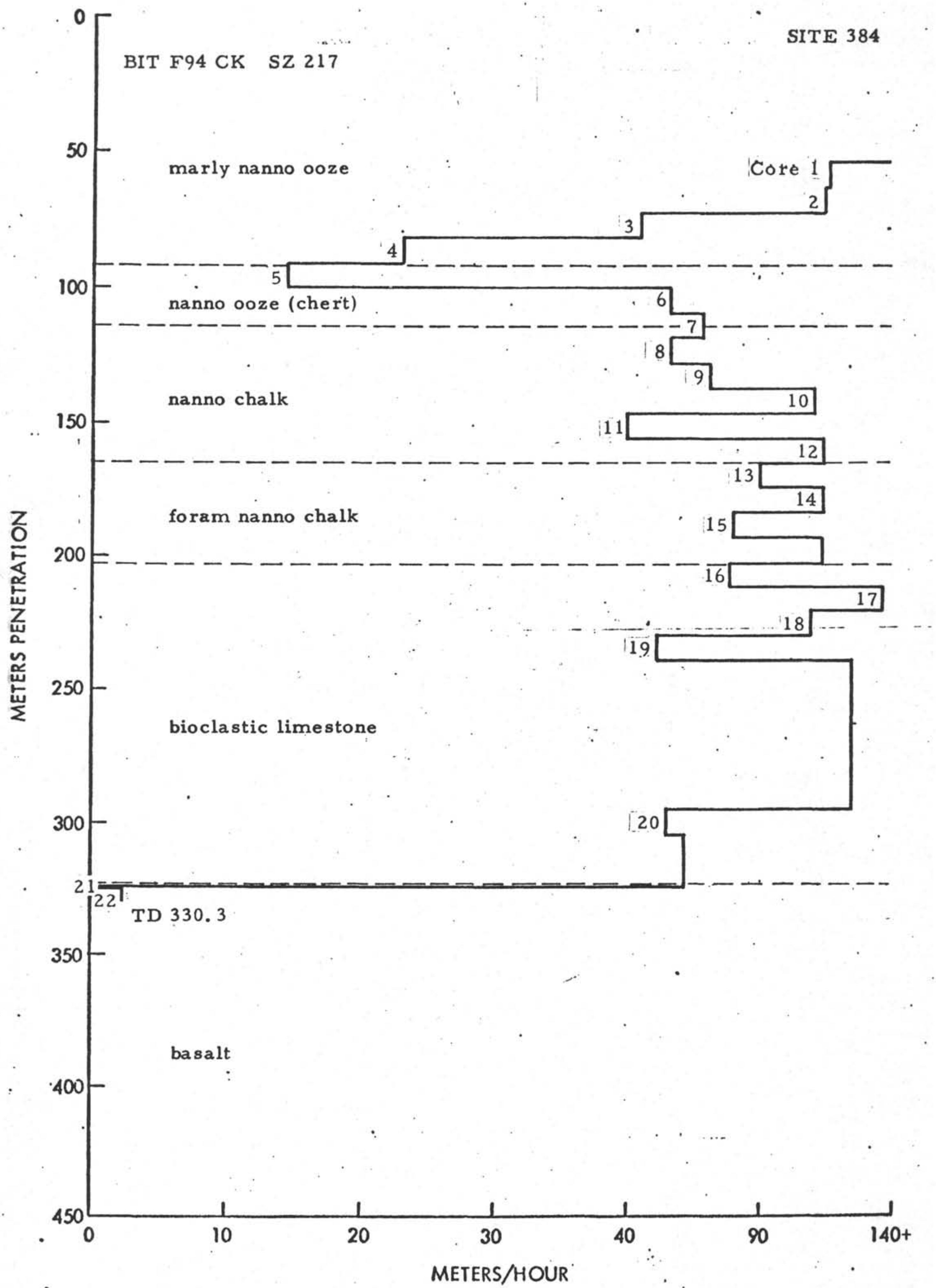


SITE 382
BIT F94 CK SZ 218
Core 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
clay silt, sand, interbedded
hemipelagic clay
volcanigenic clay
volcanic breccia
silty clay
METERS PENETRATION
0
50
100
150
200
250
300
350
400
450
0
10
20
30
40
90
140+
METERS/HOUR

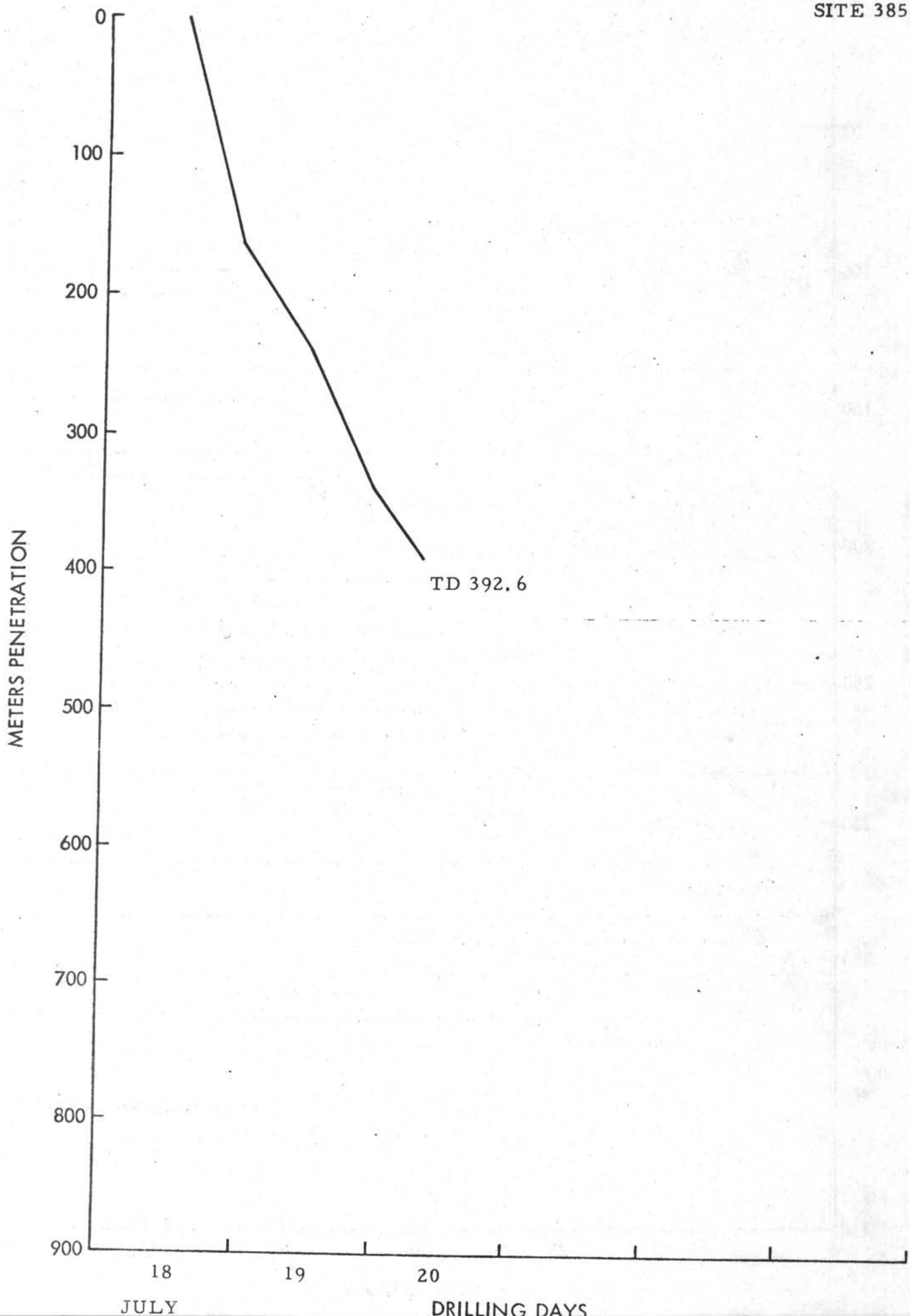


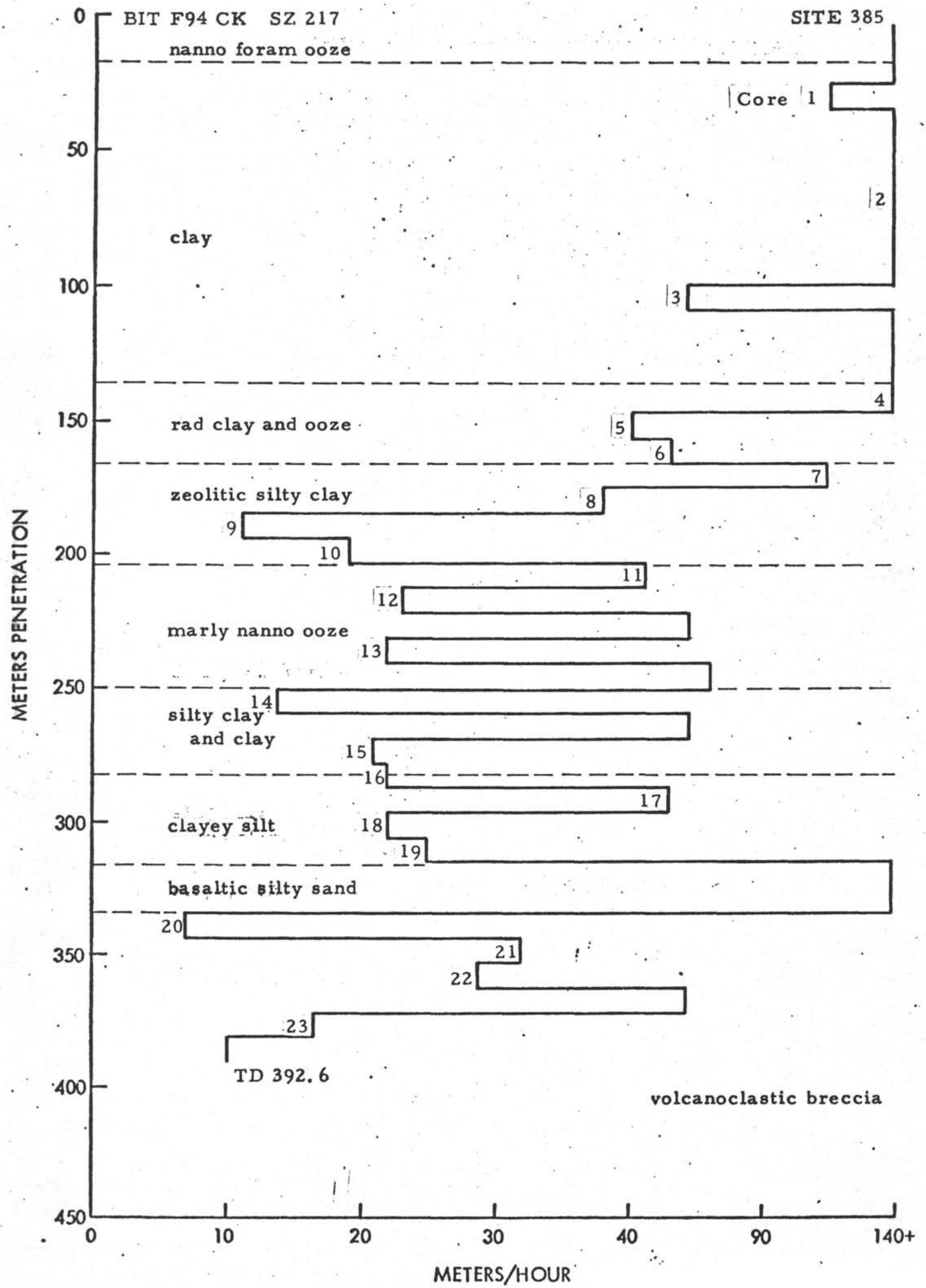
SITE 382
volcanic siltstone, claystone and sandstone
Core 23
volcanoclastic breccia
24
25
TD 520.5
METERS PENETRATION
450
500
550
600
650
700
750
800
850
900
0
10
20
30
40
90
140+
METERS/HOUR


0
100
200
300
400
500
600
700
800
900
METERS PENETRATION
TD 330.3
13
14
15
JULY
DRILLING DAYS

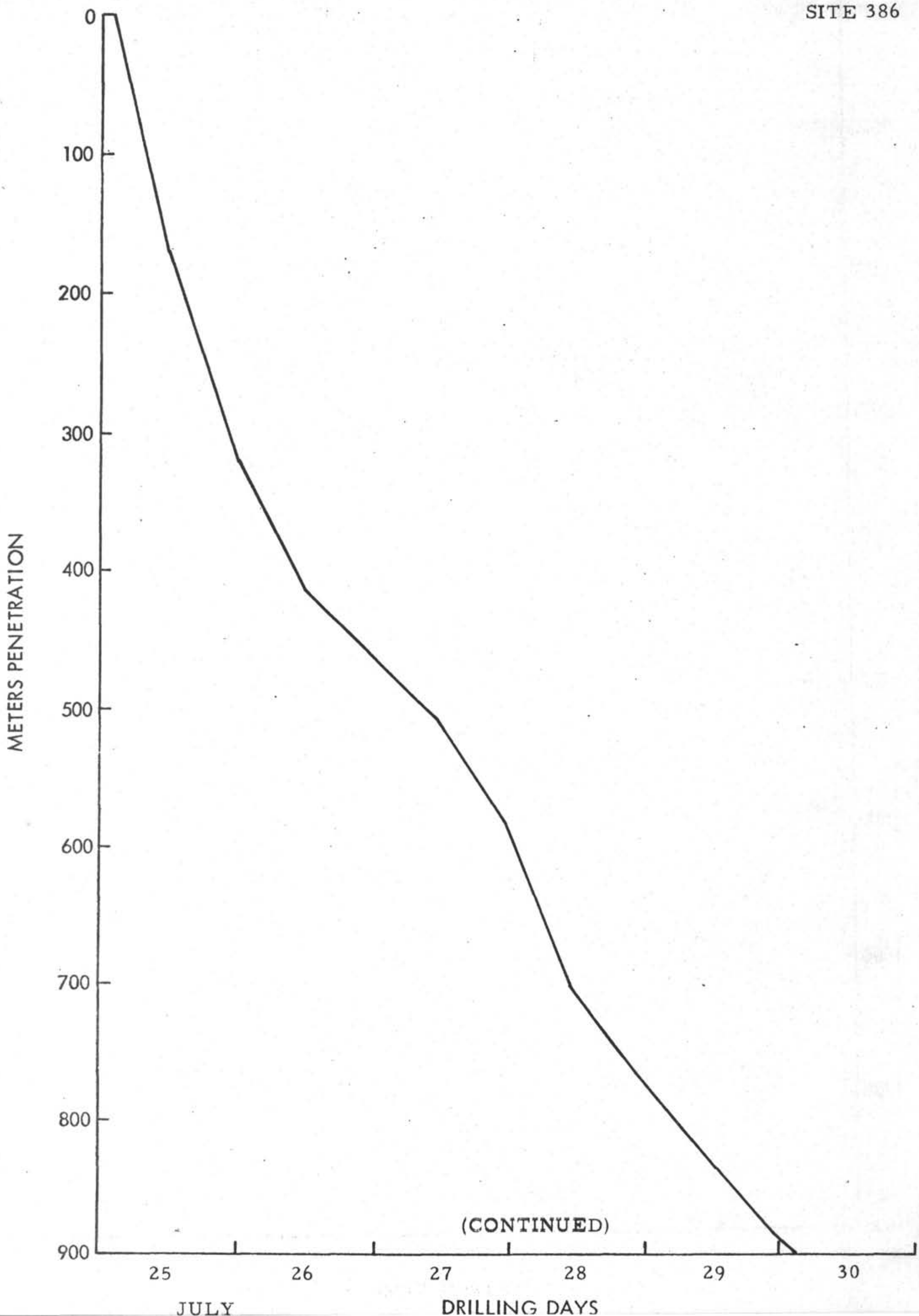


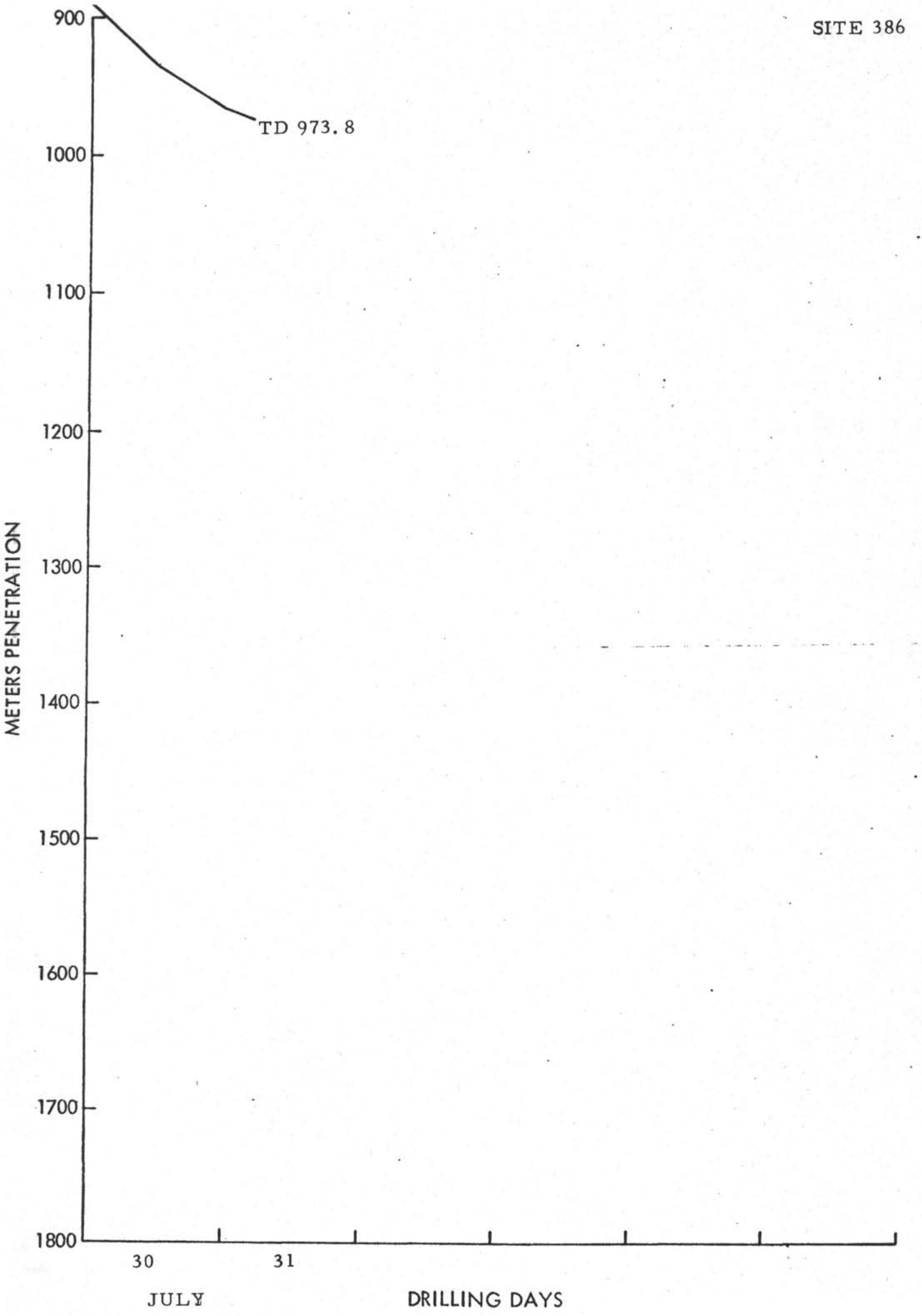
SITE 384
BIT F94 CK SZ 217
marly nanno ooze
nanno ooze (chert)
nanno chalk
foram nanno chalk
bioclastic limestone
basalt
TD 330.3
Core 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
METERS PENETRATION
0
50
100
150
200
250
300
350
400
450
0
10
20
30
40
90
140+
METERS/HOUR

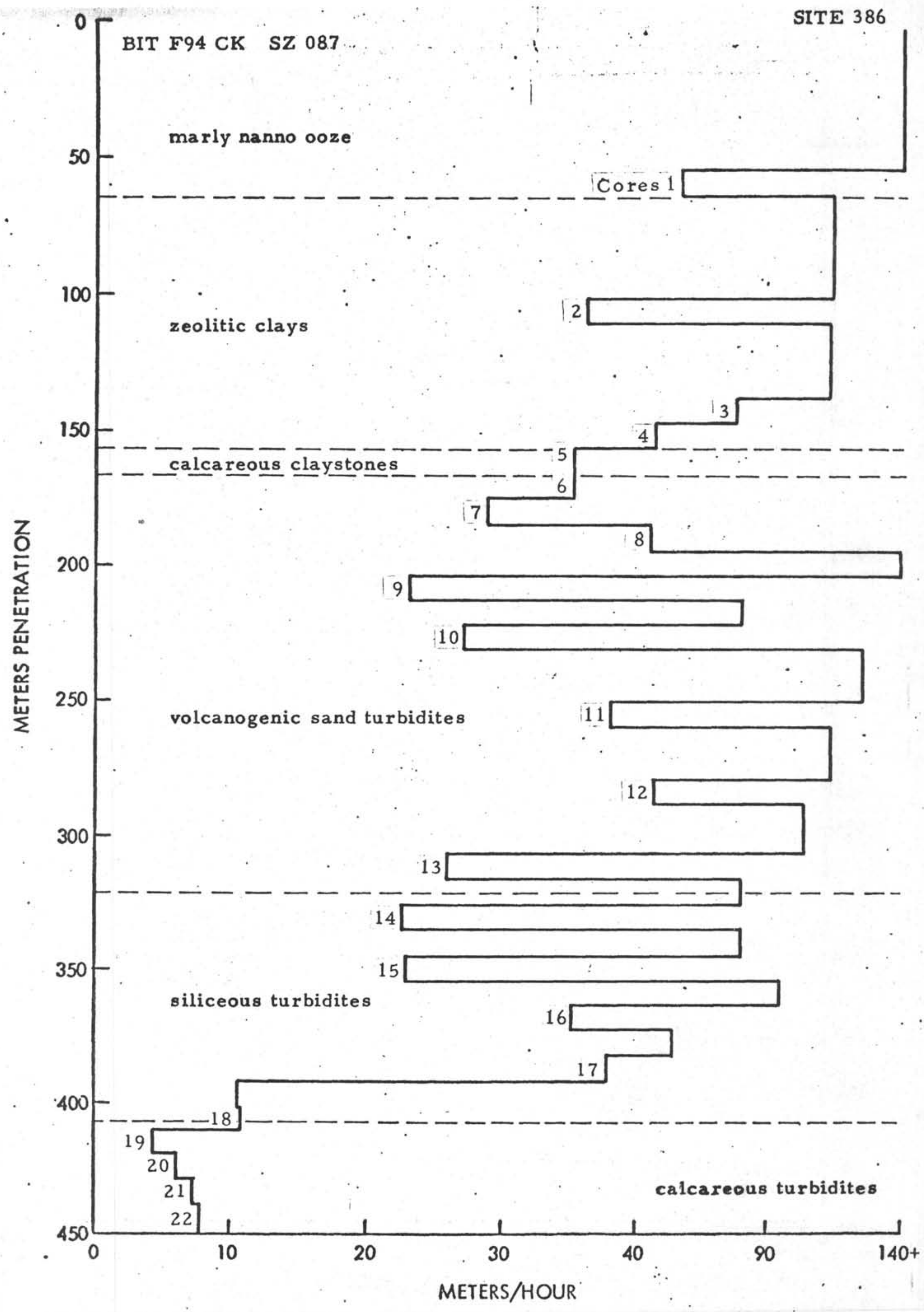

0
100
200
300
400
500
600
700
800
900
METERS PENETRATION
TD 392.6
18
19
20
JULY
DRILLING DAYS



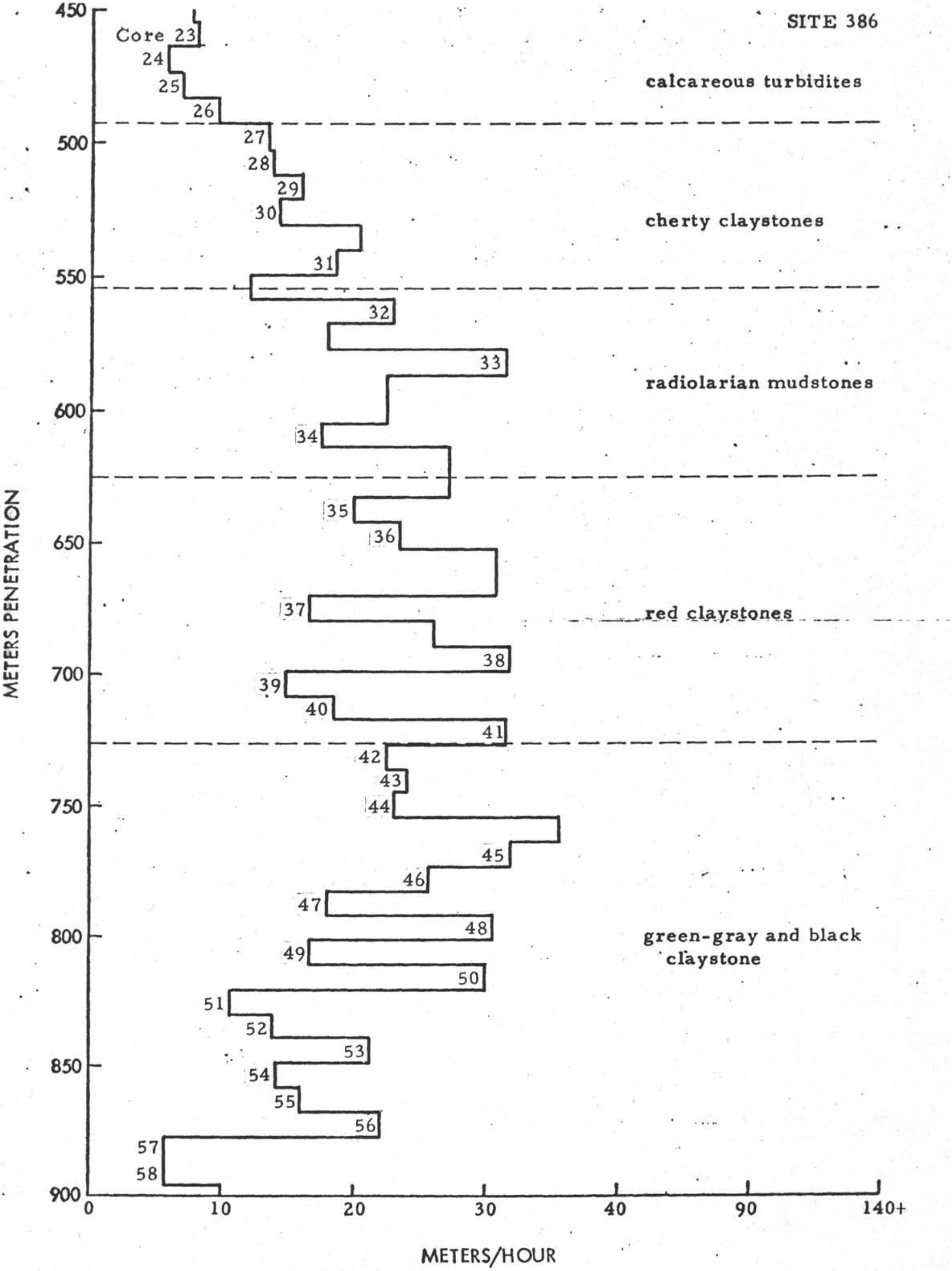
BIT F94 CK SZ 217
SITE 385
nanno foram ooze
Core 1
2
clay
3
4
rad clay and ooze
5
6
7
zeolitic silty clay
8
9
10
11
12
marly nanno ooze
13
14
silty clay and clay
15
16
17
clayey silt
18
19
basaltic silty sand
20
21
22
23
TD 392.6
volcanoclastic breccia
METERS PENETRATION
0
50
100
150
200
250
300
350
400
450
METERS/HOUR
0
10
20
30
40
90
140+

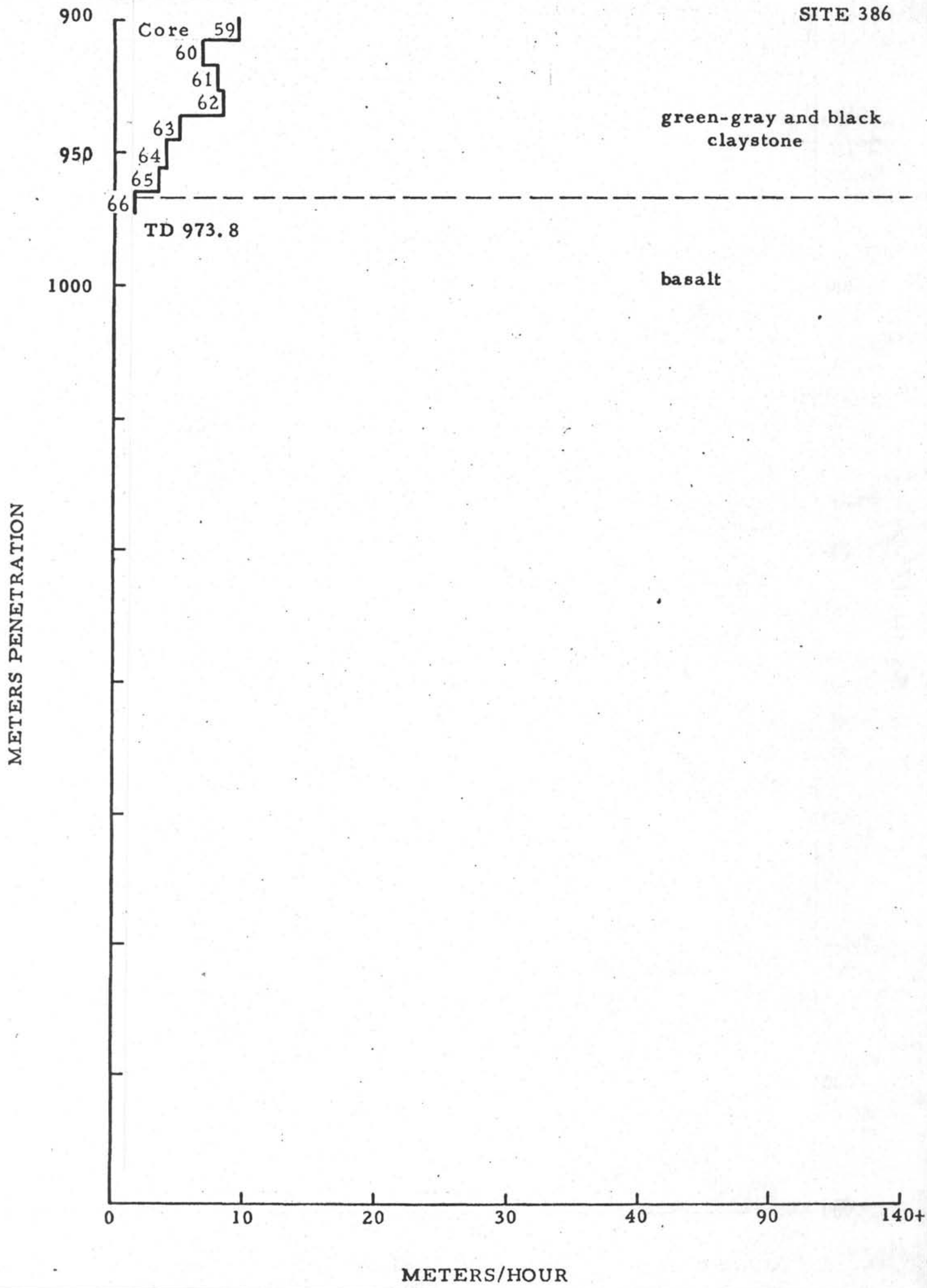

0
100
200
300
400
500
600
700
800
900
METERS PENETRATION
(CONTINUED)
25
26
27
28
29
30
JULY
DRILLING DAYS


SITE 386
TD 973.8
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
METERS PENETRATION
30
31
JULY
DRILLING DAYS

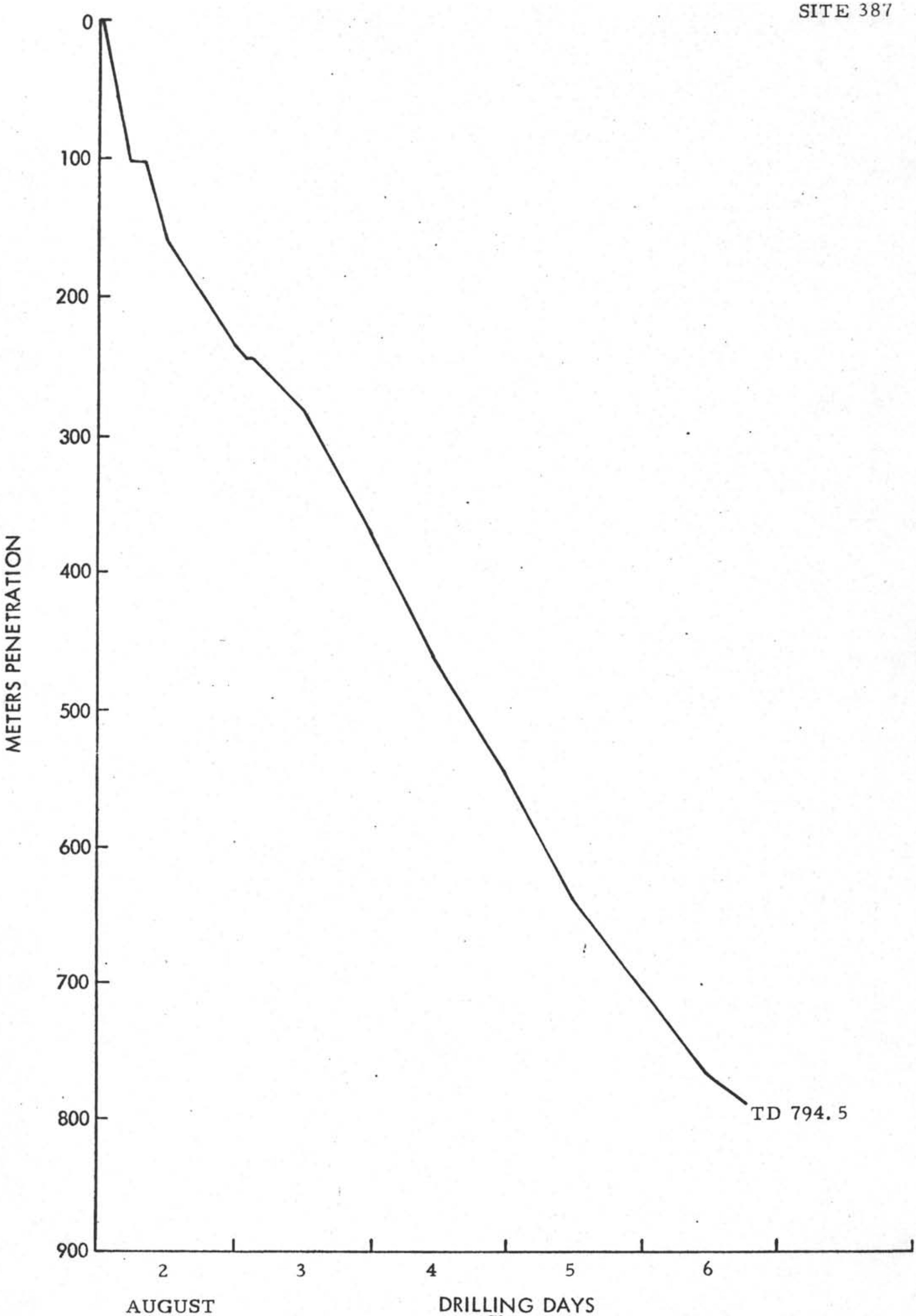


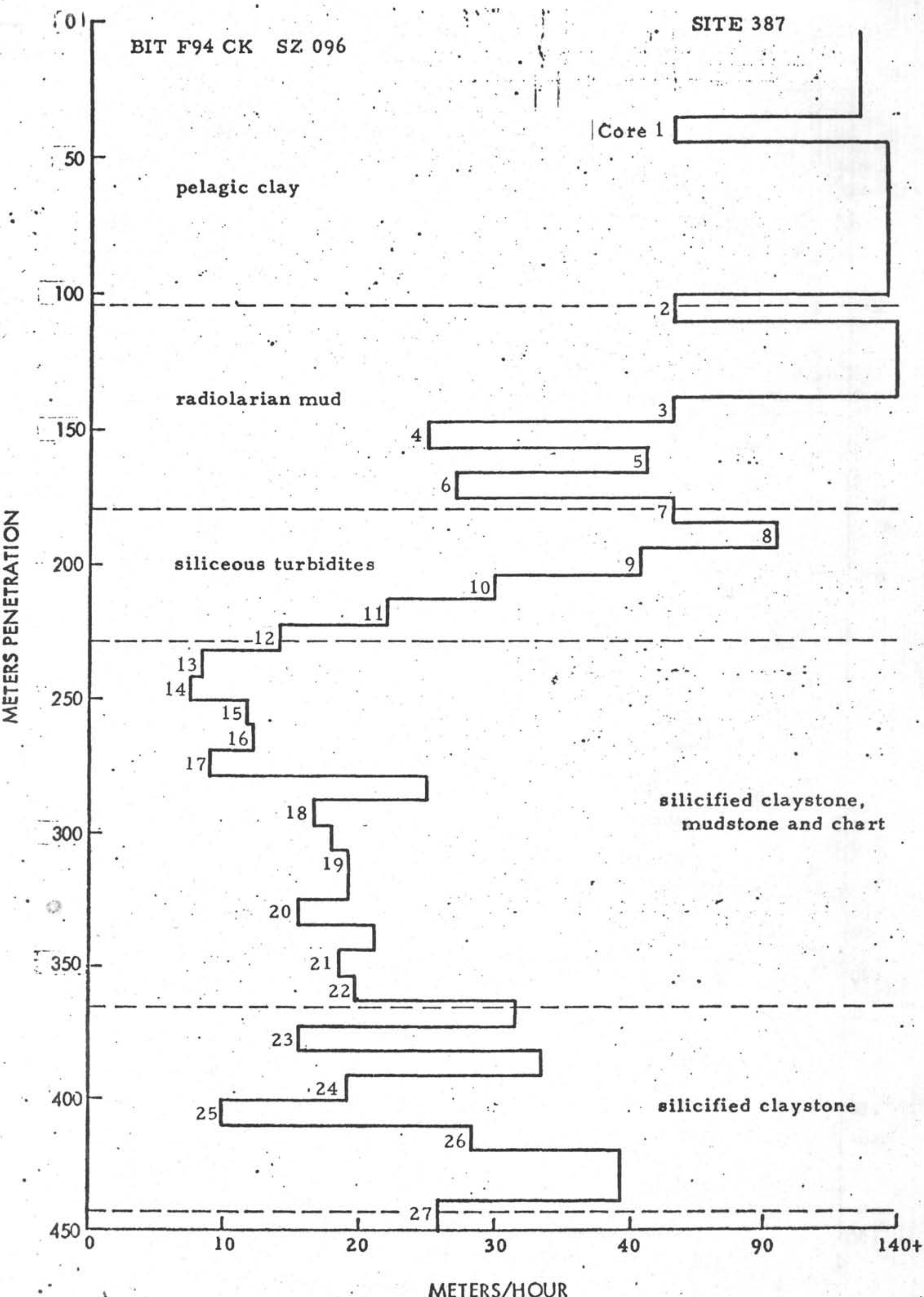
SITE 386
BIT F94 CK SZ 087
marly nanno ooze
zeolitic clays
calcareous claystones
volcanogenic sand turbidites
siliceous turbidites
calcareous turbidites
Cores 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
METERS PENETRATION
0
50
100
150
200
250
300
350
400
450
METERS/HOUR
0
10
20
30
40
90
140+

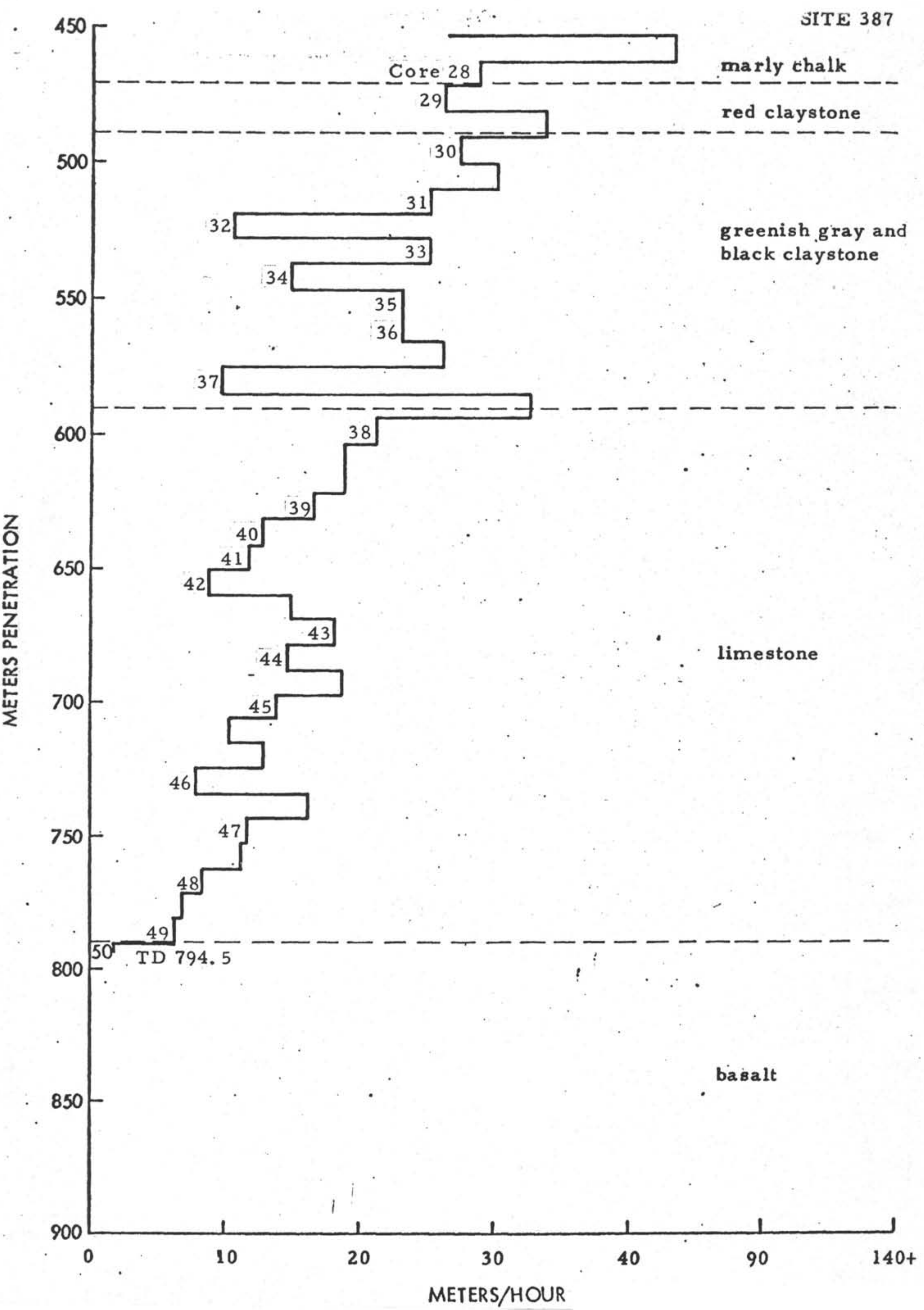

SITE 386
calcareous turbidites
cherty claystones
radiolarian mudstones
red claystones
green-gray and black claystone
METERS PENETRATION
METERS/HOUR
Core 23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
450
500
550
600
650
700
750
800
850
900
0
10
20
30
40
90
140+



SITE 386
900
Core 59
60
61
62
63
950
64
65
66
TD 973.8
green-gray and black claystone
basalt
1000
METERS PENETRATION
0
10
20
30
40
90
140+
METERS/HOUR


0
100
200
300
400
500
600
700
800
900
METERS PENETRATION
TD 794.5
2
3
4
5
6
AUGUST
DRILLING DAYS


SITE 387
BIT F94 CK SZ 096
Core 1
pelagic clay
radiolarian mud
siliceous turbidites
silicified claystone,
mudstone and chert
silicified claystone
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
METERS PENETRATION
0
50
100
150
200
250
300
350
400
450
METERS/HOUR
0
10
20
30
40
90
140+



SITE 387
marly chalk
red claystone
greenish gray and black claystone
limestone
basalt
Core 28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
TD 794.5
METERS PENETRATION
450
500
550
600
650
700
750
800
850
900
METERS/HOUR
0
10
20
30
40
90
140+

DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 44

SUMMARY

Leg 44 was the culmination of over seven successful years of geological exploration by the GLOMAR CHALLENGER for the Deep Sea Drilling Project. On the voyage prior to mobilization work for the International Phase of Ocean Drilling all of the hoped for goals were not obtained due to various difficulties, however, seven of the fifteen scientific objectives were satisfied. Included in the achievements was the deepest penetration of deep ocean sediments; 1412 meters beneath the ocean floor.

The leg started on August 15, 1975 in Norfolk, Virginia and ended 49.13 days later, September 30, 1975, again in Norfolk, Virginia. The CHALLENGER traveled 2052.0 nautical miles and drilled eleven holes at five sites along the eastern coast of the United States. Water depths varied between 2606 meters and 4981 meters. Hole depths averaged 337 meters and ranged from 9.5 meters to 1412 meters. A total of 1342.5 meters of coring was attempted with 546.8 meters recovered for a recovery percentage of 40.7%.

Time distribution for the leg was 4.1 days in port, 10.8 days cruising and 34.2 days on site. The on-site time consisted of 7.7 days tripping drill string, 2.3 days drilling. 14.2 days coring. 0.8 days positioning the ship, 1.3 days for mechanical downtime, 3.0 days attempting re-entry and 4.9 days for miscellaneous problems.

SITE 388 - LOWER CONTINENTAL RISE

The first site to be drilled on Leg 44 was located approximately 300 miles east of Cape Hatteras. The scientific objective of this location was to penetrate the basement with the hope that this basement might be more representative of the magnetic quiet zone. Close interval coring of the sedimentary section (1300 meters thick) was planned.

After arriving at the proposed location, the beacon was dropped and the drilling crew started running the drill string. After running the bottomhole assembly and 68 stands of drill pipe, the electric auxiliary brake failed. Fortunately the manual brake stopped the pipe, however, it was necessary to pull the string of pipe and travel back to the Norfolk area to make the necessary repairs.

Three and a half days later the ship returned to the site and was able to use the beacon that had been dropped initially to position on. The drill string was again made up and run to bottom. A pinger inner core barrel was a part of the bottomhole assembly and as a result of improper assembly, the barrel could not be retrieved with the wireline. Therefore, the complete drill string had to be pulled and disassembled.

Once again, the drill string was made up and Hole 388A was spudded on August 23. While running in to retrieve Core No. 9, the sandline caught in the swivel and some strands were broken. The wire below this point was cut off and removed. When run back to retrieve the core it was found to be too short to reach bottom. This sandline was removed from the drum and replaced with a new one from the drawworks. Cores No. 9 and No. 10 were recovered, but while running in to retrieve Core No. 11, the line was stopped momentarily by a ball of line tar inside the drill pipe. It stopped and started just quickly enough to throw a kink in the line. It was straightened out and considered usable, however so much line tar had been squeezed out of this new line that it could not latch on to the inner barrel. After a few more attempts to retrieve the core barrel, this sandline also broke. The broken end was too snarled to save and splice and because the remaining cable was again too short to retrieve cores, it was necessary to leave the site.

SITE 389 - BLAKE ESCARPMENT NOSE

The second site to be drilled was located approximately 280 miles east of Jacksonville, Florida, on the lip of the Blake Nose. The scientific objective was to determine the precise age of a shallow water Cretaceous reef and if possible, to determine the reason for the termination of the reef building.

The drill string was made up and a hole washed to about 30 meters and a core was cut from 30.5-40 meters. Three attempts were made to retrieve the core with unsatisfactory results. After four hours the drill string was pulled and when it was recovered, the bottom bumper sub was found to be badly bent. The core contained about two meters of manganese nodules and it was concluded that the bending was due to the bottomhole assembly sliding across the bottom on a bed of nodules. The bumper sub was bent in an open position. Because of these bottom conditions, it was decided to abandon the location and move to a more favorable area.

SITE 390, 390A - BLAKE ESCARPMENT NOSE

This site was located about 4000 feet from Site 389. The scientific objectives were the same as for Site 389, but because of the move and the fact that a new beacon was dropped, a new site number was assigned.

A surface core was taken and failed to find a thick accumulation of manganese nodules. Six cores were cut and recovered with no trouble. However, when attempting to retrieve Core No. 7, the overshot came up with only the latch assembly which had unscrewed from the rest of the inner barrel.

A fishing tool was made aboard ship and run two times but did not engage the fish and had line tar in it as well. The welder then made another fishing tool which also failed on the first attempt. It was then attached to the bottom of another core barrel and dropped. It took hold of the fish but it broke loose when at the derrick floor. On the next try it again apparently engaged the fish, but the shear pin in the overshot was sheared and both barrels were dropped. The third try was the charm and both barrels were recovered, however they were so well fastened together that a cutting torch had to be used to separate them.

Cores No. 8 and No. 9 were recovered with no trouble. Then, after 6.5 meters of Core No. 10 had been cut, the drill pipe became stuck and could not be rotated or pulled up and circulation was lost. After working the pipe, the pipe was freed in about one half hour but circulation could not be regained. An attempt was then made to retrieve the inner barrel. After shearing the pin on the overshot three times, the pipe was pulled. When the string was recovered, the outer core barrel was so badly plugged with sediments that it required a 10,000 lb pull with the drawworks to get the inner barrel out. The drill string was then made up again to drill Hole 390A. After washing to 9.5 meters, the hole was continuously cored to a total depth of 142.5 meters and abandoned with no further technical difficulties.

SITE No. 391 - BLAKE BAHAMA BASIN

This site, which is located approximately 250 miles east of Jacksonville, Florida, had as its main objective to drill to basement in the Blake-Bahama Basin and perhaps reach the oldest basement of the Atlantic Ocean. This site was assigned the highest priority and it was anticipated that re-entry techniques would be necessary to attain the expected goals. Therefore, the drilling program was designed around re-entry with plans for at least 20 days on site and considerable amounts of coring at close intervals.

Upon arrival at the desired site a double life beacon was dropped, the drill string was made up, and a mudline core taken. The drill string was then washed to 79.5 meters which established the amount of casing that would be required to support the re-entry cone.

After retrieving the drill string, the re-entry cone was keel hauled and the necessary amount of casing was landed. The drilling assembly was latched to the cone and the support cables to the cone released. As the drill string was being lowered a considerable weight loss was noted and when the string was brought up, it was found that the cone had unlatched and fallen to the bottom. The loss of the cone was attributed to the fact that the three spring loaded guide base latches had not fully engaged the cone and casing securely.

HOLE 391A

A new cone was assembled and the casing landed with a careful check to be sure that it was securely attached. The string was run and the casing and cone washed in. When the casing reached 5023.5 meters approximately 25.5 meters remained to be washed in. As the casing would not go deeper the shifting sub was run to release the casing and verify if the cone was on the bottom. There was some difficulty in releasing the shifting sub and after it was released and coming out, the sandline stopped suddenly and broke with 3000 feet remaining in the drill pipe. It required about 13 hours of fishing with two different spears to recover the broken sandline. The pin had sheared in the overshot so another run was required to retrieve the shifting sub. When it was recovered, the three drag blocks and springs were missing. It appeared that the drag blocks were released as a result of abnormal twist on the new cable. This twist apparently caused the profile key keeper to unscrew. These drag blocks (profile keys) then jammed between the tool and the drill pipe on the trip out and stopped the tool. The blocks dropped by the tool landed on top of the inner barrel. The drag blocks then wedged on top of the core barrel which could not be recovered with the overshot and it was necessary to pull the drill string to recover the core barrel. During the fishing attempts, the drilling assembly had been washed from 4974 meters to 5060 meters and a core was cut from 5060.0-5069.5 meters.

After tripping the pipe attempted re-entry began on September 6 at about 2230 and was completed at 2300 on September 7. (As the drill string was run in on this re-entry, it was taped before running to get a more accurate depth measurement. When the string touched bottom a mudline core was taken and numbered Core 1, Hole 391B). The first re-entry attempt began when the EDO tool was extended at 0215 and found what appeared to be the cone directly beneath it so at 0218 the hole was re-entered. After retrieving the tool, the drill string was lowered and stopped at 5012 meters. Apparently the cone had not been re-entered, so the drill string was pulled off bottom and re-entry was again attempted. On the second attempt, after apparently entering the cone, a picture of the casing could not be generated. While the tool was being checked, the drill pipe was lowered and again stopped at about 5000 meters. The pipe and scanning tool were picked up and third and fourth attempts were made, but the sonar tool failed to operate satisfactorily. The fifth time re-entry was achieved and again found firm sediments at 5005 meters. It was decided to drill ahead and assume that possibly the cone and about 31 meters of casing had been separated from the balance of the casing.

After cutting Core No. 21, the pressure gauge indicated that the inner barrel had not seated properly and possibly the bit could be plugged. While running in to retrieve the core barrel, the cable stopped after about 10,000 feet had spooled off and kinked badly. The overshot latched onto the core barrel at this point, but would not move and the pin sheared. The pin sheared three more times and it was decided to pull the string. While the string was being pulled, a long splice was made in the kinked cable. When the pipe had been pulled far enough to see the core barrel, it was found to be wedged in the drill pipe because the pivot pin in the latch assembly had backed out. This had been tack welded previously but a new thread lock had been supplied which supposedly made tacking unnecessary. Needless to say, all pivot pins will be tacked in the future.

HOLE 391C

The first attempt at re-entry on Hole 391A began at 2200, September 10, 1975 and ended at 1200, September 13, 1975. In all, eight attempts were made during this time and each was aborted either due to sonar tool failure or inability to determine where the cone was supposedly located when viewing range was decreased. Also, when the drill string was lowered it encountered resistance after one to one and a half stands had been added. After the eighth attempt, it was decided to make Hole 391C a single bit attempt at reaching all the geological objectives. A total of 54 cores were attempted, but it was necessary to pull the string at a total depth of 1412 meters. The pipe was pulled because of torquing and no recovery in the last two cores. When the bit was recovered, three cones were gone and the fourth was in poor condition. No additional attempts were made at this site.

SITE 392 - BLAKE ESCARPMENT NOSE

After abandoning Site 391, the ship returned to the vicinity of Sites 390 and 390A. With the time remaining, it was hoped that additional geological information could be obtained about the postulated Cretaceous reef.

Site 392 was abandoned after drilling and coring to only 60 meters. Drilling was very hard, requiring about 90 minutes to core three meters. Due to the hard drilling and the possibility of damaging the bottomhole assembly before it was buried, the vessel was moved to a more suitable location.

The ship was offset about 1500 feet and drilling on Hole 392A was begun. After drilling and coring to a depth of 79.0 meters, the hole was continuously cored to a total depth of 349 meters. Coring was slow and hard and recovery was poor. When the hole was abandoned and the bit recovered, it had two cones missing and the bearings were gone in the other two remaining cones.

After the drilling was completed at this hole and the drill string broken down, the bottomhole assembly was magnafluxed and no defects were found. The bottomhole assembly was broken down and stowed in the casing rack preparatory to going into drydock when the ship arrived in Norfolk.

DRILLING AND CORING ASSEMBLY

The standard DSDP bottomhole assembly was used at Sites 388, 389, 390 and 392. This consisted of a bit, bit sub (with float valve), core barrel, top sub, latch sub, three 8-1/4" drill collars, one 5 foot stroke Baash-Ross bumper sub, three 8-1/4" drill collars, two 5 foot stroke bumper subs, two 8-1/4" drill collars, one 7-1/4" drill collar and one joint of 5-1/2" drill pipe. At Site 391 where re-entry was planned, a modification was made in the drilling assembly. Below the top two bumper subs an index sub and a latch sub were added to hold and release the casing and cone when they had been jetted into position.

The only problem with the drilling assembly occurred when the bottom bumper sub was bent while taking a mudline core at Site 389. When the drill string was pulled and the inner core barrel recovered, it was found to contain about 1-1/2 meters of manganese nodules. It is probable that the bumper sub was bent while sliding across the bottom on a bed of nodules.

Another problem developed while running the drill string on the first site visited. This problem was the failure of the electric brake after about 60 stands had been run. The driller was able to slow the string with the manual brake just as the elevators hit the derrick floor. It was found that a triggering module had burned out. There was no spare on board and it was necessary to return to the Norfolk area to make the necessary repairs. This area in the braking system had been a problem on Leg 43 and the module had been replaced while making a crew change in Norfolk. A cable was also replaced which was probably the cause of the problem not only on Leg 44 but the previous voyages as well. No further trouble developed in this area during the voyage.

CORING AND DRILLING EQUIPMENT

The standard DSDP core barrel was used on all sites. Core recovery averaged about 40% which is not outstanding. Some of this could be attributed to the nature of the rocks encountered and only six core barrels were empty when retrieved. Of these, four were empty because the bit was worn out and the other two were due to plugged bits, which were cleared with a center bit.

However, additional problems developed with the sandline and inner core barrel. The first of these occurred while running in to retrieve a core barrel. The sandline caught in a sheave and broke several strands of cable. It was planned to cut and splice the cable but it was in poor condition so the bad part was cut off. After cutting the cable it was too short to reach the core barrel, so it had to be changed and a new cable spooled onto the core reel.

After replacing the cable and retrieving two more cores, the overshot could not recover the core barrel due to line tar. While running in after cleaning the overshot, the cable stopped momentarily (apparently on a tar ball) and the cable kinked. This did not appear too serious, however, after two more runs the cable parted and it was necessary to pull the drill string. About 3000 feet of cable were lost because it was so badly-kinked it could not be salvaged and spliced. While underway to the next location, the line tar was cleaned out of the drilling assembly. The second drill collar above the core barrel had the lower 18 feet filled with line tar.

The line tar problem from this cable and another that was delivered by tug, was much worse than from previously purchased cables. It will be necessary to check with the manufacturer and provide a more reasonable amount of coating.

The next problem that developed was the recovery of only the latch assembly while attempting to retrieve a core. This happened because the latch assembly apparently had not been welded to the swivel. Again, the new cables excessive twisting action could have contributed to this problem. It required seven attempts using different fishing tools that were designed and built on the spot to recover the core barrel.

At Site 390 after coring 6.5 meters, the drilling assembly could not be rotated, moved up or down and circulation was lost while cutting Core No. 10. After about 30 minutes, rotation and up/down movement was regained but not circulation. It was decided to pull the inner barrel and spot some mud to regain circulation, however, the inner barrel could not be recovered and it was necessary to pull the string. When the outer barrel was recovered the inner barrel was found to be wedged because the annulus between the inner and outer barrels was filled with cuttings. It required over a 10,000 lb pull with the drawworks to extract the inner barrel.

The last core barrel problem developed when it appeared that the core barrel had not seated properly, probably due to a plugged bit. While running in with the overshot, the cable stopped about 10,000 feet in the hole and kinked the cable. The pin in the overshot was also sheared. After three attempts at recovering the core barrel and shearing the pin each time, the string was pulled. When the core barrel was reached it was found to be jammed in the pipe because the pivot pin in the latch assembly had unscrewed. This had not been tack welded because a new locking compound had been supplied which supposedly eliminated the need for tack welding. Needless to say, a tack weld will be made in the future. Following recovery of the core barrel, it was necessary to cut out the kinked portion of the cable and make a long splice.

The pinger core barrel was run twice on this leg with questionable results due to the circumstances. The first time it was placed in the bit was at the first site on the leg. When the electric brake failed and the string hit the derrick floor, the shock spring was compressed sufficiently to pull the bottom of the transducer above the bottom fingers in the core catcher. When it dropped back, the fingers were pushed down and wedged the transducer. It also caused the case to be sprung and could not be used again. The second time the pinger was used was when the ship returned to the first site after repairing the electric brake. The string was run to bottom and the pinger gave a good display. After making what was thought to be a good core attempt, the core barrel could not be recovered and it was necessary to pull the drill string. When on deck it was found that the inserts in the spacer had been installed upside down. After the pin had been sheared, the inserts fell out and wedged between the ball latch assembly and the latch sleeve. Some change should be made in the spacer so this incorrect installation of the inserts will not happen in the future.

PRESSURE CORE BARREL

Two runs were made with the pressure core barrel on this leg. Unfortunately neither attempt recovered gas or clathrate material. The first run was made in soft green calcareous clay. When the tool was recovered the locking ring was extruded and the landing lugs in their uppermost position. A pressure check detected no pressure differential. There was 15 cm of clay in the cutting shoe and the ball valve was open and returned to closed position only upon the shock of breaking loose the non-drive sleeve. The second attempt was made in relatively stiff green clay. When recovered, the locking ring was extruded and landing lugs in uppermost position. Again, a pressure check showed no differential pressure. Recovery consisted of four meters in the liner and 1-1.5 meters between the cutting shoe and core liner guide. After a difficult removal of the core from all assemblies, the ball valve was still in the open position. From observations on this leg it would appear that some method should be developed to insure closing the ball valve.

BITS

Only two bits were used to drill the sites on this leg. Both were Smith F94CK bits, but one was 10" and the other 10-1/8". The 10" bit was used on Holes 388A, 389, 390, 390A, 391, 392 and 392A. It drilled and cored a total of 912.5 meters and lasted 67.4 hours. The 10-1/8" bit was used on Holes 391A, 391B, 391C and drilled and cored 2080.0 meters and lasted 85.6 hours. When recovered, the 10-1/8" bit had three cones missing and the bearings were gone in the remaining cone. The 10" bit had two cones missing and the bearings gone in the cones. The average penetration rate for these two bits on this leg was 109.35 meters per hour.

BEACONS

Seven ORE beacons were dropped on this leg, three double life and four single life and all performed successfully. One of the double life beacons was operating perfectly after 22 days, when the site was abandoned. The fact that all of the beacons had their batteries changed in Norfolk prior to departure on this leg could account for their excellent performance. One double life beacon was dropped but was not used because of a SAT-NAV error and the ship was moved 2.6 miles.

POSITIONING

Positioning on this leg performed excellently with only minor problems. There was noted by the GMI electronic technician, however, excursions of up to 200 feet during drilling operations although no fault could be found in the positioning system. The lack of problems in positioning on this leg could also be attributed to unusually fine weather enjoyed by all.

RE-ENTRY

Re-entry had been originally planned for several sites on this leg but at only one site was re-entry attempted, however, other operational problems developed before re-entry could be attempted. The first problem developed when the re-entry cone was keel hauled and the casing string was made up, run, and latched into the cone. The bottomhole assembly was then made up and engaged to the casing. The support cables were cut and the assembly was lowered, however, the driller noticed a considerable weight loss. The assembly was pulled up to the moon pool and it was found that the cone was gone. When the casing was pulled up it appeared that all three of the spring loaded guide base latches had not engaged the cone and casing. The cone then slipped off the casing and fell to the bottom.

A new cone and casing assembly was made up and lowered to the ocean bottom and jetted in. The shifting tool was lowered to release the drill string. After a number of attempts it released the casing and the tool was being retrieved when the sandline stopped suddenly about 3000 feet from the surface. The line broke and the tool and cable fell to the top of the inner barrel. A sinker bar fishing tool was made to spear the cable and tool. After three attempts the spear unscrewed and also fell to the top of the pile in the drill pipe. Another spear was made and recovered the first spear, wire, and overshot, leaving the shifting tool. A run back in was made and recovered the shifting tool minus three drag blocks and springs. It was not possible to recover the inner barrel because the drag blocks were on top of the inner barrel and would not let the overshot engage. It was then necessary to pull the drill string to recover the core barrel. It is believed that the drag blocks were released as a result of the new cable twisting and allowing the connector adjuster to unscrew when the mandrel spring was compressed. The connector did not have a set screw or even a hole for a set screw which would have prevented this part from unscrewing. The other problem was when the pivot pin unscrewed and has been discussed earlier in the report.

The first re-entry attempt took about three minutes after the scanning tool was made up and reached the bottom of the drill string, however, after lowering the drill pipe about 38 meters, it encountered resistence and it was believed that re-entry had not been achieved so the drill string was pulled. (The hole should have been open to 95.5 meters. This amount of hole had been made after setting the cone and releasing the casing) It then required four more attempts and 20 hours to re-enter. Drilling and coring continued until the inner barrel stuck going in and the pipe had to be pulled. After the sandline was spliced, re-entry was again attempted. The first attempt began at midnight on September 11, 1975 and after eight attempts, at noon September 13, 1975, Hole No. 391C was spudded. The inability to re-enter seems to be that the cone could not be located or identified accurately. The electronic technicians and the Captain have written their ideas and suggestions on how successful re-entry can be obtained. The major problem concern that seems to exist with the present system of drilling in deep oceans into thick sedimentary sections is the possiblity of the cone settling in very soft bottom ooze and then being convered with large amounts of cuttings.

HYDROCARBONS

Although this leg was programmed to drill through thick sections of sediments near the continental margin no evidence of hydrocarbons could be detected.

WEATHER & CURRENTS

As stated earlier in this summary, the weather encountered on this leg was ideal for safe operation of the drilling equipment. The proposed sites were very close to "Hurricane Alley" and although a couple of hurricanes were observed on the weather maps, they caused the ship no problem.

The only incident that could be related to currents was the loss of the re-entry cone. The fact that the cone did not latch properly could be attributed to the fact that a strong current was running and could have tipped the cone slightly and the latching dogs did not catch.

COMMUNICATIONS

As might be expected, daily communications on 17 MHZ with radio WWD was maintained with the possible exception of one or two days due to atmospheric conditions. Usually communication was best between 1900 and 2400 GMT. Likewise, voice communications via radio WOM (Jacksonville) on 4 or 8 MHZ was good and easily established at almost any time. Communications on medium frequency (500 KCS band) was usually very poor due to local thunderstorms prevalent in this area. No Navy station could be contacted, as none are left in the area. Weather reports and amvers messages could be sent to Coast Guard stations at San Juan, Norfolk, or Boston with ease, however, these stations all decline to handle any other form of traffic. Commercial communication with east coast stations was likewise good.

Equipment performance, aside from a few slight failures which were easily repaired was good. The TMC continued to perform well with the same power tube which has been in the equipment since last December. Observing a five minute warm-up time and applying 6.3 volts to the filament of this tube has made a world of difference in the performance of the TMC.

Both radars continued to operate satisfactorily. One failure occurred, in the after radar, when the bearing receiver motor and associated gearhead failed. The radar is inoperative but can be quickly repaired when a new motor and gear box assembly is available.

The Loran equipment was returned to the ship with a defective switch coupling. This was repaired and satisfactory bearings obtained throughout most sites, although the vessel was out of range of the ground wave of most Loran C slave stations most of the time.

From a communications standpoint, volume of traffic handled was fairly large and there were no problems. This condition should apply through the two forthcoming Legs, 45 and 46.

PERSONNEL

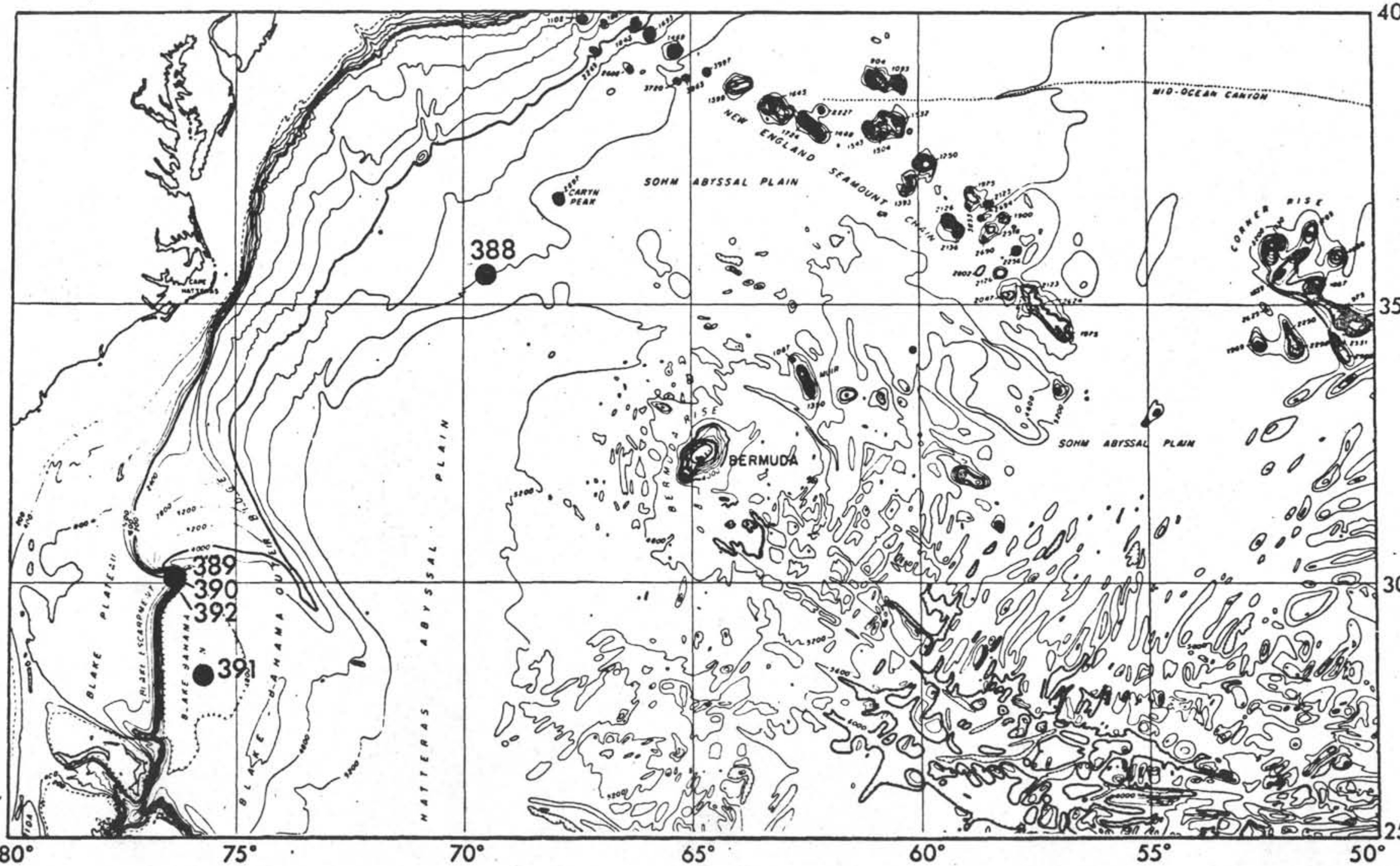
Although this leg was plagued almost from the first day with strange and unusual problems, the personnel of both Glomar Marine and SIO teamed together to make it as successful a leg as possible.

The scientific party representing Canada, France, Russia and the United States also retained their enthusiasm throughout the leg even though only about one half of the scientific objectives were achieved. A great deal of pleasure was derived from their dedication.

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

DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 44

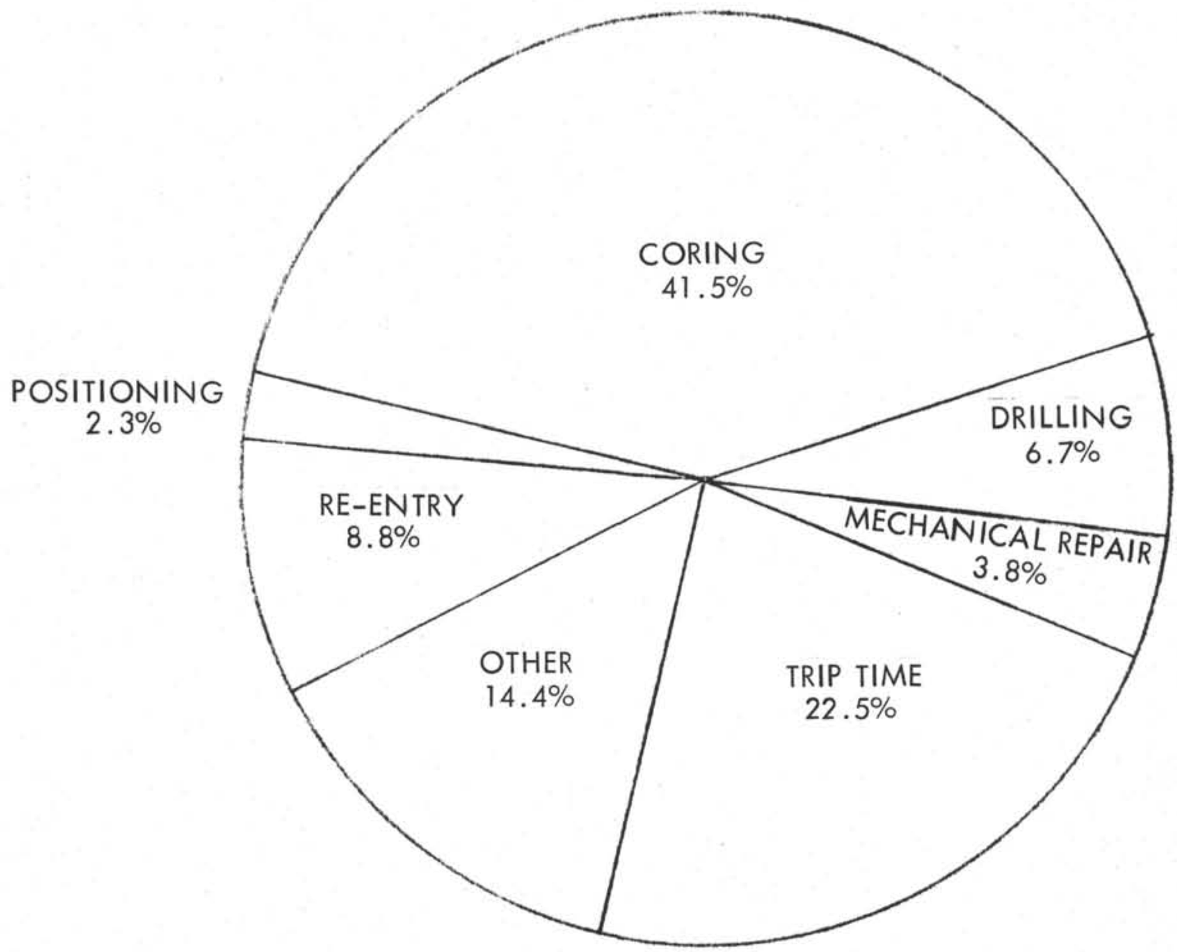
Total Days (August 12, 1975 - September 30, 1975)		49.13
Total Days In Port		4.1
Total Days Cruising Including Site Survey		10.8
Total Days On Site		34.2
Trip Time	7.7	
Drilling Time	2.3	
Coring Time	14.2	
Positioning	.8	
Mechanical Downtime	1.3	
Re-entry	3.0	
Other	4.9	
Total Distance Traveled (Nautical Miles)		2243
Average Speed (Knots)		8.64
Number of Sites		5
Number of Holes Drilled		11
Number of Cores Attempted		149
Number of Cores With Recovery		142
Percent of Cores With Recovery		95.3
Total Meters Cored		1342.5
Total Meters Recovered		546.81
Percent Recovery		40.7
Total Meters Drilled		2024
Total Meters of Penetration		3366.5
Percent of Penetration Cored		39.8
Maximum Penetration (Meters)		1412
Minimum Penetration (Meters)		9.5
Maximum Water Depth (Meters)		4981
Minimum Water Depth (Meters)		2606.5



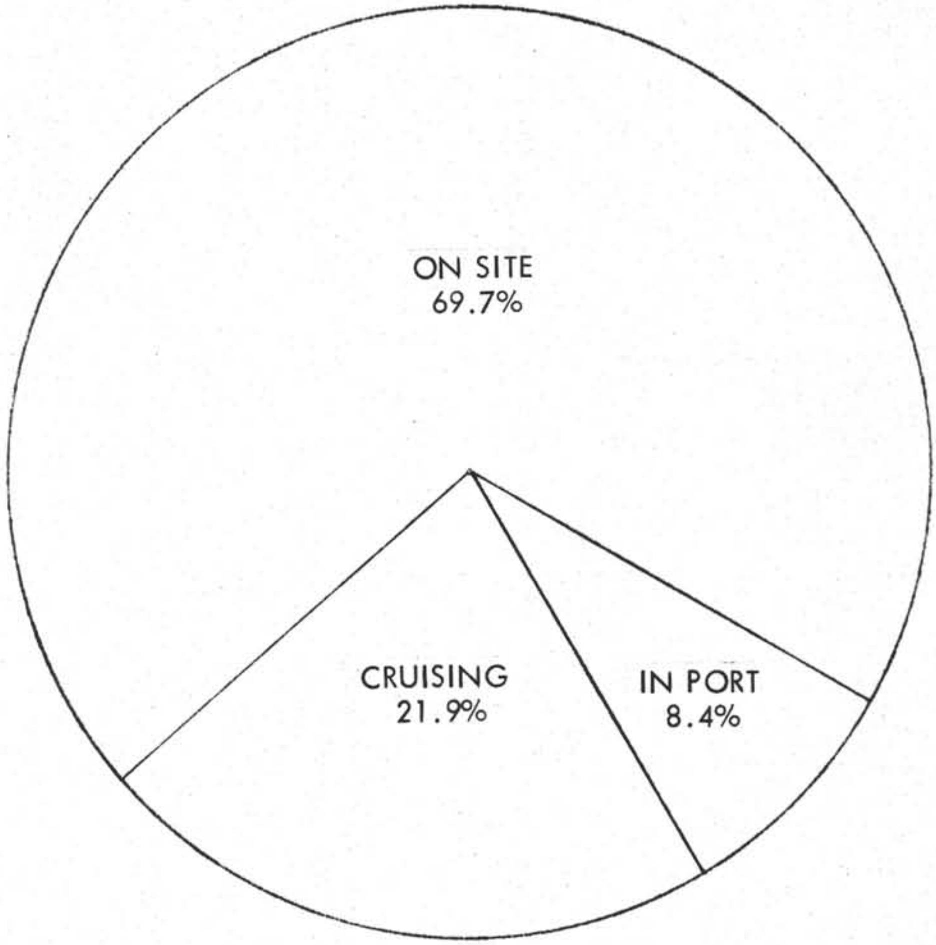
LEG 44

DRILL SITES

DEEP SEA DRILLING PROJECT
LEG 44
ON SITE TIME BREAKDOWN



TOTAL TIME DISTRIBUTION
LEG 44



DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 44

Site No.	Make	Freq. kHz	Serial Number	Site Time Hours	Remarks			
388	ORE	16.0	296	204	Dropped 1530	8/17/75	4939 meters	Double Life
388	ORE	13.5	352	201.5	Dropped 1800	8/17/75	4939 meters	Single Life
389	ORE	13.5	314	22	Dropped 1314	8/28/75	2730 meters	Single Life
390	ORE	16.0	304	41	Dropped 1350	8/29/75	2681 meters	Single Life
390A	ORE	16.0	304	33.5				
391	ORE	16.0	332	0	Dropped 0800	9/2/75		Double Life
391	ORE	13.5	315	18.5	Dropped 1317	9/2/75	4973 meters	Double Life
391A	ORE	13.5	315	243.0				
391B	ORE	13.5	315	---				
391C	ORE	13.5	315	222.0				
392	ORE	16.0	348	20.0	Dropped 0605	9/23/75	2609.5 meters	Single Life
392A	ORE	16.0	348	96.5				

DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 44

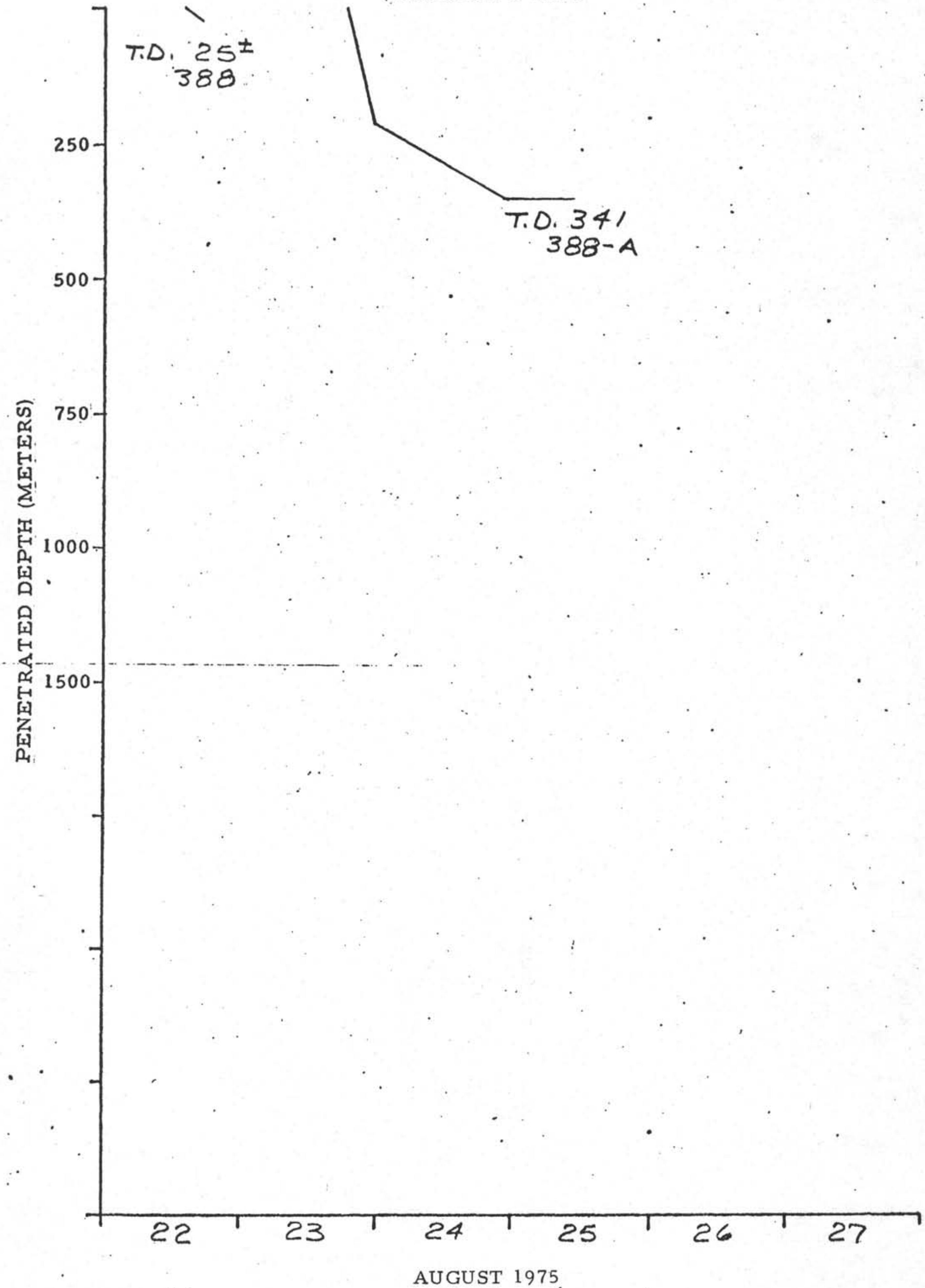
Hole	Mfg.	Size	Type	Serial Number	Meters Cored	Meters Drilled	Meters Total Penet.	Hours On Bit	Condition	Remarks
388	Smith	10 1/8"	F94CK	SZ-218	9.5	---	9.5	---	Re-run	Pinger core attempt
388A	Smith	10"	F94CK	CA-751	98.5	242.5	341.0	3.9		
389	Smith	10"	F94CK	CA-751	9.5	30.5	40.0	0.13	Re-run	
390	Smith	10"	F94CK	CA-751	92.0	114.0	206.0	3.73	Re-run	
390A	Smith	10"	F94CK	CA-751	133.0	9.5	142.5	2.78	Re-run	10.54 hrs subtotal
391	Smith	10"	F94CK	CA-751	4.5	79.5	84.0	0.5	Re-run	11.04 hrs subtotal
391A	Smith	10 1/8"	F94CK	SZ-088	199.5	523.0	658.5	9.32		
391B	Smith	10 1/8"	F94CK	SZ-088	9.5	---	9.5	0.03	Re-run	
391C	Smith	10 1/8"	F94CK	SZ-088	501.0	911.0	1412.0	76.3	3 cones gone	
392	Smith	10"	F94CK	CA-751	12.5	47.5	60.0	3.3	Re-run	
392A	Smith	10"	F94CK	CA-751	282.5	66.5	349.0	53.05	2 cones gone; bearings gone in 2 cones remaining	

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG 44

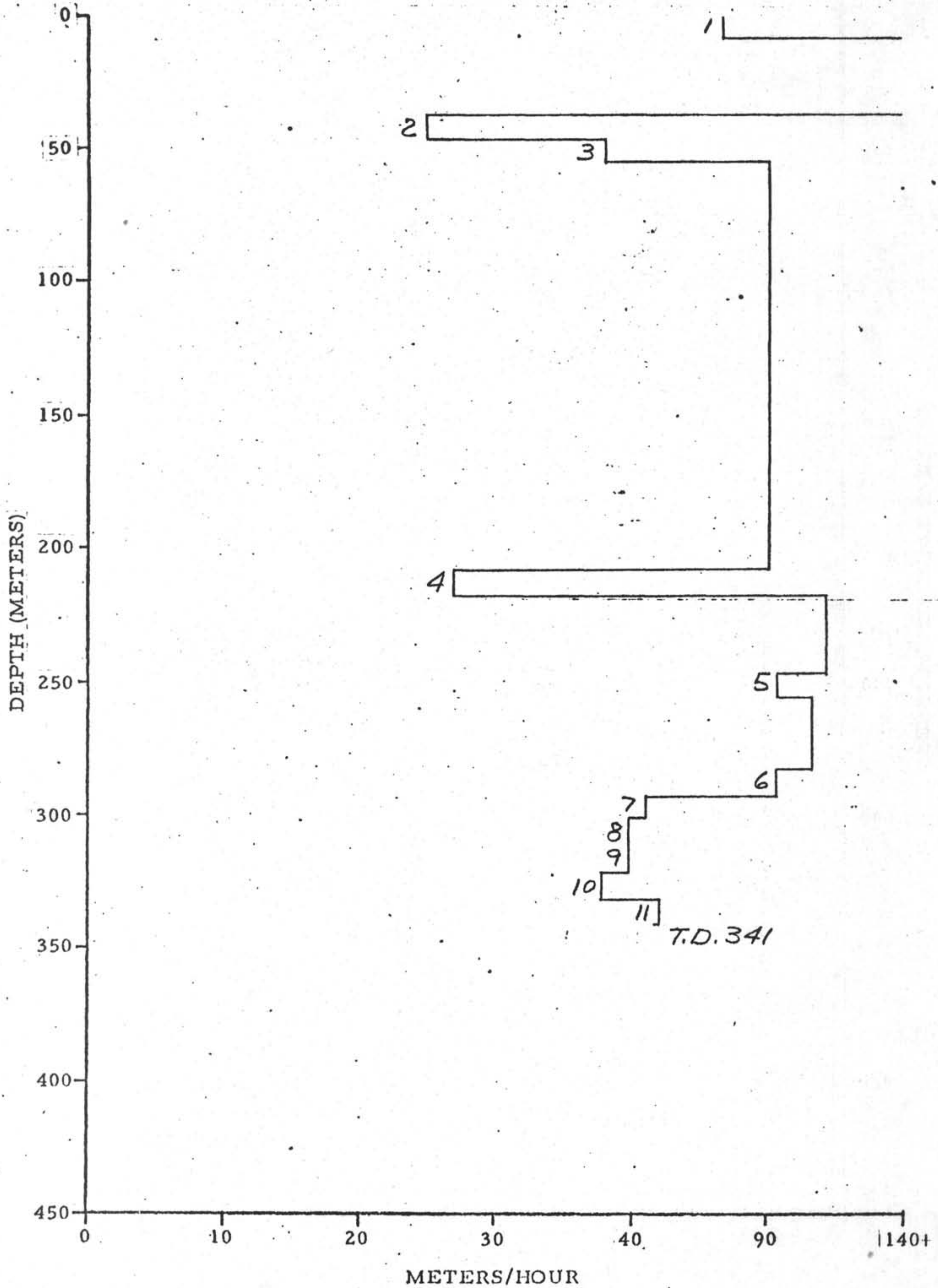
Date	Site Number	Cruise	Trips	Drill	Core	Stuck Pipe	Wait On Weather	Position Ship	Mech. Repair	Port Time	Re-entry	Other	Total Time
Aug 12-15										82.95			82.95
Aug 15-17		42.8						2.5					45.3
Aug 17-18	388		12.0						3.0			0.5	15.5
Aug 18-20		39.0											39.0
Aug 20										15.7			15.7
Aug 20-22		35.0						1.0					36.3
Aug 22-23	388		21.5									2.5	24.0
Aug 23-26	388A		27.25	8.0	17.75				7.0			11.0	71.0
Aug 26-28		59.0						1.0					60.0
Aug 28-29	389		14.0	3.0	0.5							7.5	22.0
Aug 29-31	390		13.0		13.0			1.0				11.0	41.0
Aug 31-Sept 1	390A		10.5		18.0							5.0	33.5
Sept 1-2		16.0						6.5					22.5
Sept 2-3	391		15.5	1.0	2.0								18.5
Sept 3-13	391A		50.25	12.0	37.5				8.5		72.5	62.25	243.0
Sept 13-22	391C		10.5	27.5	164.5				7.0			12.5	222.0
Sept 22-23		12.0						5.5					17.5
Sept 23-24	392			1.0	5.0				3.0				14.5
Sept 24-28	392A		5.0	2.0	81.0			2.5	1.0			5.0	96.5
Sept 28-30		58.6											58.6
Total		262.4	185.0	54.5	339.25			20.0	29.5	98.65	72.5	117.25	1179.35

DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 44

Hole	Latitude	Longitude	Water Depth Meters	No. of Cores	Cores With Recovery	% of Cores w/Rec.	Meters Cored	Meters Recovered	Percent Recovered	Meters Drilled	Total Penet. Meters	Avg. Rate Penet.	Time on Hole	Time on Site
388	35°31.33'N	69°23.76'W	4930	1	0	0.0	0.0	0	0	--	--	---	39.5	
388A	35°31.33'N	69°23.76'W	4930	11	11	100.0	98.5	42.9	43.5	242.5	341.0	87.4	71.0	110.5
389	30°08.54'N	76°05.57'W	2730	1	1	100.0	9.5	3.5	37.0	30.5	40.0	307.0	22.0	22.0
390	30°08.54'N	76°06.74'W	2666.5	10	10	80.0	92.0	27.2	29.5	114.0	206.0	55.2	41.0	
390A	30°08.54'N	76°06.74'W	2666.5	14	14	100.0	133.0	86.8	65.2	9.5	142.5	51.3	33.5	74.5
391	28°13.73'N	75°36.76'W	4981	1	1	100.0	4.5	2.3	51.0	79.5	84.0	186.6	18.5	
391A	28°13.61'N	75°37.00'W	4974	21	21	100.0	199.5	129.96	65.1	523.0	722.5	77.7	243.0	
391B	28°13.61'N	75°37.00'W	4974	1	1	100.0	9.5	9.3	97.8	0.0	9.5	285.0	0.0	
391C	28°13.61'N	75°37.00'W	4974	54	50	92.5	501.0	216.25	43.1	911.0	1412.0	18.5	222.0	483.5
392	29°54.63'N	76°10.68'W	2609.5	2	2	100.0	12.5	3.2	25.6	47.5	60.0	18.2	14.5	
392A	29°54.63'N	76°10.68'W	2606.5	33	31	93.9	282.5	25.4	8.9	66.5	349.0	6.6	96.5	111.0
		Totals		149	142	95.3	1342.5	546.81	40.7	2024.0	3366.5	109.35		821.5

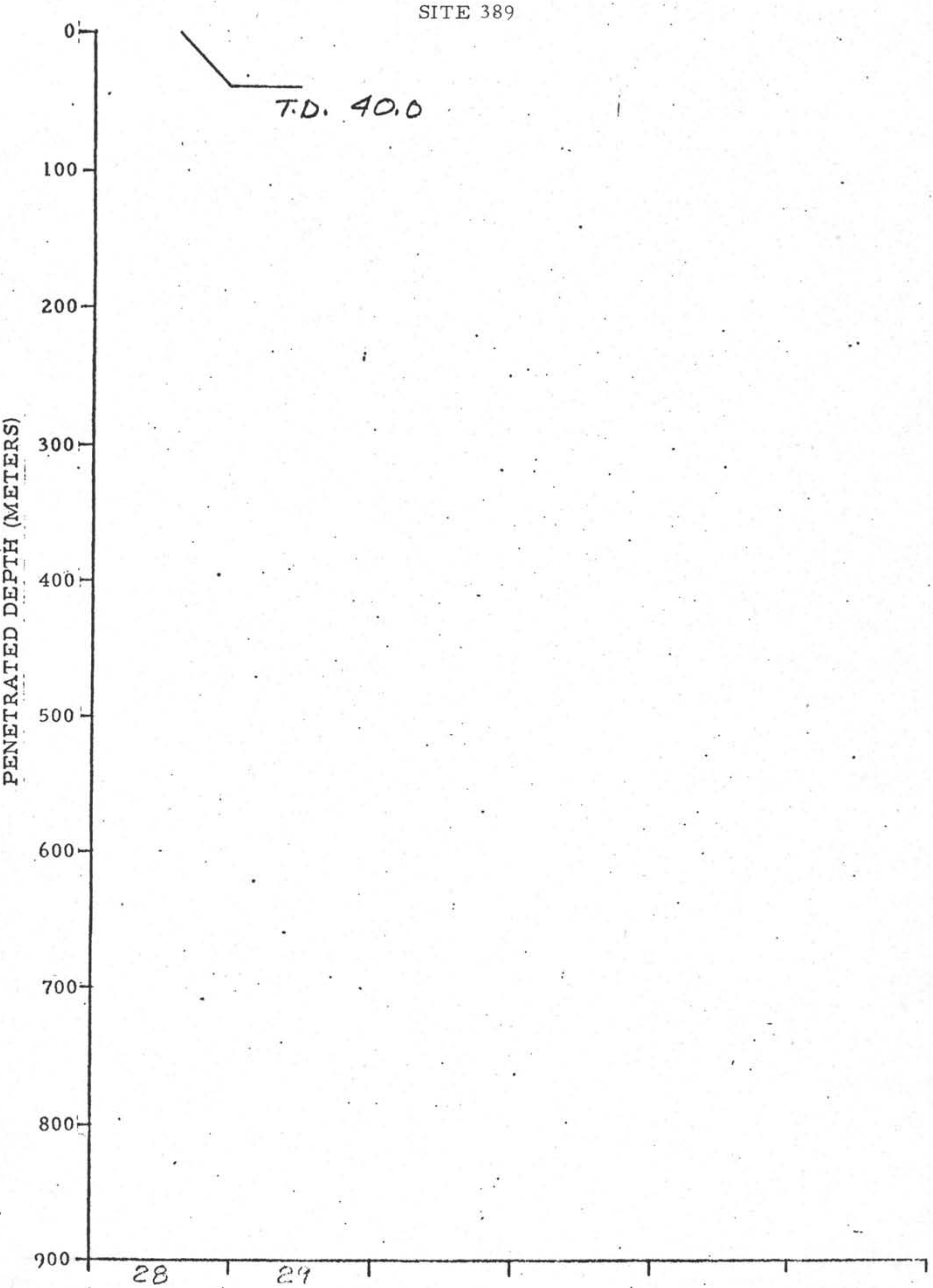

T.D. 25±
388
T.D. 341
388-A
250
500
750
1000
1500
PENETRATED DEPTH (METERS)
22
23
24
25
26
27
AUGUST 1975

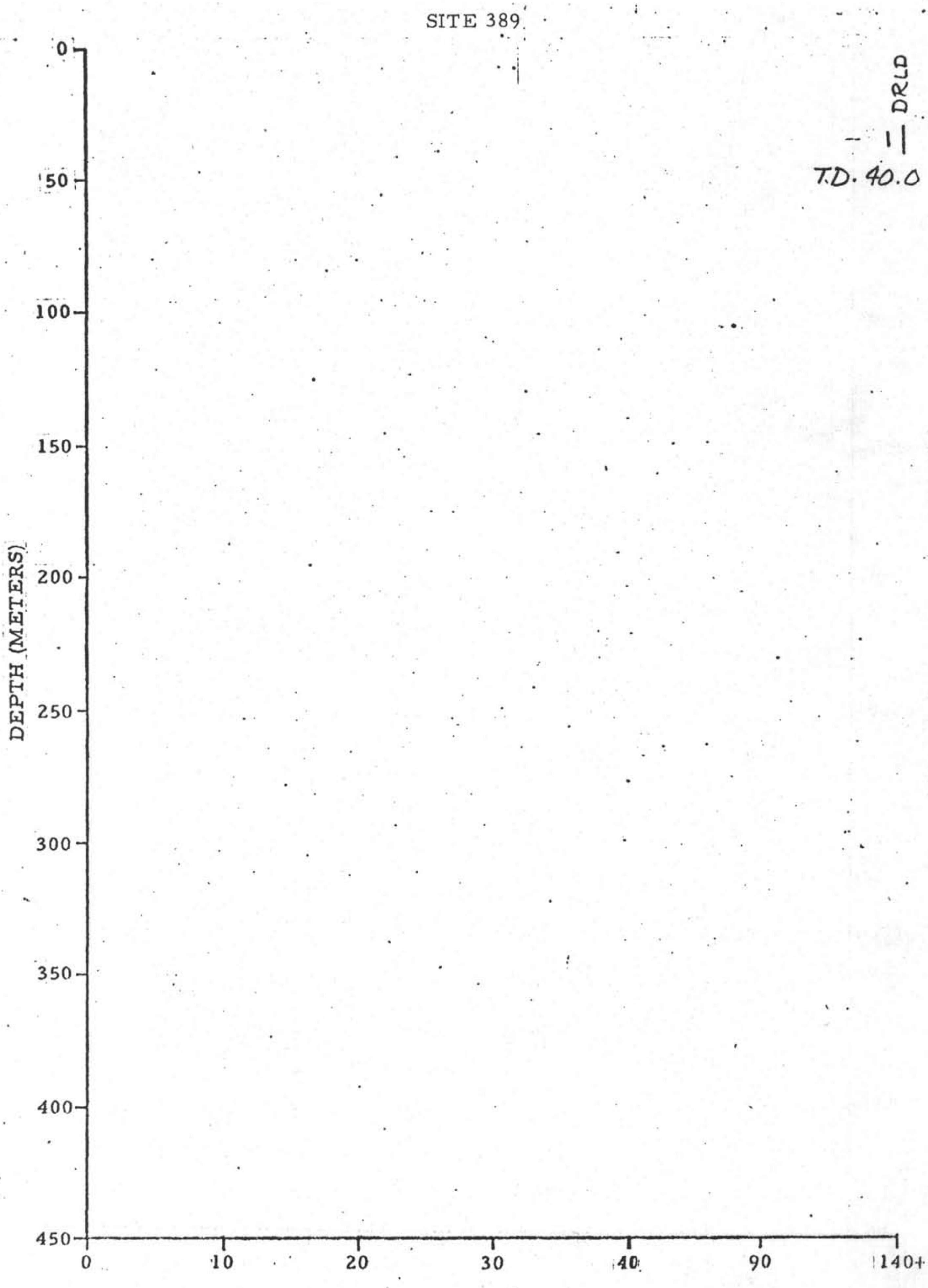
SITE 388A



0
50
100
150
200
250
300
350
400
450
DEPTH (METERS)
1
2
3
4
5
6
7
8
9
10
11
T.D. 341
0
10
20
30
40
90
140+
METERS/HOUR

SITE 389


T.D. 40.0
0
100
200
300
400
500
600
700
800
900
PENETRATED DEPTH (METERS)
28
29
AUGUST 1975


DRLD
T.D. 40.0
DEPTH (METERS)
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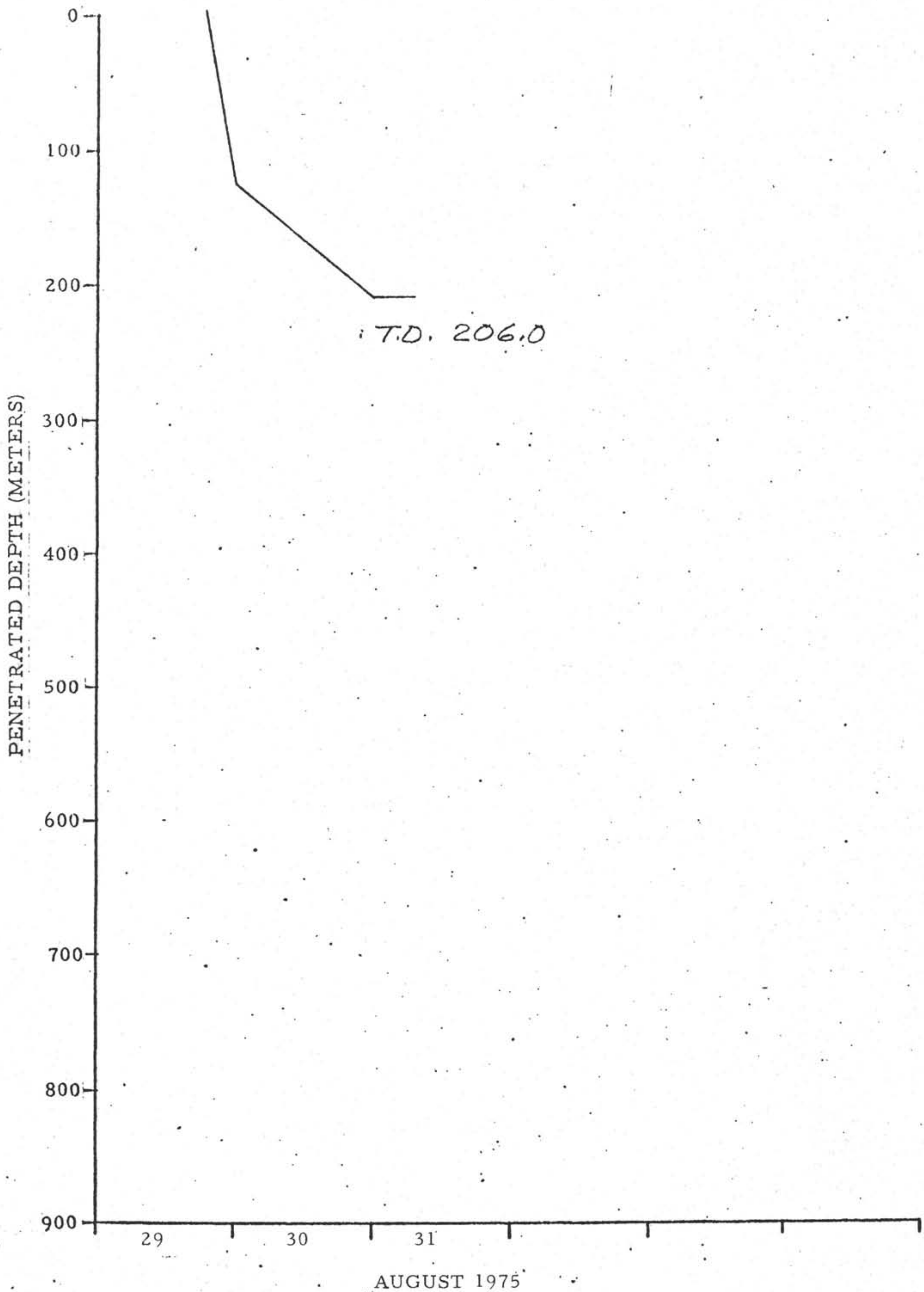
150
200
250
300
350
400
450
0
10
20
30
40
90
140+
METERS/HOUR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100
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400
500
600
700
800
900
PENETRATED DEPTH (METERS)
T.D. 206.0
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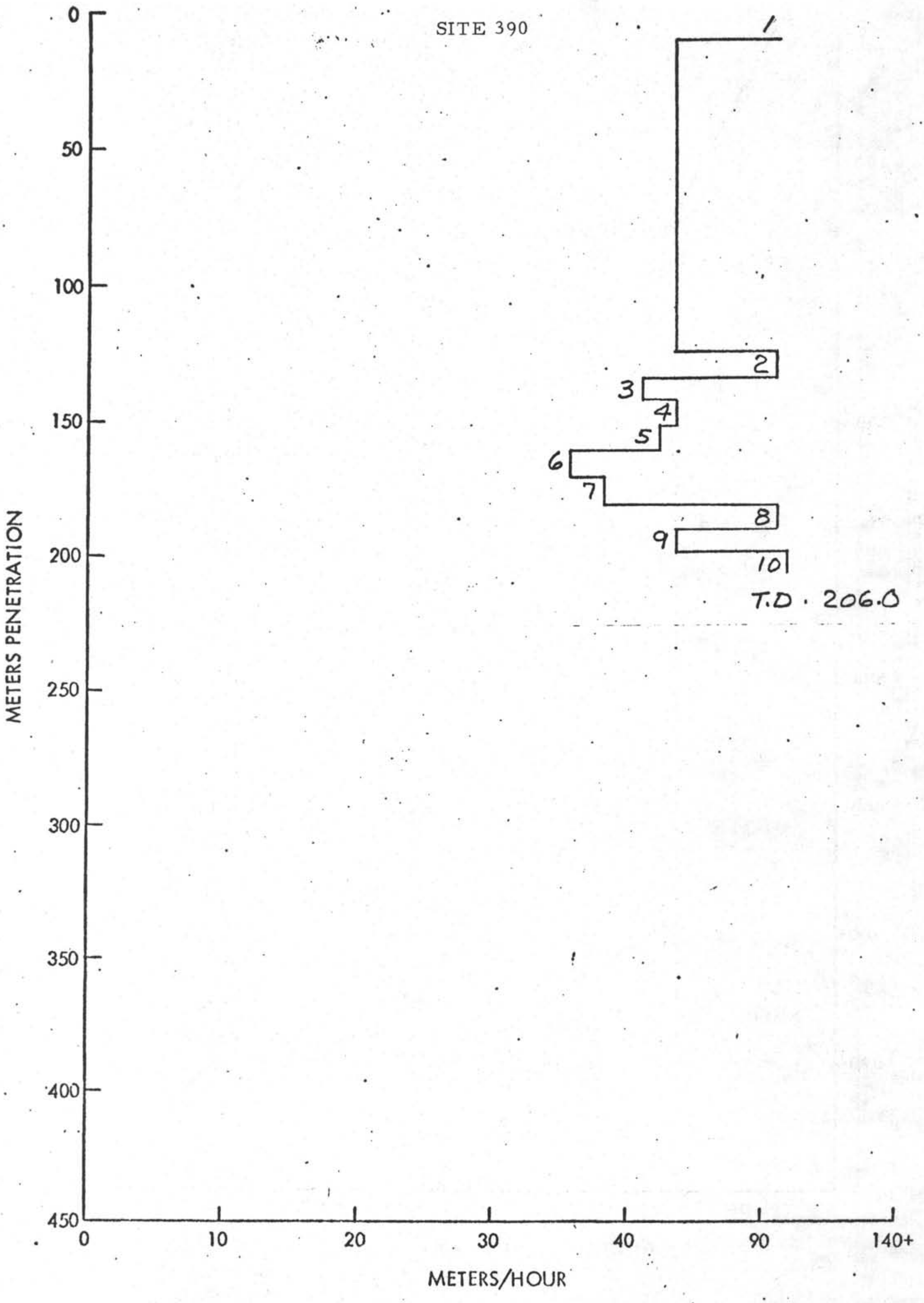
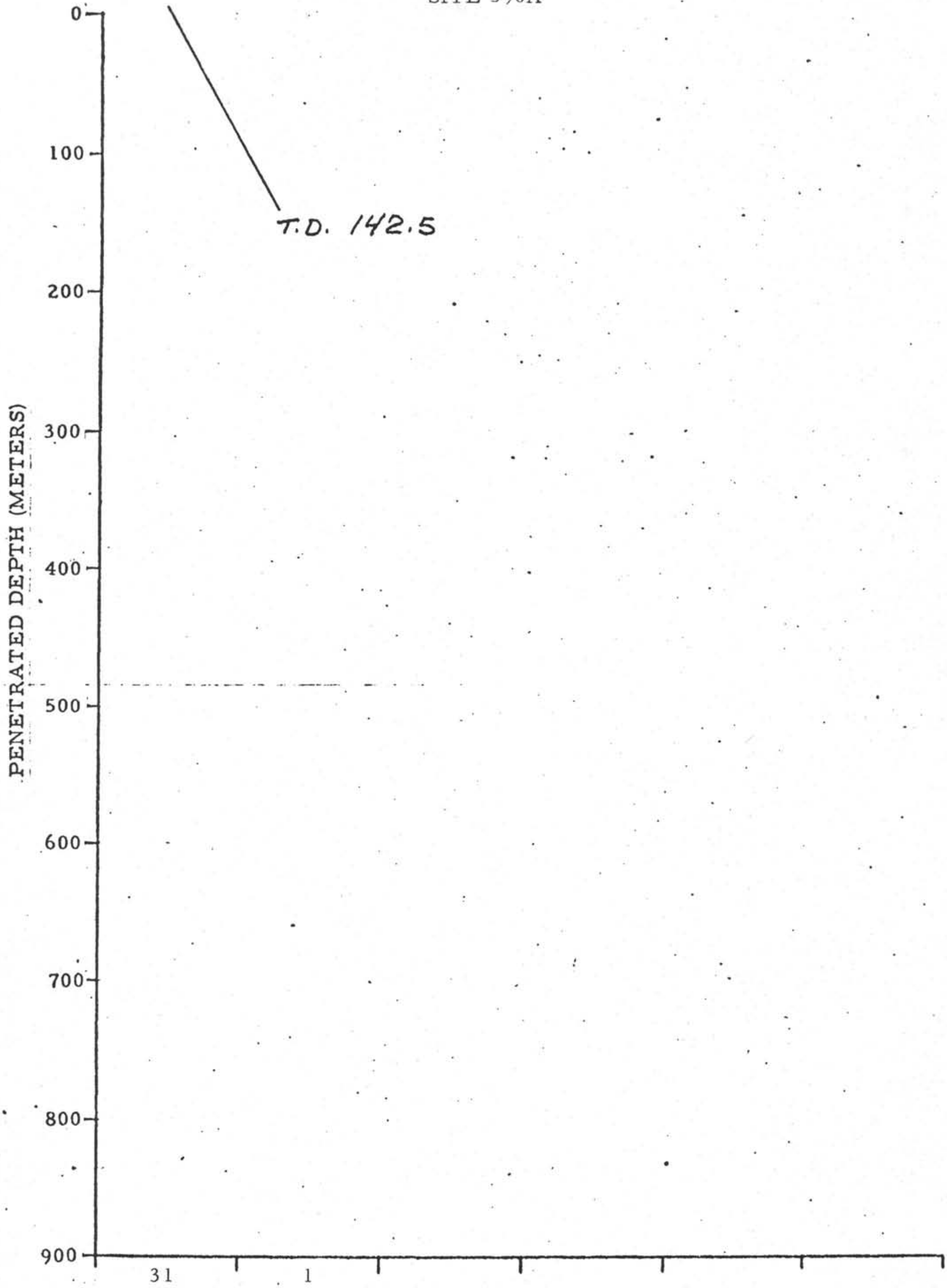
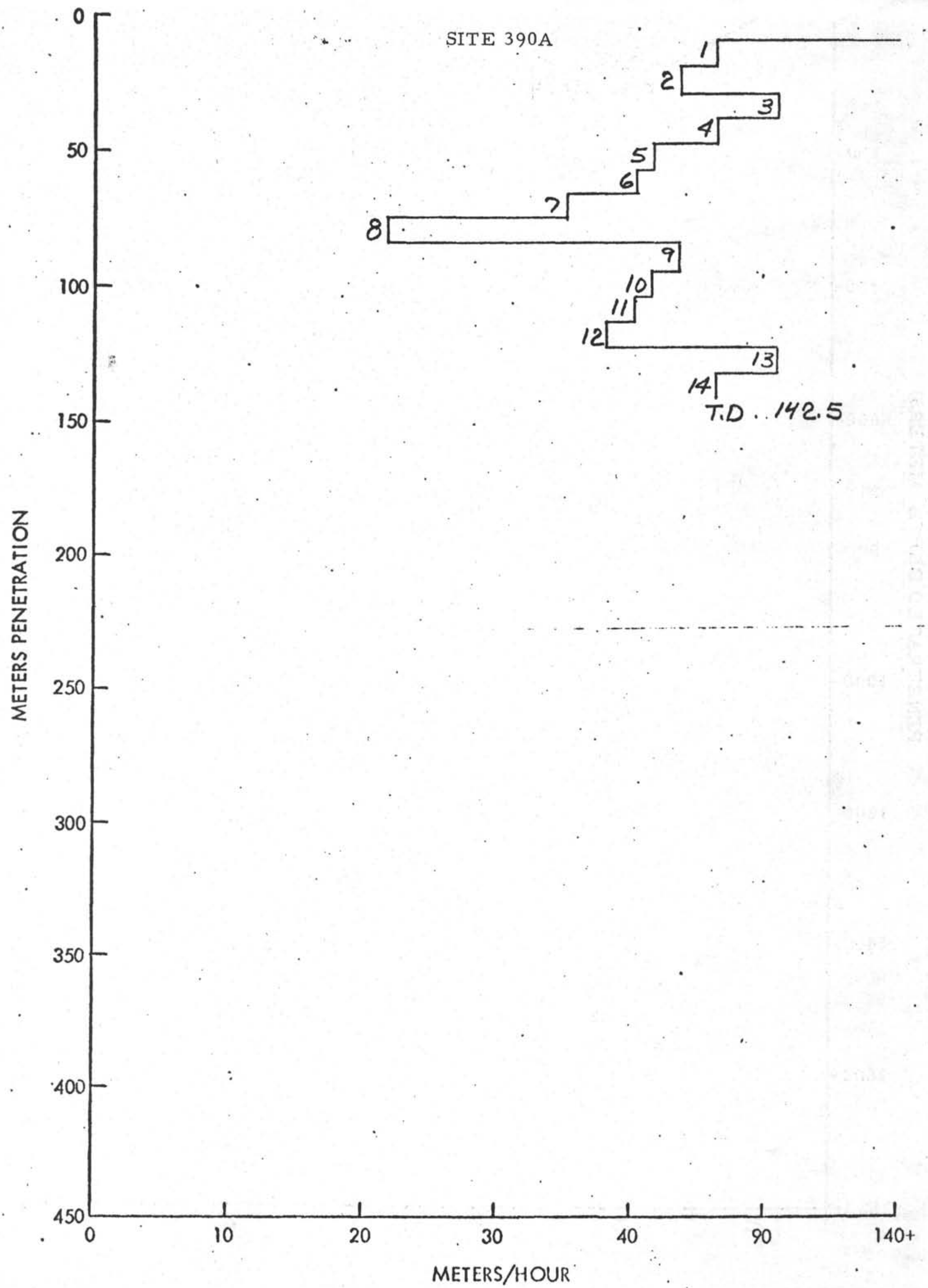
30
31
AUGUST 1975

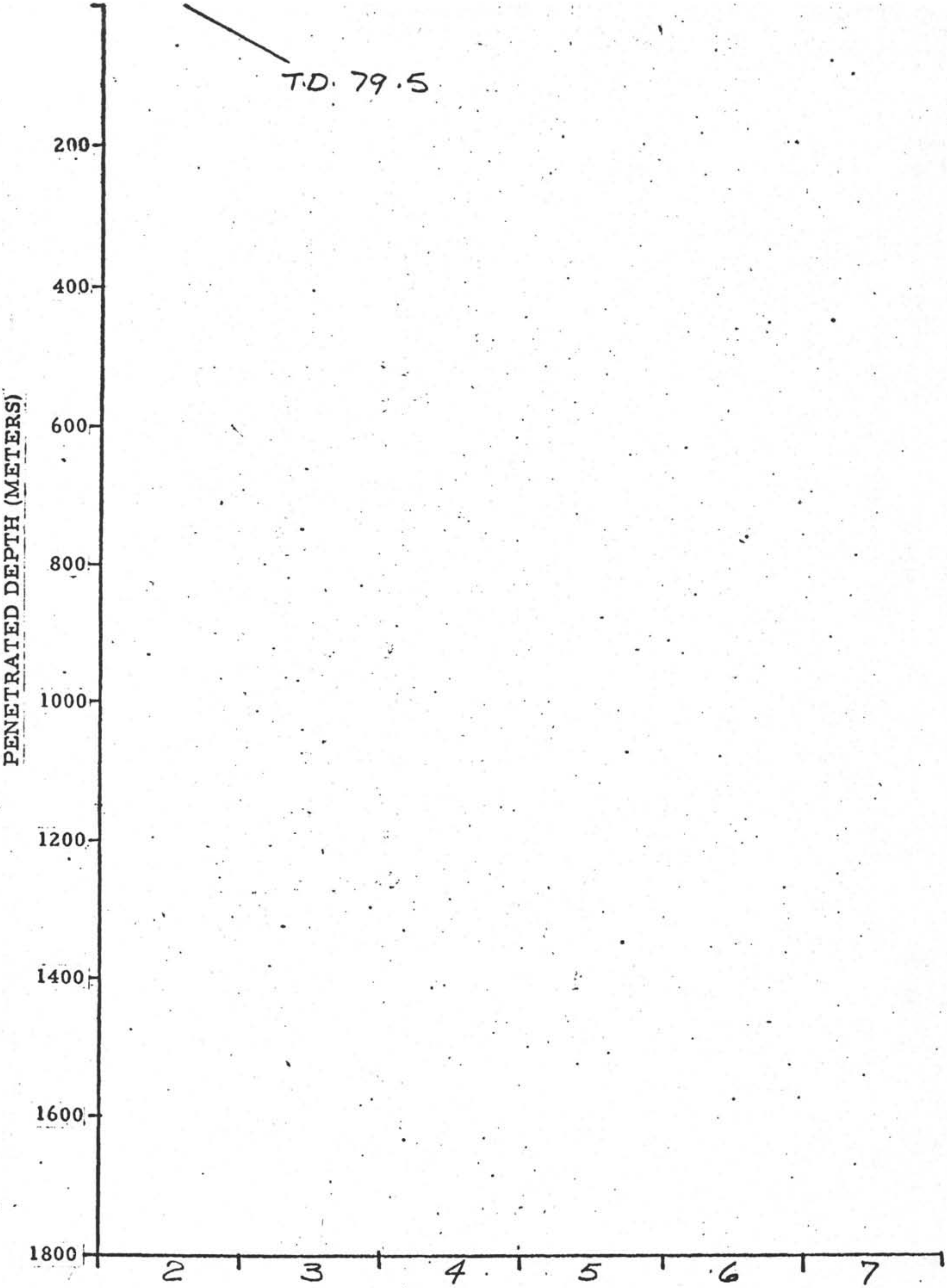

SITE 390
METERS PENETRATION
0
50
100
150
200
250
300
350
400
450
METERS/HOUR
0
10
20
30
40
90
140+
1
2
3
4
5
6
7
8
9
10
T.D · 206.0



AUGUST-SEPTEMBER 1975



SITE 390A
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
T.D . 142.5
0
10
20
30
40
90
140+
METERS/HOUR


T.D. 79.5
PENETRATED DEPTH (METERS)
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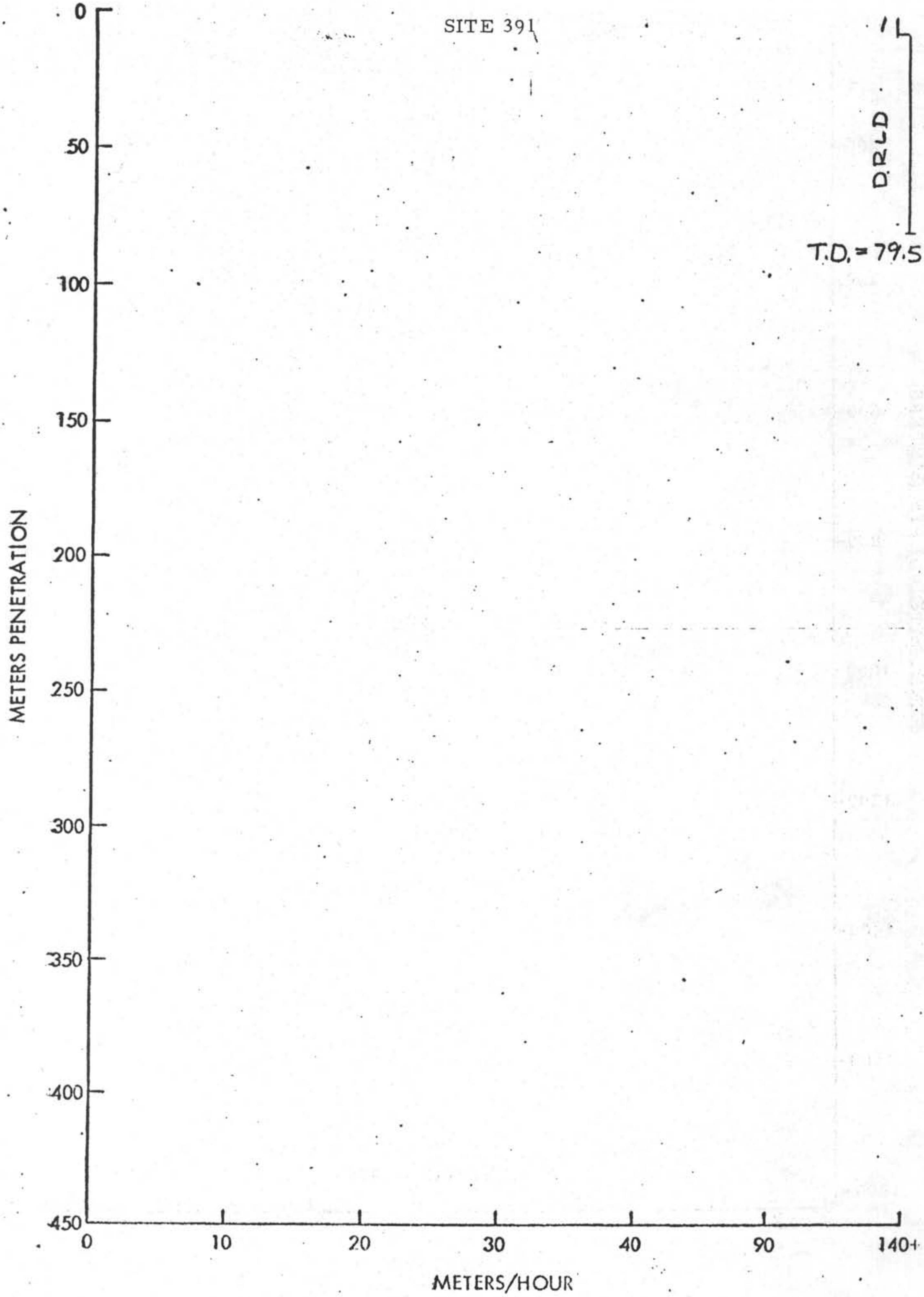
600
800
1000
1200
1400
1600
1800
2
3
4
5
6
7

SITE 391



DRLD
T.D. = 79.5
METERS PENETRATION
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50
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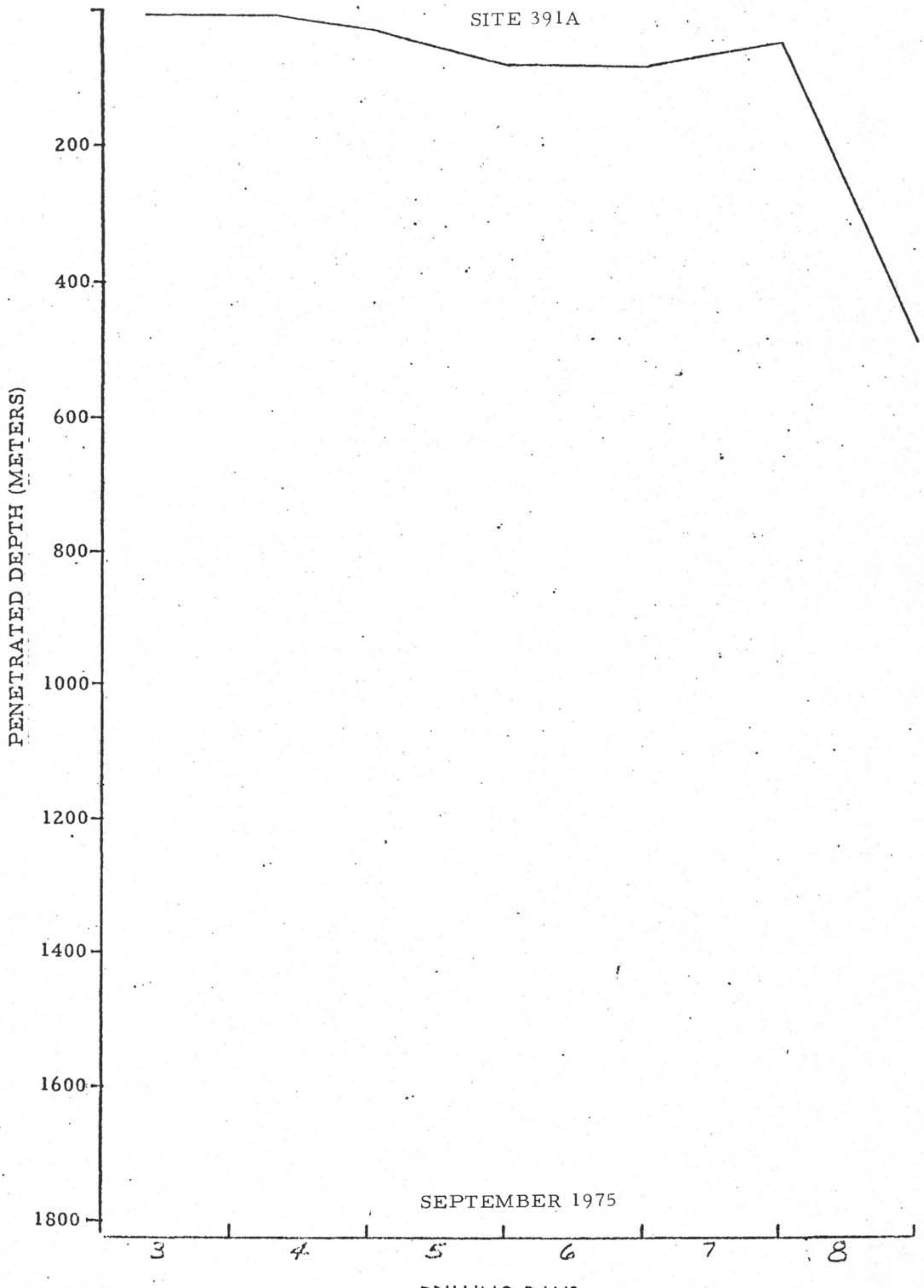
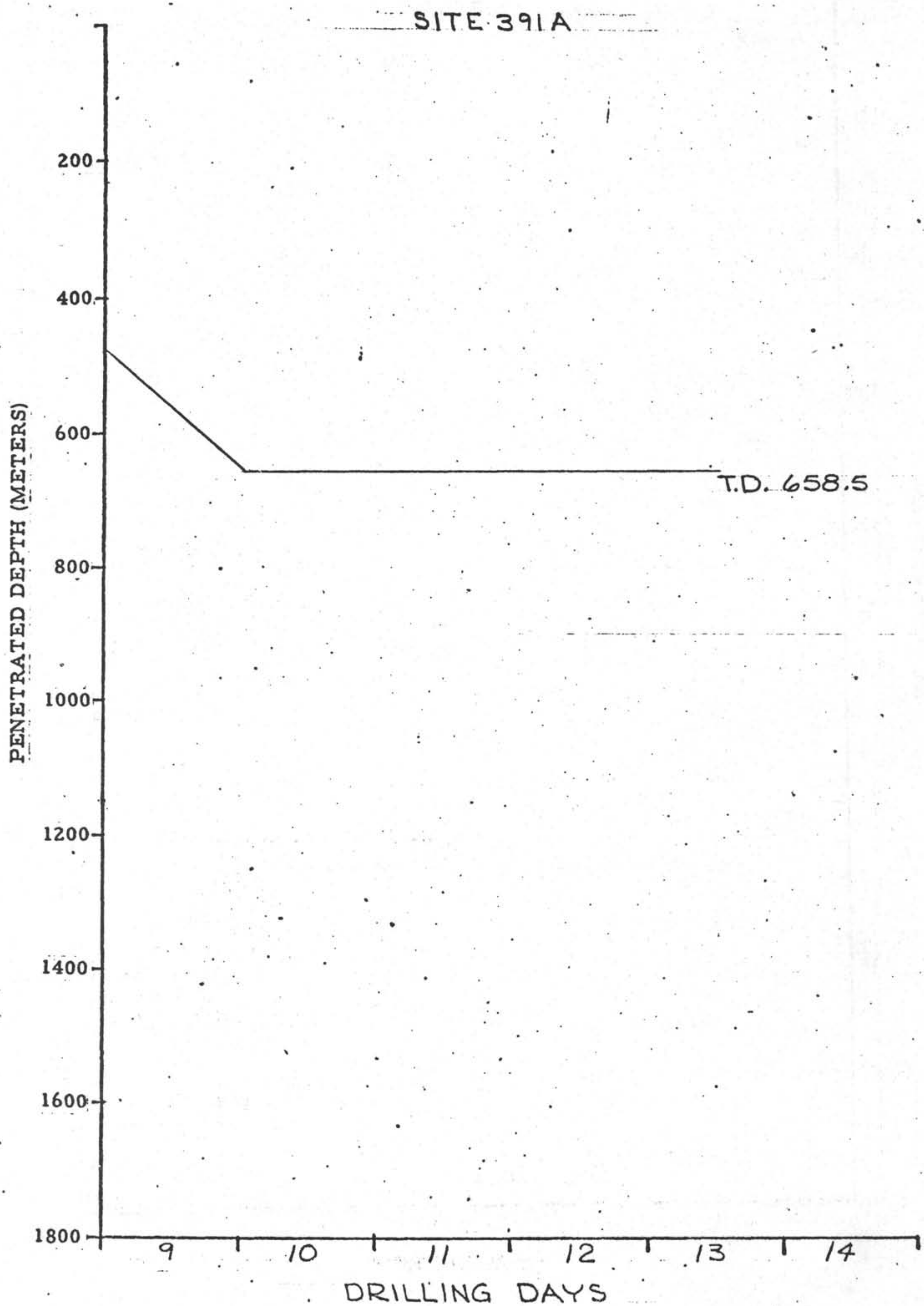
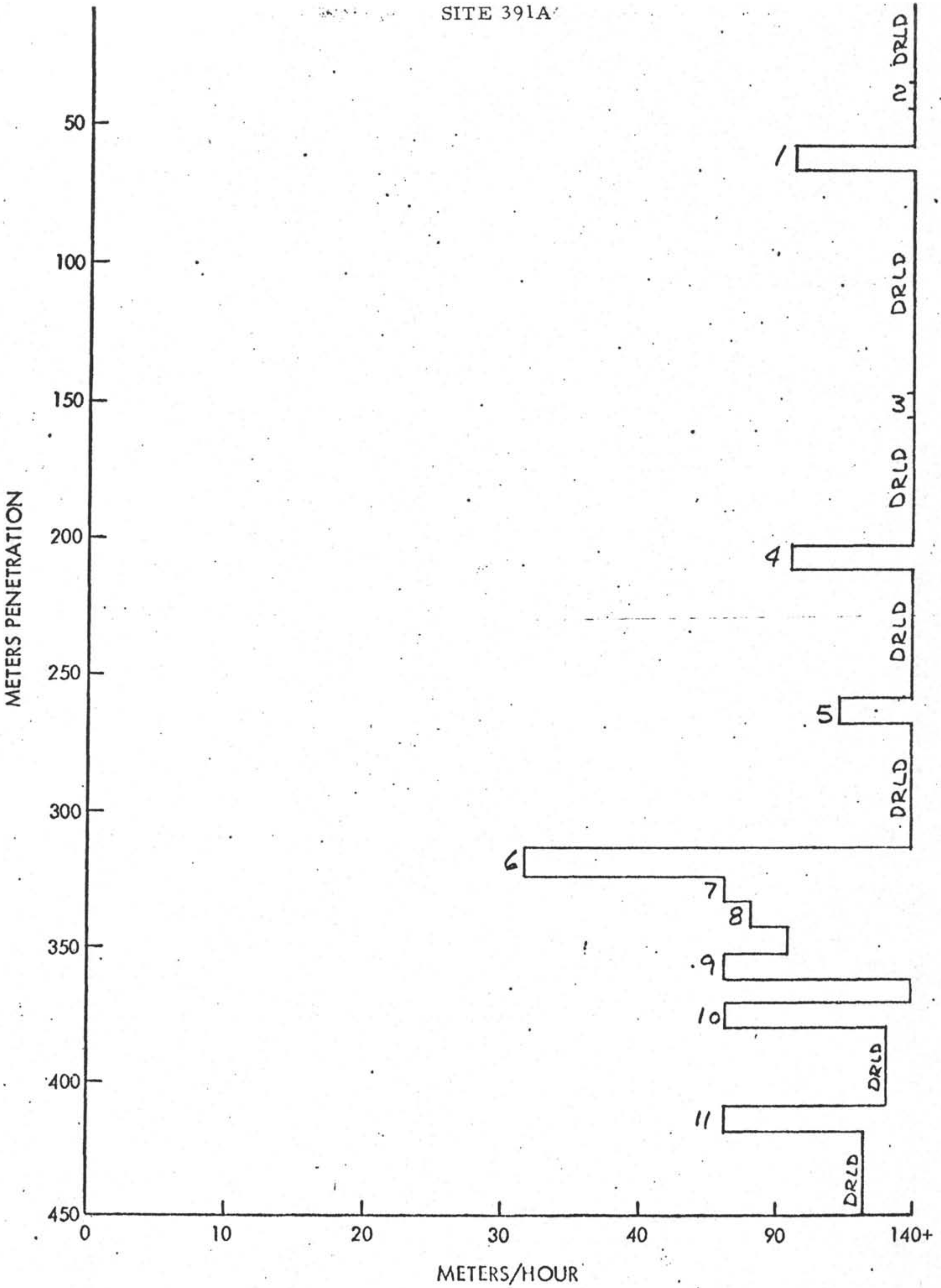
150
200
250
300
350
400
450
0
10
20
30
40
90
140+
METERS/HOUR


SITE 391A
PENETRATED DEPTH (METERS)
200
400
600
800
1000
1200
1400
1600
1800
SEPTEMBER 1975
3
4
5
6
7
8
DRILLING DAYS

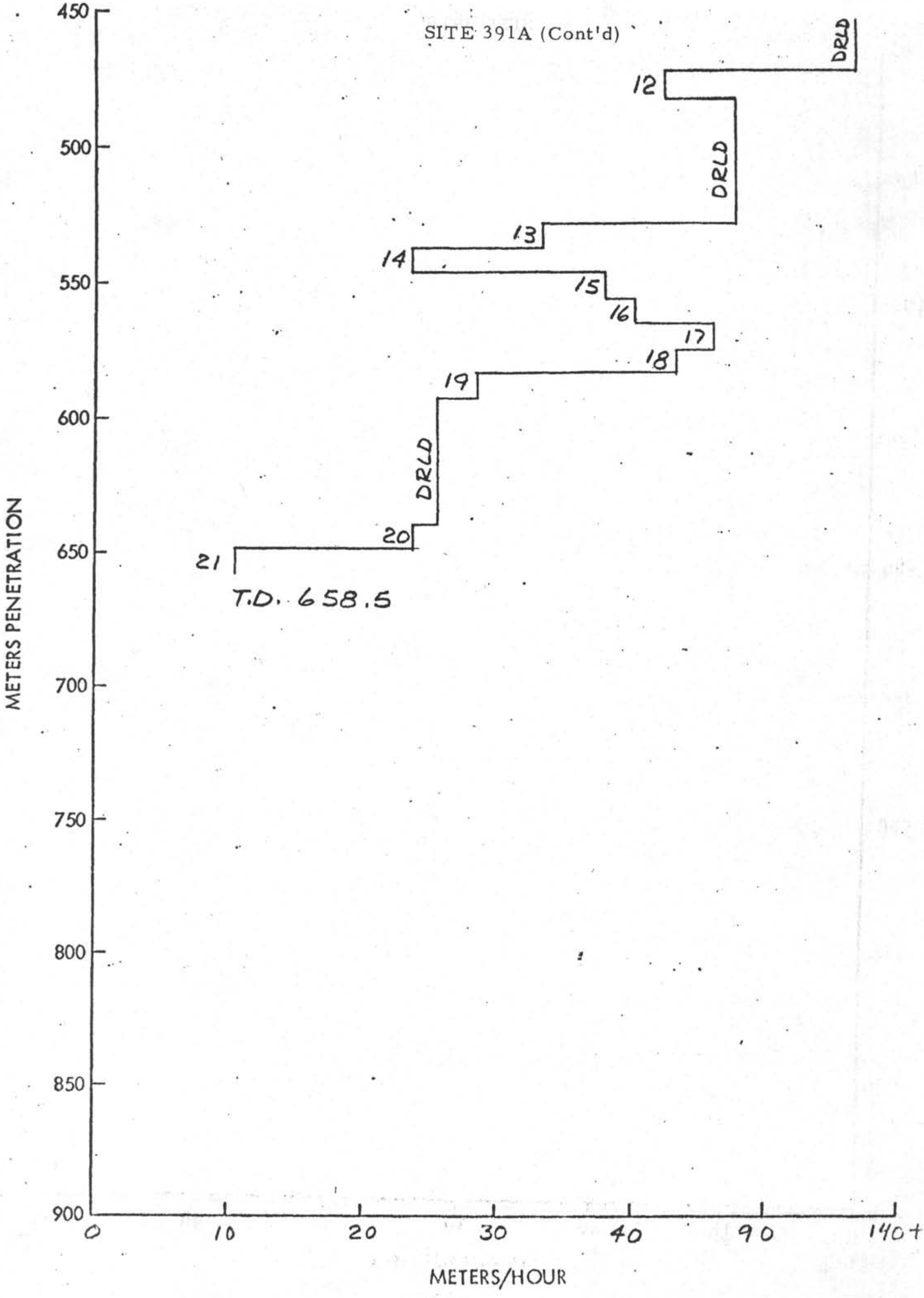

SITE 391A
PENETRATED DEPTH (METERS)
200
400
600
800
1000
1200
1400
1600
1800
T.D. 658.5
9
10
11
12
13
14
DRILLING DAYS

SITE 391A



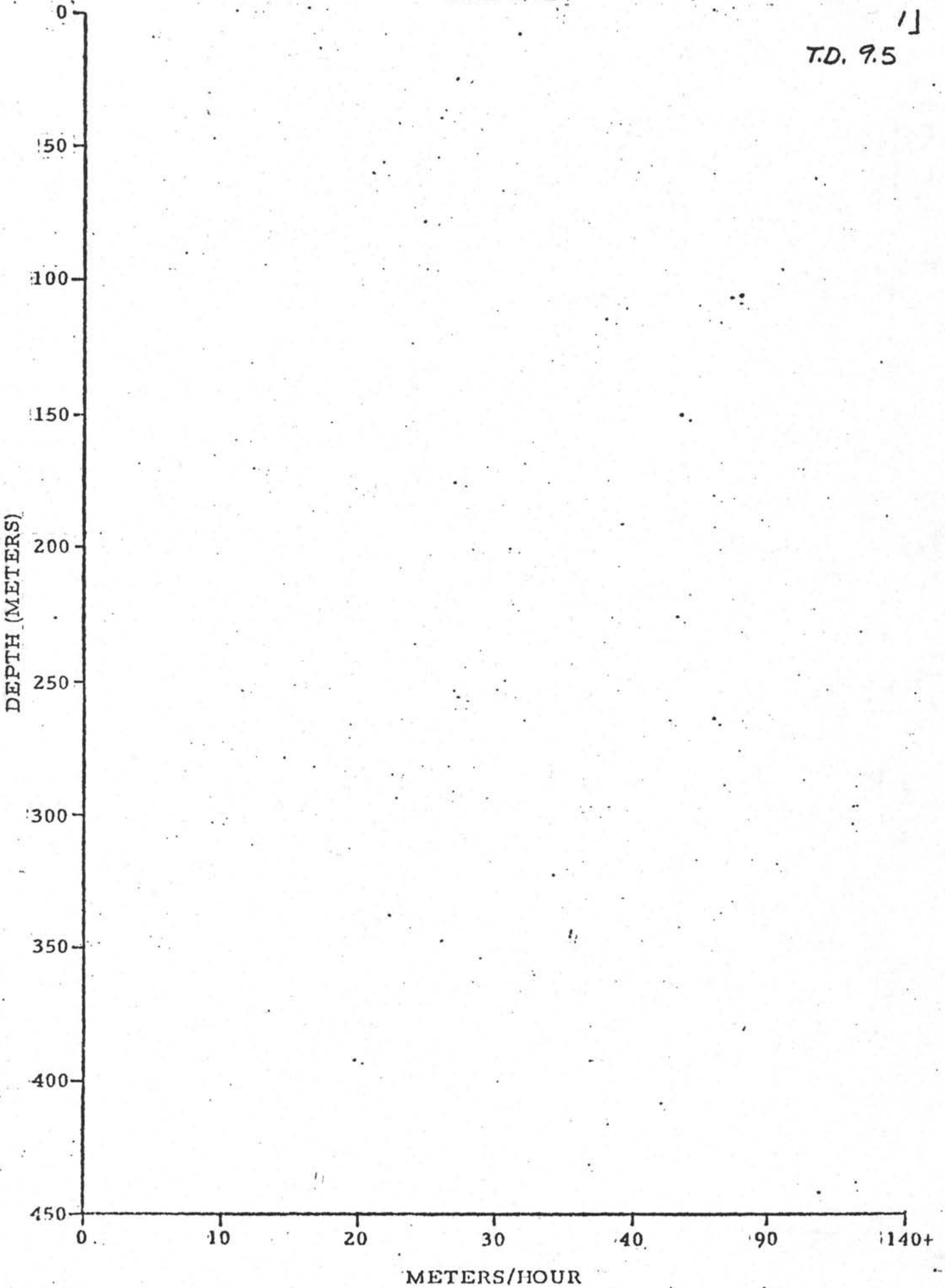
METERS PENETRATION
50
100
150
200
250
300
350
400
450
0
10
20
30
40
90
140+
METERS/HOUR
1
2
3
4
5
6
7
8
9
10
11
DRLD
DRLD
DRLD
DRLD
DRLD
DRLD
DRLD
DRLD

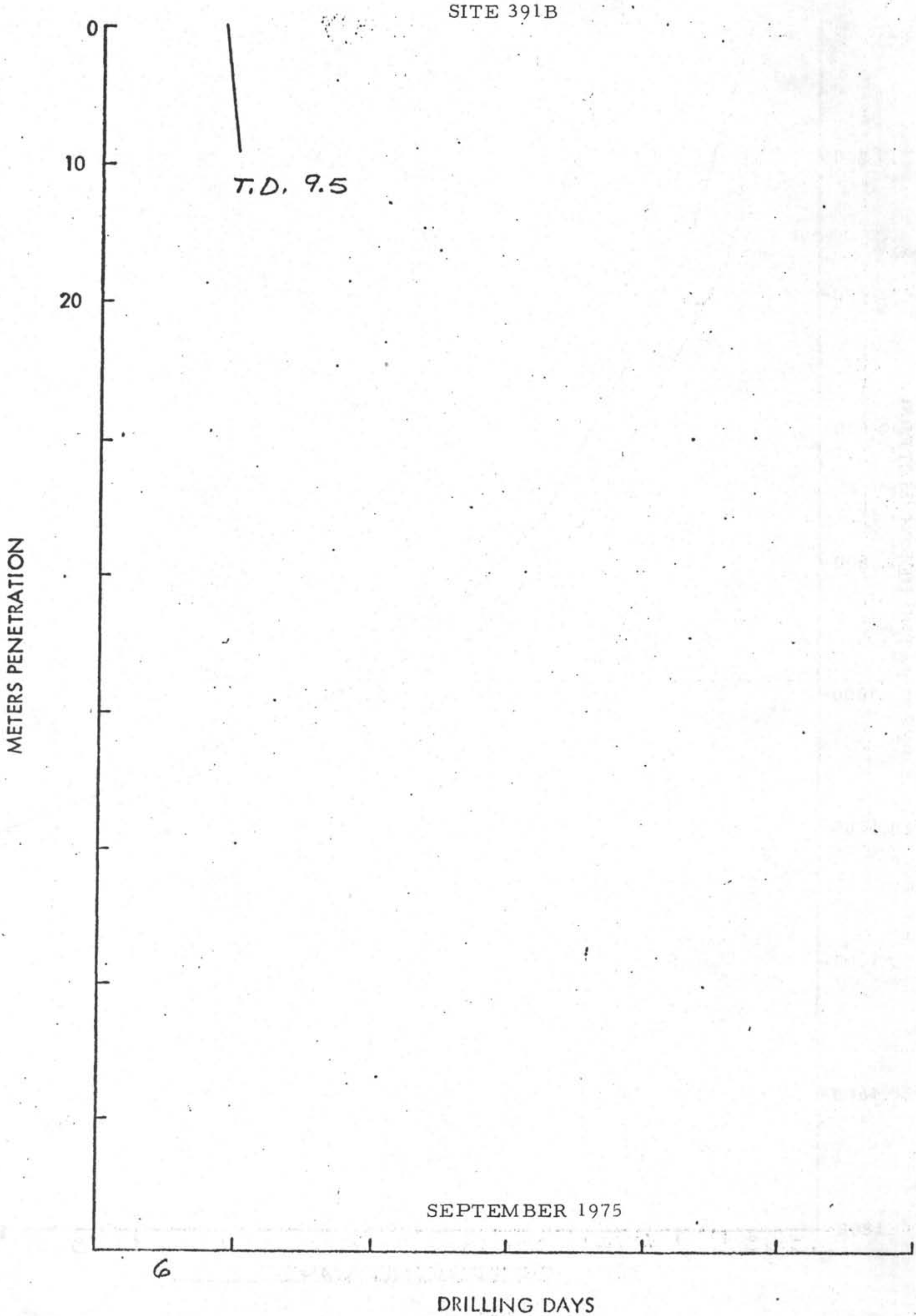
SITE 391A (Cont'd)

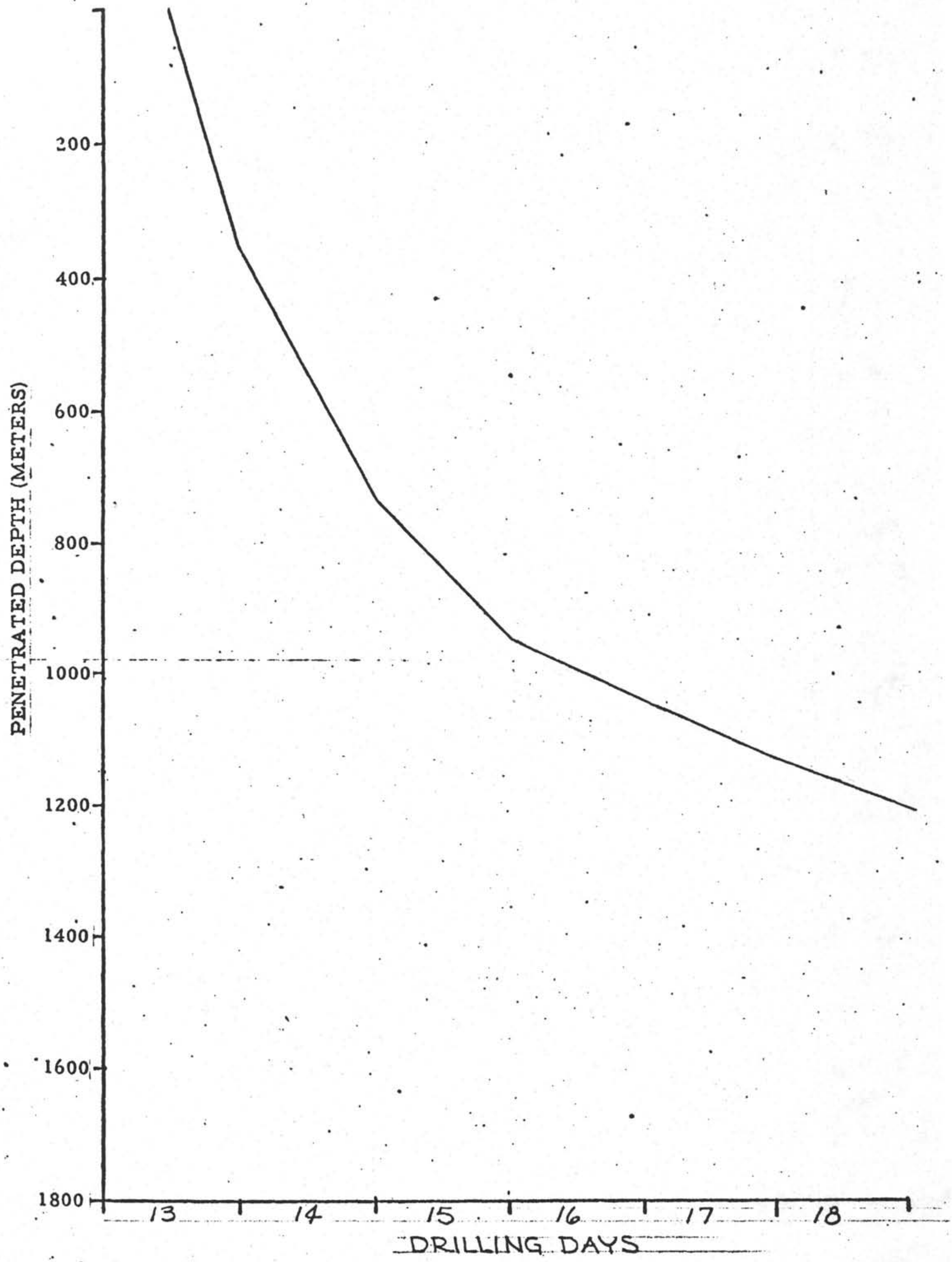


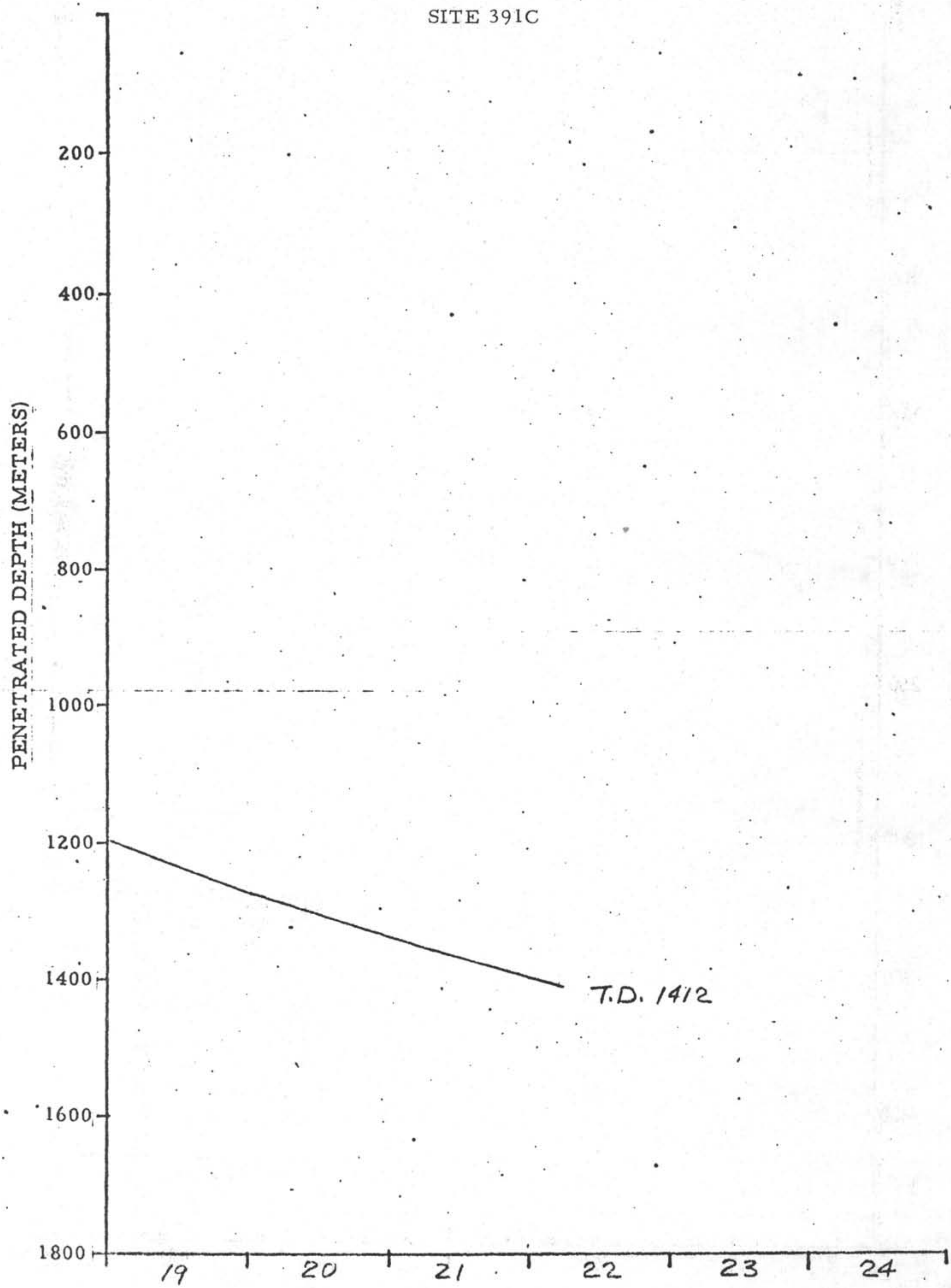
SITE 391B

1]
T.D. 9.5

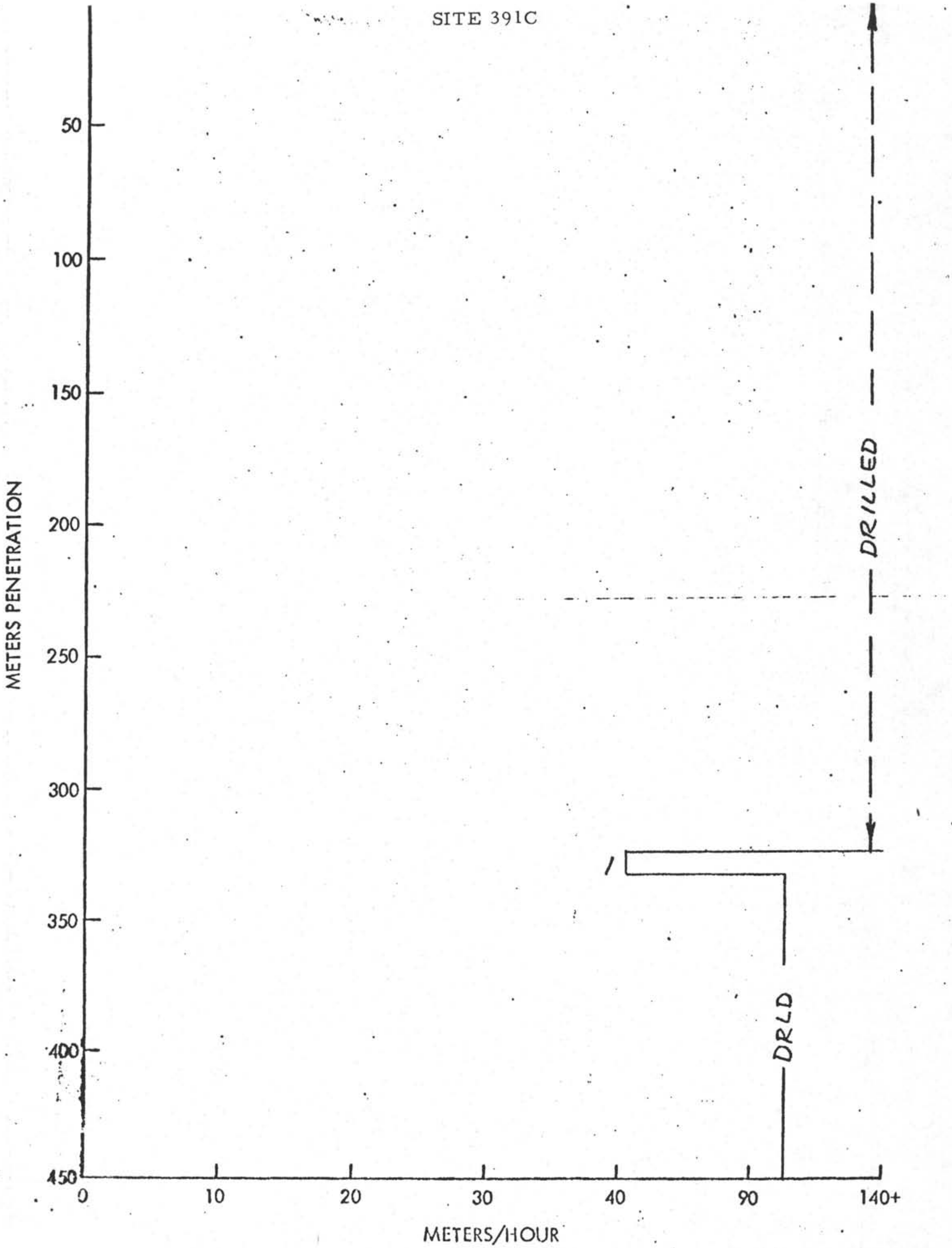



0
10
20
T.D. 9.5
METERS PENETRATION
SEPTEMBER 1975
6
DRILLING DAYS

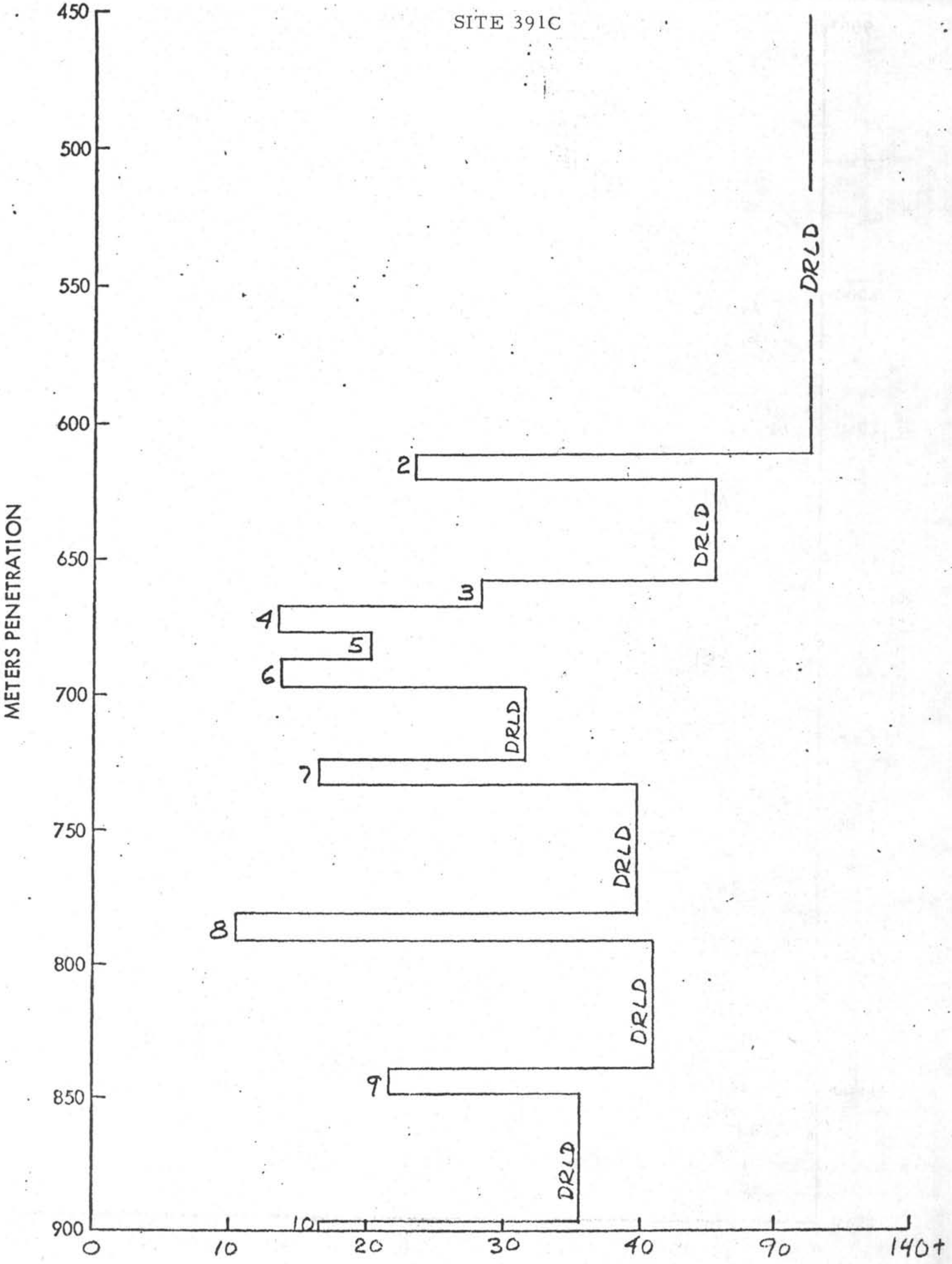

PENETRATED DEPTH (METERS)
200
400
600
800
1000
1200
1400
1600
1800
13
14
15
16
17
18
DRILLING DAYS

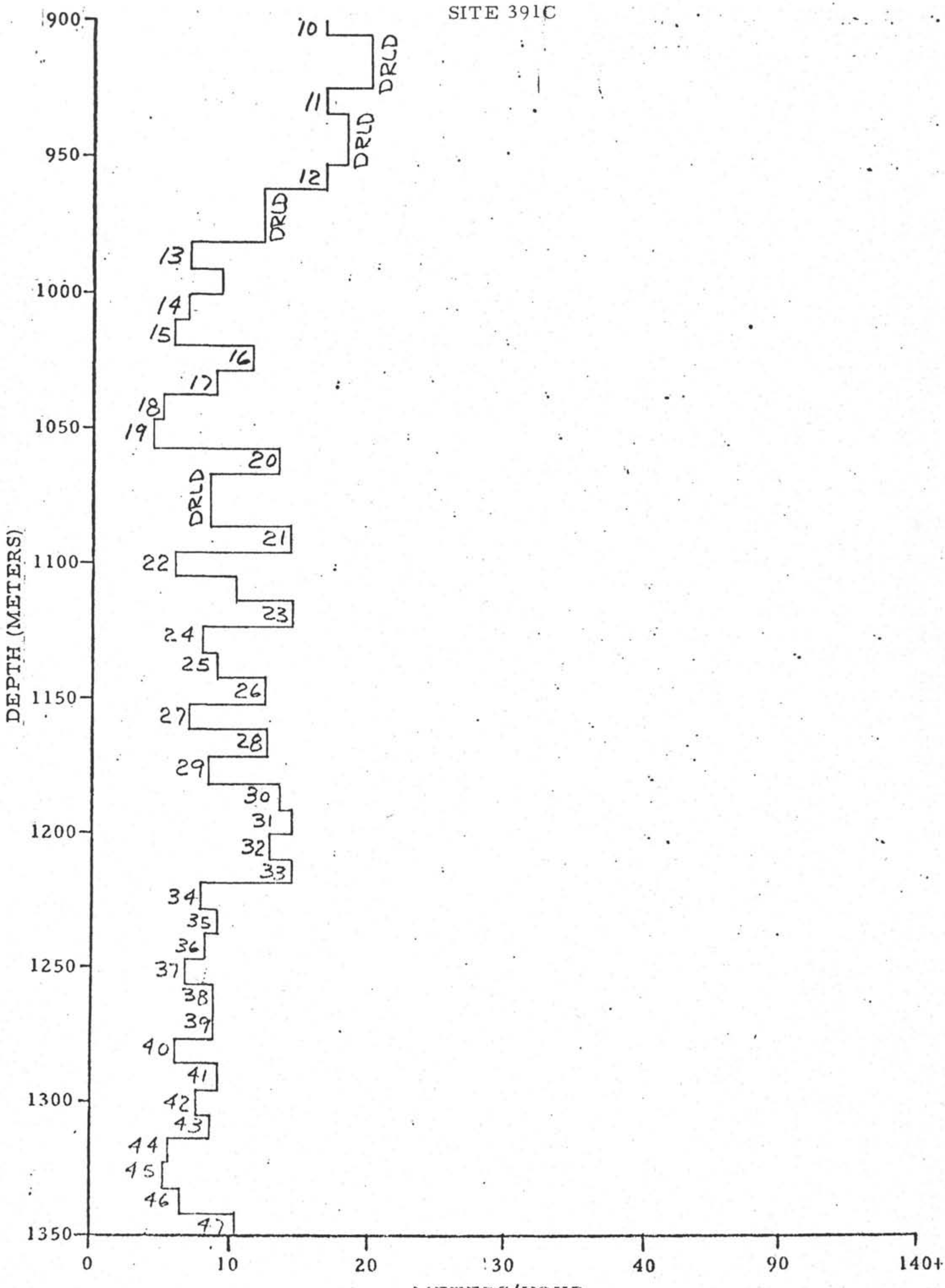


SEPTEMBER 1975


METERS PENETRATION
50
100
150
200
250
300
350
400
450
DRILLED
1
DRLD
0
10
20
30
40
90
140+
METERS/HOUR

SITE 391C


METERS PENETRATION
450
500
550
600
650
700
750
800
850
900
DRLD
2
DRLD
3
4
5
6
DRLD
7
DRLD
8
DRLD
9
DRLD
10
0
10
20
30
40
90
140+
METERS/HOUR


SITE 391C
DEPTH (METERS)
900
950
1000
1050
1100
1150
1200
1250
1300
1350
0
10
20
30
40
90
140+
METERS/HOUR
DRLD
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
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29
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46
47

DEEP SEA DRILLING PROJECT
IPOD ENGINEERING TRIALS
OPERATIONS RESUME
LEG 44A

The Engineering Trials of the GLOMAR CHALLENGER and her equipment were conducted following a 35-day IPOD mobilization period which included drydocking and an extensive shipyard overhaul. The primary objective of the cruise consisted of verifying the soundness and preparedness of the ship and her systems through the actual deployment of the modified re-entry and casing systems. A deep multiple re-entry hole was to be drilled through a thick (1600-1700 m) sediment section and into basement rock. Cores obtained in the lower portion of the hole would be of scientific value and would complement scientific data compiled on Leg 44.

A series of setbacks, mechanical and otherwise, delayed operations to the extent that a revision of the objectives became necessary. The deep drilling goal eventually was cancelled and a program set up that would test as many components of the entire system as possible in the remaining time of the leg.

NARRATIVE

The 35-day IPOD mobilization period came to an end at noon on 4 November 1975. Leg 44A officially commenced while the CHALLENGER was at sea for acceptance trials about eighty miles off the North Carolina coast.

A beacon was dropped for the primary purpose of testing improvements and changes made in the dynamic positioning system during the shipyard period. While holding station, a short drill string was run to test the hoisting equipment and the electric brake.

The logging winch was also tested at this time by making a "dummy" run inside the drill pipe. No hole was spudded at this location.

The vessel got underway for Norfolk at 1710 5 November 1975 and arrived in port at 0445 6 November 1975.

The 2.3 days spent in port were consumed primarily in fueling and the loading of bulk bentonite, barite and cement along with re-entry hardware, casing and ship's stores. Yard work deficiencies noted on the sea trials were corrected concurrently and official ship visits were conducted.

The GLOMAR CHALLENGER departed Norfolk, Virginia on 8 November 1975 and arrived in San Juan, Puerto Rico on 27 November 1975. Of the ensuing 19.0 day Engineering Trial cruise, 12.9 days were spent on site and 6.1 were spent underway.

2.9 days were required to reach the drilling site located about two miles south of DSDP Site 391. The beacon for Site 393 was dropped at 1042, 11 November, but rig operations did not commence until several hours of dynamic positioning system calibrations and software changes had been accomplished.

An exploratory hole was drilled to determine exact water depth and the depth to which conductor casing was to be set. The core barrel was pulled twice to pinpoint the mudline at 4961.5 meters below rig floor and the 14-7/8" bit was washed in without incident to 5020 meters. The final two meters were penetrated with difficulty and the sediment was considered suitable for landing the casing shoe. The hole was terminated at this depth and the drill string was pulled.

While the pipe was being pulled, the weather began to deteriorate. Due to the oblique movement of a strong cold front, the ship remained under the influence of 25 mph or greater winds and six to eight foot seas for nearly two days. These conditions were considered too hazardous to both personnel and equipment to proceed with handling the re-entry cone. The operation was delayed a total of 43.5 hours, but the time was not completely lost as several hours were spent on the dynamic positioning system during this period that would have necessitated operational delays otherwise. The stronger forces provided very good positioning test conditions and stationkeeping capabilities were proven excellent.

On the morning of 15 November, the weather had moderated sufficiently to permit resumption of operations. The re-entry cone, which had been preassembled, was moved to the port rail and then keelhauled to its position beneath the moon pool without major problems.

The sixteen inch conductor casing was then made up, run through the rotary table and hung off in the moon pool. A two-hour delay occurred when the top joint was "egged" during an attempt to remove the collar. It was necessary to remove the joint and replace it.

The next step involved making up the bottomhole assembly. This operation went smoothly until the time came to lower the running assembly into the casing hanger and attach the casing to the bottomhole assembly by installing the shoulder ring. Difficulty was encountered in making up the threads of this connection and another two hours were lost. In addition, 4-1/2 hours were consumed in latching the casing hanger into the lower portion of the re-entry cone. The operation very nearly came to a halt when the spring-type latch ring was pulled from its groove and remained in the cone while the hanger assembly was pulled back up. The ring was eventually recovered, however, and a satisfactory latch was achieved.

The drill string was run to the sea floor without further incident and Hole 393A was spudded at 1315 hours on 16 November. The casing was washed in exactly as planned with the shoe landed at 5021 m. The rotary shifting tool was run on the sandline to shift the internal sleeve of the running tool and to release the casing.

After upward retrieval of the shifting tool had begun, the line pull increased to about 2500 lbs above the line weight and then fell off sharply, indicating the line had parted. About 5000 ft of line was retrieved before the broken end was reached. It was unknown at this time whether the sleeve had been shifted, so it was decided to attempt to recover the remainder of the line and the shifting tool, thus guaranteeing that the sleeve would be shifted before an unlatching attempt was conducted. The end of the line was recovered using a cable fishing spear and shortly after retrieval commenced, a line pull about 1000 lbs greater than the earlier pull was noted and the tension fell off to about the correct line weight. This was interpreted as the shifting of the sleeve. A great deal of line was recovered and spooled onto the sand reel when a broken end was again pulled from the pipe. It was now not known whether the sleeve had shifted or how much line remained at the bottom of the pipe. The Bowen sand reel was nearly filled with old line and the drawworks sandline was almost certainly too short for another fishing attempt. It was considered possible that the sleeve had been shifted and as a great deal of time would be consumed before another fishing attempt could be made, it was decided to attempt to unlatch the casing. The drill string would not rotate on the first attempt, but after slow pumping and varying the hook load by raising and lowering at total depth, free rotation was accomplished.

The free rotation, coupled with a decreased hook load, were interpreted as release of cone and casing. When the drill string was pulled, however, the casing was found to be attached with the cone missing and the latch ring still in its groove. (Subsequent review of the TOTCO Drilling Record indicates that the cone may have been released either during the unlatching attempts or after several stands of pipe had been pulled)

At this point (17 November) it was decided that the remaining seven operating days were insufficient for the attainment of any of the deep drilling or scientific objectives, considering the time involved in assembling and deploying another re-entry cone. The remainder of the cruise became a demonstration of the viability of as many key systems and components as possible within the time frame. The procedure set up was to locate the cone left on bottom and, if possible, enter it and land the conductor casing and drill ahead.

About 36 hours were consumed in disposing of old sandline and spooling new and in conducting tests intended to ascertain the basic soundness of the casing latching system and the rotary shifting tool. The casing string and bottomhole assembly were reassembled and again difficulty was experienced in making up the shoulder ring to the casing hanger.

The drill string was again run to just above the sea floor and the new sandline was run to retrieve the inner core barrel prior to lowering the scanning sonar tool. Anomalous weight indicator readings were noted as the retrieving tool neared bottom (too much weight). The winch had been stopped and the weight situation was being investigated when the sandline parted at the crown. The falling end of the line fouled in the travelling block and it was possible to clamp the line at the rig floor avoiding another fishing job. Investigation of the double crown sheave assembly revealed that the line had been running off one of the sheaves for some time. A deep groove in the sheave pin indicated that the line had jumped the sheave as it was originally strung over the crown.

After retrieving the core barrel, the re-entry sonar tool was lowered and scanning for targets began at noon on 20 November. Two targets were identified and procedures were initiated to close the more prominent target. At this point, one hour and forty minutes after commencing scan, power regulation at the tool was lost and it was necessary to retrieve the tool. The electrical problem was readily traced to a short cable armor about eighty feet from the cable head. Also, when the tool was recovered, the lower spacer subs of the sonar tool had backed off, probably during retrieval and were still inside the drill string. About 6-1/2 hours were required to cut off approximately 100 feet of cable and rehead. During this time, the spacer subs were successfully fished with a spear designed for inner core barrels.

After the sonar tool and logging cable had been properly reassembled, the second re-entry attempt was made. Again, two targets were quickly discerned and the drill string was maneuvered toward the more distinct target. As the target was brought into the shorter range scales, it failed to resolve itself into the familiar pattern of reflectors of an upright cone. Observers were in general agreement that the target was probably the cone but was not in an upright attitude. The decision was made to carry the re-entry exercise through to completion and make every effort to "hit" the target. After nearly 3-1/2 hours of scanning, the display indicated the bit was passing directly over the target and a stab was made at 0530, 21 November. No indication was noted of contact with the target or of entry into the previous hole.

The new hole was designated 393B and the casing was washed in as before, although more weight and pump pressure were required. As the last joint was being washed down, it was discovered that the positioning system had received no beacon signal for several minutes. A new beacon was dropped and promptly began transmitting unacceptable pulses necessitating the launch of a second replacement beacon. It was necessary to pull the casing back above the mud line while the new beacon fell as there was no time to run the shifting tool and release it. In all, 1-1/2 hours elapsed between the initial beacon failure and the time the bit cleared the mud line.

At noon, 21 November, after taking position on the new beacon, Hole 394 was spudded. Again, the casing was washed in without incident. The rotary shifting tool was run on the sandline and the sleeve was shifted with about 1000 lbs steady overpull on the line. The casing was released without undue difficulty, although some manipulation of the drill string was necessary. Free rotation was again noted and weight indication was again inconclusive. Twenty four meters of hole was made below casing to verify disengagement.

A round trip of the drill pipe was then made to replace the 14-7/8" bit with a standard ten inch core bit. The casing running tool was removed and a standard bottomhole assembly was run.

When Hole 394A was spudded at 1450 m, 22 November, about thirty hours of site time remained for testing the pressure and conventional coring systems and the heave compensator. The heave compensator was in the string for the duration of the operation at this hole. Unfortunately this was the only flat calm day of the cruise and test conditions were poor for the heave compensator.

One attempt to obtain a pressurized core was made but was unsuccessful. Critical parts of the pressure core barrel assembly were damaged and further attempts were precluded. Five conventional cores were also cut on this hole.

On the morning of 23 November, a rendezvous was made with the U. S. Navy destroyer USS Glover and official visitor Mr. Richard Malow of the House Appropriations Committee was transferred aboard.

When it was determined that additional testing time would be of little value, it was decided to pull the drill string a few hours earlier than planned and use the time in port to correct as many problems as possible.

After the bit was on deck, about 7-1/2 hours were spent conducting positioning system noise level tests. The CHALLENGER departed Site 394 at 0530, 24 November and arrived at San Juan, Puerto Rico at 1610, 27 November. Except for a twenty minute stop to check a final positioning system program update, this portion of the cruise was uneventful.

DRILLING AND CORING EQUIPMENT

Downhole drilling and coring equipment were trouble free. Low core recovery was experienced on the first three cores attempted after the pressure core barrel run. It is believed that the dimensions of the pressure core barrel allowed sediment to partially jam the bit throat and prevent subsequent barrels from latching into position. A full core was obtained on the fourth attempt, indicating that the blockage had washed out.

Two very costly sandline failures occurred. The first, which ultimately led to the loss of the re-entry cone, was the low-tension breakage of the line which had failed on Leg 44. The line was apparently not overrun or slacked sufficiently to allow kinking and the cause of the failure remains unexplained. The break occurred "up hole" from the long splice installed on Leg 44, so that "locked in" torsional stresses from the previous break can be eliminated as a probable cause. The second break occurred on the first run of a newly installed line and was the result of the line becoming unstrung at the crown sheave. A total of about 15 hours were lost in shifting crown sheave assemblies and in splicing the sandline as intermediate steps were necessary to remove the twist from the line remaining in the pipe.

The drill pipe racker, normally a trouble-free system, was responsible for 2-1/2 hours lost time on the first pipe trip. One of the conveyor guide posts on the port rack had been bent, apparently by a suspended crane load in port. This resulted in breakage of conveyor rollers. In addition to replacing the rollers and straightening the post, it was necessary to replace a burst hose in the racker hydraulic system. The two problems were unrelated.

BITS

The new 14-7/8 inch F94C core bit was used for jetting in on all holes spudded except for 394A. As there was less than five hours jetting time in very soft formations with no rotation, there was predictably no sign of wear or damage to the bit. Although many variables are involved, there was no noticeable difference in quality of core or in recovery in the small amount of soft sediment cored between the 14-7/8 and 10 inch bits. A rerun 10 inch F94CK bit was utilized in Hole 394A and was retrieved in excellent condition.

RE-ENTRY ELECTRONICS

Extensive testing of and minor modifications to the EDO scanning sonar tool were accomplished in Norfolk and during the early part of the cruise. Electronics engineers representing EDO Western, DSDP and GMI were on board, as were one GMI and two DSDP electronics technicians. The two re-entry attempts provided valuable experience in equipment operation and in general, re-entry procedures for all concerned.

The performance of the electronics appeared to be excellent and an improvement over recent re-entry attempts. Two well defined targets were detected on each attempt and are generally considered to have been the beacon floatation and the re-entry cone (in an improper orientation).

BEACONS

Beacon performance was very good with the exception of the unacceptable pulse characacteristics of the first replacement beacon dropped at Site 393. Although it was necessary to drop a second replacement, a subsequent check showed that the pulse envelope had returned to normal. The signal had been normal when the beacon was "presoaked".

The abrupt loss of signal from the original double-life beacon at Site 393, after ten days of consistently strong performance, was an abnormal failure mode. Review of conditions surrounding the signal loss yielded the conclusion that Hole 393B was spudded very close to the beacon and that the beacon was covered by sediment during the washing-in operation.

DYNAMIC POSITIONING SYSTEM

Numerous changes to both hardware and software of the positioning system were accomplished in the shipyard. A considerable amount of testing and calibration remained at the beginning of Leg 44A, although adequate stationkeeping had been demonstrated during the sea trial period.

25.3 hours of operating time were consumed in integrating and "tuning" the overall system, introducing computer program updates and in various testing and validation procedures. Many hours were also devoted to these activities while operations were delayed by weather and during pipe trips.

Difficulty was experienced in calibrating thrusters and main shafts to provide proper and uniform RPM in response to given control voltages from the positioning electronics. This was complicated by the fact that numerous primary and back-up field excitation circuits are involved and by varying torque responses in the main propulsion motors. At the end of Leg 44A, this problem is not completely resolved as a disparity remains between the responses of port and starboard shafts.

Despite the continuing work on the system, stationkeeping was excellent for the duration of site occupancy until the final day. A rapid excursion of several hundred feet occurred and corrected itself after the drill string had cleared the mudline. By the time checks could be run, no abnormalities could be detected, although a temporary malfunction in the vertical reference gyro was suspected.

CEMENTING EQUIPMENT

The B. J. cementing unit was refurbished in Norfolk and was converted from a batch mixer to a continuous jet mixing unit. Unfortunately, since the Leg 44A operation did not progress to the setting and cementing of 11-3/4 inch surface casing, operational testing of the cementing equipment will be deferred until Leg 45.

LOGGING EQUIPMENT

The Schlumberger logging winch was also extensively refurbished during the shipyard period and no major mechanical problems were encountered on the trial leg. Some concern was generated over the malfunctioning of the cable odometer drive unit which was replaced in Norfolk but the problem was minor. A second cable tension device was obtained during the yard period for redundancy. It developed an electrical problem on its first run and will be replaced by the original unit pending repair.

Damaged armor on the logging cable was found to be the source of the interrupted circuit which terminated the first re-entry attempt. The nature of the damage indicated the cable had been either kinked or struck by a heavy object while on deck prior to the re-entry operation.

RE-ENTRY HARDWARE

The re-entry cone had been preassembled on the dock in Norfolk and was carried to the operating area on its side in the starboard casing rack area. A new lower cone was mated to the last of the older style upper cone sections. The upper cones are nearly identical in design and dimensions and only very minor modifications were required to make the assembly compatible.

Although the new assembly was both longer and heavier than earlier cones, no significant problems were encountered in handling and keelhauling the cone once the weather had settled. It was necessary to shorten one handling sling to achieve required clearance of the bulwark.

Sixteen inch casing handling equipment and procedures proved entirely adequate. Difficulty was experienced in stabbing into the short shoe joint due to lack of lateral support. An unsuccessful attempt to unscrew the collar from the top joint with the rig tongs resulted in severely "egging" the joint. The elevators would not latch around the deformed joint and it was necessary to cut holes in the damaged collar and lift the string with slings to replace the joint. In the future, collars will be removed with a cutting torch. The buttress casing thread greatly facilitated stabbing this large diameter casing under conditions of considerable vessel motion.

The 8V straight thread utilized in making up the shoulder ring to the top connection of the 17" casing transition joint proved to be unacceptably susceptible to damage and cross-threading. Design changes call for a coarser tapered thread to be employed and for the connection to be altered in such a manner that threads will not come into contact with the latch sleeve assembly as it is lowered into place.

Review of the problems encountered in latching the casing into the cone determined that excessive friction existed between the latch ring and the inside of the constant diameter section at the base of the cone. It was also found that, without positive centralization, the latch ring could be pushed far enough to one side that a shoulder or projection could engage it and possibly pull the ring from its groove. Close scrutiny of design specifications also revealed that maching tolerances of the castings involved were such that, in a "worst case" situation, it was possible that there would be insufficient clearance for the latch ring to engage.

To correct these deficiencies the following actions were scheduled to be accomplished upon the ship's arrival in San Juan:

1. The remaining casing hanger assemblies on board were to be removed to a machine shop where the tolerances were to be "opened up" to preclude even a possibility of physical interference with ring engagement.

2. All remaining latch rings were to be replaced with rings of a reduced spring constant (i.e. greater inside diameter). In addition, corrugated steel "marselle" centralizing rings were to be provided to hold the latch rings in position.

Examination of the latch ring recovered after the accidental disengagement of the re-entry cone from the casing string yielded strong evidence that the ring had been fully engaged and that unlatching had occurred simultaneously with rotation of the drill string. Under normal operating conditions, rotation would never be attempted until after there were positive indications that the releasing sleeve had been shifted. It was generally agreed, however, that disengagement should not have been possible under these or any conditions which could have been imposed upon the system. A design review has been initiated to render the system fail-safe.

The casing running tool and latch sleeve assemblies showed no damage whatsoever after three one-way trips with casing attached and three jetting-in operations. When the shifting tool was finally brought into position, the sleeve was shifted and the casing was released according to design.

The wireline shifting tool utilized was of the "Rotary" type. This tool was designed by DSDP as a backup for the previously employed Baker shifting tool. Recent failure involving the Baker tool prompted this first full operational test of the Rotary tool. Review of the initial failure to shift and release the casing string indicates that the tool had not descended far enough to engage the sleeve when the sandline failure occurred. On the final attempt, when the shifting tool was finally retrieved through the casing running tool assembly, a normal release was achieved. About 1000 pounds of extra pull was required to shift the sleeve.

HEAVE COMPENSATOR

Another thwarted objective of the cruise was the long awaited full operational test of the heave compensator system. In addition, a newly installed active mode control system and driller's console indicator panel were to be checked out by an on-board Brown Brothers representative. Due to the many operational delays the compensator was not picked up until less than two days operating time remained. The vessel heave during the period of the test was one foot or less. This was completely inadequate to test the active mode of operation. The passive mode appeared to be acceptably operational, although the test was less than adequate due to lack of heave. Minor electrical problems were identified in a power cable and in the anti-slingshot valve indicator circuitry of the driller's console panel.

SPECIAL TOOLS - PRESSURE CORE BARREL

One run of the pressure core barrel was made and core was obtained only from below the ball valve. Damage to the ball, the seat, and the ball operating linkage indicated that pressure within the barrel had not equalized during descent and that a pressure differential across the ball valve had existed at the time the barrel landed and opened the valve. Some pressure was found to be in the chamber upon retrieval of the barrel. The bleed-off was plugged or otherwise inoperative and the pressure had to be relieved as the valve was unscrewed. No spares were on board for certain deformed parts of the ball valve assembly operating linkage, so no additional attempts were conducted.

FISHING TOOLS

On two occasions, proper wireline fishing tools saved at least a partial pipe trip. After the first sandline failure, a cable spear which had been fabricated and used on Leg 44 was employed to retrieve the broken line. The line was recovered on the first attempt and was thoroughly engaged by the barbs of the tool.

The re-entry sonar tool was retrieved after the first attempt, with the lower spacer subs missing. A commercially made tubing spear we used to recover the subs which were still screwed together.

SHIP'S ENGINEERING

Engine room work requirements continued throughout the cruise. In addition to the normal operation and maintenance of ship's machinery, equipment installed or repaired in the shipyard had to be closely monitored. Considerable effort was required by engineering personnel and the electronics technicians in the continual testing and calibrating of thrusters and main shafts for dynamic positioning.

On 17 November, the bearing of No. 5 D. C. generator failed. Before the engine could be shut down, the heat had caused metal from the bearing to be fused to the shaft race. Six days were required to hand hone the shaft to the point where a new bearing could be installed.

DECK DEPARTMENT AND UNDERWAY

Steaming time from Norfolk to the operating site was 2.8 days and from the site to San Juan was 3.4 days. The cruising periods were uneventful with an average speed of 8.9 knots logged.

The deck forces were involved with cleaning and preservation of exterior surfaces and equipment. A superb job of long-splicing a sandline was done by AB Seamen Skaare and Garcia. The open sea transfer of Mr. Malow (congressional representative) from the USS Glover to the GLOMAR CHALLENGER was also accomplished without incident.

WEATHER AND CURRENTS

Weather conditions throughout the voyage were quite good. A slow moving frontal system produced wind and sea conditions which would not have halted normal drilling and coring operations. These conditions would have been marginal, however, for handling and keel-hauling the old style re-entry cone. It was generally agreed that handling of the new heavier and larger cone assembly should not be attempted until weather presented less of a hazard to personnel and hardware.

Surface currents were essentially non-existent as indicated by the minimal amount of thrust required to hold the ship on station. Some subsurface current was indicated, however, by horizontal displacement of the drill pipe against the guide in the moon pool. This was evident on the first trip as the cone and conductor casing were being lowered.

NAVIGATION

A minor problem developed in the satellite navigation system shortly before sailing from Norfolk, but the system was reactivated during the first day at sea. On site Sat Nav fixes fell within patterns about 1000 yards in diameter. Celestial navigation remained the back up for the satellite system. The LORAN C unit presently installed is obsolescent and not considered worth the cost of restoring to dependable operating condition. The pitometer log remains inoperative.

PERSONNEL

Although the cruise itself was relatively short, the crew had been subjected to a very heavy workload throughout the shipyard period. This, together with the operational adversities experienced, produced the effects of stress and fatigue normally noted near the end of long voyages. No serious injuries or illness occurred during the cruise.

Due to extensive turnover in the drilling and engineering departments, training in systems and methods peculiar to the CHALLENGER was required for several men. To the credit of supervisory personnel, this was accomplished with minimal loss of efficiency.

Despite the fact that relatively little core was recovered, SIO personnel were kept busy making final adjustments to the extensive changes in the scientific spaces and performing maintenance, storage and inventory functions.

In general, a high degree of cooperation and professionalism under difficult circumstances can be credited to all who were involved in the operation.

Glen N. Foss

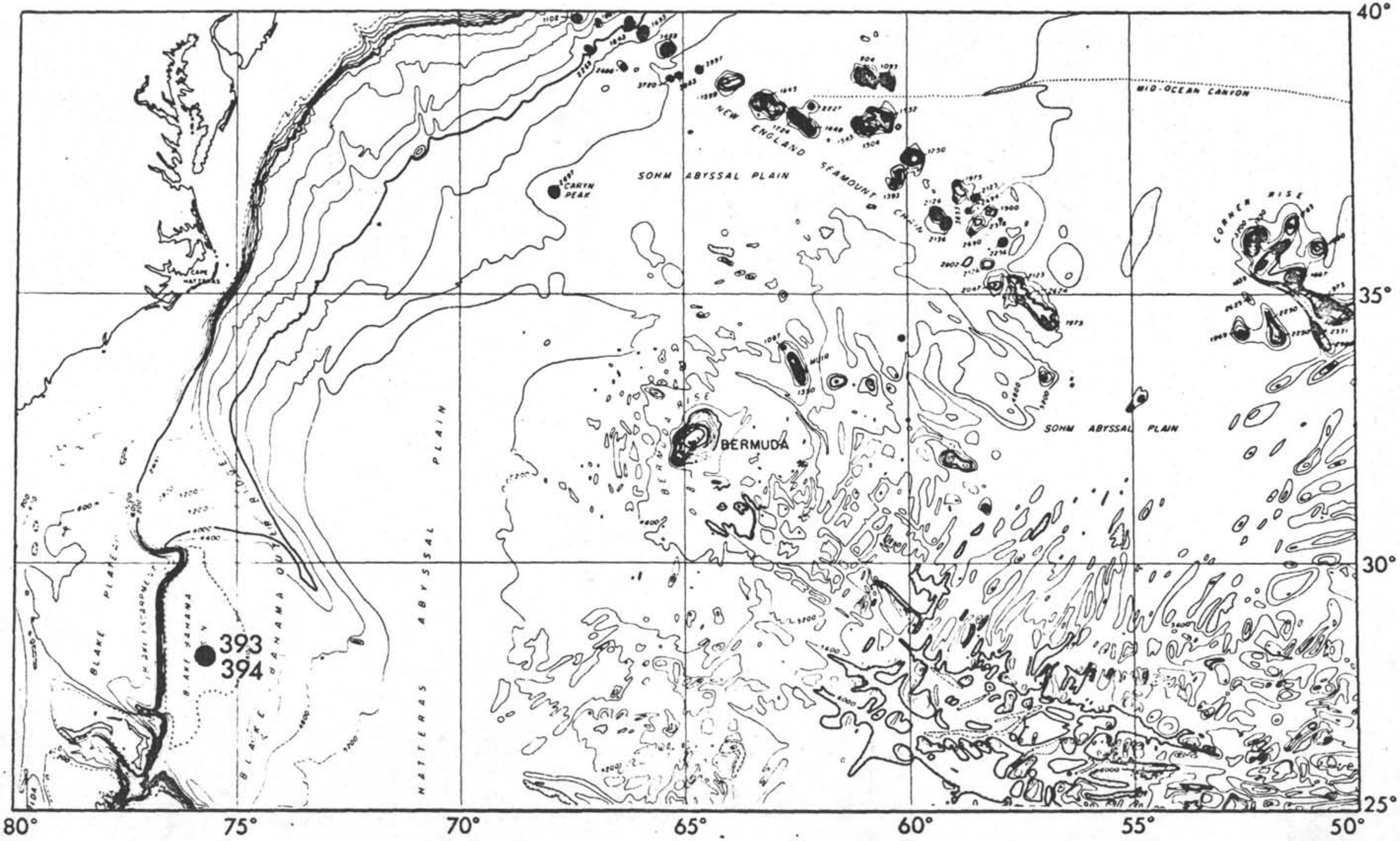
Glen N. Foss
Cruise Operations Manager
Deep Sea Drilling Project

DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 44A

Total Days - Leg 44A		23.1
Total Days In Port		2.3
Total Days Cruising*		8.0
Total Days On Site		12.8
Trip Time	3.8	
Drilling Time	0.6	
Coring Time	0.7	
Re-entry	2.5	
Mechanical Downtime	1.1	
Position Ship & Positioning System	1.0	
Wait On Weather	1.8	
Other	1.3	
Total Distance Traveled (Nautical Miles)**		1463
Average Speed (Knots)		8.9
Sites Investigated		2
Holes Drilled		5
Number Of Cores Attempted		8
Number Of Cores With Recovery		8
Total Meters Cored		74.5
Total Meters Recovered		31.1
Percent Recovery		41.7
Total Meters Drilled		545.0
Total Meters Of Penetration		619.5
Percent Of Penetration Cored		12.0
Maximum Penetration - Meters		364.5
Minimum Penetration		55.5
Maximum Water Depth - Meters		4961.5
Minimum Water Depth		4961.5

* Includes 1.7 Days Sea Trials

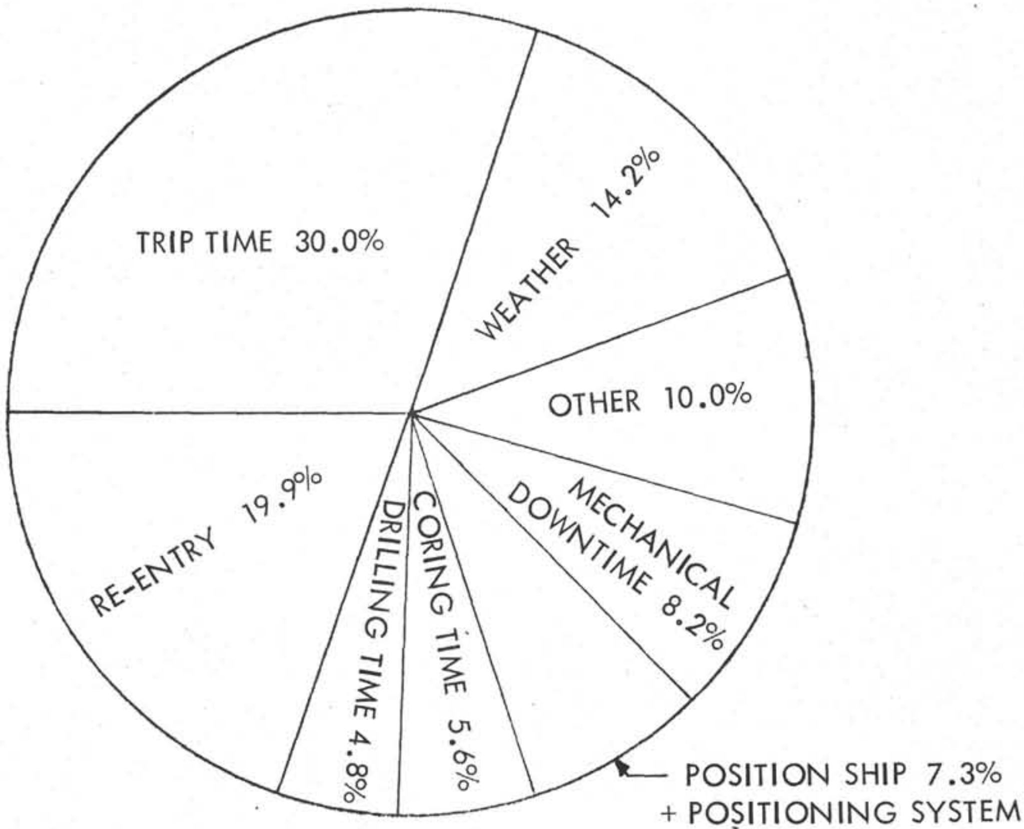
** Includes Inside Steaming and Return From Sea Trial Area to Norfolk



LEG 44A

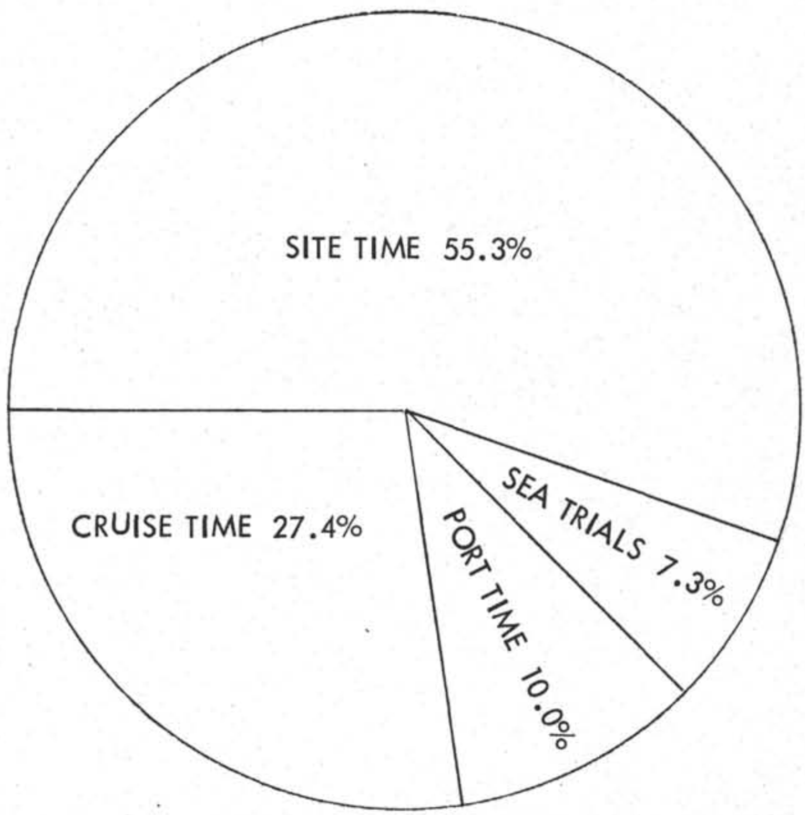
DRILL SITES

DEEP SEA DRILLING PROJECT
ON-SITE TIME DISTRIBUTION
LEG 44A



TOTAL TIME ON SITE: 12.8
TOTAL SITES: 2
TOTAL HOLES: 5

DEEP SEA DRILLING PROJECT
TOTAL TIME DISTRIBUTION
LEG 44A



START LEG: November 4, 1975
FINISH LEG: November 27, 1975
TOTAL TIME: 23.1 Days

DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG - 44A

Site No.	Make	Freq. kHz	Serial Number	Site Time Hours	Remarks
Test	ORE	13.5	363	19.2	Single Life - Strong For Duration
393	ORE	16.0	334	239.0	Double Life - Failed Abruptly
394	ORE	16.0	347		Single Life - Signal Initially Distorted & Unusable
394	ORE	13.5	371	66.5	Double Life

DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 44A

Hole	Mfg	Size	Type	Serial Number	Meters Cored	Meters Drilled	Meters Total Penet.	Hours On Bit	Conditior	Remarks
393	Smith	14-7/8"	F94C	697AN	8.0	47.5	55.5	1.5	T1, B1, SE	
393A	Smith	14-7/8"	F94C	697AN	9.5	50.0	59.5	1.0	T1, B1, SE	
393B	Smith	14-7/8"	F94C	697AN	- -	56.0	56.0	1.0	T1, B1, SE	
394	Smith	14-7/8"	F94C	697AN	- -	84.0	84.0	1.5	T1, B1, SE	
								5.0		Total Jetting Only
394A	Smith	10"	F94CK	RC902	57.0	307.5	364.5	3.1	T1, B1, S?	Three Previous Runs For 11.1 Hours
								14.2		Total

DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 44A

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
393	28° 11.78'N	75° 35.98'W	4961.5	1	1	100	8.0	4.3	53.8	47.5	55.5	37.0	91.8	
393A	28° 11.80'N	75° 35.94'N	4961.5	1	1	100	9.5	9.5	100.0	50.0	59.5	83.5		
393B	28° 11.80'N	75° 35.94'W	4961.5							56.0	56.0	56.0	64.0	239.3
394	28° 11.70'N	75° 35.76'W	4961.5							84.0	84.0	56.0	16.3	
394A	28° 11.70'N	75° 35.76'W	4961.5	6	6	100	57.0	17.3	30.4	307.5	364.5	117.6	51.2	67.5
Totals				8	8	100	74.5	31.1	41.7	545.0	619.5	76.5		306.8