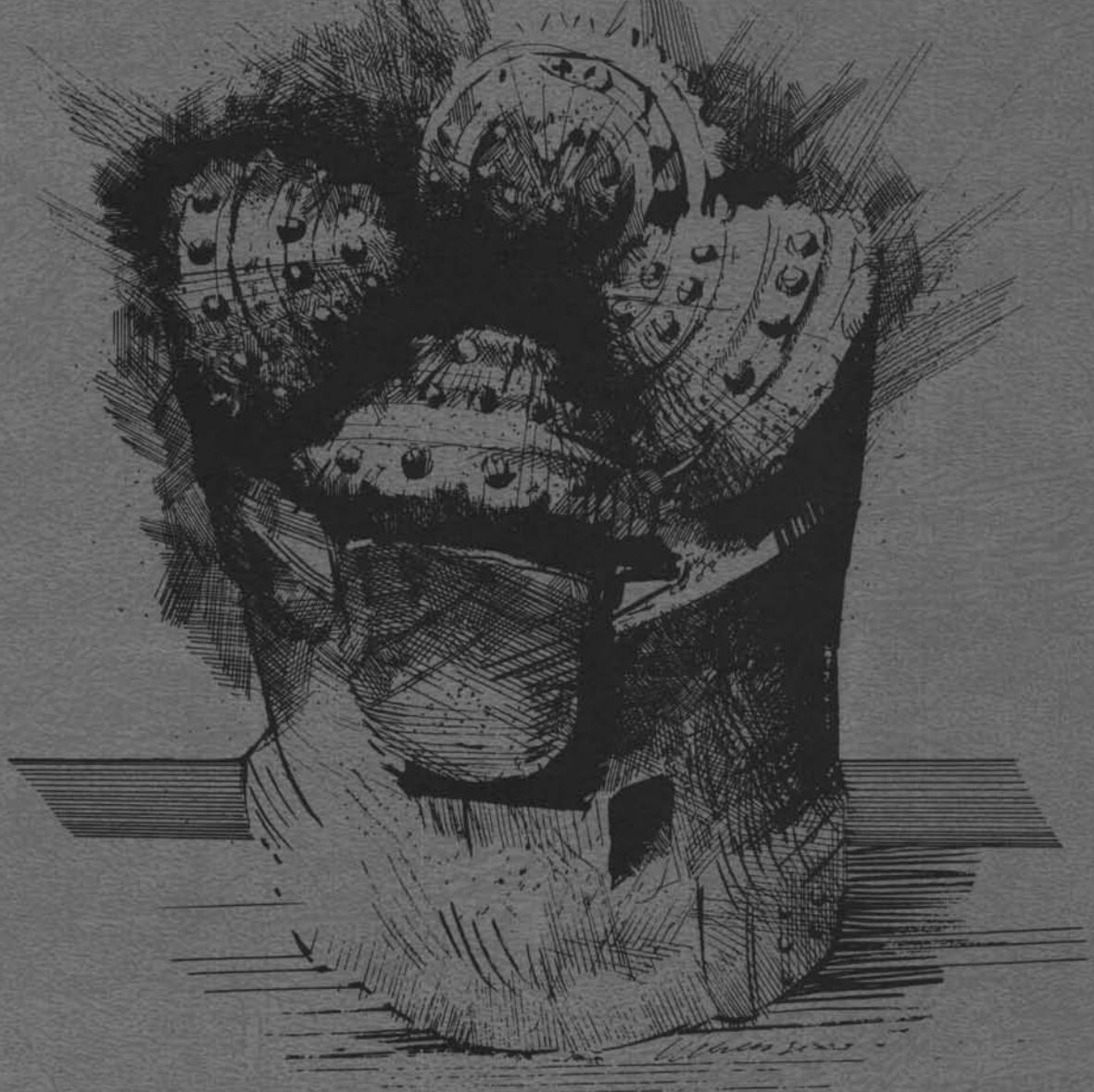
DEEP SEA DRILLING PROJECT
TECHNICAL REPORT No. 6

CORE BITS

CONTRACT NSF C-482



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University of California, San Diego

CORE BITS

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By

Deep Sea Drilling Project
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INTRODUCTION

It was early in the operational history of the Deep Sea Drilling Project that it became evident that core drilling bits for the coring and recovery of deep ocean sediments would have to be redesigned.

The hitting of unexpected very hard layers of chert or flint while drilling with tungsten carbide drag bits, milled cutter bits and diamond bits resulted in the almost complete destruction of the three aforementioned bit varieties. (Figures 1 and 2).

After careful study, it was agreed that a tungsten carbide insert roller bit might provide the solution to penetrating hard chert or flint and retain satisfactory core recovery in most sediments.

Tungsten carbide insert roller cone bits of three-and-four-cone cutter construction are now used exclusively in the DSDP coring program.

The evolution of core drilling bits from Leg 1 through Leg 32 of the Deep Sea Drilling Project is discussed in this report.

Scripps Institution of Oceanography of the University of California at San Diego is managing institution for the Deep Sea Drilling Project under contract to the National Science Foundation. The Project is a part of the Foundation's National Ocean Sediment Coring Program.

ACKNOWLEDGEMENTS

Overall supervision of redesigning Deep Sea Drilling Project core drilling bits by Operations Manager Valdemar F. Larson, a factor which enabled drillers to successfully cut through beds of chert or flint, is gratefully acknowledged.

Our thanks for the development, manufacture, and now exclusive use aboard D/V Glomar Challenger of the tungsten carbide insert roller cone bits of three-and-four-cone-cutter construction also go to cruise operations managers listed on Pages 45-46 Global Marine Inc. drilling supervisors, Smith Tool Company and the Marine Science Development Shop of Scripps Institution of Oceanography.

Invaluable technical assistance given by W. A. Roberts, Chairman of the Committee for the Evaluation of Core Bit Proposals, and all members of this Committee listed on Page 22 is acknowledged. Also providing technical assistance were the many oilfield bit manufacturers.

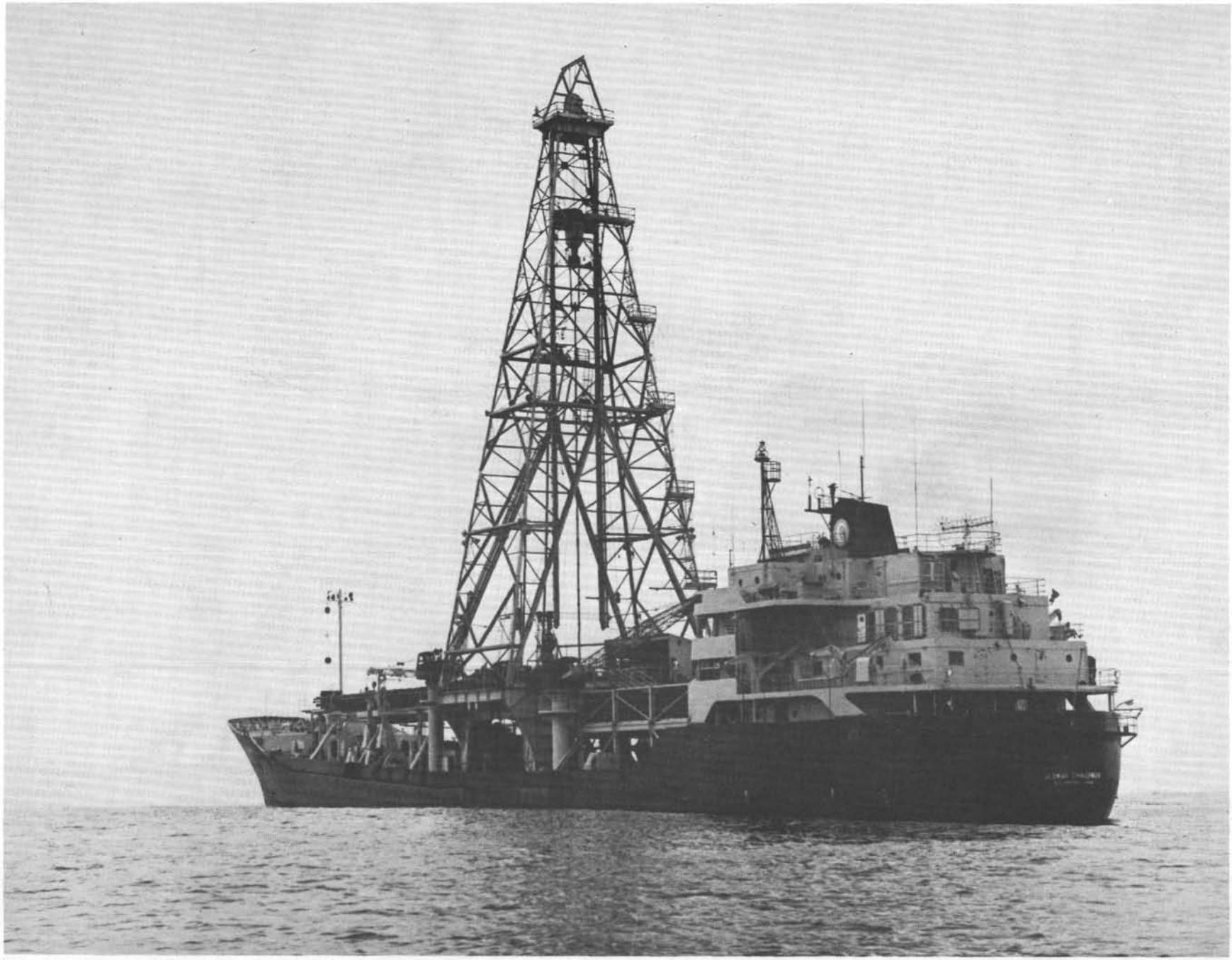
Chief Scientist Dr. N. Terence Edgar, John Eberhardt, of Standard Oil Company of California, and former Project Engineer Darrell L. Sims collaborated on an extremely helpful engineering study, "Methods to Penetrate Hard Formations in Deep Ocean Basins." See DSDP Technical Report No. 2.

The continuing help of Mr. A. R. McLerran, National Science Foundation Field Project Officer with DSDP, and the support of the Foundation is warmly acknowledged.

The support and guidance of the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES) in fostering the entire Project and its responses to scientific and technical imperatives is fully appreciated.

M.N.A. Peterson
Principal Investigator and
Project Manager
Deep Sea Drilling Project

April 1974



CONTENTS

DEVELOPMENT OF CORE BITS FOR THE DEEP SEA DRILLING PROJECT

During the initial planning phases of the Deep Sea Drilling Project, it was generally thought that the sediments to be encountered in the deep ocean would be as extremely soft as those found during the preliminary drilling phase of Project Mohole (Phase I). Core bits faced with inserts of tungsten carbide or similar hard metal were considered to be adequate for general use. Diamond core bits were planned for, if and when needed: for example, in hard formations.(1) These had been the conclusions reached during the preliminary drilling Phase of Project Mohole regarding a single bit penetration, i.e., that diamonds would be capable of drilling soft, semi-hard and hard-to-drill rocks.(2) Coring bits and suitable wireline coring equipment were obtained from both Christensen Diamond Products Company and the Hycalog Company.(3 and 4) Both companies had been actively involved in floating vessel wireline coring operations. Christensen equipment had been used on the drilling ship "Cuss I" during the Phase I drilling of Project Mohole, while Drilling and Service Company (acquired by Hycalog in September of 1967) participated in coring work from the small coring vessels "Eureka" and "Caldrill" for various oil companies in the Gulf of Mexico and for Columbia University on the Blake Plateau East of the Bahamas in the Atlantic Ocean.

Based on discussions with these and other companies and individuals, the Project went to sea initially in August, 1968, with a variety of core bits, mostly of the drag or diamond design. A long-tooth milled cutter roller core bit was also included. (Figures 3 - 5). A 9-1/4" x 2-1/2" diameter core bit was selected for the 8-1/4" drill collars. During Leg 1, diamond and diamond drag core bits were used primarily except at Site No. 4 where a milled cutter cross section core bit was used. Starting at Site No. 4, it became apparent that, where chert was found, the scientific objectives of that site probably would not be met. A massive section of chert was encountered at Site No. 7, where drilling rates as low as six inches per hour were recorded. The chert was very hard and abrasive, but seemed to fracture easily. Leg No.1 Cruise Operations Manager Jim Dean concluded from this experience, "If it were possible to re-enter a hole and change bits, these sections could probably be penetrated more quickly and more easily with a 'button' roller bit."(5)

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(1) University of California Request For Proposal For Drill Ship And Answers Given At Proposer's Conference, June 9, 1967 to those responding to the RFP. (Not published).

(2) Experimental Drilling In Deep Water At La Jolla And Guadalupe Sites, Publication No. 914, National Academy of Sciences, National Research Council, Washington, D.C., 1961.

(3) Marine Rigid Barrel Wireline Coring System Series E-8710, Operating Manual, Christensen Diamond Products, Co., May 28, 1968.

(4) P. R. Crocker and R. L. Brakefield, 18-1/4" Outside Diameter Wireline Core Barrel Manual, Hycalog, Inc.

(5) Technical Report No. 1, Operations Resumes, Leg 1-18, Deep Sea Drilling Project, October 1971

Figure 1

Chert layers in the deep ocean sediments led to the early destruction of milled cutter core bits initially used in the Deep Sea Drilling Project. /2

Figure 2

Diamond core bits also faired poorly in the deep ocean chert layers. /3

Again, on Leg 2, chert formations were encountered. Several new core bits were tried that showed promise of increased durability and rates of penetration. These were the "Sinter-Set" crushed tungsten carbide bits and the "controlled bite" tungsten carbide drag bit. Following Leg 2, Cruise Operations Manager Dan R. Bullard said, "The massive set diamond bit remains the only solution to penetration in thick chert sections. Even with these bits, results have been marginal and costly." Massive set diamond core bits costing upwards to $8,000 has not been budgeted for, and considering their marginal success, only a limited number were made available.

By the end of Leg 3, many of the techniques for recovering the soft oozes of the deep ocean had been worked out and an overall core recovery of 95% was achieved. Cruise Operations Manager Dean evaluated the three basic core bit designs at the end of Leg 3 as follows:

"(1) Tungsten Carbide Drag Bit - Does not penetrate and core satisfactorily in the hard formations.

"(2) Milled Cutter Bits - Susceptible to losing cones and could not take the punishment of the pounding from a floating vessel.

"(3) Diamond Bits - Have performed best in all types of formations. Two types of diamond bits have been used: the massive set (650 carats) and the blade, or drag, type. There had not been enough difference in performance of these two to economically justify the continued use of the massive set diamond bit."

During Leg 3, a larger diameter 9-7/8" x 2-1/2" core bit was run. Even though there was no noticeable difference in the performance of this bit from the 9-1/4" x 2-1/2" previously run, the 9-7/8" size was standardized by subjective evaluations in the field. Face discharge diamond bits were generally accepted as better. They did not wash the core away. Conventional water courses were retained at the center to keep the diamonds cool when very hard formations (chert or basalt) were encountered.

During Leg 4 in the Atlantic Ocean, two attempts were made to penetrate Horizon "A" chert without success. Drilling has shown that Horizon "A", a somewhat continuous seismic reflector mapped in various parts of the Atlantic Ocean by oceanographers was in most cases composed of chert layers of Eocene age. On both attempts, massive set diamond bits were completely demolished. (Figure 6). Leg 4 Cruise Operations Manager Bullard reported that, "viewed in light of other attempts to penetrate this chert section, it must be concluded that a diamond bit is incapable of penetrating this formation unless the section is thin or is not completely developed into chert.

"Apparently Horizon "A" consists of chert sections possibly one or two feet thick, laminated with other materials. In any event, it is not homogeneous chert section 15 to 31 meters thick as one might be led to believe. This probably accounts for earlier optimist reports indicating penetration of 31 meters of chert, when actually it was more in the order

Figure 3

9-1/4" x 2-1/2" milled cutter core bit furnished by Hycalog Company at the beginning of DSDP

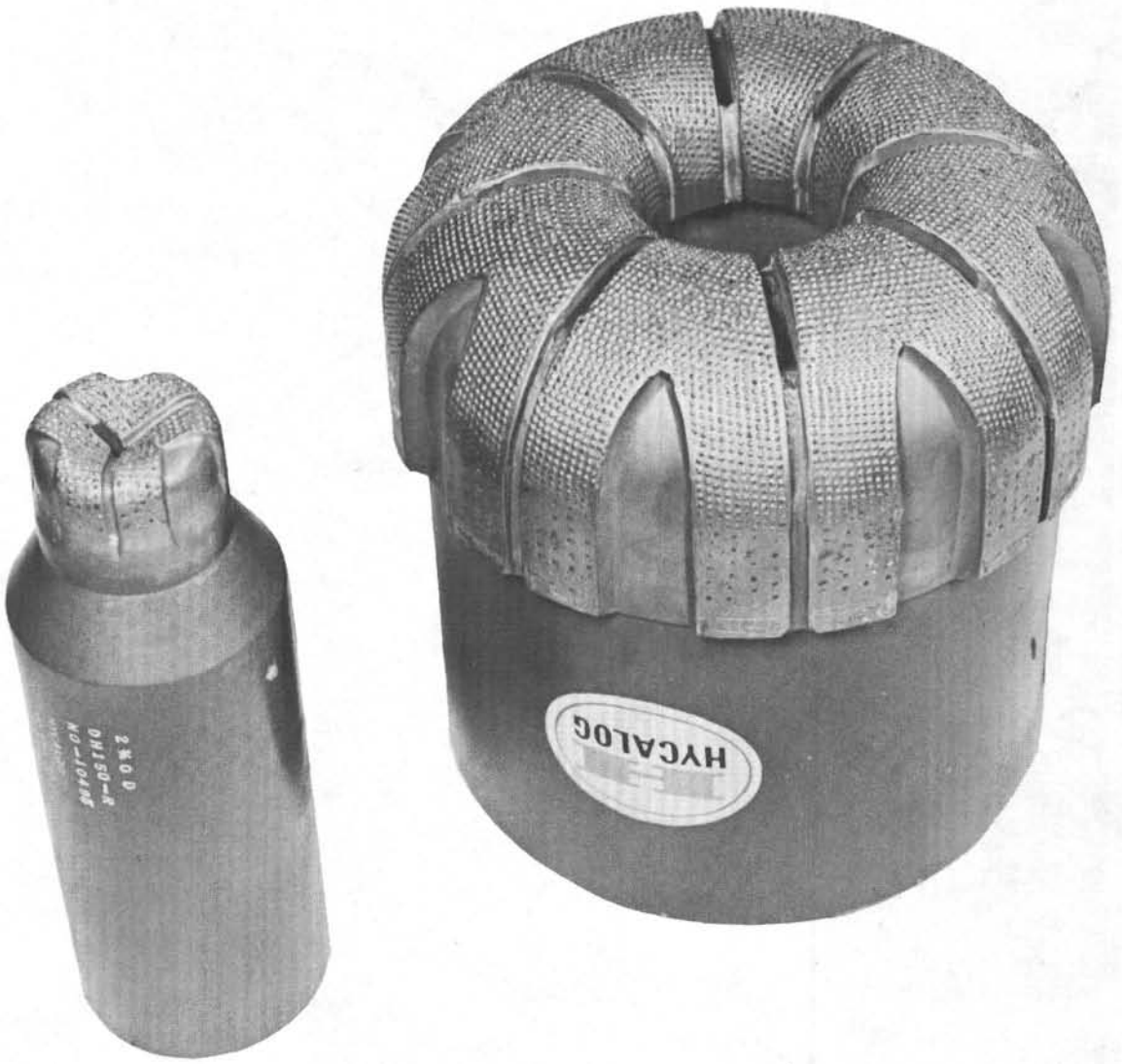

Figure 4

Massive set diamond core bits were used early in DSDP.

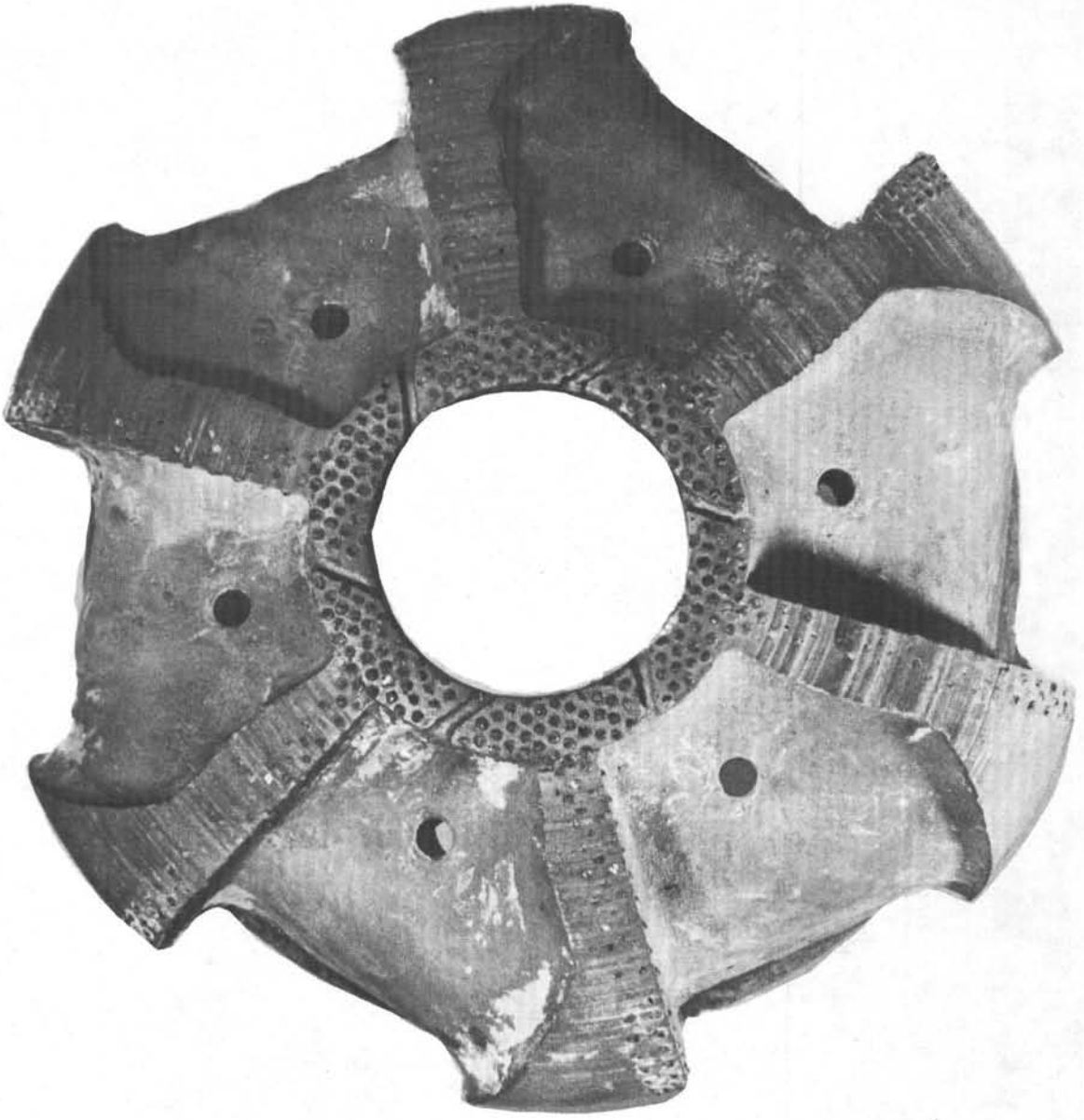

Figure 5

This is a 9-1/4" x 2-1/2" diamond drag core bit which was among the first used by DSDP.

Figure 5A

Pictured is a 9-7/8" x 2-1/2" controlled-bite diamond drag core bit.

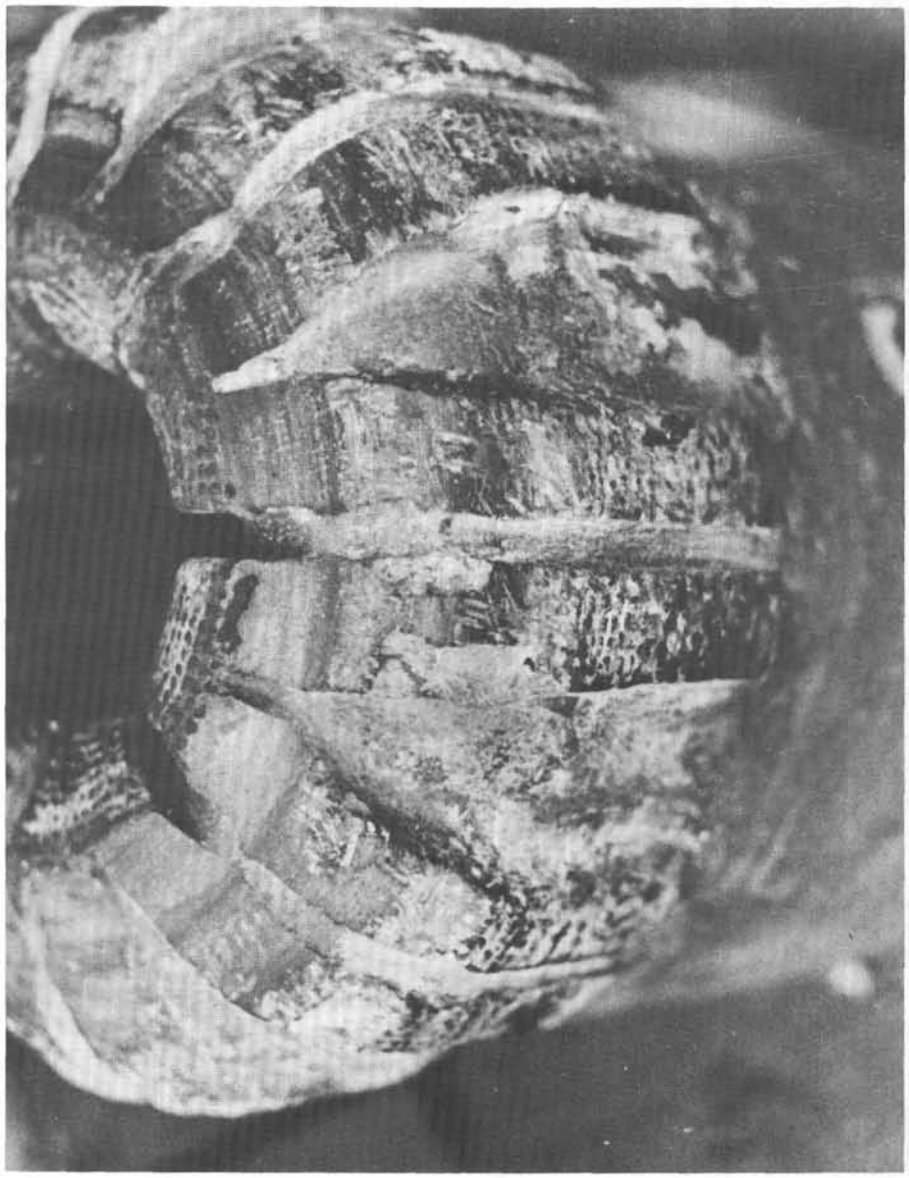

Figure 6

This massive set diamond bit was just about completely demolished by chert layers.

of five to ten feet. However, the statistical chances of success in penetrating this formation with existing equipment are so slight that further attempts should be discouraged."

Bullard went on to suggest that a solution would be to seek aid from industry in constructing a 12-1/4" "insert" roller core bit. This was the type of bit normally used for drilling chert, and chances of penetrating chert sections would be greatly increased. "This," said Bullard, "points out the need for a re-entry system in expanding the scope of the Deep Sea Drilling Project, since even with a chert bit, more than one run would probably be necessary."

During Leg 4, "Sinter-Set" crushed carbide bits were used satisfactorily on the majority of holes. (Figure 7). Economic considerations dictated that these, or light set diamond bits (Figure 8), continued to be used as the basic drilling tool. During Leg 4, the throat diameter was decreased slightly to 2-15/32" to improve the entrance of the core. Face discharge water courses were used to prevent washing away of the soft oozes.

During Legs 5 and 6, light set diamond and "Sinter-Set" crushed tungsten carbide core bits were used. In addition, a "Sintered" drag core bit with small crushed diamonds was tested without showing any marked advantages. (Figure 9).

During equipment tests for Project Mohole Phase II, a tungsten carbide insert roller core bit had been tested to determine its suitability for the penetration of basalt. (Figure 10). Hole conditions deteriorated after a single insert core bit was run, and final evaluation was not made. The one run made a total of 55 feet in 28 hours and four minutes with 53 feet of recovery in basalt, and the bit worn out.(6)

Design of the bit was of a six-cutter construction that had been in common use by the Hughes Tool Company for milled cutter core bits. These bits have three frusto-conical-shaped core-forming cutters equally spaced around the core between three conically shaped outside or gauge cutters.(7) (Figure 8).

A conclusion made by Brown & Root (Prime Contractors to the National Science Foundation for Project Mohole) at the time of the test, was that "the conventional carbide core bit performed very well and will be satisfactory to use in deep hole formations not suitable for diamond bit drilling. Such hard and friable formations as chert will destroy diamond bits."

Because of the many problems with cherts that were preventing the accomplishment of the scientific objectives to sample the entire sedimentary column of the deep ocean, the Deep Sea Drilling Project began an investigation that led to a report, "Engineering Study Methods to Penetrate Hard Formations in Deep Ocean Basins." While the major conclusion of the report was to develop a re-entry system for multiple core bit runs, it also recommended that an evaluation be made of the tungsten carbide insert roller core bit as soon as possible.(8)

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(6) Stage A: Report - Equipment Evaluation Test Well At Uvalde, Texas, Mohole Project, Contract No. C260, May 1, 1965.

(7) Rotary Core Drilling, Hughes Tool Company, Houston, Texas, 1949.

(8) J. R. Eberhart, D. L. Sims, Dr. N. T. Edgar, Engineering Study - Methods To Penetrate Hard Formations In Deep Ocean Basins, June 30, 1969. (Published in the Deep Sea Drilling Project's Technical Report No. 2.

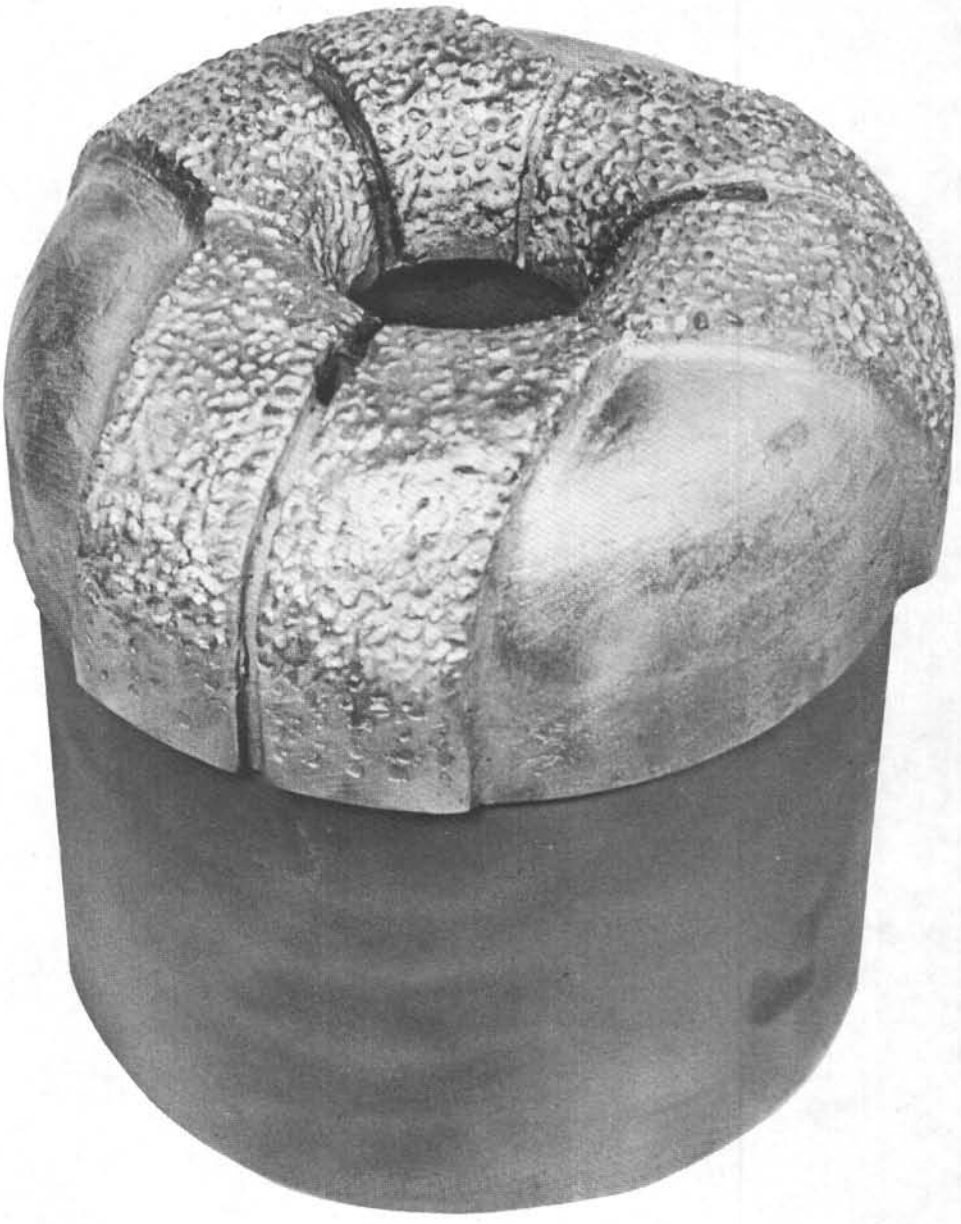

Figure 7

"Sinter-Set" crushed carbide core bits were effective in the soft oozes of the deep oceans.

Figure 8

"Light Set" diamond core bits with face discharge circulation and an upset face in the core-forming area were used during the initial 18 months of the Deep Sea Drilling Project.

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Figure 9

A "Sinter-Set" drag core bit with crushed diamonds did not show any marked advantage.

Figure 10

This is a tungsten carbide insert roller core bit used during Phase II of the Mohole Project and at Sites 61 and 63 of the Deep Sea Drilling Project. /14

Two of the Project Mohole Phase II insert roller core bits were made available to the Deep Sea Drilling Project by the National Science Foundation and placed aboard D/V Glomar Challenger for Leg 6. Unfortunately, this voyage was in an area of the eastern Pacific Ocean that had insufficient soft sediment cover to support the drill collars required for the 35,000 to 40,000 pounds of weight thought to be required to penetrate hard formations with insert bits. One bit and the required crossover sub were lost in handling. A new crossover was then made available for Leg 7 and a trial was finally made at Sites No. 61 and No. 63. The new insert bit performed well. Torque was reduced, penetration rate in firm sediments was increased and 33 feet of basalt were cored with the recovery of 23 feet. The bearings were quite loose at the end of 11 hours. Although little chert was encountered, the insert roller core bit showed promise of extending the Deep Sea Drilling Project's capability of sampling the older, deeper sediments.

An attempt was made to purchase additional insert roller core bits from the Hughes Tool Company. However, as the company had generally discontinued the manufacture of core bits many years previously, it was reluctant to furnish special core bits in small lots. A four-month delivery time was forecast even in larger lots.

Because of funding limitations, alternate means to capitalize on these bits were sought.

Insert rock bits are designed to cut a small diameter core. (Figure 11). The usual tri-cone roller rock bit has a "spear point" on the No. 1 cone that extends to the center of the bit to remove the rock in the very center of the hole. When insert bits were first introduced, this "spear point" was provided. However, in very hard rocks, they had a tendency to be cut off during drilling. Bit manufacturers found that, if insert bits were built with the "spear point", penetration remained satisfactory even though a small core was cut. The core apparently broke off and gave no problem.

It was based on this latter design that the Deep Sea Drilling Project went to a bit manufacturer in nearby Los Angeles to see whether a satisfactory core bit could be manufactured from standard rock bit components welded onto the standard Hycalog core bit body. (DSDP, by late 1969, had standardized on a modified Hycalog barrel).

The Smith Tool Company agreed to build a prototype unit and have it ready for delivery in six weeks at Tahiti, for the beginning of Leg 9. This concept was greeted with a great deal of skepticism. Many thought recovery in the soft sediments would be greatly reduced. Despite this, a design was worked up. It was found that four, standard, Smith 7-5/8" type 9C cutters could be fitted around the shank of a core bit. The resultant size was 10-1/8" with a 2-15/32" core diameter. Four cones, it was hoped, would provide for better stablization of the core once cut. This bit was completed on schedule and evaluated during Leg 9. (Figure 12).

During Leg 8, coring was accomplished with various diamond and "Sinter-Set" crushed carbide core bits. Penetration rates were low in the limestone and chert encountered. Some success was reported using a circle set diamond bit with 525 carats. (Figure 13).

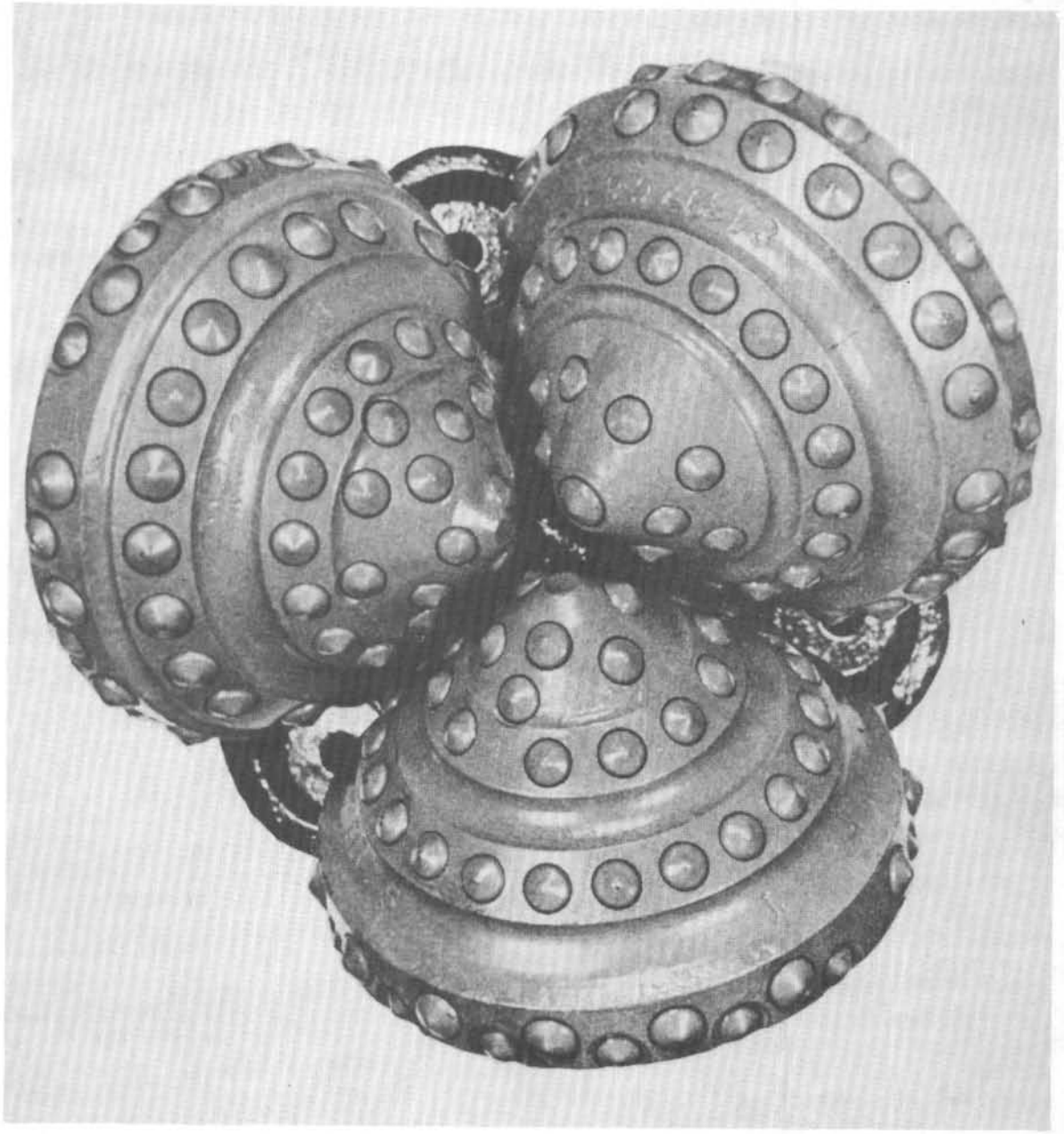

Figure 11

Here's an insert rock bit used for "chert" drilling. Note that the bit cuts a small core in the center.

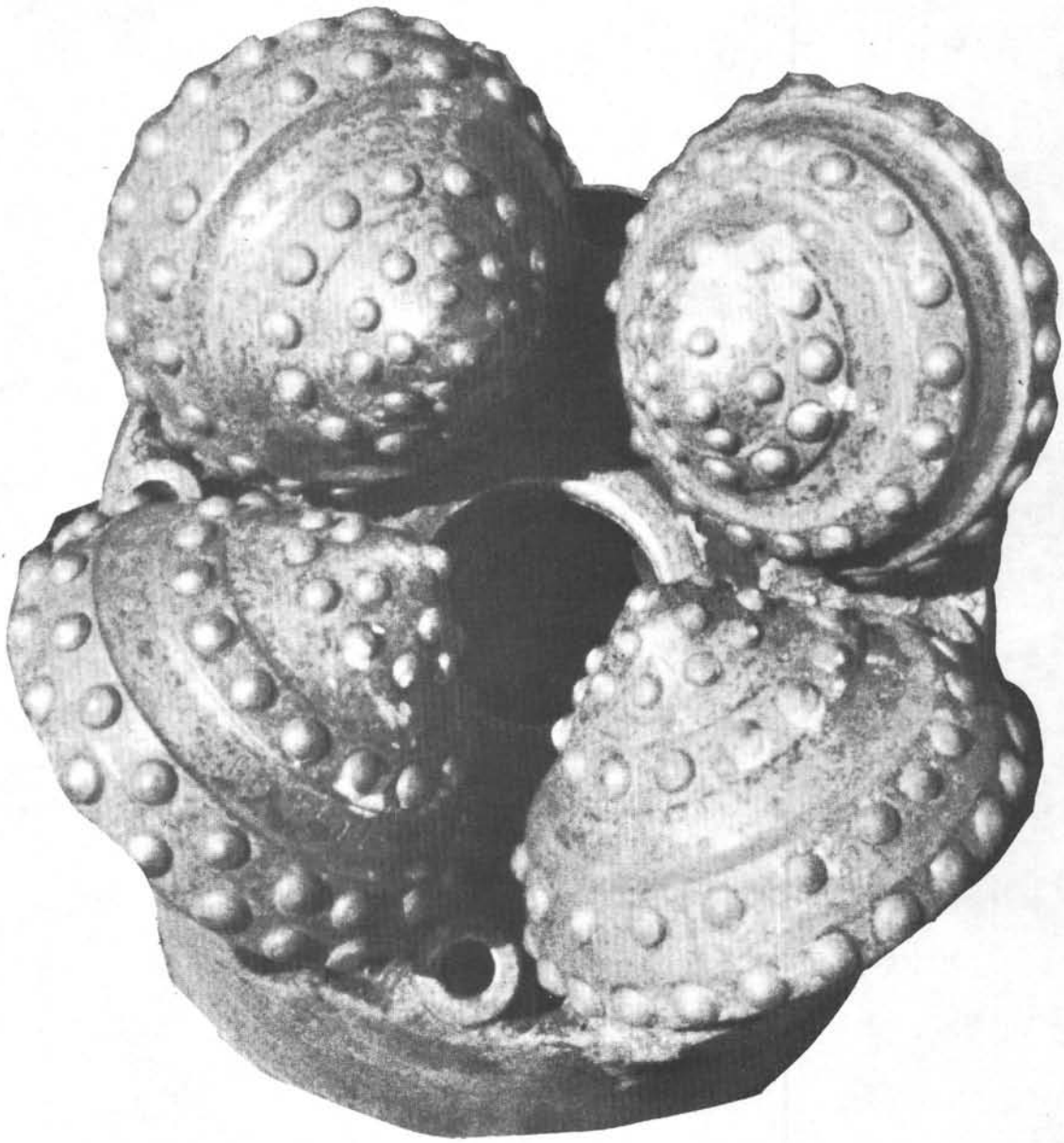

Figure 12

Pictured is the first insert core bit using standard rock bit cones. Note the lack of a core-forming guide of any consequence.

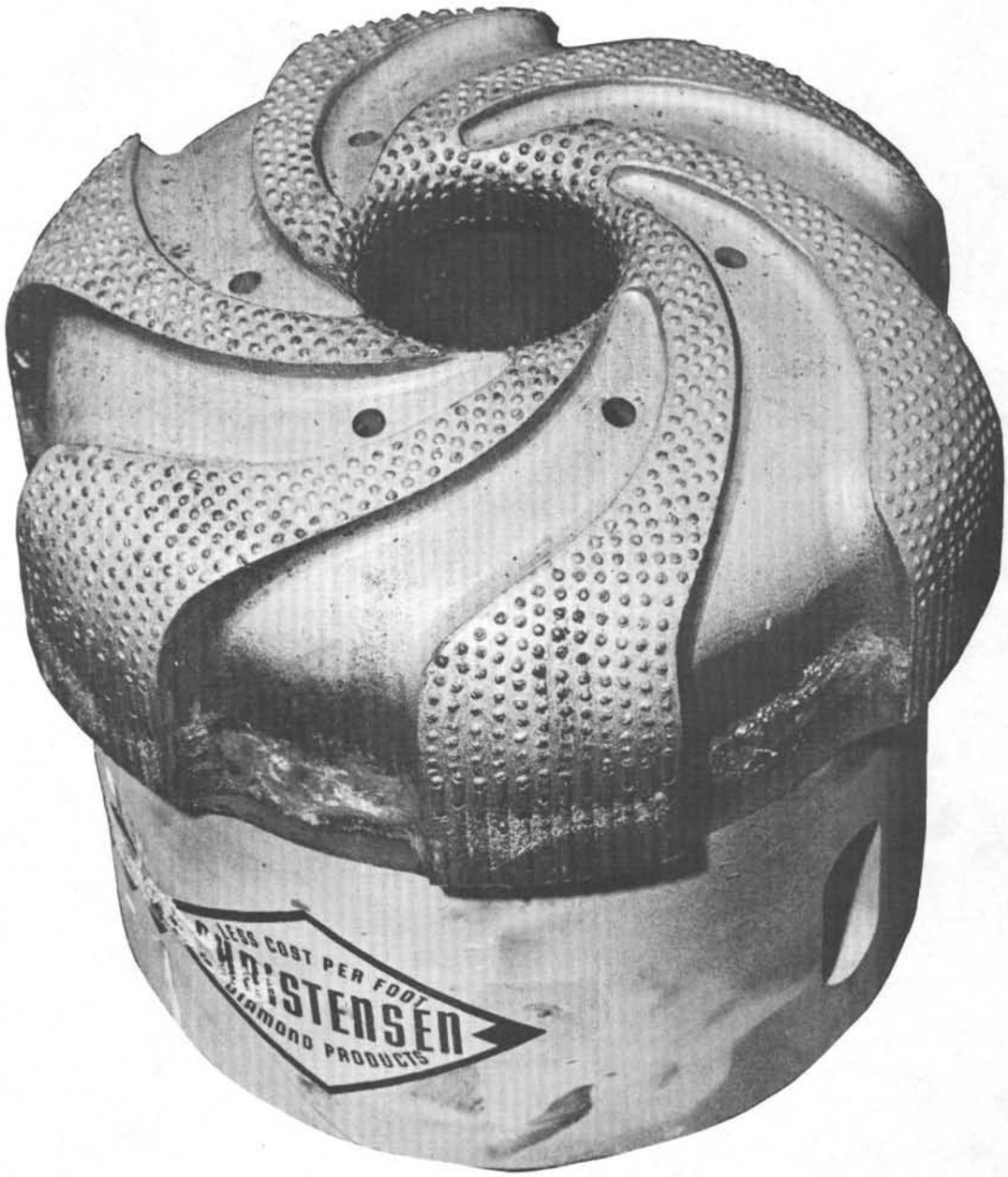

Figure 13

Penetration of chert on Leg 8 of DSDP with this circle set diamond bit gave engineers a little encouragement for the continued use of diamonds. /18

On Leg 9, the newly designed insert bit was run on Site No. 77 and Site No. 78. Of the 828 meters cored, 757 meters (2,482 feet) of sediments were recovered. The bits ability to recover the soft oozes of the deep ocean had been proven. Ironically, the sediments on these sites in the eastern Pacific Ocean were young and without cherts. Basement was reached on both sites, however little penetration of basalt was achieved, as the bit appeared to be severely "balled-up" by stiff clays. Design modifications were made to cover this "balling" by extending the core forming guide closer to the cones and extending the bit nozzles closer to the cones. From the appearance of the core, it appeared the bit had apparently tried to "walk". Stabilizer pads were therefore added to the body. On the remainder of Leg 9 sites, light set (250 carat) and massive set (500 carat) diamond core bits were run and performed satisfactorily. The light set diamond bit had a crown at the center to aid in core forming. (Figure 8).

On Leg 10, a second four-cone roller insert core bit was run in limestone, dolomite, and chert. The improvements suggested by the experience on Leg 9 had not yet been implemented. The penetration rate achieved was much better than that recorded by the diamond bits in use, but unfortunately core recovery was poor.

During Leg 11, off the east coast of the United States, the roller insert core bit had its first real extensive trial. Successes during this voyage and Leg 12 changed the whole Deep Sea Drilling Project outlook regarding core bits. Scientists were successful in reaching beyond the cherts into the older Mesozoic rocks and into basement. Time would show that most of the sediment objectives in the deep ocean could be reached with a single roller insert core bit.

The development of a core bit using standard rock bit components had allowed the Project to take advantage of modern-day rock-bit technology with its improved metallurgy and bearings. Its geometry also allowed larger bearings to be used. Bit costs were greatly reduced.

During Leg 11, 155 meters (508 feet) of hard formation cores were recovered. Both three and four cutter roller insert core bits were used. (Figures 14 and 15). On Site No. 100, for example, 200 meters were drilled (equivalent to the maximum penetration of Site No. 4, Leg 1, at the same location) before a core was attempted. The first core was chalk containing chert pebbles. The remaining 117 meters, prior to reaching basalt, were firm to hard limestone with scattered chert pebbles and/or thin chert layers. Fourteen meters of basalt were cored and five meters were recovered. Penetration rate in the basalt was two meters an hour. A drill bit life of 37-3/4 hours was achieved.

Slow progress was reported in hard clay. At Site No. 107, operations were terminated at 77 meters because of the slow penetration ratio (3 meters/hour). The need for longer inserts in the cones was pointed out by Leg 11 Cruise Operations Manager Jim Dawson, who rightly prophesied that "this type bit may eventually become the standard for the Deep Sea Drilling Project."

Figure 14

Note the added core guide on this type 9C 4-cone insert roller core bit which is also known as a "button" bit.

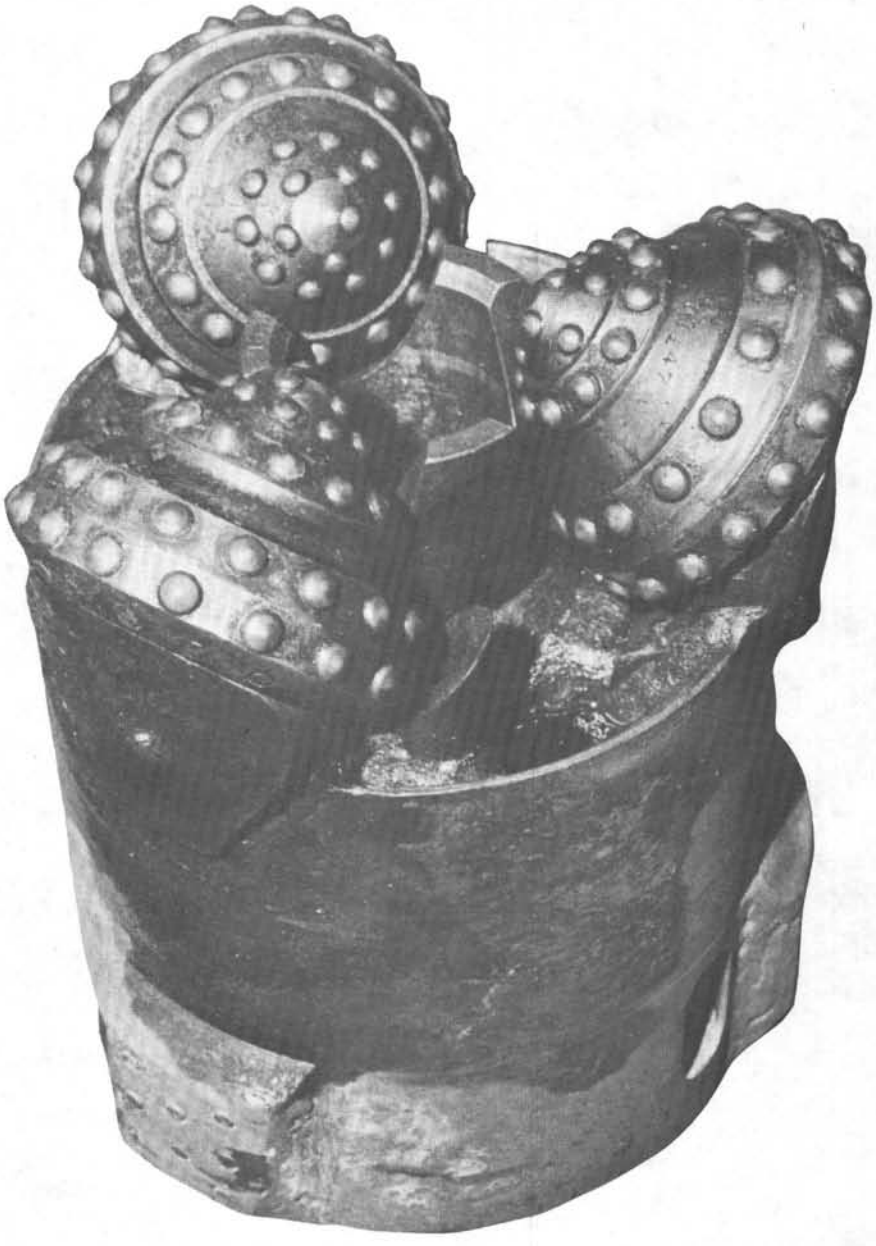

Figure 15

Here's a type 9C 3-cone insert roller core bit.

Initially, core bits were furnished from Christensen Diamond Products Company and Hycalog Company, both of whom had provided the wireline coring equipment in response to a University Request For Quotation.

Once evaluation of the various types of drag and diamond bits had been made, competitive bidding was used. Bits were purchased from Williams Diamond Bits Company, Varel, Christensen and Hycalog.

After the initial 18-month term of DSDP was completed and the Project was funded for an additional 30 months, a formal attempt was made to accelerate improvements of core bits that would meet the demands of deep ocean sediment coring without a large internal Project staff.

A Request For Proposal for the development of core bits was prepared and sent out concurrently with the trial of the new Smith insert roller core bit. Replies were solicited from all manufacturers of drill bits for the oil well drilling industry. A Bidders' Conference was held in January 1970, and a panel from the oil well drilling industry was convened in February, 1970, to evaluate the technical section of the proposals received. Mr. W. A. Roberts, Executive Vice President, Phillips Petroleum Company, was instrumental in setting up this AD HOC Committee, and graciously acted as chairman.

The AD HOC Committee members for evaluation of core bit proposals were:

W. A. Roberts, Chairman	Phillips Petroleum Company
B. J. Livesay	University of Tulsa
Jack Marsee	Loffland Brothers Company
J. W. Cox	TransWorld Drilling Company
W. A. Glass	Big Chief Drilling Company
J. N. Pederson	The Offshore Company
R. E. Throckmorton	Sharp Drilling Company
Lejeune Wilson	Santa Fe Drilling Company
T. B. Houck	Parker Drilling Company
C. H. Young	Helmerich & Payne International Drilling Company

A picture of the AD HOC Committee members is Figure 16.

Responsive Proposals had been received from American Coldset, Hycalog, Smith, Varel and Christensen prior to the February, 1970 AD HOC Committee meeting. To allow a meaningful evaluation to be made, the committee separated the Proposals into two categories; namely, diamond cutter core bits and roller cutter core bits. The evaluation procedure was also separated into two parts. The committee considered only the Smith and Varel Proposals responsive regarding roller cutter core bits. All five proposers were considered responsive regarding diamond core bits.

Figure 16

DRILLING TECHNIQUES ADVISORY PANEL - The newly named Drilling Techniques Advisory Panel for the highly successful Deep Sea Drilling Project, composed of members from the contractor drilling industry, met recently in La Jolla, California, with DSDP officials to review and evaluate proposers' bids for supplying core bits and to recommend their selection of a supplier. DSDP is managed by Scripps Institution of Oceanography of the University of California at San Diego, under contract to the National Science Foundation. Left to right, first row, Darrell L. Sims, Project Engineer, DSDP; A.R. McLerran, National Science Foundation Special Assistant for Coring Operations with DSDP; Kenneth E. Brunot, Project Manager, DSDP; Panel Chairman W.A. (Bob) Roberts, Senior Vice President, Phillips Petroleum Company, Bartlesville, Oklahoma; V.F. Larson, Operations Manager, and James A. Dawson, Cruise Operations Manager, DSDP. Second row, B.J. Livesay, University of Tulsa; W.R. (Bob) Jack, Contracts and Planning Administrator with DSDP, and Carl H. Young, Helmerich & Payne International Drilling Company, Tulsa, Oklahoma. Third row, John W. Cox, Transworld Drilling Company, Oklahoma City, Oklahoma; Lejeune Wilson, Santa Fe Drilling Company, Santa Fe Springs, California; Jan Pederson, The Offshore Company, Morgan City, Louisiana, and Ted Houck, Parker Drilling Company, Tulsa, Oklahoma. Last row, W.A. Glass, Big Chief Drilling Company, Oklahoma City, Oklahoma; Jack Marsee, Loffland Brothers Company, Tulsa, Oklahoma, and R.E. Throckmorton, Sharp Drilling Company, Midland, Texas. The core bit at the left is a tungsten carbide model, while a roller-type bit is at the right.

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After completing their evaluation, the committee entered into a general discussion during which it was concluded that "in the view of all of those representatives of the drilling industry present on the committee, the roller bit cutter head was considered superior for successfully coring chert stringers encountered by the Deep Sea Drilling Project. This opinion was based on the general failure of diamond bits to successfully drill in either broken chert or massive chert formations."

Chert apparently tends to break up and roll under diamond bits, thus destroying the matrix metal holding the diamonds in place. The need to pursue roller core bits for the Deep Sea Drilling Project had become clearer.

The committee's technical evaluation of Smith's Proposal was the highest, and development of roller core bits has been continued with Smith Tool Company. As the results from Leg 12 were quite encouraging, the envisioned large-scale development program was not carried out. Negotiations with Smith Tool Company resulted in prices comparable with those in the oil well drilling industry.

During Leg 12, shaped inserts were tried for the first time. Previously only rounded inserts had been used. No noticeable difference in penetration rate was observed. Overall performance was excellent with high penetration rates and long bit life reported on both styles of bits.

Torque was noticeably reduced over that of diamond or drag type bits. Torque seldom exceeded 8,000 ft lbs, and no bottomhole assembly failures occurred, even though hard formations were encountered before the bottomhole assembly was buried. In the Bay of Biscay, however, penetration rates in mudstone dropped to six-to-eight feet per hour. The need for longer teeth was evident.

During Leg 13, in the Mediterranean Sea, several cross-section roller core bits were evaluated. As a result of the solicitation of the Request For Proposal for the development of core bits, the Deep Sea Drilling Project was made aware that several of the Reed type PD-2 milled cutter core bits were still available, even though manufacture of these bits had been suspended indefinitely by Reed. (Figure 17). These core bits were superior for penetration in the lithified formations encountered in the Mediterranean Sea, and core recovery was adequate to meet scientific objectives. Later, development of extended insert roller bits made these core bits obsolete. At this time, however, these bits filled a need in some formations that could not be penetrated by the rounded insert or "button" bit.

During Leg 13, a cross-section "button" bit was also evaluated. The bit performed fairly well, but did not hold core gauge too well. The bearings in the bit were not comparable to those manufactured from standard rock bit components, and no further evaluations were made. (Figure 18).

Figure 17

While drilling and coring in the Mediterranean Sea during Leg 13, DSDP used this Reed PD-2 milled cutter cross section core bit with success.

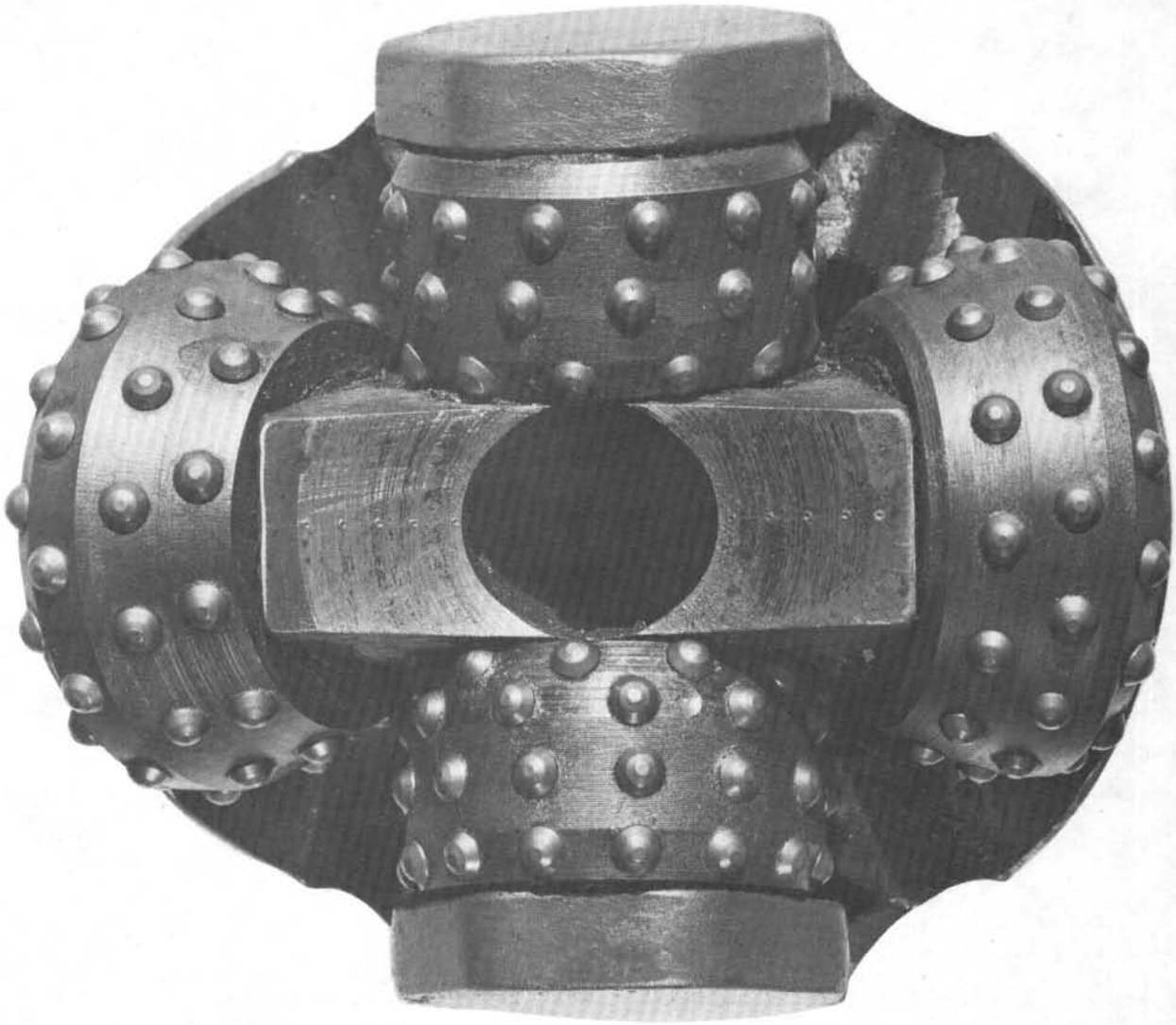

Figure 18

Cross section insert core bit manufactured by Varel for the Deep Sea Drilling Project.

When maximum recovery was desired on Leg 13, light set diamond or "Sinter-Set" tungsten carbide core bits were used.

The "button" core bits were used on all but one site during Leg 14. Cruise Operations Manager Del Redding stated that "although the 'button' bit has a low penetration rate in the limey clays and mudstones, its ability to drill limestone, chert, and basalt, and to remain on bottom for long periods of time, make it almost a necessity."

One of the Reed cross-section milled tooth core bits was run at Site No. 139, where neither chert nor basalt was expected. The penetration rate did not increase as expected, but core recovery dropped far below an acceptable figure. The conclusion was that the Reed core bit was "walking" (i.e., not rotating about the axis of the bit) and drilling up the core before it could get in the barrel. It was suggested that stabilizer pads be provided as had been done on the "button" bits.

On Leg 15, the "button" bits were used on all but two sites in anticipation of chert layers. Extensive, interbedded, chert sections were encountered and successfully penetrated with the "button" bits. In no case was drilling terminated because of the inability to penetrate chert beds. Basement, diabase or basalt, was cored at five sites.

At Site No. 147 and No. 148 that had geochemical objectives, light set diamond core bits were used to improve recovery in very soft formations. The complete crown from one of these bits separated from the bit shank. This was apparently caused by failure of the matrix bond because of a defect in manufacturing.

At Site No. 146, re-entry was used to assure reaching basement in a location where Site No. 29 of Leg 4 had been terminated at 432 meters because of the inability to penetrate successive chert layers. The first core bit, a Smith "button" four cutter type, penetrated 701 meters or to within 61 meters of basement and when pulled, still had an estimated 25 to 30% additional life.

The need for extended insert cutter had been considered since Leg 11. Standard cutters could not be used, as that cones of normal rock bits with extended inserts were not of equal size.(9) After Leg 12, when the chisel or shaped insert (Smith Tool type 5) was shown to be ineffective in clays, Smith Tool Company developed special type four cutters of equal size. The type four insert differs from the type five in that the major chisel shaped insert rows extend 0.245" from the cone shell, as opposed to the 0.178" of insert extension of the type 5 cutting structure. As a special production run was required, these type 4 core bits were not available until Leg 16.

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(9) L.L. Garner and T. E. Maxwell, "The Development of Rotary Core Drilling Bits for the Deep Sea Drilling Project".

On Leg 16, the type 4 extended insert core bit was evaluated. (Figure 19). The results were outstanding. Three bits of this type were run. Each one was not only able to cut chert and basalt successfully, but cut the whole section faster than the regular "button" bits. In addition, the only good recoveries in basalt were made with this type bit. Cruise Operations Manager Redding felt this new bit would have drilled the hard clays and shales that he encountered on Leg 14 in the Atlantic Ocean much faster than the regular "button" bits. He went on to predict that the type 4 core bit would be an outstanding advance because there had been numerous instances that holes had been abandoned before reaching basalt because of the slow penetration rates in the hard clays and shales. He further encouraged the evaluation of even longer shaped inserts.

Sealed bearings were run on Leg 16 for the first time. This one bit was used on four holes and penetrated 677 meters. The bearings were still in fair condition. The sealed bearing had lived up to expectations. The sealed-bearing design selected for trial was the same as that used successfully by Smith Tool Company in the oil fields. The design consisted of a Belleville spring seal, with a compensating system or equalizer to displace pressure build-ups that occur in the system. The standard design and size availability made it possible to have them available early. Up until this time, regular or non-sealed bearings had been used. As sea water was the circulating fluid, there was some concern over the need for the improved lubrication.

During Leg 17, extended insert roller core bits were used extensively. All performed very well, in that each successfully penetrated the hard chert stringers and was still capable of penetrating the basalt. In most instances the bits also penetrated the chert better than the compact inserts. The limiting factor on these bits seemed to be the bearing life, even though total rotating time and bit weight were low.

Average rotating time on Leg 17 was 11 hours 35 minutes, with bit weights of 2,000 to 30,000 pounds. It was suspected that the dull bearing grades ranging from five to eight were caused primarily by the continued pounding on the bottom of the hole from the heave of the vessel. The seals on several of the bearings had failed. Some of these failures appeared to have been caused by chert chips cutting away a portion of the shirttail of the legs and exposing the seal itself to the chips.

On Leg 18, type 4 extended insert bits were continued in use. Both three and four cutter bits were used. Cruise Operations Manager Lamar P. Hayes felt that the 3-cone sealed bearing bits with extended shaped inserts (type 4) gave the best performance. On one site this bit drilled 875 meters of sand with very little pump pressure. The shaped inserts were like new, but the bearings were loose. When a type 4 four-cutter core bit was used, it did not provide the faster penetration of the three-cutter bit.

A Reed PD-2 milled cutter cross section core bit was used with disappointing results. After drilling only 38 meters of sand and gumbo, the cones were sanded up and locked. Core recovery was only 21.2%. No further trials of milled cutter core bits have been made, and all have now been removed from D/V Glomar Challenger as obsolete.

Figure 19

This type 94 extended insert core bit with sealed bearings penetrated 1,185 meters (3,888 feet) of deep ocean sediments on Leg 17 of DSDP. /29

In an effort to reduce core disturbance, a spring-loaded, extended, inner-core barrel coring system was used on Leg 18 at Site No. 173. (Figure 20). This required a special 3-9/16" x 11-1/4" core bit that was fabricated at the Scripps Institution of Oceanography's Marine Science Development Shop from Reed insert cutters. It was very successful in recovering less disturbed cores. The inner core barrel extended four inches below the bit, directly on the formation. In firm or hard formations, the spring-tensioned inner barrel would compress upward until the cutter shoe was flush with the face of the core bit. The core recovered at Site No. 173 was 95% sand with some clay and thin chert streaks. Of 333 meters cored, a recovery of 59.5% was achieved, with 80 to 120 gpm of circulation used continuously. This would not have been possible with the standard coring assembly.

This inner-barrel system was used again on Leg 18 at Site 180. Here a fine silty sand would jam the inner barrel and only a core catcher of sediment would be recovered. These silts were very water sensitive, and the only successful technique for core recovery was to dry-drill approximately one meter and then break circulation. This latter method increased torque and this caused the latch to fail, releasing the core barrel and resulting in zero recovery. The conclusion was that the extended inner barrel was not suitable for gumbo or sticky clay.

On Leg 19, a type 93 insert bit was used and did an excellent job. (Figure 21). The limiting factor still seemed to be the bearing life. On Leg 19, the average rotating time for four 3-cutter type 93 core bits was 25 hours 57 minutes, with an average penetration of 1,793 meters. Cutting structures were in excellent condition and they appeared almost new.

The weak point in the bearing was the thin portion of the shirttail that supported the seal. When worn, it exposed the seal to abrasive conditions. Once the seal failed, so did the bearing. (Figure 22).

At one time the wear was attributed to chert cuttings. However, chert was not encountered on Leg 19. The hardest formations other than the basalt basement were mudstone and limestone. On these bits, the core would be cut under gauge as the bearing gave out. On one occasion, a 1-1/2" core was reported.

In the deep abyssal plains of the Western Pacific on Leg 20, numerous problems were encountered because of chert layers. Type 94 insert bits were run on most sites. Many broken teeth were reported.

Again, on Leg 21 type 94 insert bits were run. Excessive shirttail wear was reported causing premature seal and bearing failure. Cruise Operations Manager T. C. Bangs reported that "the excellent performance of the sealed-bearing, shaped-insert bit makes re-entry appear unnecessary at this time."

On Leg 22, types 93 and 94 were run with good results. A journal bearing bit was run and performance appeared satisfactory.

Figure 20

A special insert core bit built at the SIO Marine Science Development Shop for use with an extended inner barrel coring system is inspected by Global Marine Inc. Drilling Superintendent J. P. Guess.

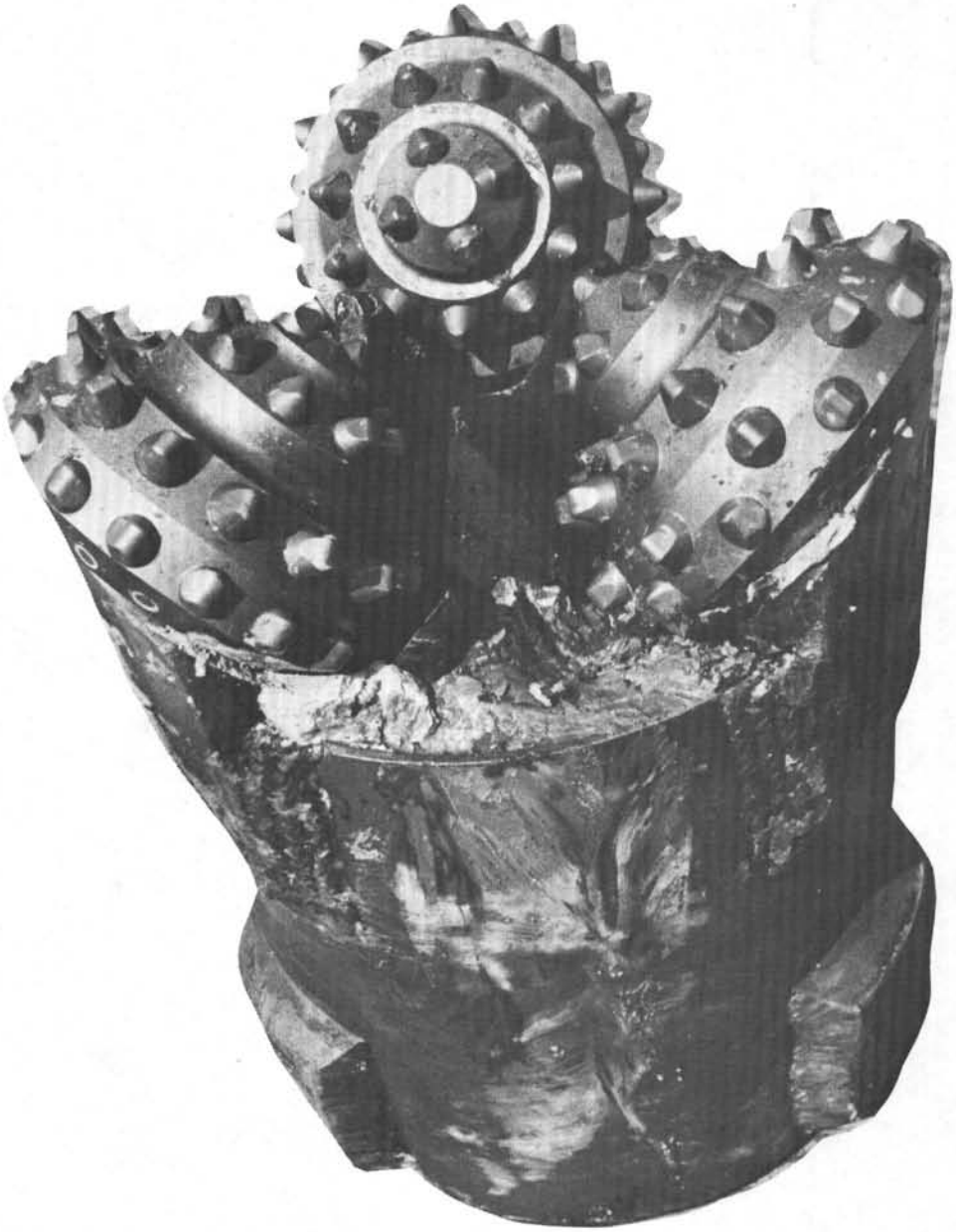


Figure 21

This type 93 extended insert core bit (3-cutter) with longer inserts was found to be especially good for penetrating shale.

/32

Figure 22

Shirttail wear has been a problem. Additional hard facing was applied by Smith and has greatly reduced the problem.

A type 94 four-cutter bit penetrated 1,300 meters on Leg 23. The same type bit cored 80.5 meters of basalt on Leg 24 after penetrating 506 meters of sediments. Hard facing had been added to the shirttails, and this helped prevent premature bearing failure.

On Leg 25, the core forming guides were badly bent inward. (Figure 23). Recently a strong core guide has been developed and is now being evaluated. (Figure 24).

The journal bearing which had proven satisfactory on Legs 21 and 27 was given general useage. The four-cutter type 94 journal bearing core bit is now considered to have the best overall performance and is gradually becoming the accepted standard.

In areas of considerable clay, the longer toothed type 93 performs better and in areas of extensive chert, the type 9C "button" core bit is preferred.

Experience has shown that the three-cutter core recovery rate is as high as with the four-cutter design and will achieve a faster rate of penetration. As might be expected, however, its bearings will not stand up as long.

SUMMARY

General

The development of roller insert core bits capable of penetrating the hard chert layers of the deep ocean sediments has been a rewarding one. These bits have allowed most of the scientific objectives of the Deep Sea Drilling Project's sediment coring program to be achieved without the need for time consuming multiple bit runs. Compromises have been required, however, and some scientific objectives have only partially been met. Continued improvement are needed.

Core Quality

In the soft oozes of the deep ocean, the recovery rate has been quite high regardless of the core bit type. These cores, when compared to cores taken by standard oceanographic piston corers, are of poor quality. Bedding planes, if remaining at all, are badly distorted. Paleontologists report that sections are often repeated. Improvement in core quality will probably require:

(1) A More Favorable Ratio Between Cutter and Core

The extended inner barrel system (Figure 20) offers this potential. The system used on Leg 18 had a 3-1/2" x 2-1/2" core head as compared to the Project's usual 10-1/8" x 2-1/2" core bit. (As the inner barrel actually does the cutting of the core, considerable disturbance is created. A non-rotating inner-inner could be fitted to overcome this)

Figure 23

Core guides often became flared and would actually impinge on the cutter. New, stronger guides are being evaluated.

Figure 24

This photograph shows the new, stronger core-forming guide now being used to overcome flaring. (See Figure 23): It is a Smith 4-cone type 94 with journal bearings.

(2) Constant Variable Weight

The use of bumper subs in the bottomhole assembly to compensate for vessel heave appears to give large weight fluctuations. Often it appears that the bit is lifted off bottom. In these situations, the inner barrel acts much like a pump. (The inner barrel is fitted with an upper check valve; the core catcher acts as the lower check valve). At best, the bumper subs provide only two coring weights.

A hydraulic Heave Compansation System is to be provided in the near future. This will allow the constant variable weights required.

In the extremely soft oozes at the ocean floor that do not require rotation, a piston corer system could be developed. A similar system is now under evaluation in conjunction with a pinger to locate the ocean floor.

Recovery

In the upper sediments (oozes) of the deep ocean, coring is accomplished without circulation and recovery is quite high. Once circulation is required, recovery drops from nearly 90% to approximately 40%. This lower recovery is caused by the core being washed away. Recovery improves as the sediments become indurated.

Present core bit designs allow nearly half of the circulation to be directed on to the core. The extended inner barrel system overcomes this problem and has demonstrated its ability to improve the recovery rate.

As discussed above, the extended inner barrel system, however, leads to core disturbance, and alternate methods are required. An encouraging concept would provide a pack-off at the core bit to direct circulation away from the core.

In interbedded formations (particularly when the thin chert streaks are found in soft chalk), recovery is very poor, less than 10%. Constant weights that should be possible with a hydraulic heave compensation system along with the recent improvements in the core guide, should be an assist.

Penetration Rate

Usually this has not been a major concern since the use of the extended insert core bit came into general use. Compromises have been made on the amount of drilling weight used to avoid costly tool failures during the "spud-in" operations. Circulation rates have been kept to a minimum to improve bumper sub action.

With the greater interest now being shown by the scientific community in the recovery of basement rock, greater emphasis will be required in improving the hydraulics and weight/rotary programs used.

Improved hydraulics will probably require some type of pack-off between the core bit and inner barrel. This will allow the development of replaceable jet nozzles.

Weight/rotary programs will be helped by the development of the hydraulic heave compensation system.

Bit Life

The development of a core bit that used standard rock bit components has allowed the Deep Sea Drilling Project to enjoy the many recent bearing improvements being made by the rock bit industry.

Dull roller bearing core bits have usually shown severe brinelling of the bearing races. This only confirms the generally poor performance of bumper subs in compensating for vessel motion. A hydraulic heave compensation system should minimize the resultant weight fluctuations and lead to greatly increased bit life. The use of replaceable nozzles along with a good hydraulics program should also extend bit life.

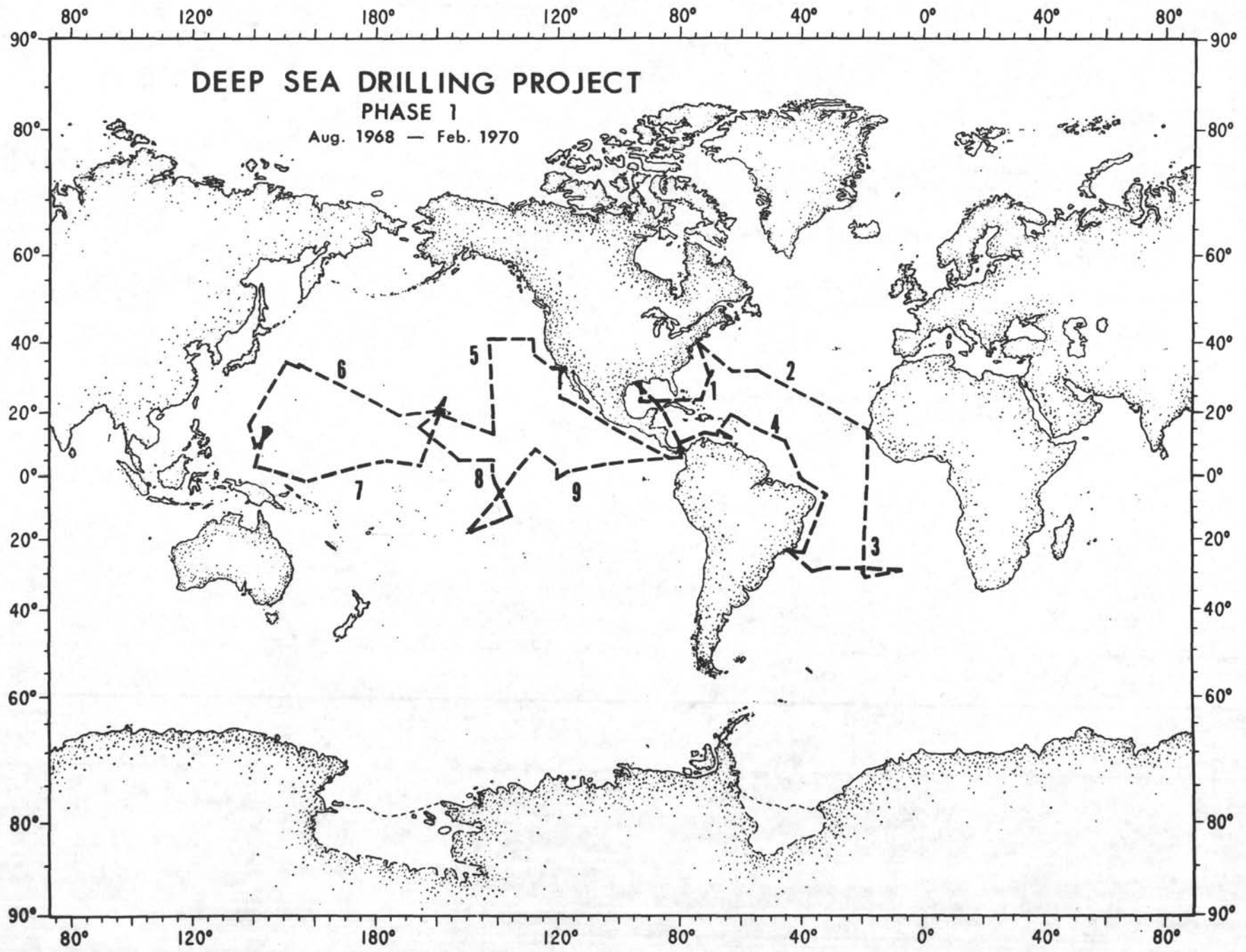
Other

Innovations to meet the particular needs of various scientific programs will be required. The Deep Sea Drilling Project plans to maintain a close working relationship with the drilling industry: operator, contractor, service company and manufacturer.

An example of innovative tools developed and not yet utilized was a diamond bit with a collet-connected crown. (Figure 25).

Figure 25

Here's a special diamond core bit with removable collet connected crown. This bit will allow the use of standard size logging tools once total depth was reached or allow use of an extended inner barrel system in upper sediments. It was built by Hycalog.


DEEP SEA DRILLING PROJECT
PHASE 1
Aug. 1968 — Feb. 1970
80° 120° 180° 120° 80° 40° 0° 40° 80°
90° 80° 60° 40° 20° 0° 20° 40° 60° 80° 90°
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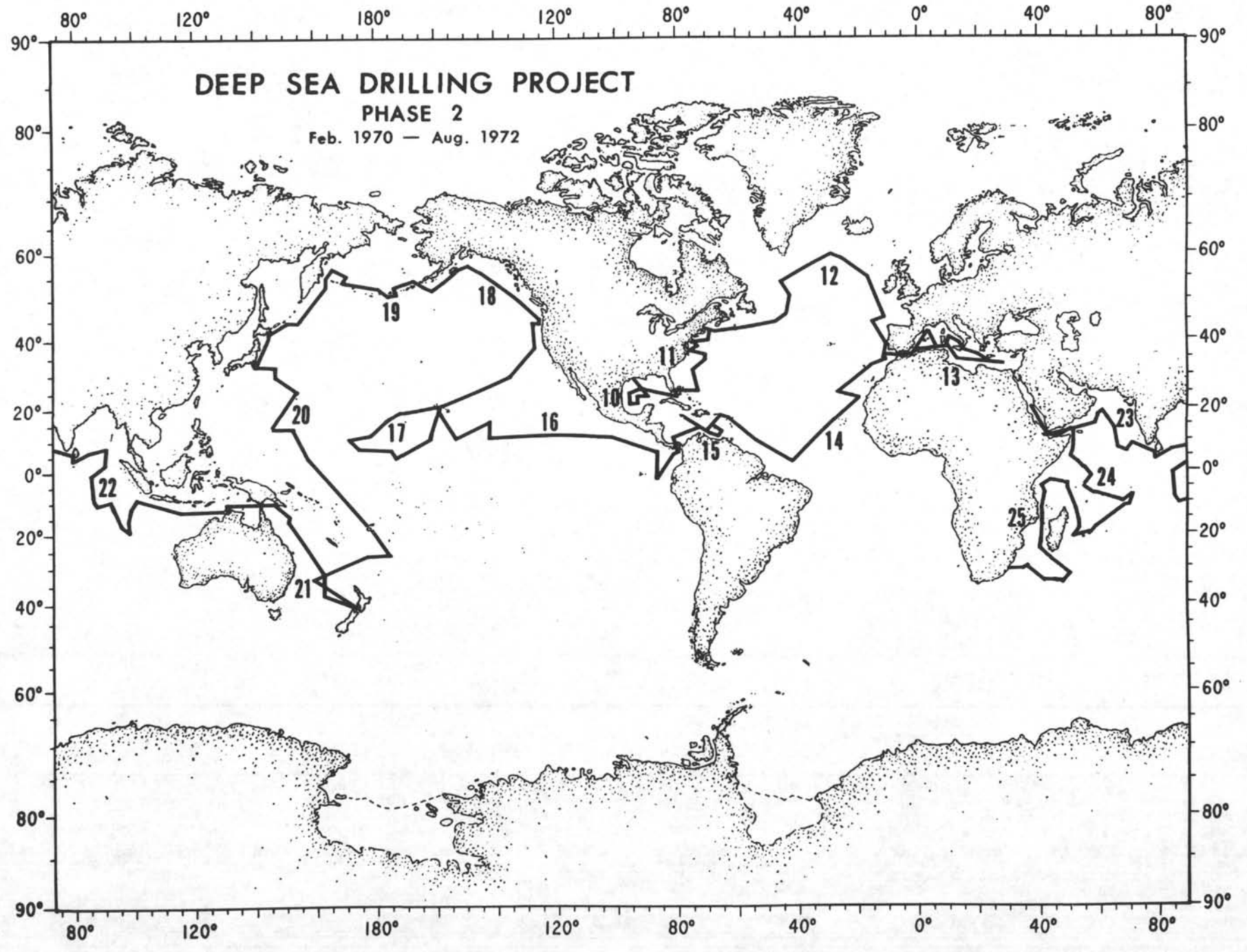
DEEP SEA DRILLING PROJECT
PHASE 2
Feb. 1970 — Aug. 1972
80° 120° 180° 120° 80° 40° 0° 40° 80°
90° 80° 60° 40° 20° 0° 20° 40° 60° 80° 90°
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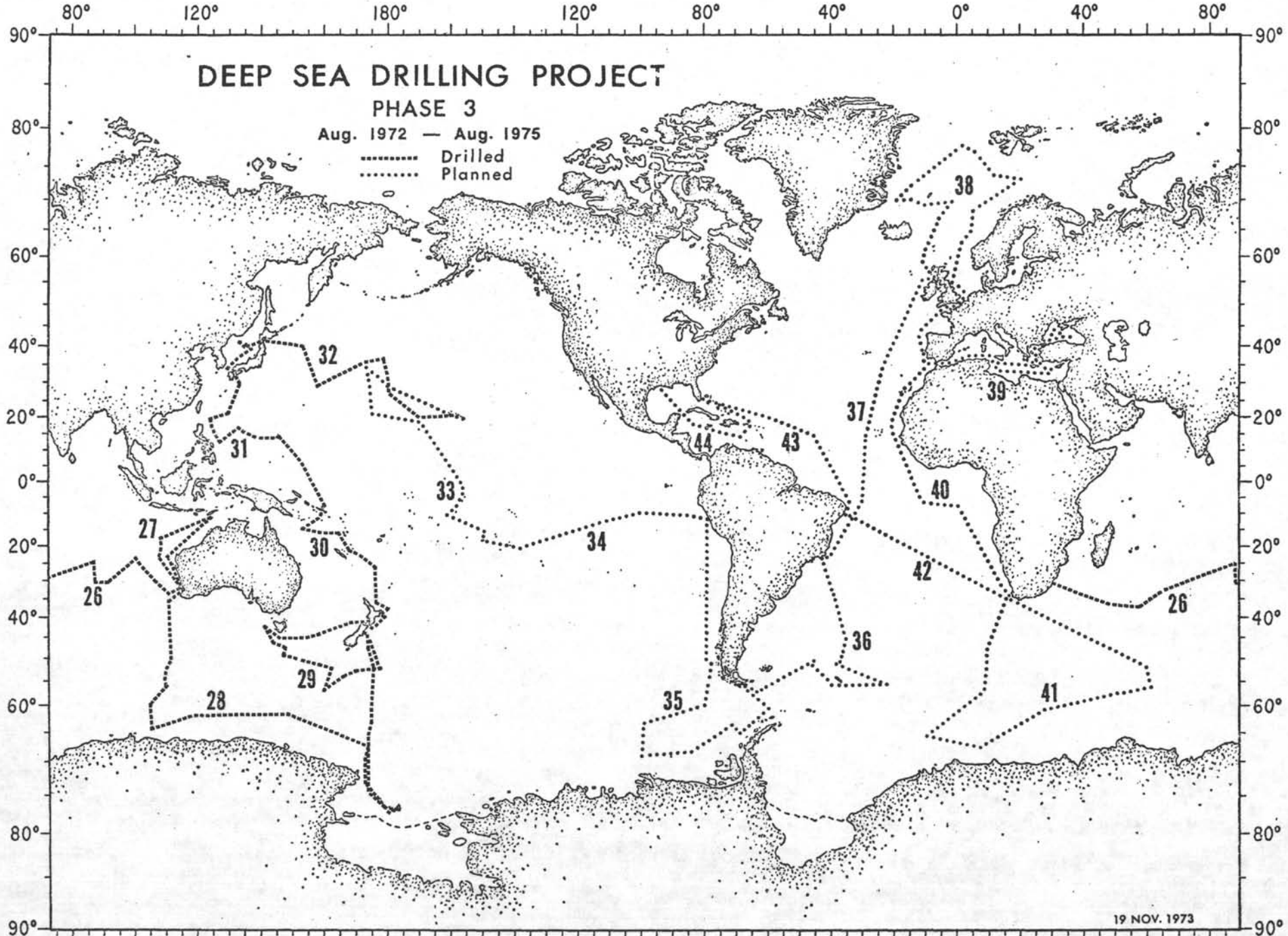
DEEP SEA DRILLING PROJECT
PHASE 3
Aug. 1972 — Aug. 1975
Drilled
Planned
80° 120° 180° 120° 80° 40° 0° 40° 80°
90° 80° 60° 40° 20° 0° 20° 40° 60° 80° 90°
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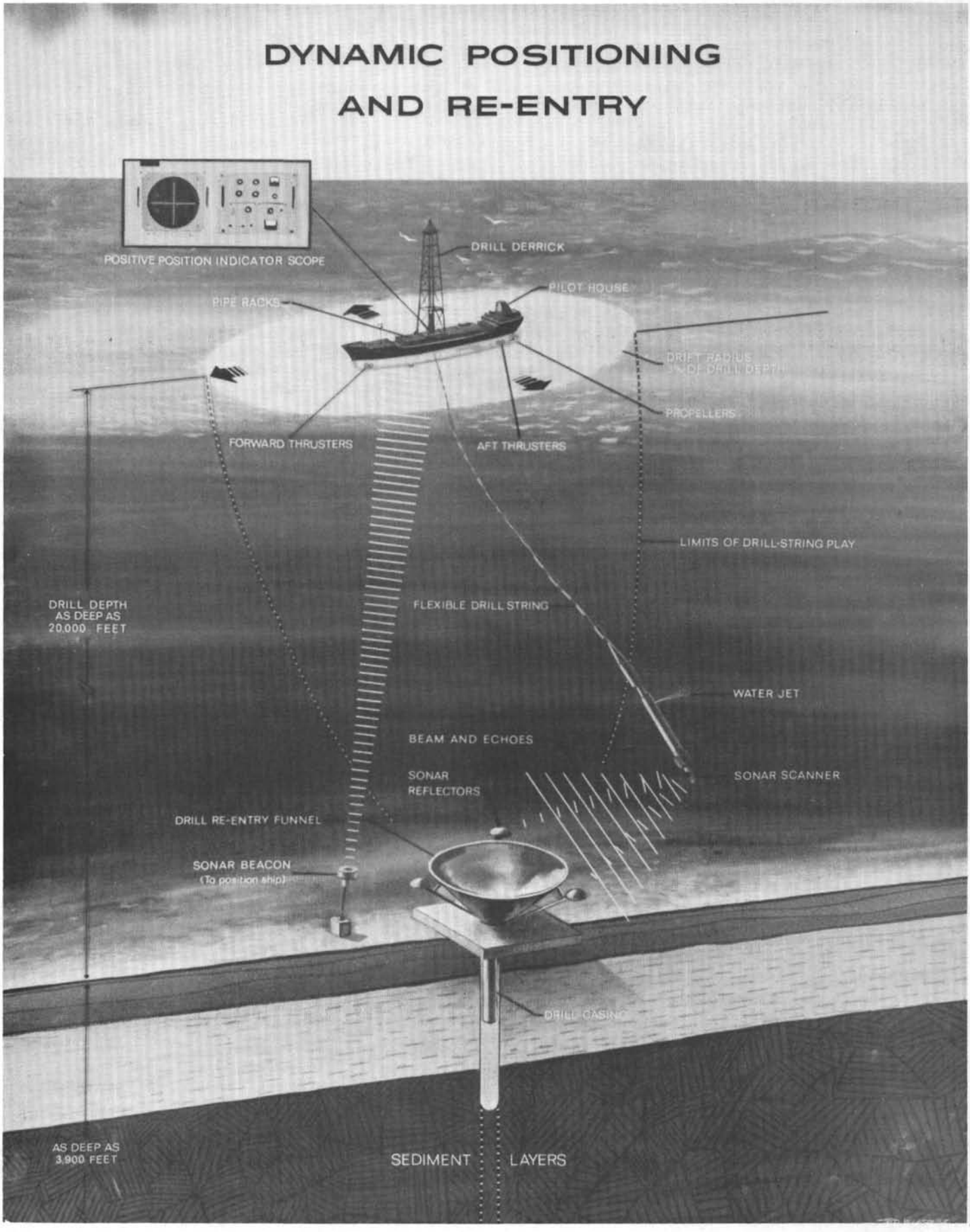
19 NOV. 1973


DYNAMIC POSITIONING
AND RE-ENTRY
POSITIVE POSITION INDICATOR SCOPE
DRILL DERRICK
PILOT HOUSE
PIPE RACKS
DRIFT RADIUS
PROPELLERS
FORWARD THRUSTERS
AFT THRUSTERS
LIMITS OF DRILL-STRING PLAY
DRILL DEPTH
AS DEEP AS
20,000 FEET
FLEXIBLE DRILL STRING
WATER JET
BEAM AND ECHOES
SONAR
REFLECTORS
SONAR SCANNER
DRILL RE-ENTRY FUNNEL
SONAR BEACON
(To position ship)
DRILL CASING
AS DEEP AS
3,900 FEET
SEDIMENT LAYERS

APPENDICES

APPENDIX I

SUMMARY OF CRUISE OPERATIONS MANAGERS

I	Galveston - Hoboken	James T. Dean	Mobil
II	Hoboken - Dakar	Dan R. Bullard, Jr.	Tenneco
III	Dakar - Rio	James T. Dean	Mobil
IV	Rio - San Diego	Dan R. Bullard, Jr.	Tenneco
V	San Diego - Honolulu	William F. Allinder	Texaco
VI	Honolulu - Guam	Dan R. Bullard, Jr.	Tenneco
VII	Guam - Honolulu	Valdemar F. Larson	DSDP
VIII	Honolulu - Tahiti	William F. Allinder	Texaco
IX	Tahiti - Galveston	James A. Dawson	Gulf
X	Galveston - Miami	William F. Allinder	Texaco
XI	Miami - Hoboken	James A. Dawson	Gulf
XII	Boston - Lisbon	William F. Allinder	Texaco
XIII	Mediterranean	Roy E. Anderson	Esso
XIV	Lisbon - San Juan	H. D. Redding	Phillips
XV	San Juan - Cristobal	Roy E. Anderson	Esso
XVI	Cristobal - Honolulu	H. D. Redding	Phillips
XVII	Honolulu - Honolulu	Thomas E. Maxwell	Sun
XVIII	Honolulu - Kodiak	Lamar P. Hayes	DSDP
XIX	Kodiak - Yokahama	Thomas E. Maxwell	Sun

XX	Yokahama - Suva	Lamar P. Hayes	DSDP
XXI	Suva - Darwin	Ted C. Bangs	Union
XXII	Darwin - Colombo	Lamar Hayes	DSDP
XXIII	Colombo - Djibouti	Ted C. Bangs	Union
XIV	Djibouti - Port Louis	Lamar P. Hayes	DSDP
XXV	Port Louis - Durban	John R. Shore	Chevron
XXVI	Durban - Fremantle	Lamar P. Hayes	DSDP
XXVII	Fremantle - Fremantle	Carl M. Morris	Marathon
XXVIII	Fremantle - Christchurch	Lamar P. Hayes	DSDP
XXIX	Christchurch - Wellington	Carl M. Morris	Marathon
XXX	Wellington - Guam	Valdemar F. Larson	DSDP
XXXI	Guam - Hakodate	John R. Shore	Chevron
XXXII	Hakodate - Honolulu	Lamar P. Hayes	DSDP
XXXIII	Honolulu - Tahiti	Stan T. Serocki	DSDP
XXXIV	Tahiti - Callao	Erick Janssson	AMOCO

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The Development of Rotary Core Drilling Bits for the Deep Sea Drilling Project

By

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ABSTRACT

Because of the increased emphasis on offshore drilling and exploration, there has been a need for rapid improvement in the design and development of rotary core drilling bits for deep ocean drilling.

During the last 3½ years, the Scripps Institution of Oceanography of the U. of California at San Diego has been under contract with the National Science Foundation for the management of the Deep Sea Drilling Project. The Deep Sea Project has entailed the drilling and coring of deep ocean sediments with short sections of basalt and chert basement rocks from the drill ship Glomar Challenger.

Cores of the soft sediments and hard basement rocks have been successfully drilled with excellent core recovery in water depths exceeding 20,000 ft. Numerous rotary core drilling bits were tested with varying results.

A variety of core bit cutting structure designs were required to drill and core both the unconsolidated soft sediments and the hard chert and basalt sections.

To date, 12 rotary core drilling bit designs have been tested on the Glomar Challenger. This paper will discuss the results of each design tested. The paper will also review the present state of the art in rotary core drilling bit design and discuss the major areas of needed improvement. Areas of improved design that are needed are stabilization, improved sintered tungsten carbide insert cutting structures, sealed bearings, and general rotary core drilling bit design.

References and illustrations at end of paper.

INTRODUCTION

The art of core drilling subsurface formations for the exploration of minerals, oil and scientific knowledge has progressed sporadically for over 100 years. Rotary roller core bit design has not changed much since the mid 1920's. This lack of development of rotary core bit design has been caused by a number of factors that include high coring costs, the development of improved diamond coring bits, improved logging techniques, and improved methods of obtaining small cores.

Because of the increased emphasis on offshore drilling and exploration, there has been a recent need for rapid improvement in the design and development of rotary core drilling bits for deep ocean drilling.

During the last 3½ years, the Scripps Institution of Oceanography of the U. of California at San Diego has been under contract with the National Science Foundation for the management of the Deep Sea Drilling Project.

The operational objective of the Deep Sea Drilling Project is the sampling of deep ocean sediments along with a short section of basement formation at various worldwide sites for scientific purposes. The drill ship Glomar Challenger has been utilized for 3½ years to drill approximately 158 holes at 109 different sites.[1-3]

This paper discusses the various coring methods, the sequence of coring problems, and the development of roller-type, tungsten carbide insert, rotary core bits.

DEVELOPMENT HISTORY OF CORE BITS

Early Core Bit Development - 1863 to 1969

Leschat, a French engineer who was using a rotary drilling method for wells in 1861, probably developed the first rotary core bit in 1863.[4] Leschat's rotary core bit was patterned after Kind's cable tool core barrel that was invented in 1854.[4] Core barrels with diamond set bits were used with good success in the mining industry about this same period, but they were not introduced to the oil industry until 1921.[4] One of the earliest rotary core bits was the "poor-boy", or "Texas-type". This bit was made from a piece of pipe with saw teeth, either torch cut or hack-sawed, to increase the rate of penetration (Fig. 1). General usage of this bit was reported around 1905.[5]

One of the first oil companies to work on the development of rotary coring tools was Shell Oil Co. Their first work was with a diamond core bit to obtain samples of coal in Holland. In 1919 Shell used a double barrel core tool to core in the Santa Fe Springs, Calif., oil field.[6] Rotary core drag bits with tungsten carbide teeth were first used in the oil fields about 1923.[6]

In 1926 Hughes Tool Co. and Reed Roller Bit Co. introduced the first roller core bits for hard rock formations. The wire-line core barrel was introduced by Reed Roller Bit Co. during the same period.[6]

During the period from 1930 to 1969, the development of rolling cutter core bits did not progress nearly as fast as the development of diamond core bits for oilwell drilling. The most popular hard formation rotary coring bits with roller cutters that were developed had six cutters. Three cutters cut the core and three cutters cut the gauge (Fig. 2).

Recent Rotary Core Bit Development 1969 to 1972

To better understand the why's and wherefore's of recent rotary core bit development, perhaps a review of the operational objectives and procedures of the Deep Sea Drilling Project is in order.

The operational objective of the Deep Sea Drilling Project is the sampling of deep ocean sediments along with a short section of basement at various worldwide sites for scientific purposes. A highly efficient wire-line coring system is utilized which takes a nominal 2½-in. diameter core up to 9 m (30 ft) in length. Work in the deep oceans prior to the beginning of the project in Aug., 1968, indicated that the sediments would, for the most part, be extremely soft and easy to penetrate. Therefore, a variety of drag (both tungsten carbide and diamond-faced) and long-tooth milled cutter roller core bits were provided. A few massive set (600 to 800 k) diamond core bits were also provided for coring harder formations and/or basement.

One of the scientific (and operational) findings of the early voyages in both the Atlantic and Pacific Oceans was the widespread occurrence of cherts in the sediments of the Eocene and older ages. Coring at many of the sites was terminated due to the early dulling of the core bits in these cherts. The diamond core bits, which had been in the project's contingency planning for the harder formations, performed somewhat better than the drag and soft formation roller bits; however, premature dulling was frequent. It appeared that chert fragments were breaking loose and destroying the matrix that held the diamonds.

An engineering study was prepared by the DSD project staff.[7] The basic conclusion of this study was that a re-entry system utilizing sonic techniques was the least expensive and most reliable method that would extend the drilling capabilities of the Glomar Challenger. The report investigated the improvement of core bits and concluded that "a bit that will core and drill both the soft unconsolidated formations and the very hard formations is not now commercially available and establishing a source for such bits in the quantity used on the DSDP (low by rock bit manufacturers' standards) is, at this time, economically unfeasible." The report did recommend, "evaluate as soon as possible the performance of the carbide insert roller core bits." and, "if the tests are promising, continue a search for a manufacturer." This study and report initiated the most recent developments in the rotary core drilling bits.

DESCRIPTION OF DEEP-SEA DRILLING PROJECT OPERATIONS

Coring operations in the deep ocean basins differ from normal land coring operations primarily due to two reasons: (1) the physical

characteristics of the sediments penetrated and (2) mechanical limitations imposed by operating without the penetrated sediments being cased or having an annulus to provide a closed circulating system.

The typical drilling assembly (Fig. 3), including the basic wire-line core barrel assembly (Fig. 4), consists of some 330 ft of 8¼-in. drill collars and four bumper subs with a total travel of 20 ft. The assembly weighs approximately 45,000 lb in air and provides some 35,000 lb effective weight at the bottom of the hole for the 10-1/8 x 2½-in. OD bit.

In most areas of operation the sediments near the sea floor consist of soft unconsolidated oozes that become firmer as the depth increases. In many areas relatively thin layers of very dense, hard chert, 1 to 6 in. thick, are found interbedded in firm to hard clays, chalks and limestone. Occasionally the chert layers occur very near (within 100 ft) the ocean flood. These variances in types of sediments imposed mechanical limitations and dictated the use of varied techniques within the same hole.

Typical operations consist of taking punch cores; that is, lowering the drill string and penetrating the sediments by the application of weight only until firm sediments are encountered, usually at a depth of about 100 ft. During this phase of the operation, neither circulation of fluid nor rotation of the string is utilized. When firm to fairly firm sediments are encountered, the drill string is rotated 25 to 50 RPM and circulation is used as necessary to prevent excessive torque. As the sediments grade to firm and hard with depth, the drill string is rotated at 50 to 75 RPM and raw sea water used as a circulating medium as required. Typical drilling weights for the core bits vary from 10,000 to 30,000 lb.

When chert layers are encountered at such shallow depths that the hole above cannot provide lateral support for the bottom-hole assembly, they are penetrated by using low bit weight (less than 10,000 lb), low rpm (25 to 35), and maximum circulation rates. When the chert is encountered at deeper depths, maximum weight, rotational speeds of 50 to 75 rpm, and maximum circulation are used. Maximum weight and circulation rates and 75 rpm are used for the penetration of basalt and basement rock.

TUNGSTEN CARBIDE INSERT ROLLER CORE-BIT DEVELOPMENT FOR THE DSDP

The first tungsten carbide rotary core bit used on the DSD project was run on Leg 7. This core bit was a six-cutter design (Fig. 5). Core drill results during Leg 7, using the tungsten carbide insert bit, indicated a tungsten carbide insert roller cutter would penetrate the ocean sediments. In cooperation with V. F. Larson of the DSDP, Smith Tool started a tungsten carbide core-bit development program in Oct., 1969.

Leg 7 (Aug.-Sept., 1969, Guam-Honolulu)

An insert roller core bit that had been procured for test work on Project Mohole was obtained and run on Leg 7 in the Western Pacific.

In preparation for Leg 9, a four-cone TCI core bit was developed (Fig. 6). This design concept was primarily the idea of V. F. Larson of the DSDP. The new core bit consisted of using a three-cone, proven oilfield Type 9 (hard formation) cutting structure and converting it for use as a core bit. The idea was to increase the bearing capacity over the six-cutter design used on Leg. 7. The 7-7/8-in. three-cone bearing size was selected, making the core bit 10-1/8-in. in diameter and the core size 2½-in. in diameter. The 7-7/8-in. rock bit components were modified from proven parts and adapted to a specially manufactured core-bit body using a Hycolog connection for mating with the core-barrel assembly.

Leg 9 (Dec., 1969, and Jan., 1970, Tahiti-Galveston)

Results indicated the new TCI Type 9 roller cutter core bit would successfully penetrate and core the soft oozes. Penetration rate was slowed at times because of bit balling in soft chalk and limestone. Due to the bit balling problems during Leg 9, it was decided to add extended jet nozzles in preparation for Leg 10. The flow from the extended jet nozzles was directed across the cone face (Fig. 7) to eliminate the core-bit balling problem.

Leg 10 (Feb.-March, 1970, Galveston-Miami)

Results with the bits with extended nozzles indicated the bit balling problem was corrected. Leg 10 core recoveries further indicated the need to concentrate on designing for better core recovery. The core guide (Fig. 7) was extended closer to bottom to provide more support and protection for the core while entering the inner barrel.

Leg 11 (May, 1970, Miami-Hoboken)

Using the core bits with extended core recovery. Extensive use of the TCI roller core bits was made, and this resulted in the recovery of several thick limestone sections that included the oldest cores found to date. In an attempt to increase penetration rates, several three-cone core bits were evaluated along with the four-cone core bits. Bit wobble from lack of stabilization contributed to recovery of undersized cores. It was agreed to add stabilizer lugs to the core-bit body (Fig. 7) to help

prevent undersized cores. To gain better penetration through the clays and ooze, a Type 5 three-cutter design was proposed. It was believed that the Type 5, which uses a chisel-shaped carbide insert, would more effectively penetrate the softer sediments than the conventional double-cone inserts used on the Type 9 cutters. In order to increase the unit load per insert on the Type 5, it was agreed to try a three-cutter design. One additional advantage gained in using three-cutter vs the four-cutter design was that it allowed room for additional core guide support or protection for the core.

Leg 12 (June-July, 1970, Boston-Lisbon)

Bits with Type 9 cutters and bits with Type 5 shaped inserts were alternated. No noticeable change in rate of penetration was noted. Improved rates were needed. Erratic core diameters were experienced.

Leg 13 (Aug.-Sept., 1970, Mediterranean)

Many sites had large amounts of clay, and milled cutter bits were used to improve penetration. Rapid dulling of the cutting structure in hard formations made their use far from satisfactory. Extended inserts were investigated. It was decided to try the Type 4 extended chisel insert structure. The Type 4 insert structure differs from the Type 5 structure in that the major chisel-shaped insert rows extend 0.245 in. from the cone shell, as opposed to 0.178 in. of insert extension on the Type 5 cutting structure. Special cutters would be required as the cones of normal rock bits with extended inserts are not of equal size.

Leg 14 (Oct., 1970 to Jan., 1971, South Atlantic)
and
Leg 15 (Oct., 1970 to Jan., 1971, Caribbean)

Extensive use of Type 94 TCI roller core bits was satisfactory in the deep ccean pelagic sediments. Penetration rates in soft limestones suffered. Stabilizer lugs were added to the bit body and helped maintain core size.

Leg 16 (Jan.-March, 1971, Colon-Panama-Honolulu)

Type 94 rotary core bits with extended inserts saw general use, resulting in improved penetration and core recovery in all formations cored. Core recovery being the prime goal, the next program set up was to try sealed-bearing core cutters. Regular or nonsealed bearings, it was felt, could affect core size and recovery due to bearing wear. The sealed-bearing design selected for trial was the same as that used successfully in the oil fields (Fig. 8). The design consists of a Belleville spring seal, with a compensating system or equalizer to displace pressure buildups that occur in the system. The standard design and seal size availability made it possible to try the first sealed-bearing roller cutter core bit on Leg 17.

In addition to testing sealed bearings for Leg 17, it was requested that the Type 4 cutting structure be used.

Leg 17 (March-May, 1971, Mid-Pacific)

Results with the sealed-bearing cutters indicated an increase in the average hours on bottom. Penetration rates again increased using the Type 4 structure. Inner row tungsten carbide insert wear (Fig. 9) was noticeable for the first time on the Type 4 structure.

In order to test the complete range of carbide structures that could be made available, the Type 3 structure was requested for tests on Leg 19. The Type 3 structure incorporates chisel-shaped inserts with 0.370-in. extension vs the 0.245-in. extension as used on the Type 4 (Fig. 10). (See Table 1, Leg 17 Bit Summary.)

Leg 19 (July-Aug., 1971, Bering Sea)

Drilling results on Leg 19 indicated yet another increase in coring rates by using the Type 3 cutting structure over the Types 4 and 5. Sealed-bearing cutters again indicated substantial increases in coring time on bottom over the nonsealed-cutter types. The leg shirttail (Fig. 11) during Leg 19 experienced considerable wear or the eroding away of the applied hardmetal protection to the core bit leg, thus exposing the seal and bearings to the formation.

Of particular interest was the absence of any noticeable parent metal wear on the Type 3 cutter (Fig. 11) as opposed to the Type 9. Parent metal wear is the wearing away of the rolling cutter cone outer-base metal between inserts.

Leg 19 results indicated a need to proceed with testing sealed friction bearings against the sealed roller bearings. The severe up-and-down motion experienced with drilling-ship drilling operations can cause shock loading to the bit even if bumper subs are employed. This shock causes the roller bearings in a cutter to "brinell" the cone and leg bearing races. This brinelling causes bearing journal spalling, which is the failure of the carburized bearing surfaces by fatigue. Laboratory test data published in 1969 (Fig. 12) indicates the advantage of friction bearings over roller bearings.[8] The use of sealed friction bearing cutters may reduce the brinelling action and result in longer cutter-bearing life.

Fig. 13 illustrates a cost per foot/cored

summary of various type coring bits as used on the DSD project (Table 2, Leg 19 Bit Summary).

SUMMARY

It was demonstrated that either a three- or four-cutter roller core bit would effectively core the ocean sediments, thus establishing a new precedent in cutter designs for rotary coring bits. Larger bearings, as used on the new three- and four-roller cutter designs when compared with the older six-cutter designs, resulted in greater bearing life.

Tungsten carbide inserted roller cutter core bits, Types 9, 5 and 4, all effectively core ocean sediments. The Type 4, and especially the Type 3 with extended chisel inserts, demonstrated the ability to core at a faster penetration, the oozes as well as the harder basement sections encountered. On Leg 17 it was demonstrated that as hours on bottom are increased, insert wear occurs on the inner insert tows. If this particular problem continues, an insert grade change will be tested on the inner row inserts.

Bit balling was corrected by adding extended nozzles directed at the cutters. Bit stabilizer lugs, sealed bearings and an improved core sleeve design all helped increase core recovery. The Type 3 with extended chisel inserts of 0.370 of an in. as compared to the Type 9 double-cone insert with 0.110 of an in. extension, indicated the Type 3 had little parent metal wear or damage on the rolling cutter external surface.

Leg 17 and Leg 19 drilling results indicated sealed-bearing roller core bits averaged 26 hours per bit vs 14.8 hours per bit for nonsealed roller TCI core bits.

A lesser cost per foot cored was demonstrated using extended insert roller core bits over other type core bits tried to date.

A core recovery analysis of three-cutter vs four-cutter roller bit designs was made by the DSDP. It was determined there is no significant difference in recovery rates, to date, between three-cutter vs four-cutter core bits.

CONCLUSIONS

Preliminary findings indicate the extended insert cutter designs with 0.370-in. extension evidenced less bearing failures due to brinelling as is usually the case with the double-cone Type 9 insert structure with a 0.110-in. extension. This phenomenon may in some way explain the inability of diamond bits to core effectively the soft and hard interspersed sections. Evidently the longer extended inserts help absorb or compensate for uneven bit loading. Diamond bits in these sections demonstrated matrix destruction.

Roller cutter core-bit development will continue on the Deep Sea Drilling Project. Present plans call for the testing of various types of friction bearings. Future test legs will undoubtedly see new seal designs tried. Cutting structure improvements will continue; insert grade changes will be tested as hours on bottom are increased. Additional inserts may be tested on the nose rows of cutters.

To improve core recovery, extended, non-rotating inner core barrels have been used at several sites. This system does allow circulation while coring very soft material; however, it has been unable to achieve penetration in harder formation. More work is planned. Future design considerations include a more true roll cutter profile to reduce the amount of inner row insert drag. This would reduce inner-row insert wear and permit better core-trimming ability.

The re-entry system was developed in 1970 and was used in conjunction with insert core bits to complete the evaluation of a site that had been terminated on an earlier voyage due to chert. This site in the Caribbean was completed in Dec., 1970. Since that time, due primarily to the improvements made in tungsten carbide rotary core bits during the last 2 years, multiple bits (re-entry) have not been required to meet the scientific objective of the project.

ACKNOWLEDGMENTS

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Invaluable assistance and guidance were received from V. F. Larson, Acting Head, Engineering and Operations, Deep Sea Drilling Project.

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TABLE 1 - LEG 17 - BIT SUMMARY, MID-PACIFIC

SITE	BIT DESCRIPTION SIZE	TYPE	SER. NO.	DISTANCE CORED CORE M	RECOVERY M	%	ROT. TIME Hr.	PENET. RATE M/Hr.	BIT CONDITION	REMARKS
164	10 1/8 X 2 7/16	94 (1)(4)	GT 331	259	81.1	31.5	13.5	19.2	T-1, B-6 2 Cone Locked 4 Inserts Gone O-1/4 - Cone ID-2 1/2	1/8 UG On Cone-New 1/4 UG On Pads-New Clay - Chert 10M - Basalt
165	10 1/8 X 2 7/16	94 (1)(4)	GT 332	14	8	57.0	0.17	82.5	Not Pulled	
165A	10 1/8 X 2 7/16	94 (1)(4)	GT 332 RERUN	371	131.4	35.0	11.80	41.5	B-1, T-1 IG Excellent Condition	Cut Min Of 20M Basalt
166	10 1/8 X 2 7/16	94 (1)(4)	GT 332 RERUN	237	155.3	65.3	8.62	35.9	T-3, B-7 IG	Good Penetration Cut 7M Basalt
166A	10 1/8 X 2 7/16	94 (1)(4)	GT 332 RERUN	9	6	66	0.05	180.0	T-3, B-7 IG ID-2 7/16	Piston Core
	CUMULATIVE		GT 332	631	300.7	47.6	20.62	39.9		
167	10 1/8 X 2 7/16	94 (1)(4)	GT 101	867	298.6	34.5	60.73	19.5	T-5, B-8 IG Throat 2 1/2	Good Penetration Poor Recovery In Chert. Cut 18M Basalt
168	10 1/8 X 2 7/16	94 (1)(4)	GS 956	28	7.5	26.7	1.12	67.0	Lost In Hole. No Dull Grade.	
169	10 1/8 X 2 7/16	94 (1)(4)	GS 957	96	12.4	12.9	12.08	19.7	T-8, B-5, 1/4 OG ID-2 7/16	Cut Numerous Chert Layers - 31M Basalt
170	10 1/8 X 2 7/16	9 (2)(3)	GR 567	134	30.7	22.8	10.63	18.4	T-1, B-5 IG ID-2 7/16	Chert-LS-And 4M Basalt
171	10 1/8 X 2 7/16	94 (2)(4)	GC 281	356	173.3	48.7	11.38	41.5	T-1, B-5 IG ID-2 7/16	Chert-LS-And 9M Basalt

SUMMARY OF BITS USED

5-NEW SMITH 10 1/8 X 2 7/16 TYPE 94
4 CONE SEALED BEARING
1-NEW SMITH 10 1/8 X 2 7/16 TYPE 94
4 CONE NON-SEALED BEARING
1-NEW SMITH 10 1/8 X 2 7/16 TYPE 9
3 CONE NON-SEALED BEARING

(1) SEALED BEARING
(2) NON-SEALED BEARING
(3) 3-CUTTER
(4) 4-CUTTER

TABLE 2 - LEG 19 - BIT SUMMARY, BERING SEA

SITE	BIT DESCRIPTION SIZE	TYPE	SER. NO.	DISTANCE CORED CORE	DISTANCE CORED RECOVERY		ROT. TIME	PENET. RATE	BIT CONDITION	REMARKS
				M	M	%	Hr.	M/Hr.		
183	10 1/8 X 2 7/16	94C ②④	HC 757	361	150	41.5	8.38	61.5	T-1, B-4 IG 1 Broken Insert	Cored 11M Basalt
184	9 7/8 X 2 15/32	Diamond	962	186	123.2	66.2	8.05	75.0	20% Salvage	
184A	10 1/8 X 2 7/16	93CJS ①③	HM 619				2.63	254.0	T-1, B-1 OK F/Rerun	Siltstone And Hard Mudstone
		Center Bit	2371						OK F/Rerun	
184B	10 1/8 X 2 7/16	93CJS ①③	HM 619 RERUN	121	50.2	41.6	17.80	54.5	T-2, B-8 Cones Loose	Siltstone And Hard Mudstone
	CUMULATIVE		HM 619	121	50.2	41.6	20.43	80.0		Shirttail Cut Off Bearings Exposed
185	10 1/8 X 2 7/16	93CJS ①③	HM 621	216	97.6	45.1	8.05	90.5	T-1, B-1 IG OK F/Rerun	Drilled Soft To Firm Sediments - No Chert
186	10 1/8 X 2 7/16	93CJS ①③	HM 620	245	140.7	57.6	11.58	80.0	Pull To Mud Line Move To Site 187	
187	10 1/8 X 2 7/16	93CJS ①③	HM 620 RERUN	36	6.8	78.9	2.92	126.7	T-1, B-2 IG	Bright Wear On Shirttail
	CUMULATIVE		HM 620	281	147.5	52.5	14.50	89.5		OK F/Rerun
188	10 1/8 X 2 7/16	93CJS ①③	HM 621 RERUN	146	57.4	39.3	4.58	139.5	T-1, B-3 IG	OK F/Rerun
189	10 1/8 X 2 7/16	93CJS ①③	HM 621 RERUN	174	74.2	42.6	26.40	33.0	T-2, B-8 IG	Hard Sandstone And Mudstone
	CUMULATIVE		HM 621	536	229.2	42.7	39.03	57.3		
190	11 1/2	93 ①④	0	142	85	59.9	4.37	143.5	T-1, B-1 IG OK F/Rerun	
191	10 1/8 X 2 7/16	9C ①④	GT 644	130	44.1	34	28.73	32.0	Pulled To Mud Line Move To Site 191A	Cored Mudstone & 1 1/2M Basalt
191A	10 1/8 X 2 7/16	9C ①④	GT 644 RERUN	36	21.5	59.6	0.17	300.0	Not Pulled	Moved 400 Ft. East Of 191
191B	10 1/8 X 2 7/16	9C ①④	GT 644 RERUN	9	8.5	94.5	0.033	270.0	T-3, B-5 OG	Site 191B Is 500 Ft. East Of 191
	CUMULATIVE		GT 644	175	74.1	42.3	28.93	33.8		Inserts Missing On Cone Nose
192	10 1/8 X 2 7/16	93CJS ①③	HM 617	308	152.4	49.5	13.05	72.2	Pulled Above Mud Line - Moved To 192A	
192A	10 1/8 X 2 7/16	93CJS ①③	HM 617 RERUN	47	38.2	81.3	16.82	63.0	T-2, B-8 OG Shirttails Cut Off Cone Missing	Mudstone 13M Basalt
	CUMULATIVE		HM 617	355	190.6	53.6	29.87	66.8		
193	10 1/8 X 2 7/16	9C ②③	FK 945	29	12.3	42.4	0.40	177.5	T-1, B-1 OK F/Rerun	

SUMMARY OF BITS USED

1-SMITH 10 1/8 X 2 7/16 TYPE 94C
4-CONE NON-SEALED BEARING
4-SMITH 10 1/8 X 2 7/16 TYPE 93CJS
3-CONE SEALED BEARING
1-SMITH 10 1/8 X 2 7/16 TYPE 9C
4-CONE SEALED BEARING
1-SMITH 10 1/8 X 2 7/16 TYPE 9C
3-CONE NON-SEALED BEARING
1-RSS 11 1/2 TYPE 93
4-CONE SEALED BEARING
1-WILLIAMS 9 7/8 X 2 15/32 DIAMOND BIT

① SEALED BEARING
② NON-SEALED BEARING
③ 3-CUTTER
④ 4-CUTTER

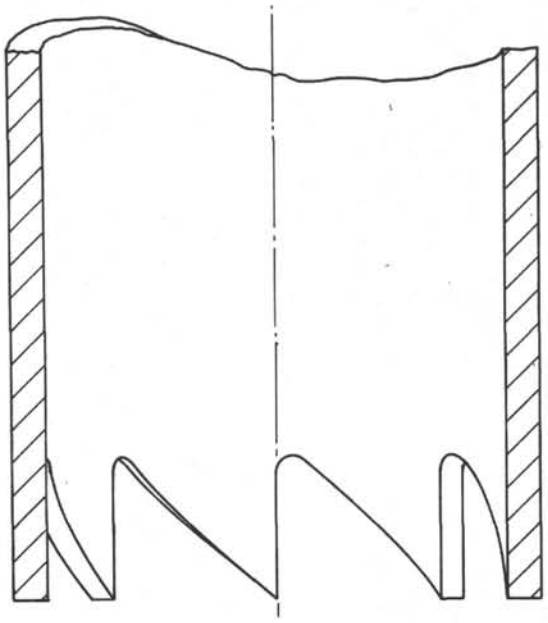

Fig. 1 - Poor boy core bit.

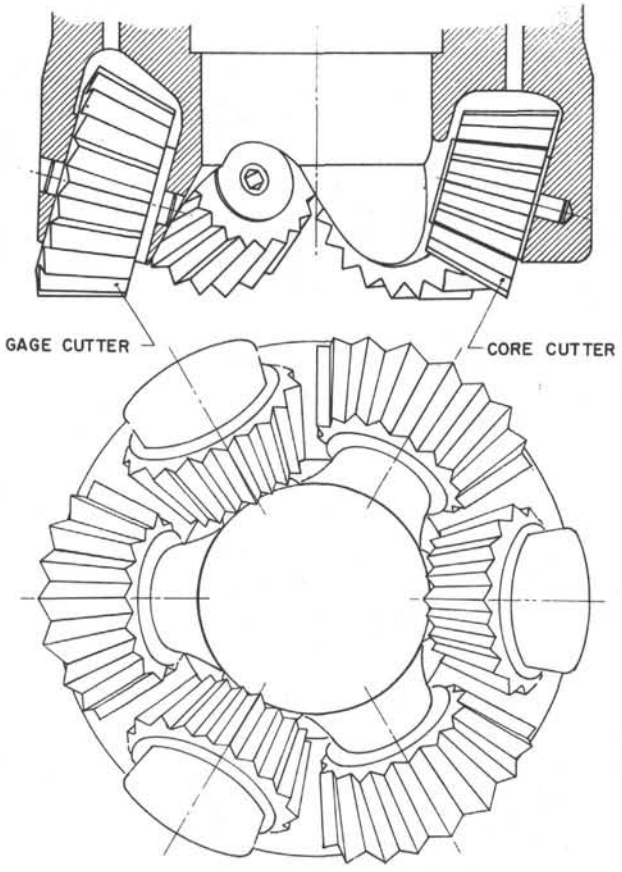

Fig. 2 - Six cutter mill tooth core bit.

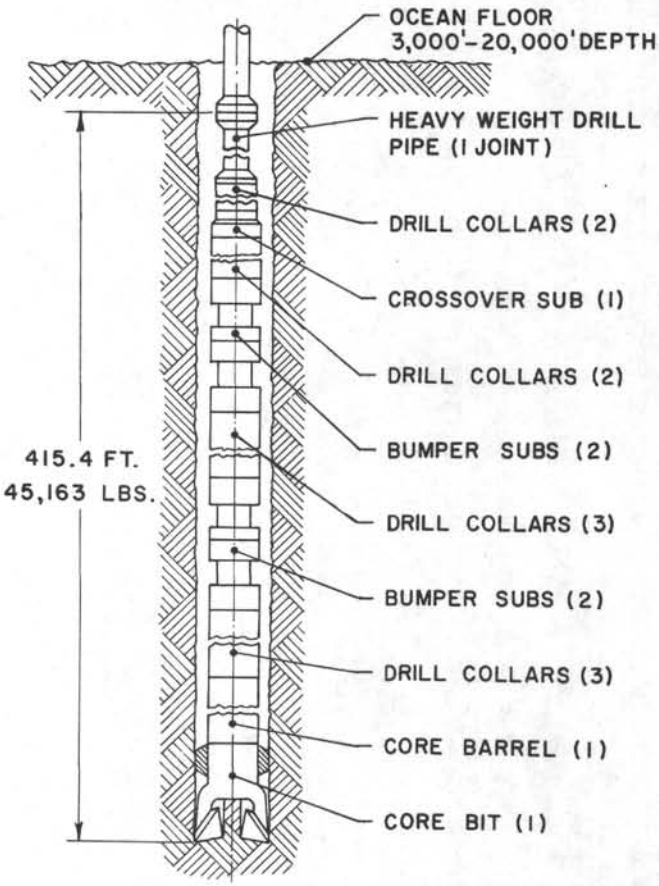

Fig. 3 - Typical drilling assembly.

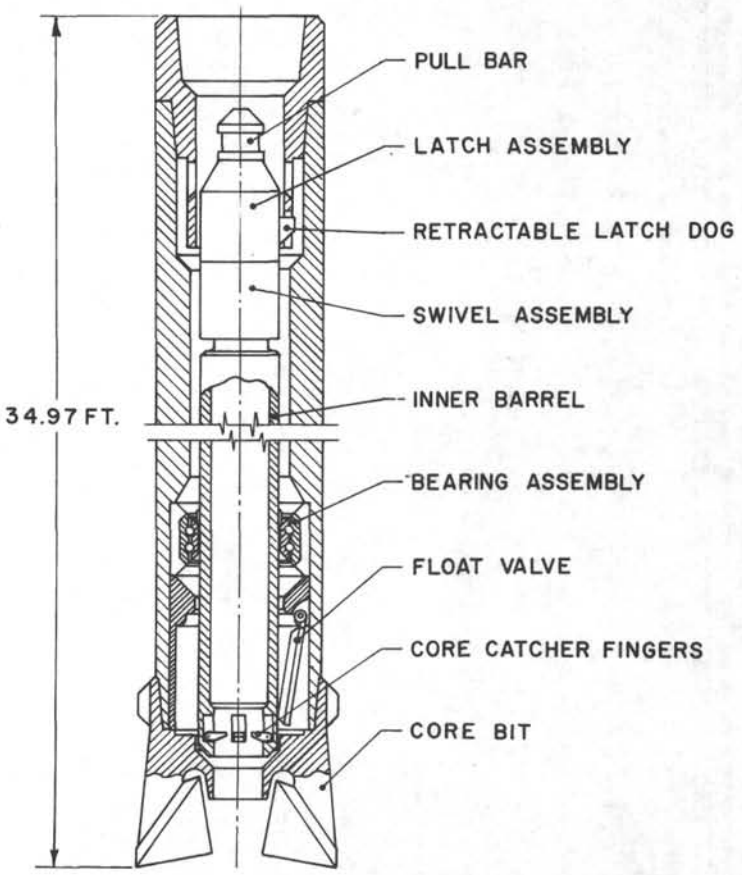

Fig. 4 - Wireline core barrel assembly.

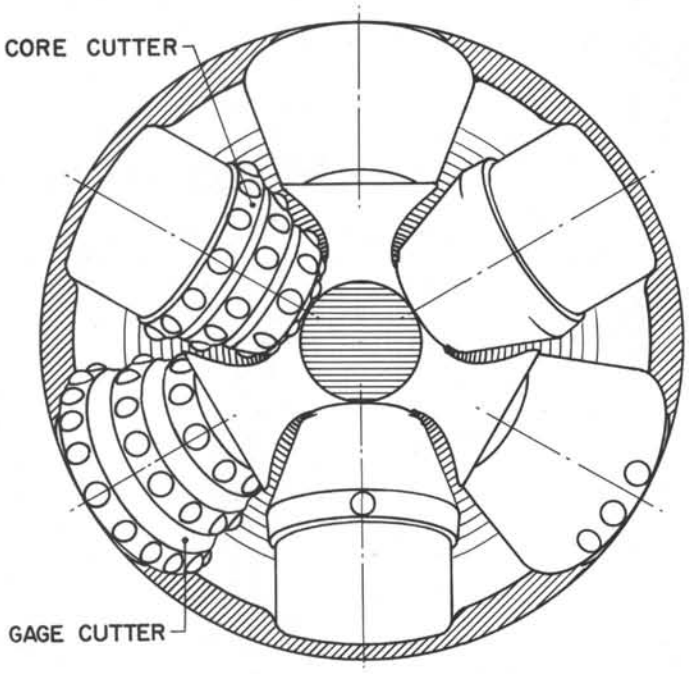

Fig. 5 - Six cutter tungsten carbide insert core bit (first tungsten carbide insert roller core bit used on DSDP.

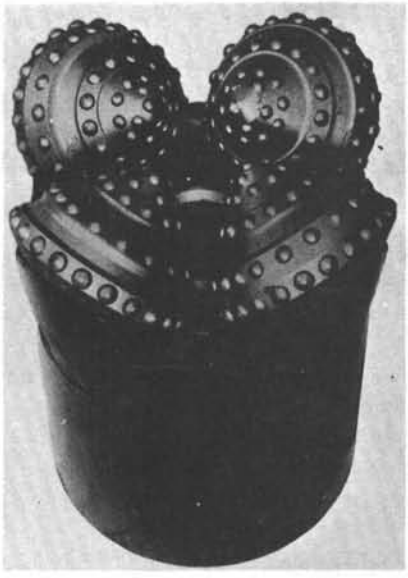

Fig. 6 - Type 9 core bit developed for Leg 9.

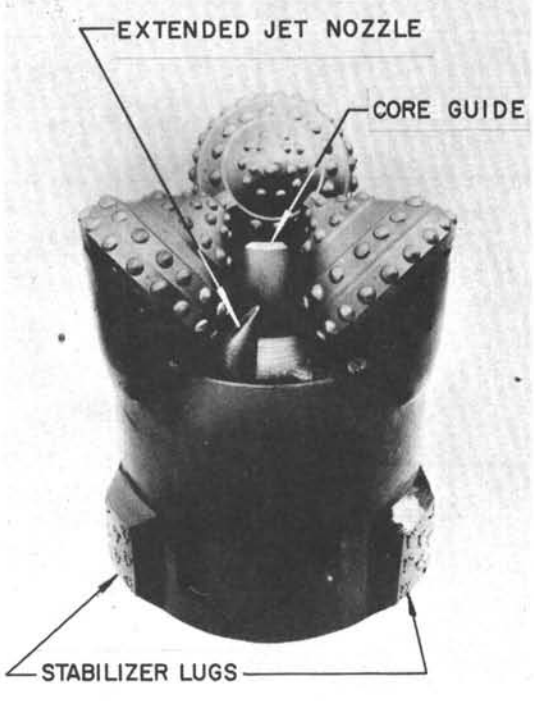

Fig. 7 - Three cone tungsten carbide roller core bit.

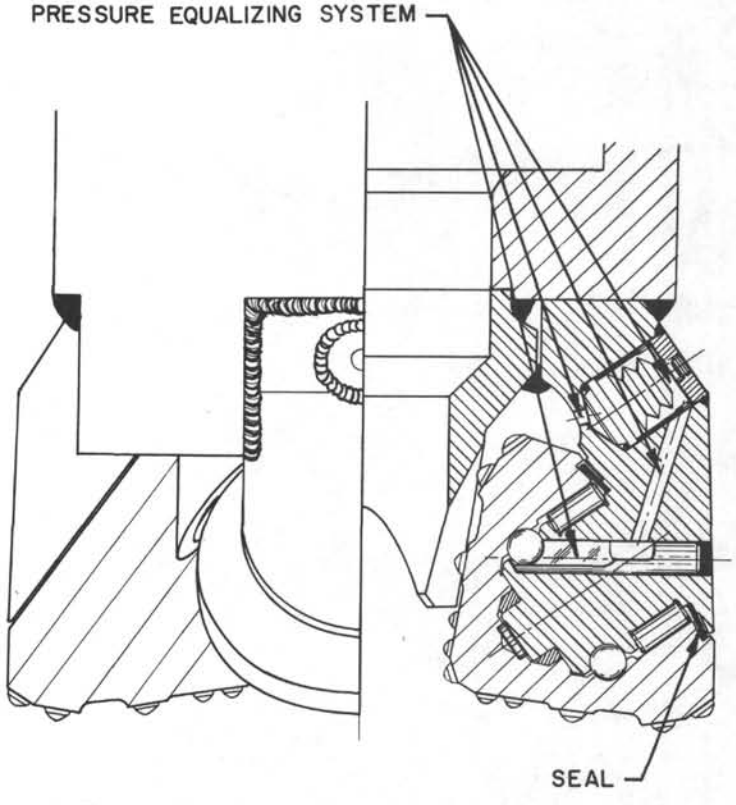

Fig. 8 - Sealed bearing assembly.

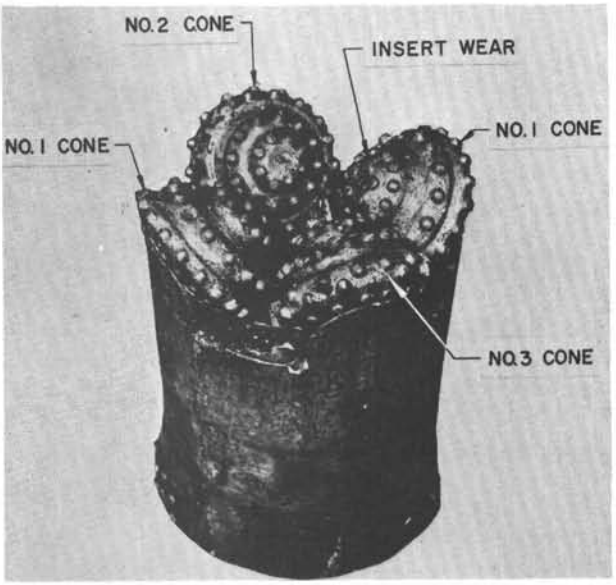

Fig. 9 - Four cone tungsten carbide roller core bit, Type 4.

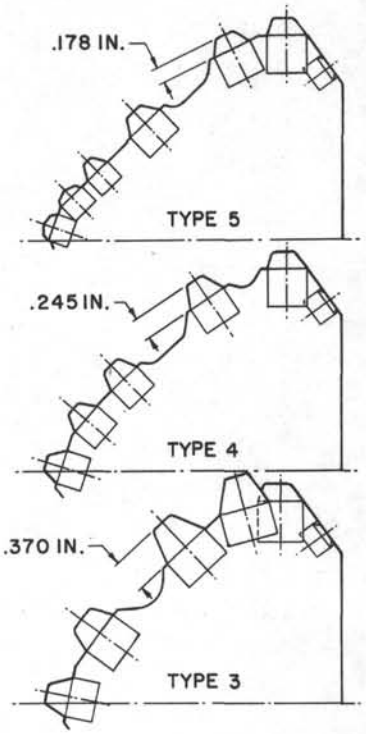

Fig. 10 - Insert extension comparison.

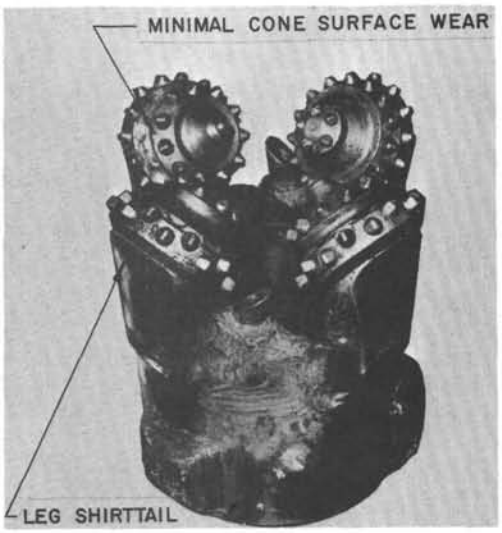

Fig. 11 - Type 3 core bit used on Leg 19.

WEIGHT LBS.	RPM	HOURS	
		ROLLER BEARING	SEGMENT BEARING
40,000	60	60 HRS TO SPALL	200 HRS NO WEAR
50,000	60	35 HRS TO SPALL	200 HRS NO WEAR
75,000	60	16 HRS TO SPALL	30 HRS .004 SEGMENT WEAR
100,000	60	7 HRS TO SPALL	10 HRS .006 SEGMENT WEAR

Fig. 12 - 7-7/8 three-cone bearing test, roller vs segment bearing, compiled from 144 controlled laboratory tests.

TYPE	NO. NEW BITS	TOTAL COST	FEET CORED	$/FT. CORED	TOTAL PENET.	$/FT. PENET.	%REC.
DIAMOND $3900	67	$261,300	30463	8.57	107492	2.43	74
TUNGSTEN $1492	18	$ 26,856	5883	4.56	18248	1.47	48
MILLED CTR. $745	6	$ 4,470	1756	2.54	9312	.48	43
STD. INSERTS $2525	40	$100,800	24101	4.18	76833	1.31	60
EXT. INSERTS $2700	15	$ 40,500	16928	2.39	26337	1.53	54

Fig. 13 - Cost summary, original data.

CORE BIT SUMMARY

The following pages contain a performance record of every bit used by the Deep Sea Drilling Project from Leg 1 through Leg 32.

CORE BIT SUMMARY - LEG I

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
1	25°51.5'N 92°11.0'W August 12-16, 1968 2822m (9,259')	9-1/4 Christensen Diamond Drag Unknown	9	8	89	78m 256'	49m 161'	64	770m 2,526'	
2	23°27.3'N 92°35.2'W August 19-21, 1968 3572m (11,720')	9-1/4 Christensen Diamond Drag Unknown	6	6	100	35m 115'	14m 46'	38	144m 472'	
3	23°01.0'N 92°01.4'W August 21-23, 1968 3747m (12,294')	9-1/4 Hycalog Diamond Drag #9756	11	11	100	99m 325'	48m 157'	42	628m 2,060'	
4	24°28.68'N 73°47.52'W August 29-31 5319m (17,452')	9-1/4 Hycalog Roller, Milled Cutter #18	5	5	100	45m 148'	14m 46'	31	259m 849'	
4A	24°28.68'N 73°47.52'W September 1-2, 1968 5319m (17,452')	9-1/4 Hycalog Diamond Drag #9756	3	3	100	18m 59'	62m 203'	34	207m 680'	
5	24°43.59'N 73°38.46'W September 4-5, 1968 5354m (17,567')	9-1/4 Hycalog Diamond #9757	3	3	100	25m 83'	6m 20'	25	79m 259'	

CORE BIT SUMMARY - LEG I

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
5A	24°43.59'N 73°38.46'W September 6-10, 1968 5354m (17,567')	9-1/4 Hycalog Diamond #9757	7	3	43	34m 111'	1m 3'	5	274m 900'	
6	30°50.39'N 67°38.86'W September 12-14, 1968 5124m (16,812')	9-1/4 Christensen Diamond Drag Unknown	6	6	100	46m 151'	26m 85'	56	256m 840'	
6A	30°50.39'N 67°38.86'W September 14-15, 1968 5124m (16,812')	9-1/4 Christensen Diamond Drag Unknown	1	1	100	8m 26'	9m 29'	104	24m 78'	Rerun
7	30°08.04'N 68°17.80'W September 16-17, 1968 5181m (17,000')	9-1/4 Christensen Diamond #Y2821	2	2	100	10m 32'	10m 32'	100	224m 735'	
7A	30°08.04'N 68°17.80'W September 18-19, 1968 5181m (17,000')	9-1/4 Christensen Diamond #Y2821	3	3	100	18m 59'	5m 16'	26	296m 971'	Rerun

CORE BIT SUMMARY - LEG 2

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
8	35°23.01'N 67°33.2'W October 4-6, 1968 5183m (17,006')	9-1/4 Hycalog Diamond DJ8 #10083	3	2	66	27m 89'	5m 16'	17	258m 847'	
8A	35°23.0'N 67°33.2'W October 6-8, 1968 5183m (17,006')	9-1/4 Hycalog Diamond DJ8 #10083	4	3	75	35m 115'	3m 10'	8	314m 1,030'	Rerun
9	32°46.4'N 59°11.7'W October 22-25, 1968 4973m (16,316')	9-1/4 Christensen - Diamond Tungsten Carbide #F1369	12	7	58	108m 354'	36 118'	34	491m 1,613'	
9A	32°46.4'N 59°11.7'W October 25-30, 1968 4973m (16,316')	9-1/4 Christensen - Diamond Tungsten Carbide #F1369	6	6	100	32m 105'	11m 35'	35	834m 2,736'	Rerun
10	32°51.7'N 52°12.9'W November 3-7, 1968 4711m (15,458')	9-1/4 Hycalog - Diamond Tungsten - Blade Bit #10085	20	20	100	171m 561'	76m 249'	45	459m 1,506'	
11	29°56.6'N 44°44.8'W November 9-10, 1968 3571m (11,716')	9-1/4 Hycalog- Diamond Tungsten Drag #10085	1	1	100	9 29'	6m 20'	66	24m 79'	Rerun

CORE BIT SUMMARY - LEG 2

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
11A	29°56.6'N 44°44.8'W November 10-12, 1968 3571m (11,716')	9-1/4 Hycalog Tungsten Drag #10085	8	3	37	52m 171'	7m 23'	13	285m 935'	Rerun
12	19°41.01'N 26°02.0'W November 17-19, 1968 4552m (14,936')	9-1/4 Hycalog Diamond Full Face #10084	0	0	0	0	0	0	0	Lost bottomhole assembly.
12A	19°41.01'N 26°02.01'W November 20, 1968 4556m (14,950')	9-1/4 Hycalog - Sinter Set Tungsten Massive #9754	0	0	0	0	0	0	0	Lost bottomhole assembly.
12B	19°41.7'N 26°00.0'W November 20-21, 1968 4556m (14,950')	9-1/4 Hycalog Blade W/Tungsten #9754	4	3	75	26m 85'	2m 7'	11	218m 715'	
12C	19°41.7'N 26°00.0'W November 21-22, 1968 4556m (14,950')	9-1/4 Hycalog Blade W/Tungsten #9754	12	10	83	118m 387'	30m 98'	26	115m 377'	
12D	19°41.7'N 26°00.0'W November 22-23, 1968 4556m (14,950')	9-1/4 Hycalog Blade W/Tungsten #9754	5	4	80	58m 190'	39m 128'	68	58m 190'	

CORE BIT SUMMARY - LEG 3

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
13	6°02.40'N 18°13.71'W December 3-5, 1968 4567m (14,986')	9-1/4 Hycalog Diamond DJ8P #10082	3	3	100	27m 89'	27m 89'	98	145m 476'	
13A	6°02.40'N 18°13.71'W December 6-11, 1968 4591m (15,064')	9-1/4 Hycalog Diamond DJ8P #10082	7	7	100	32m 105'	13m 43'	42	462m 1,517'	
14	28°19.89'S 20°56.46'W December 21-23, 1968 4340m (14,239)	9-1/4 Hycalog Diamond 0B5,FD-RWC #10182TC	11	11	100	92m 302'	80m 262'	87	108m 354'	Basement
15	30°53.38'S 17°58.99'W December 24-26, 1968 3924m (12,876')	9-1/4 Hycalog Diamond 0B5,FD-RWC #10182TC	11	11	100	83m 272'	81m 266'	98	142m 466'	Rerun
16	30°20.15'S 15°42.79'W December 27-28, 1968 3508m (11,509')	9-1/4 Hycalog Tungsten, WL BG WL #10051	12	11	91	101m 331'	100m 328'	99	175m 574'	Tungsten carbide bit with klustrite chips. Penetrated 5" basement.
17	28°02.74'S 6°36.15'W Dec 31, 1968 - Jan 2, 1969 4272m (14,017')	9-1/4 Hycalog Roller Milled Collar #22	5	5	100	36m 118'	36m 118'	100	92m 302'	

CORE BIT SUMMARY - LEG 3

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
17A	28°02.74'S 6°36.15'W Dec 31, 1968 - Jan 2, 1969 4272m (14,017)	9-1/4 Hycalog Roller Milled Collar #22	4	4	100	35m 115'	35m 114'	100	101m 331'	
17B	28°02.74'S 6°36.15'W Dec 31, 1968 - Jan 2, 1969 4272m (14,017')	9-1/4 Hycalog Rolled Milled Collar #22	5	4	80	37m 121'	36m 118'	96	124m 407'	
18	27°58.72'S 08°00.70'W January 3-4, 1969 4014m (13,172')	9-1/4 Christensen Diamond Drag #61805	7	7	100	53m 174'	53m 174'	99	178m 584'	Basalt
19	28°32.08'S 23°40.63'W January 7-9, 1969 4674m (15,337')	9-1/4 Christensen Diamond #PE61536	12	12	100	103m 338'	98m 321'	94	148m 486'	Basalt
20	28°31.57'S 26°50.58'W January 10-14, 1969 4480m (14,700'W)	9-1/4 Christensen Diamond 61536 #F2872	1	1	100	6m 20'	6m 20'	95	6m 20'	
20A	28°31.47'S 26°50.73'W January 10-14, 1969 4516m (14,819')	9-1/4 Christensen Diamond 61536 F2872	4	4	100	25m 83'	11m 35'	42	64m 210'	Rerun

CORE BIT SUMMARY - LEG 3

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
20B	28°31.47'S 26°50.73'W January 10-14, 1969 4516m (14,819')	9-1/4 Christensen Diamond 61536 #F2872	1	1	100	9m 29'	9m 29'	100	15m 49'	Rerun
20C	28°31.47'S 26°50.73'W January 10-14, 1969 4505m (14,780')	9-7/8 Hycalog Diamond 0B5FD-R WC #10190	6	6	100	50m 164'	49m 161'	98	70m 230'	Basalt - bit in good condition.
21	28°35.10'S 30°35.85'W January 15-17, 1969 2111m (6,928')	9-7/8 Hycalog Diamond 0B5FD-R WC #10190	9	9	100	71m 232'	73m 240'	100	130m 427'	Rerun
21A	28°35.10'S 30°35.85'W January 15-17, 1969 2111m (6,928')	9-7/8 Hycalog Diamond #10190	3	3	100	27m 89'	27m 89'	99	81m 266'	Rerun. Combination tungsten and diamond bit in good condition. Hole bad - no cores.
22	30°00.35'S 35°15.00'W January 18-20, 1969 650m (2,134')	9-7/8 Hycalog Diamond #10190	5	5	100	45m 147'	39m 128'	87	242m 794'	Rerun. Hole bad - no cores. Bit in good condition.

CORE BIT SUMMARY - LEG 4

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
23	6°08.75'S 31°02.60'W February 1-4, 1969 5079m (16,664')	9-1/4 Hycalog Diamond DJ8P #10291	9	7	77	72m 236'	23m 75'	31	207m 679'	
24	6°16.30'S 30°53.53'W February 4-6, 1969 5148m (16,889')	9-1/4 Hycalog Diamond DJ8P #10291	4	2	50	36m 118'	6m 20'	14	234m 768'	Rerun
24A	6°16.58'S 30°53.46°W February 6-8, 1969 5148m (16,889')	9-1/4 Hycalog Tungsten SS6WC #10239	4	4	100	35m 115'	4m 13'	9	551m 1,808'	
25	0°31.00'S 39°14.40'W February 10-11, 1969 1916m (6,286')	9-1/4 Hycalog Tungsten SS6WC #10240	9	5	55	64m 210'	26m 85'	40	65m 212'	
25A	0°31.00'S 39°14.14'W February 11, 1969 1916m (6,286')	9-1/4 Hycalog Tungsten SS6WC #10305	3	1	33	20m 65'	3m 10'	14	77 253'	Rerun
26	10°53.55'N 44°02.57'W February 14-16, 1969 5169m (16,954')	9-1/4 Hycalog Tungsten SS6WC #10305	1	0	0	10m 32'	0 0	0	9m 29'	

CORE BIT SUMMARY - LEG 4

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
26A	10°53.55'N 44°02.57'W February 16-20, 1969 5185m (17,014')	9-1/4 Hycalog Tungsten SS6WC #10305	5	5	100	44m 144'	14m 46'	31	48m 157'	Rerun
27	15°51.39'N 56°52.76'W February 24-26, 1969 5521m (17,223')	9-1/4 Hycalog Diamond DJ8P #10292	7	7	100	56m 184'	30m 98'	52	170m 558'	
27A	15°51.39'N 56°52.76'W February 26-27, 1969 5521m (17,223')	9-1/4 Hycalog Diamond DJ8P #10292	5	5	100	46m 151'	32m 105'	68	81m 266'	
28	20°35.19'N 65°37.33'W March 3-7, 1969 5521m (18,109')	9-1/4 Hycalog Diamond DJ8P #10291	9	7	77	65m 212'	15m 49'	21	405m 1,329'	Rerun
29	14°47.11'N 69°19.36'W March 9-10, 1969 4247m (13,933')	9-1/4 Hycalog Tungsten SS6WC #10242	20	19	95	163m 535'	85m 279'	52	228m 748'	
29A	14°47.11'N 69°19.36'W March 10-11, 1969 4247m (13,933)	9-1/4 Hycalog Tungsten SS6WC #10242	5	5	100	45m 148'	4m 13'	7	86m 282'	Rerun

CORE BIT SUMMARY - LEG 4

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
29B	14°47.11'N 69°19.36'W March 11-12, 1969 4247m (13,933')	9-1/4 Hycalog Tungsten SS6WC #10242	10	10	100	87m 285'	52m 171'	61	231m 758'	Rerun
29C	14°47.11'N 69°19.36'W March 12-14, 1969 4247m (13,933')	9-1/4 Hycalog Diamond DJ9P #10292	3	3	100	1m 3'	2m 7'	7	249m 817'	Rerun
30	12°52.92'N 63°23.10'W March 16-17, 1969 1218m (3,994')	9-1/4 Hycalog Tungsten SS6WC #10295	16	16	100	135m 436'	63m 207'	44	432m 1,417'	
31	14°56.60'N 72°01.63'W March 19-21, 1969 3369m (11,049')	9-1/4 Hycalog Diamond DJ89 #10386	10	10	100	91m 297'	42m 138'	45	306m 1,004'	

CORE BIT SUMMARY - LEG 5

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
32	37°07.63'N 127°33.38'W April 15-18, 1969 4758m (15,605')	9-5/8 Hycalog Diamond DB SD #10419	14	13	92	112m 367'	86m 282'	77	215m 705'	Rerun
33	39°28.48'N 127°29.81'W April 20-22, 1969 4284m (14,051')	9-7/8 Hycalog Diamond DBSD #10455	15	15	100	121m 398'	111m 364'	92	295m 967'	Rerun
34	39°28.21'N 127°16.54'W April 23-28, 1969 4322m (14,175')	9-7/8 Hycalog Diamond - DSFD-8P #10386	18	18	100	135m 443'	105m 345'	78	384m 1,260'	Rerun
35	40°40.42'N 127°28.48'W April 28-May 6, 1969 3373m (11,063')	9-7/8 Hycalog Diamond - DBFD #10460	17	17	100	140m 459'	95m 312'	68	389m 1,276'	
36	40°59.08'N 130°06.58'W May 6-9, 1969 3273m (10,735')	9-7/8 Hycalog Diamond - DBFD #10460	14	14	100	113m 371'	112m 367'	99	115m 377'	Rerun
37	40°58.74'N 140°43.11'W May 9-12, 1969 4682m (15,356')	9-7/8 Hycalog Diamond - DBFD-5R #10459	5	4	80	31m 102'	30m 98'	98	31m 102'	

CORE BIT SUMMARY - LEG 5

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
38	38°42.12'N 140°21.27'W May 12-15, 1969 5137m (16,849')	9-7/8 Hycalog Diamond - DBFD-5R #10454	6	6	100	47m 154'	47m 154'	100	47m 154'	
39	32°48.28'N 139°34.29'W May 15-17, 1969 4929m (16,165')	9-7/8 Hycalog Diamond - DBFD-5R #10454	2	2	100	16m 53'	16m 53'	100	17m 56'	
40	19°47.57'N 139°54.08'W May 17-22, 1969 5183m (16,999')	9-7/8 Hycalog DBFD-5R #10459	19	18	95	153m 502'	128m 420'	84	156m 512'	
41	19°51.25'N 140°02.88'W May 23-25, 1969 5339m (17,515')	9-7/8 Hycalog Diamond - DBFD-5R #10458	5	4	80	33m 108'	25m 83'	77	34m 112'	
42	13°50.56'N 140°11.31'W May 26-28, 1969 4848m (15,901')	9-7/8 Hycalog Diamond - DBFD-8P #10386	11	11	100	100m 328'	92m 302'	92	99m 325'	Rerun
42A	13°50.56'N 140°11.31'W May 28-29, 1969 4848m (15,901')	9-5/8 Hycalog Diamond - DBFD-8P #10386	3	2	66	8m 26'	7m 23'	87	113m 371'	Rerun

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CORE BIT SUMMARY - LEG 5

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
43	17°06.59'N 151°22.51'W June 2-3, 1969 5405m (17,728')	9-1/4 Hycalog Tungsten - WLB6-WC #9753	2	2	100	8m 26'	8m 26'	100	9m 29'	

CORE BIT SUMMARY - LEG 6

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
44	19°18.5'N 169°00.0'W June 14-15, 1969 1478m (4,848')	9-7/8 Hycalog Diamond DBPD-5R #10581	5	5	100	32m 105'	28m 92'	87	76m 249'	
45	24°15.9'N 178°30.5'W June 17-20, 1969 5507m (18,063')	9-7/8 Hycalog Diamond DBPD-5R #10456	1	0	0	9m 29'	0 0	0	97m 318'	
45A	24°15.9'N 178°30.5'W June 19-20, 1969 5507m (18,063')	9-7/8 Hycalog Tungsten SS6WC #10585	4	3	75	35m 115'	7m 23'	19	117m 385'	
46	27°58.8'N 171°26.3'E June 25, 1969 5773m (18,935')	9-7/8 Hycalog Diamond #10580	1	1	100	9m 29'	9m 29'	100	10m 32'	
47	32°26.9'N 157°42.7'E June 28-30, 1969 2689m (8,820°)	9-5/8 Hycalog Diamond DJFD-8P #10577	1	1	100	9m 29'	9m 29'	100	129m 423'	
47A	32°26.9'N 157°42.7'E June 28-30, 1969 2689m (8,820')	9-5/8 Hycalog Diamond DJFD-8P #10517	2	1	50	10m 32'	2m 7'	23	123m 405'	

CORE BIT SUMMARY - LEG 6

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
47B	32°26.9'N 157°42.7'E June 28-30, 1969 2689m (8,820')	9-5/8 Hycalog Diamond-DJFD-8P #10517	14	14	100	120m 394'	103m 340'	86	140m 460'	
48	32°24.5'N 158'01.3'E June 30 - July 1, 1969 2619m (8,590')	9-5/8 Hycalog Diamond DJFD-8P #10515	1	0	0	9m 29'	0 0	0	84m 310'	
48A	32°24.5'N 158°01.3'E June 30 - July 1, 1969 2619m (8,590')	9-5/8 Hycalog Diamond DJFD-8P #10515	1	1	100	1m 3'	1m 3'	66	59m 195'	
48B	32°24.5'N 158°01.3'E June 30 - July 1, 1969 3619m (8,590')	9-5/8 Hycalog Diamond DJFD-8P #10515	3	3	100	21m 69'	21m 69'	100	62m 203'	
49	32°24.1'N 156°35.01'E July 2-3, 1969 4282m (14,045')	9-7/8 Hycalog Diamond DBFD-7 #10462	2	2	100	9m 29'	9m 29'	100	18m 59'	
49A	32°24.1'N 156°35.0°E July 2-3, 1969 4282m (14,045')	9-7/8 Hycalog Diamond DBFD-7 #10462	2	2	100	14m 46'	10m 32'	69	15m 49'	Rerun

CORE BIT SUMMARY - LEG 6

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
50	32°24.3'N 156°36.01'E July 3, 1969 4487m (14,717')	9-7/8 Hycalog Tungsten Carbide #10583	2	1	50	7m 23'	2m 7'	39	45m 148'	
50A	32°24.3'N 156°36.0'E July 3-4, 1969 4487m (14,717')	9-7/8 Hycalog Tungsten Carbide #10583	4	4	100	31m 102'	25m 83'	82	36m 118'	Rerun
51	33°28.5'N 153°24.3'E July 4-5, 1969 5980m (19,614')	9-7/8 Christensen Diamond 4580 #110586	3	2	66	17m 56'	9m 29'	54	132m 433'	
51A	33°28.5'N 153°24.3'E July 5-6, 1969 5980m (19,614')	9-7/8 Christensen Diamond 4580 #110586	2	2	100	15m 49'	11m 35'	75	111m 364'	Rerun
52	27°46.3'N 147°07.8'E July 9-10, 1969 5744m (18,840')	9-5/8 Hycalog Tungsten SSPD 3 WV #10582	10	10	100	68m 223'	45m 148'	66	69m 226'	
53	18°02.0'N 141°11.5'E July 13-16, 1969 4690m (15,383')	9-7/8 Hycalog Diamond DBFD5R #10579	8	8	100	35m 115'	14m 46'	41	100m 328'	

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CORE BIT SUMMARY - LEG 6

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
53A	18°02.02'N 141°11.5°E July 16-17, 1969 4639m (15,221')	9-7/8 Hycalog Diamond DBPD-5R #10579	3	3	100	27m 89'	25m 83'	92	62m 205'	Rerun
53B	18°02.02'N 141°11.5'E July 17, 1969 4651m (15,262°)	9-7/8 Hycalog Diamond DBFD-5R #10579	1	1	100	9m 29'	9m 29'	100	21m 71'	Rerun
54	15°36.6'N 140°18.1'E July 17-19, 1969 4990m (16,367')	9-5/8 Hycalog Tungsten SSFD-3W #10584	9	9	100	65m 212'	28m 92'	43	294m 963'	Basalt
55	09°18.1'N 142°32.9'E July 21-22, 1969 2850m (9,348')	9-7/8 Hycalog Diamond #10579	14	14	100	128m 420'	122m 400'	95	131m 430'	
56	08°22.4'N 143°33.6'E July 23-25, 1969 2508m (8,226')	9-7/8 Hycalog Diamond DBFD-5R #10579	0	0	0	0	0	0	0	Rerun - no cores - lost beacon.
56A	08°22.4'N 143°33.6'E July 23-25, 1969 2508m (8,226')	9-7/8 Hycalog Diamond DBFD-5R #10579	0	0	0	0	0	0	0	Rerun

CORE BIT SUMMARY - LEG 6

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
56B	08°22.4'N 143°33.6'E July 25, 1969 2508m (8,226')	9-7/8 Hycalog Diamond BDFD-5R #10579	10	10	100	91m 299'	88m 289'	96	270m 886'	Rerun
57	08°40.9'N 143°32.0'E July 25-28, 1969 3310m (10,857')	9-5/8 Hycalog Diamond DJFD-8P #10576	3	3	100	9m 29'	39m 128'	39	335m 1,099	Basalt 10 feet.
57A	08°40.9'N 143°32.9°E July 28, 1969 3310m (10,857')	9-5/8 Hycalog Diamond DJFD-8P #10576	4	4	100	31m 103'	23m 75'	73	329m 1,079'	Basalt - rerun.
57B	08'40.9'N 143'32.0'E July 28, 1969 3310m (10,857')	9-5/8 Hycalog Diamond DJFD-8P #10576	1	1	100	9m 29'	9m 29'	100	9m 29'	Rerun
58	09°14.1'N 144°25.1'E July 28-30, 1969 4496m (14,747')	9-5/8 Hycalog Diamond DJPD-8P #10576	1	1	100	5m 15'	0 1/4'	6 20'	24m 79'	Rerun
58A	09°14.1'N 144°25.1'E July 29, 1969 4496m (14,747')	9-5/8 Hycalog Diamond DJFD-8P #10576	2	1	50	9m 29'	4m 13'	50	141m 463'	Rerun

CORE BIT SUMMARY - LEG 6

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
58B	09.14'N 144°25.1'E July 30, 1969 4496m (14,747')	9-5/8 Hycalog Diamond- DJFD-8P #10576	1	1	100	10m 32'	10m 32'	100	120m 395'	Rerun
59	11°46.8'N 147°34.9'E July 31 - August 2, 1969 5547m (18,194')	9-7/8 Hycalog Diamond DBFD-5R #10457	1	0	0	1m 3'	1m 3'	0	123m 404'	
59A	11°46.8'N 147°34.9'E August 2, 1969 5547m (18,194')	9-7/8 Hycalog Diamond DBFD-5R #10457	3	1	33	28m 92'	3m 10'	11	67m 220'	
59B	11°46.8'N 147°34.9'E August 2, 1969 5547m (18,194')	9-7/8 Hycalog Diamond DBFD-5R #10457	6	6	100	46m 151'	22m 72'	47	135m 443'	
60	13°40.0'N 145°41.9'E August 3-5, 1969 3728m (12,228')	9-7/8 Hycalog Diamond DBFD-5R #10457	9	9	100	55m 180'	35m 115'	64	348m 1,142'	

CORE BIT SUMMARY - LEG 7

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
61	12°05.02'N 147°03.70'E August 11, 1969 5570m (18,270')	9-5/8 Hughes - Roller Insert Tungsten Carbide # Unknown	2	2	100	13m 43'	3m 10'	23	101m 330'	7' basalt.
61A	12°05.02'N 147°03.70'E August 12, 1969 5570m (18,270')	9-5/8 Hughes - Roller Insert Tungsten Carbide # Unknown	1	1	100	13m 43'	3m 10'	26	99m 325'	Rerun - T-1, B-3.
62	1°52.2'N 141°56.3'E August 15-18, 1969 2602m (8,533')	9-7/8 Hycalog DBFD-5-R #10457	8	8	100	51m 168'	44m 144	87	574m 1,883'	Rerun
62A	1°52.2'N 141°56.3'E August 19-21, 1969 2607m (8,553')	9-7/8 Hycalog DBFD-5R #10457	39	39	100	345m 1,132'	311m 1,020'	90	358m 1,175'	Rerun
63	0°50.13'N 147°53.39'E August 23-26, 1969 4486m (14,714')	9-5/8 Hughes - Insert Roller Tungsten Carbide # Unknown	11	11	100	86m 282'	62m 203'	73	566m 1,857'	Rerun
63A	0°50.13'N 147°53.39'E August 27, 1969 4486m (14,714')	9-5/8 Hughes - Insert Roller Tungsten Carbide # Unknown	14	14	100	130m 428'	90m 294'	68	193m 634'	

CORE BIT SUMMARY - LEG 7

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
63B	0°50.13'N 147°53.39'E August 28, 1969 4486m (14,714')	9-5/8 Hughes - Insert Roller Tungsten Carbide Unknown	3	3	100	28m 92'	22m 72'	76	39m 128'	T-8, B-8
64	1°44.53'S 158°36.58'E August 31 - September 2,1969 2060m (6,758')	9-7/8 Hycalog DBFD-5R #10461	10	10	100	81m 266'	75m 247'	93	853m 2,798'	80% salvage.
64A	1°44.53'S 158°36.58'E September 3-6, 1969 2060m (6,758')	9-7/8 Christensen 110927-25 #R3460	11	11	100	67m 220'	68m 223'	100	990m 3,247'	
65	4°21.21'N 176°59.14'E September 12-14, 1969 6142m (20,146')	9-7/8 Hycalog DBFD-5R #10461	16	16	100	145m 476'	132m 433'	91	145m 476'	Rerun
65A	4°21.21'N 176°59.16'E September 15, 1969 6142m (20,146')	9-7/8 Hycalog DBFD-5R #10461	8	8	100	52m 170'	17m 56'	32	187m 614'	Rerun - 60% salvage.
66	2°23.61'N 166°7.31'W September 19-21, 1969 5310m (17,417')	9-7/8 Christensen 110927 #R3663	11	11	100	72m 236'	49m 161'	68	193m 633'	

CORE BIT SUMMARY - LEG 7

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
66A	2°22.61'N 166°7.31'W September 22, 1969 5326m (17,468°)	9-7/8 Christensen 110927 #R33633	8	8	100	68m 223'	66m 217'	97	70m 230'	Rerun - 20% salvage.
67	24°22.56'N 157°38.88'W September 29-30, 1969 4486m (14,714')	9-7/8 Christensen 110927 #R3458	1	1	100	4m 13'	1m 3'	33	4m 13'	
67A	24°22.56'N 157°38.88'W October 1, 1969 4484m (14,709')	9-7/8 Christensen 110927 #3458	2	2	100	10m 32'	2m 6'	18	60m 197'	30% salvage.

CORE BIT SUMMARY - LEG 8

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
68	16°43.32'N 165°10.36'W October 10-12, 1969 5466m (17,936')	9-7/8 Hycalog Diamond - SSFD3 #10864	2	2	100	15m 49'	15m 49'	100	15m 49'	Lost in hole.
68A	16°43.32'N 164°10.36'W October 13, 1969 5476m (17,969')	9-7/8 Hycalog MHJ-8P - 500 K #10920	0	0	0	0	0	0	12m 39'	U'nsuccessful due to heave of the ship. Turbocorer would not tum.
69	6°0.0'N 152°51.93'W October 17-20, 1969 4978m (16,332')	9-7/8 Hycalog Tungsten - Sinter Set #10863	7	6	86	60m 196'	46m 151'	77	232m 762'	
69A	6°0.0'N 152°51.93'W October 20, 1969 4988m (16,365')	9-7/8 Hycalog Tungsten - Sinter Set #10863	13	12	92	108m 354'	93m 305'	86	230m 755'	Rerun
70	6°20.08'N 140°21.72'W October 23-27, 1969 5059m (16,596')	9-7/8 Christensen - 520K Diamond - Circle Set #R3476	12	12	100	108m 355'	69m 226'	91	113m 371'	
70A	6°20.08'N 140°21.72'W October 27-29, 1969 5068m (16,629')	9-7/8 Christensen - 520K Diamond - Circle Set #R3476	30	29	97	218m 715'	145m 476'	67	331m 1,085'	Rerun - 90% salvage.

CORE BIT SUMMARY - LEG 8

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
70B	6°20.08'N 140°21.70'W October 29-November 1,1969 5068m (16,629')	9-7/8 Christensen - 520K Diamond - Circle Set #R3477	4	4	100	5m 16'	3m 10'	71	388m 1,273'	TD - chert - 90% salvage.
71	4°28.28'N 140°18.91'W November 2-10, 1969 4419m (14,497')	9-7/8 Christensen - 520K Diamond - Circle Set #R3476	50	49	98	442m 1,451'	369m 1,211'	82	476m 1,561'	30% salvage
71A	4°28.28'N 140°18.91'W November 8-10, 1969 4428m (14,530')	9-7/8 Williams - 250K Diamond - WP-8H #Z958	3	3	100	14m 46'	6m 20'	42	558m 1,830'	20% salvage
71B	4°28.28'N 140°18.91'W November 9-10, 1969 4428m (14,530')	9-7/8 Williams - 250K Diamond - WP-8H #Z958	0	0	0	0	0	0	250m 820'	Rerun - drilled as heat probe hole. Salvage 85%.
72	0°26.49'N 138°52.02'W November 12-15, 1969 4326m (14,192')	9-7/8 Christensen Diamond - 225K #R3464	11	11	100	88m 289'	86m 282'	97	345m 1,132'	TD - chert.
72A	00°26.49'N 138°52.05'W November 15, 1969 4335m (14,225')	9-7/8 Christensen Diamond - 225K #R3464	6	6	100	55m 180'	49m 161'	90	64m 210'	Rerun

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CORE BIT SUMMARY - LEG 8

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
72B	00°26.49'N 138°52.02'W November 15, 1969 4335m (14,225')	9-7/8 Christensen - 225K Diamond - 110927 #R3464	0	0	0	0	0	0	181m 595'	Rerun - drilled as heat probe hole. Salvage 10%.
73	1°54.58'S 137°28.12'W November 17-19, 1969 4387m (14,360')	9-7/8 Christensen - 225K Diamond - 110927 #R3457	21	20	95	174m 570'	170m 558'	98	303m 994'	TD - chert - 10% salvage.
74	6°14.20'S 136°05.80'W November 21-22, 1969 4431m (14,536')	9-7/8 Christensen - 225K Diamond - 110927 #R3465	12	12	100	101m 331'	74m 242'	72	101m 331'	Sample of basalt. Salvage 15%.
75	12°31.00'S 134°16.00'W November 24-27, 1969 4181m (13,716')	9-7/8 Christensen - 225K Diamond - 110927 #R3456	9	9	100	82m 268'	66m 217'	85	82m 268'	Chert - salvage 65%.

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CORE BIT SUMMARY - LEG 9

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
76	14°05.90'S 145°37.04'W December 9, 1969 4598m (15,085')	9-7/8 Williams 250K Diamond - WP-8H #Z958	1	1	100	9m 29'	9m 29'	100	32m 105'	Chert
76A	14°05.90'S 145°37.04'W December 10, 1969 4598m (15,085')	9-7/8 Williams - 250K Diamond - WP-8H #Z958	2	2	100	18m 59'	17m 56'	92	27m 89'	Rerun - lost in hole.
77	00°28.90'N 133°13.71'W December 16, 1969 4291m (14,077')	10-1/8 Smith Tungsten - 9C - 4CTR #CM9385	1	1	100	9m 29'	1m 3'	13	9m 29'	
77A	00°28.90'N 133°13.71'W December 16, 1969 4291m (14,077')	10-1/8 Smith Tungsten - 9C - 4CTR #CM9385	2	2	100	18m 59'	9m 29'	50	18m 59'	Rerun
77B	00°28.90'N 133°13.71'W December 17-22, 1969 4291m (14,077')	10-1/8 Smith Tungsten - 9C - 4CTR #CM9385	54	53	98	472m 1,549'	438m 1,436'	93	481m 1,579'	Rerun
77C	00°28.90'N 133°13.71'W December 22, 1969 4291m (14,077')	10-1/8 Smith Tungsten - 9C - 4CTR #CM9385	1	1	100	9m 29'	8m 26'	83	101m 331'	Rerun - inserts show little wear.

CORE BIT SUMMARY - LEG 9

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
78	07°57.00'N 127°21.35'W December 26-29, 1969 4378m (14,363')	10-1/8 Smith Tungsten - 9C - 4CTR #CM9385	37	37	100	320m 1,051'	302m 991'	94	302m	Rerun - T-1, B-6, IG.
79	02°33.02'N 121°34.00°W January 1-2, 1970 4574m (15,006')	9-7/8 Varel Diamond - 250K #7905	17	17	100	133m 437'	121m 397'	90	417m 1,363'	
79A	02°33.02'N 121°34.00'W January 3-4, 1970 4574m (15,006')	9-7/8 Varel Diamond - 250K #7905	4	4	100	37m 121'	35m 115'	95	288m 944'	Rerun - salvage 95%.
80	00°57.72'S 121°33.22'W January 5, 1970 4411m (14,472'	9-7/8 Varel Diamond - 250K #7905	6	6	100	42m 138'	40m 131'	94	200m 656'	Rerun
80A	00°57.72'S 121°33.22'W January 6-7, 1970 4411m (14,472')	9-7/8 Varel Diamond - 250K #7905	5	5	100	88m 289'	85m 279'	97	156m 511'	Rerun
81	01°26.49'N 113°48.54'W January 9-11, 1970 3865m (12,681')	9-7/8 Varel Diamond - 250K #7902	7	7	100	39m 128'	39m 128'	100	409m 1,343'	

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CORE BIT SUMMARY - LEG 9

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
82	02°35.48'N 106°56.52'W January 14-15, 1970 3707m (12,161')	9-7/8 Varel Diamond - 250K #7902	7	7	100	50m 165'	46m 151'	91	217m 713'	Rerun
82A	02°35.48'N 106°56.52'W January 15, 1970 3707m (12,161')	9/7/8 Varel Diamond - 250K #7902	3	3	100	36m 118'	27m 89'	71	110m 361'	Rerun - 5% salvage.
83	04°02.8'N 95°44.25'W January 18, 1970 3646m (11,961')	9-7/8 Varel Diamond - 500K #7901	9	9	100	62m 203'	47m 155'	77	241m 790'	
83A	04°02.8'N 95°44.25'W January 19-20, 1970 3646m (11,961')	9-7/8 Varel Diamond - 500K #7901	16	16	100	177m 580'	172m 564'	97	251m 823'	Rerun - soft basalt - 95% salvage.
84	05°44.92'N 82°53.29'W January 24-26, 1970 3097m (10,591')	9-7/8 Varel Diamond - 500K #7901	30	30	100	254m 833'	214m 702'	85	254m 833'	Rerun - 90% salvage.

CORE BIT SUMMARY - LEG 10

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
85	22°50.49'N 91°25.37'W February 22, 1970 3749m (12,300')	9-7/8 Williams Diamond #2963	5	5	100	39m 128'	27m 89'	68	210m 690'	No salvage.
85A	22°50.49'N 91°25.37'W February 24, 1970 3749'm (12,300')	9-7/8 Smith - 4 Cone Roller Tungsten #DF023E	0	0	0	0	0	0	305m 1,000'	
86	22°52.48'N 90°57.75'W February 25-26, 1970 1481m (4,859')	9-7/8 Smith - 4 Cone Roller Tungsten #DF023E	13	9	69	100m 328'	43m 141'	43	673m 2,208'	Rerun - hard dolomite.
87	23°00.90'N 92°05.16'W March 1-2, 1970 3761m (12,340')	9-7/8 Varel Diamond - 500K #7922	1	1	100	8m 26'	2m 7'	30	701m 2,300'	Lost in hole.
88	21°22.93'N 94°00.21'W March 4, 1970 2532m (8,307')	9-7/8 Varel Diamond - 140 #7918	5	5	100	35m 115'	33m 108'	94	139m 456'	100% salvage
89	20°53.41'N 95°06.73'W March 6-7, 1970 3067m (10,063')	9-7/8 Varel Diamond - 140 #7918	6	6	100	39m 128'	26m 85'	67	430m 1,410'	Rerun - 99% salvage.

CORE BIT SUMMARY - LEG 10

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
90	23°47.80'N 94°46.09'W March 9-11, 1970 3713m (12,182')	9-7/8 Williams Diamond #Z966	13	11	85	85m 279'	52m 171'	61	664m 2,179'	30% salvage.
91	23°46.40'N 93°20.77'W March 12-15, 1970 3763m (12,346')	9-7/8 Williams Diamond #Z968	25	25	100	206m 675'	148m 487'	72	896m 2,940'	45% salvage.
92	25°50.69'N 91°49.29'W March 16-17, 1970 2573m (8,442')	9-7/8 Williams Diamond #Z969	11	10	91	70m 229'	41m 135'	59	281m 922'	95% salvage.
92A	25°50.71'N 92°49.33'W March 19, 1970 2573m (8,442')	9-7/8 Williams Diamond #Z969	0	0	0	0	0	0	131m 430'	Rerun - 95% salvage.
93	22°37.25'N 91°28.78'W March 20, 1970 3090m (10,138')	9-7/8 Varel Mis. Diamond #7918	1	1	100	2m 7'	2m 7'	100	20m 65'	
93A	22°37.25'N 91°28.78'W March 20, 1970 3090m (10,138')	9-7/8 Varel Mis. Diamond #7920	0	0	0	0	0	0	8m 26'	

CORE BIT SUMMARY - LEG 10

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
94	24°31.64'N 88°28.16'W March 22-26, 1970 1793m (5,883')	9-7/8 Varel Mis. Diamond #7917	40	38	95	287m 941'	177m 581'	61	664m 2,178'	
95	24°09.00'N 86°23.85'W March 27-30, 1970 1633m (5,358')	9-7/8 Varel Mis. Diamond #7904	22	22	100	166m 544'	120m 394'	72	463m 1,520'	
96	23°44.56'N 85°45.80'W March 30-31, 1970 3439m (11,283')	9-7/8 Varel Mis. Diamond #7919	5	5	100	38m 125'	28m 92'	74	323m 1,060'	
97	23°53.05'N 84°26.74'W April 1-3, 1970 2930m (9,613')	9-7/8 Varel Mis. Diamond #7917	12	12	100	62m 203'	36m 118'	58	339m 1,112'	

CORE BIT SUMMARY - LEG 11

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
98	25°23.95'N 77°18.67'W April 9-11, 1970 2779m (9,118')	10-1/8 Smith - Roller Type Tungsten - 9C Insert #DZ520	15	15	100	122m 400'	80m 262'	65	357m 1,171'	T-1, B-2 Chert in layers.
99	23°41.10'N 73°51.00'W April 14-15, 1970 4924m (16,156')	10-1/8 Smith - Roller Type Tungsten - 9C Insert #EA385	0	0	0	0	0	0	85m 279'	Lost in hole.
99A	23°41.18'N 73°50.93'W April 16-19, 1970 4924m (16,156')	10-1/8 Smith - Roller Type Tungsten - 9C Insert #EA116	15	12	80	93m 305'	29m 96'	31	265m 870'	
100	24°41.27'N 74°47.98'W April 20-24, 1970 5334m (17,504')	10-1/8 Smith - Roller Type Tungsten - 9C Insert #EA069	13	13	100	93m 305'	29m 95'	31	331m 1,085'	
101	25°11.56'N 74°26.19'W April 26, 1970 4878m (16,005')	10-1/8 Smith - Roller Type Tungsten - 9C Insert #DZ520	2	2	100	18m 59'	16m 53'	88	28m 92'	Rerun
101A	25°16.56'N 74°26.19'W April 27-29, 1970 4878m (16,005')	10-1/8 Smith - Roller Type Tungsten - 9C Insert #DZ520	10	10	100	89m 292'	23m 75'	26	642m 2,106'	Rerun - T-3, B-8

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CORE BIT SUMMARY - LEG 11

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
102	30°43.56'N 74°27.05'W May 1-4, 1970 3436m (11,274')	9-7/8 Varel Diamond - 250K #7906	19	19	100	109m 358'	105m 344'	96	661m 2,168'	95% salvage
103	30°27.08'N 74°34.99'W May 6, 1970 3974m (13,039')	9-7/8 Williams Diamond - TC Drag #Z961	7	7	100	62m 204'	39m 128'	63	449m 1,473'	90% salvage 90% salvage
104	30°49.65'N 74°19.64'W May 7, 1970 3841m (12,537')	10-1/8 Smith - Roller Type Tungsten - 9C - 3 Cone #EA116	10	9	90	83m 272'	56m 184'	68	617m 2,024'	Rerun - T-2, B-8
105	34°53.72'N 69°10.41'W May 13-19, 1970 5261m (17,261'	10-1/8 Smith - 4 Cone Tungsten - 9C #CM938E	43	42	93	341m 1,119'	196m 643'	57	633m 2,076'	
106	36°26.05'N 69°27.69'W May 20-22, 1970 4510m (14,797'	9-7/8 Williams Diamond #Z961	6	6	100	48m 157'	25m 83'	53	360m 1,181'	Rerun - Lost in hole.
106A	36°25.28'N 69°25.77'W May 23, 1970 4514m (14,810')	9-7/8 Williams Diamond #Z961	0	0	0	0	0	0	0	Rerun

CORE BIT SUMMARY - LEG 11

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
106B	36°25.28'N 69°25.77'W May 24-26, 1970 4514m (14,810')	9-7/8 Williams Diamond #Z967	8	8	100	55m 181'	39m 128'	70	1015m 3,330'	
107	38°39.71'N 72°28.74'W May 28, 1970 2581m (8,468')	10-1/8 Smith - Roller Type Tungsten - 9C - Insert #EH584	2	1	50	11m 35'	2m 7'	17	77m 252'	
108	38°48.27'N 72°39.21'W May 29, 1970 1855m (6,086')	9-7/8 Hycalog Diamond - 500K #10920	3	2	67	50m 164'	8m 26'	16	229m 751'	95% salvage
109	37°59.04'N 71°46.71'W June 7-10, 1970 3053m (10,017')	9-7/8 Varel Diamond #7906	2	2	100	5m 16'	3m 10'	50	27m 89'	Rerun - Re-entry
110	38°02.92'N 71°45.61'W June 11-15, 1970 3040m (9,974')	9-1/4 Hycalog Tungsten - SS6WC #10241	1	1	100	3m 10'	3m 10'	100	3m 10'	Re-entry

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CORE BIT SUMMARY - LEG 12

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
111	50°25.57'N 46°22.05'W June 25-26, 1970 1811m (5,942')	9-7/8 Christensen Diamond - 500K #1927	7	6	86	48m 158'	15m 49'	31	247m 810'	TD - hard sand.
111A	50°25.57'N 46°22.05'W June 26-28, 1970 1811m (5,942')	9-7/8 Christensen Diamond #1927	12	12	100	94m 308'	59m 194'	63	199m 650'	Rerun - 5% salvage.
112	54°01.00'N 48°36.24'W June 29-July 1, 1970 3667m (12,031')	10-1/8 Smith Tungsten - 3 Cone #EH584	17	17	100	145m 476'	75m 246'	51	663m 2,175'	Rerun - basalt.
112A	54°01.00'N 46°36.24'W July 2-3, 1970 3667m (12,031')	10-1/8 Smith Tungsten - 3 Cone #EH584	5	5	100	45m 148'	32m 105'	71	124m 407'	Rerun - T-2, B-6.
113	56°47.40'N 48°19.91'W July 4-8, 1970 3629m (11,907')	10-1/8 Smith - Extended Tungsten - 9C #EV643	12	10	83	76m 249'	30m 98'	39	923m 3,028'	T-1, B-2 - no basalt.
114	59°56'N 26°48'W July 11-13, 1970 1937m (6,335')	10-1/8 Smith Tungsten - 9C - 4 Cone #EV638	9	7	78	60m 197'	46m 151'	76	623m 2,044'	TD - basalt.

CORE BIT SUMMARY - LEG 12

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
115	58°54.4'N 21°07.0'W July 14-16, 1970 2893m (9,492')	10-1/8 Smith - Extended Tungsten - 9C #EV640	8	8	100	55m 180'	9m 29'	17	227m 745'	TD - volcanic ash. T-1, B-5
116	57°29.7'N 15°55.5'W July 17-20, 1970 1161m (3,809')	10-1/8 Smith - Extended Tungsten - 9C #EV644	28	28	100	226m 742'	195m 640'	87	854m 2,802'	TD - hard cherty lime.
116A	57°29.7'N 15°55.5'W July 21, 1970 1161m (3,809')	10-1/8 Smith - Extended Tungsten - 9C #EV644	11	11	100	99m 324'	90m 295'	90	99m 325'	Rerun - T-1, B-6.
117	57°19.5'N 15°23.0'W July 22, 1970 1048m (3,438')	10-1/8 Smith Tungsten - 9C - 4 Cone #EV637	3	3	100	20m 66'	9m 29'	44	156m 512'	T-2, B-6
117A	57°19.5'N 15°23.0'W July 23-24, 1970 1048m (3,438')	10-1/8 Smith Tungsten - 9C - 3 Cone #EV641	11	10	90	66m 217'	34m 112'	52	313m 1,027'	Ok for rerun.
118	45°02.9'N 9°00.5'W July 29 - August 2, 1970 4901m (16,080')	10-1/8 Smith Tungsten - 9C - 3 Cone #EV639	21	21	100	147m 482'	52m 171'	36	761m 2,497'	T-1, B-7 - basalt.

CORE BIT SUMMARY - LEG 12

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
119	48°02.3'N 7°58.8'W August 2-8, 1970 4447m (14,591')	10-1/8 Smith Tungsten - 9C #EV642	40	40	100	368m 1,207'	192m 630'	52	711m 2,333'	T-1, B-1

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CORE BIT SUMMARY - LEG 13

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
120	36°41.39'N 11°29.94'W August 14-17, 1970 1721m (5,647')	10-1/8 Smith Tungsten - 9C #EV643	8	8	100	25m 83'	6m 20'	23	252m 827'	Rerun - T-1, B-8.
121	36°09.60'N 04'23.00'W August 17-21, 1970 1173m (3,849')	9-7/8 Reed Roller - PD-20 #9117	23	23	96	161m 528'	46m 151'	29	867m 2,844'	T-8, B-8 - basalt.
122	40°26.87'N 02'37.46'E August 21-24, 1970 2156m (7,074')	9-7/8 Reed Roller - PD-20 #8093	4	3	75	30m 98'	5m 16'	17	192m 630'	T-1, B-1, IG
123	40°37.33'N 02'50.47'E August 24-25, 1970 2300m (7,546')	9-7/8 Reed Roller - PD-20 #8093	8	7	88	71m 233'	19m 62'	28	398m 1,306'	Rerun - T-3, B-3.
124	38°52.40'N 04°59.70'E August 25-29, 1970 2736m (8,977')	9-7/8 Hycalog Tungsten - SS PD 3WC #10865	15	14	94	72m 236'	42m 138'	58	423m 1,388'	70% salvage.
125	34°37.31'N 20°25.68'E August 29 - September 3, 1970 2792m (9,161')	9-7/8 Varel Diamond - 250K #7903	11	8	73	97m 318'	47m 154'	49	97m 318'	

CORE BIT SUMMARY - LEG 13

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
125A	34°37.31'N 20°25.68'E September 3-4, 1970 2792m (9,161')	10-1/8 Smith - Insert Compact Tungsten - 9C - 3 Cone #EV644	11	10	91	91m 399'	18m 59'	20	121m 397'	Rerun - cones locked.
126	35°09.53'N 21°23.42'E September 4-5, 1970 3740m (12,271')	9-7/8 Varel Diamond - 250K #7903	6	5	83	30m 98'	18m 59'	62	129m 423'	Rerun
126A	35°09.53'N 21°23.42'E September 5-6, 1970 3743m (12,281')	9-7/8 Varel Diamond - 250K #7903	1	1	100	1m 3'	1m 3'	90	66m 216'	Rerun
127	35°43.95'N 22°29.67'E September 6-9, 1970 4664m (15,303')	9-7/8 Varel Diamond - 250K #7903	19	19	100	136m 446'	94m 308'	70	447m 1,466'	Rerun
127A	35°43.95'N 22°29.67'E September 9, 1970 4646m (15,244')	9-7/8 Varel Diamond - 250K #7903	5	5	100	31m 102'	23m 75'	74	80m 262'	Rerun
127B	35°43.95'N 22°29.67'E September 9-10, 1970 4650m (15,257')	9-7/8 Varel Diamond - 250K #7903	1	1	100	1m 3'	1m 3'	50	166m 545'	Rerun

CORE BIT SUMMARY - LEG 13

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
128	35°42.58'N 22°28.09'E September 10-12, 1970 4650m (15,257')	9-7/8 Varel Diamond - 250K #7903	11	11	100	91m 299'	78m 256'	85	480m 1,575'	Rerun
129	34°20.30'N 27°05.08'E September 12-14, 1970 3058m (10,033')	9-7/8 Varel Diamond - 250K #7921	4	3	75	13m 43'	3m 10'	22	112m 367'	95% salvage
129A	34°20.30'N 27°05.00'E September 14-15, 1970 2842m (9,325')	9-7/8 Varel Diamond - 250K #7921	3	3	100	5m 16'	3m 10'	56	81m 266'	Rerun - 85% salvage.
129B	34°20.30'N 27°05.00'E September 15-16, 1970 3052m (10,014')	9-7/8 Varel Diamond - 250K #7921	2	2	100	17m 56'	1m 3'	9	42m 138'	Rerun - 75% salvage.
130	33°36.30'N 27°52.00'E September 16-17, 1970 2989m (9,807')	9-7/8 Reed Roller Milled Cutter #8074	7	7	100	54m 177'	23m 75'	42	563m 1,847'	
130A	33°36.30'N 27°52.00'E Sept 17-18, 1970 2992m (9,817')	9-7/8 Reed - PD-2 Roller Rolled Cutter #8074	1	1	100	11m 35'	1m 3'	9	11m 35'	Rerun

CORE BIT SUMMARY - LEG 13

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
131	33°06.33'N 28°52.69'E September 18-19, 1970 3045m (9,991')	9-7/8 Reed - PD-2 Roller Milled Cutter #8157	1	1	100	9m 29'	8m 26'	89	49m 161'	
131A	33°06.33'N 28°52.69'E September 19, 1970 3047m (9,997')	9-7/8 Reed - PD-2 Roller Milled Cutter #8157	5	5	100	45m 148'	6m 20'	13	272m 892'	Rerun - 85% salvage.
132	40°15.67'N 11°26.46'E September 20-26, 1970 2845m (9,334')	9-7/8 Hycalog - Tungsten-Insert #10866	27	26	97	223m 732'	169m 554'	75	223m 732'	85% salvage
133	39°11.71'N 07°20.13'E September 27-28, 1970 2573m (8,442')	10-1/8 Varel-Insert Compact Tungsten - 4 Cone #6	8	6	75	69m 226'	7m 23'	10	192m 630'	
134	39°11.84'N 07°17.96'E September 28-29, 1970 2874m (9,430')	10-1/8 Varel-Insert Compact Tungsten - 4 Cone #6	10	7	70	73m 240'	23m 75'	31	364m 1,194'	Rerun
134A	39°11.84'N 07°17.90'E September 29-30, 1970 2874m (9,430')	10-1/8 Varel-Insert Compact Tungsten - 4 Cone #6	2	1	50	14m 46'	2m 7'	129	50m 164'	Rerun

CORE BIT SUMMARY - LEG 13

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
134B	39°11.84'N 07°17.96'E September 30, 1970 2879m (9,446')	10-1/8 Varel-Insert Compact Tungsten - 4 Cone #6	1	1	100	5m 16'	1'	4	72m 236'	Rerun
134C	39°11.84'N 07°17.96'E September 30, 1970 2879m (9,446')	10-1/8 Varel-Insert Compact Tungsten - 4 Cone #6	0	0	0	0	0	0	131m 430'	Rerun
134D	39°11.84'N 07°17.98'E September 30-October 1,1970 2881m (9,453')	10-1/8 Varel-Insert Compact Tungsten - 4 Cone #6	3	3	100	15m 49'	1m 3'	9	213m 699'	Rerun
134E	39°11.84'N 07°17.96'E October 1, 1970 2879m (9,446')	10-1/8 Varel-Insert Compact Tungsten - 4 Cone #6	3	2	67	16m 53'	6m 20'	4	222m 728'	Rerun

CORE BIT SUMMARY - LEG 14

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
135	35°20.80'N 10°25.46'W October 11-12, 1970 4162m (13,656')	10-1/8 Smith - 4 Cone Tungsten-Insert-9C #FK903	9	9	100	57m 187'	26m 85'	45	689m 2,260'	Basalt
135A	35°20.00'N 10°24.00'W October 13, 1970 4162m (13,656')	10-1/8 Smith - 4 Cone Tungsten-Insert-9C #FK903	1	0	0	9m 29'	0 0	0	49m 161'	Rerun - T-1, B-2.
136	34°10.13'N 16°18.19'W October 16-17, 1970 4179m (13,711')	10-1/8 Smith - 3 Cone Tungsten-Insert-9C #FK923	9	9	100	77m 253'	35m 115'	45	311m 1,020'	Basalt
137	25°03.64'W 27°03.64'W October 21-23, 1970 5371m (17,622')	10-1/8 Smith - 3 Cone Tungsten-Insert-9C #FK923	17	17	100	136m 446'	68m 223'	50	401m 1,315'	Rerun - basalt - T-1, B-3.
138	25°55.37'N 25°33.79'W October 25-26, 1970 5298m (17,383')	10-1/8 Smith - 4 Cone Tungsten-Insert-9C #FK903	7	7	100	54m 177'	23m 75'	43	442m 1,450'	Rerun - T-2, B-3.
139	23°31.14'N 18°42.26'W October 29, 1970 3057m (10,030')	10-1/8 Reed - 2C - Insert Tungsten - PD2 # Unknown	7	7	100	56m 184'	17m 56'	30	665m 2,182'	T-5, B-3

CORE BIT SUMMARY - LEG 14

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
140	21°44.97'N 21°47.52'W October 31-November 2,1970 4493m (14,742')	10-1/8 Smith-4 Cone Insert Tungsten - 9C #FF705	8	8	100	53m 174'	30m 98'	57	651m 2,136'	
140A	21°44.97'N 21°47.52'W November 3, 1970 4493m (14,742')	10-1/8 Smith -4 Cone Insert Tungsten - 9C #FF705	2	2	100	18m 59'	9m 29'	51	253m 830'	Rerun - T-1, B-4.
141	19°25.16'N 23°59.91'W November 5-6, 1970 4158m (13,642')	10-1/8 Smith-4 Cone Insert Tungsten Carbide-9C #FF706	10	10	100	81m 266'	72m 236'	89	298m 978'	
142	03°22.15'N 42°23.49'W November 13-15, 1970 4382m (14,377')	10-1/8 Smith-4 Cone Insert Tungsten Carbide-9C #FF706	9	9	100	72m 236'	41m 135'	56	609m 1,998'	
143	09°28.45'N 54°24.49'W November 19, 1970 3503m (11,493')	10-1/8 Smith-4 Cone Insert Tungsten Carbide-9C #FF706	0	0	0	0	0	0	23m 75'	Problem with power swivel.
143A	09°28.45'N 54°24.49'W November 20, 1970 3503m (11,493')	10-1/8 Smith-4 Cone Insert Tungsten Carbide-9C #FF706	1	1	100	9m 29'	3m 10'	30	23m 75'	Rerun

CORE BIT SUMMARY - LEG 14

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
143B	09°28.45'N 54°24.49'W November 21, 1970 3503m (11,493')	10-1/8 Smith-4 Cone Insert Tungsten Carbide-9C #FF706	0	0	0	0	0	0	36m 118'	Rerun
143C	09°28.45'N 54°24.49'W November 22, 1970 3511m (11,520')	10-1/8 Smith-4 Cone Insert Tungsten Carbide-9C #FF706	1	1	100	9m 29'	0	0	49m 161'	Rerun - lost bottomhole assembly.
143D	09°28.45'N 54°24.49'W November 23, 1970 3500m (11,484')	10-1/8 Smith-4 Cone Insert Tungsten - 9C #FF703	0	0	0	0	0	0	18m 59'	Lost bottomhole assembly.
144	09°27.23'N 54°20.52'W November 24-25, 1970 2967m (9,735')	10-1/8 Smith - 4 Cone Tungsten - Insert -9C #FK665	8	8	100	39m 128'	28m 92'	72	327m 1,072'	
144A	09°27.23'N 54°20.52'W November 26, 1970 2967m (9,735')	10-1/8 Smith - 4 Cone Tungsten - Insert - 9C #FK665	6	6	100	54m 177'	28m 92'	53	200m 656'	Rerun - T-1, B-1
144B	09°27.23'N 54°20.52'W November 26, 1970 2967m (9,735')	10-1/8 Smith - 4 Cone Tungsten - Insert - 9C #FK665	3	3	100	27m 89'	27m 89'	100	36m 118	Rerun - T-1, B-1

CORE BIT SUMMARY - LEG 15

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
145	16°34.74'N 68°03.37'W December 5-6, 1970 4358m (14,299')	10-1/8 Smith 9-C	0	0	0	0	0	0	0	Hole abandoned due to thruster failure. No penetration made.
146	15°06.99'N 69°22.67'W December 14-27, 1970 3939m (12,924')	10-1/8 Smith - 4 Cone Tungsten - Insert #FF718	35	33	94	313m 1,026'	142m 465'	45	701m 2,300'	Re-entry site.
146	15°06.99'N 69°22.67'W December 14-27, 1970 3939m (12,924')	10-1/8 Smith - 4 Cone Tungsten - Insert - 9C #FK666	9	7	78	61m 200'	19m 62'	31	61m 200'	Lost one cone - 3 cones locked.
146A	15°07.97'N 69°22.68'W December 15-27, 1970 3939m (12,924')	10-1/8 Smith - 4 Cone Tungsten - Insert - 9C #FK666	1	1	100	9m 29'	4m 13'	51	96m 315'	
147	10°42.48'N 65°10.48'N December 30-31, 1970 892m (2,927')	9-7/8 Varel Diamond - 250K #7921	18	17	94	171m 561'	110m 361'	64	171m 561'	Rerun - 73% salvage - clay.
147A	10°42.48'N 65°10.48'W December 30-31, 1970 892m (2,927')	9-7/8 Varel Diamond - 250K #7921	2	2	100	13m 43'	6m 20'	30	13m 43'	50% salvage - clay.

CORE BIT SUMMARY - LEG 15

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
147B	10°42.48'N 65°10.48'W December 31, 1970 892m (2,927')	9-7/8 Varel Diamond - 250K #7921	12	12	100	124m 407'	65m 212'	53	124m 407'	Rerun - clay.
147C	10°42.48'N 65°10.48'W Dec 31, 1970 - Jan 1, 1971 892m (2,927')	9-7/8 Varel Diamond - 250K #7921	8	6	88	73m 240'	24m 79'	33	189m 620'	Rerun
148	13°25.12'N 63°43.25'W January 2-4, 1971 1232m (4,042')	9-7/8 Hycalog Diamond - 250K #10458	31	30	97	273m 896'	181m 594'	66	273m 896'	95% salvage.
149	15°06.25'N 69°21.85'W January 5-10, 1971 3072m (13,032')	9-7/8 Hycalog Diamond - 250K #10458	43	42	98	390m 1,280'	256m 840'	65	390m 1,280	Rerun
150	14°30.69'N 69°21.35'W January 10-11, 1971 4545m (14,912')	10-1/8 Smith - 4 Cone Tungsten - Insert - 9C #FK665	12	12	100	89m 292'	42m 138'	47	180m 591'	Rerun

CORE BIT SUMMARY - LEG 15

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
150A	14°30.69'N 69°21.35'W January 11-12, 1971 4545m (14,912')	10-1/8 Smith - 4 Cone Tungsten - Insert - 9C #FK665PR	2	2	100	18m 59'	2m 7'	12	136m 446'	B-1, T-1
151	15°01.02'N 73°02.58'W January 14-15, 1971 2029m (6,657')	10-1/8 Smith 3 Cone - 9C #FK936	15	15	100	113m 371'	61m 200'	54	379m 1,243'	T-1, B-5 T-1, B-5
152	15°52.72'N 74°36.47'W January 17-22, 1971 3899m (12,793')	10-1/8 Smith - 4 Cone Tungsten - Insert - 9C #FK707	24	23	96	210m 689'	58m 190'	28	476m 1,562'	
153	13°58.33'N 72°26.08'W January 23-27, 1971 3932m (12,901')	10-1/8 Smith - 4 Cone Tungsten - Insert - 9C #FF704	20	20	100	177m 581'	70m 230'	40	776m 2,546'	T-8, B-8
154	11°05.11'N 80°22.75'W January 29-31, 1971 3338m (10,952')	10-1/8 Smith - 3 Cone Tungsten - Insert - 9C #FF946	14	14	100	132m 433'	66m 217'	50	277m 909'	T-1, B-8
154A	11'05.11'N 80°22.75'W January 29-31, 1971 3338m (10,952')	10-1/8 Smith - 3 Cone Tungsten - Insert - 9C #FF946	18	18	100	170m 558'	131m 430'	77	172m 564'	Rerun

CORE BIT SUMMARY - LEG 16

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
155	06°07.38'N 81°02.62'W February 6-8, 1971 2752m (9,029')	10-1/8 Smith Tungsten-Ext Insert 94 #GC282	12	12	100	102m 335'	57m 186'	55	552m 1,811'	T-1, B-4
156	01°40.80'S 85°24.06'W February 11-12, 1971 2369m (7,773')	10-1/8 Smith Tungsten-Ext Insert 94 #GC282	1	0	0	4m 13'	0	0	4m 13'	Rerun - T-1, B-4.
157	01°45.70'S 85°54.17'W February 12-15, 1971 2591m (8,501')	10-1/8 Smith - 3 CTR Tungsten-Ext Insert 95 #GC299	49	49	100	427m 1,401'	273m 896'	63	427m 1,401'	
157A	01°45.70'S 85°54.17'W February 15-16, 1971 2591m (8,501')	10-1/8 Smith - 3 CTR Tungsten-Ext Insert 95 #GC299	3	3	100	27m 89'	19m 63'	71	27m 89'	Rerun - T-2, B-5.
158	06°37.36'N 85°14.16'W February 18-20, 1971 1953m (6,408')	10-1/8 Smith-Insert Compact Tungsten-9C-3 CTR #FR922	36	35	97	323m 1,060'	247m 810'	79	323m 1,060'	Basalt
159	12°19.92'N 122°17.27'W March 1-3, 1971 4484m (14,712')	10-1/8 Smith-Insert Compact Tungsten-9C - 3 CTR #FR922	14	13	93	109m 358'	98m 322'	90	109m 358'	Rerun - T-2, B-6.

CORE BIT SUMMARY - LEG 16

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
160	11°42.27'N 130°52.81'W March 5-7, 1971 4940m (16,208')	10-1/8 Smith-Insert Compact Tungsten - 9C - 4 CTR #GB783	14	14	100	105m 345'	96m 315'	92	104m 341'	Basalt
161	10°50.25'N 139°57.21'W March 9-11, 1971 4939m (16,205')	10-1/8 Smith-Insert Compact Tungsten - 9C - 3 CTR #GF606	14	12	85	126m 413'	95m 312'	75	126m 413'	
161A	10°40.27'N 139°57.27'W March 11-13, 1971 4939m (16,205')	10-1/8 Smith-Insert Compact Tungsten - 9C - 3CTR #GF606	15	15	100	126m 413'	88m 289'	70	245m 804'	Rerun - basalt.
162	14°52.19'N 149°02.61'W March 15-17, 1971 4854m (15,926')	10-1/8 Smith-Insert Compact Tungsten - 9C - 3CTR #GF606	18	16	89	154m 505'	129m 423'	84	154m 505'	Rerun - basalt - T-1, B-3.
163	11°14.66'N 150°17.52'W March 20-25 5320m (17,455')	10-1/8 Smith-Ext Insert - SB9 Tungsten - 9C - 3 CTR #GC298	29	29	100	243m 797'	155m 509'	63	294m 965'	Lost all cones.
163A	11°14.66'N 150°17.52'W March 25-26, 1971 5320m (17,455')	10-1/8 Smith-Ext Insert - 94 Tungsten - 9C - 3CTR #GF606	2	2	100	5m 16'	5m 16'	100	151m 495'	Rerun

CORE BIT SUMMARY - LEG 17

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
164	13°12.0'N 161°31.12'W April 7-11, 1971 5513m (18,088')	10-1/8 Smith-Ext Insert Tungsten - 94 #GT331	28	25	90	260m 853'	81m 267'	32	260m 853'	T-2, B-7 - basalt.
165	8°10.49'N 164°51.74'W April 12-13, 1971 5053m (16,579')	10-1/8 Smith-Ext Insert- Tungsten - 4 Cone- 94 #GT332	2	2	100	14m 46'	8m 26'	57	14m 46'	
165A	8°10.49'N 175°04.9'W April 13-15, 1971 5053m (16,579')	10-1/8 Smith-Ext Insert Tungsten - 4 Cone - 94 #GT332	27	25	93	376m 1,233'	130m 426'	35	490m 1,607'	Rerun - T-1, B-1 - basalt.
166	3°45.7'N 176°49.5'W April 19-22, 1971 4962m (16,280')	10-1/8 Smith-Ext Insert Tungsten - 4 Cone - 94 #GT332	29	29	100	238m 780'	154m 505'	65	310 1,017'	Rerun
166A	3°45.7'N 176°49.5'W April 19-22, 1971 4962m (16,280')	10-1/8 Smith-Ext Insert Tungsten - 4 Cone -94 #GT332	1	1	100	9m 29'	6m 20'	66	9m 29'	T-4, B-7
167	7°04.1'N 176°49.5'W April 24 - May 3, 1971 3176m (10,420')	10-1/8 Smith-Ext Insert Tungsten-4 Cone-94 #GT101	95	72	76	867m 2,845'	298m 978'	35	1185m 3,888'	T-5, B-8

CORE BIT SUMMARY - LEG 17

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
168	10°42.22'N 173°35.85'E May 6-7, 1971 5430m (17,816')	10-1/8 Smith-Ext Insert Tungsten - 4 Cone - 94 #GT 956	5	2	40	28m 92'	8m 26'	27	73m 240'	Lost bottomhole assembly.
169	10°40.14'N 173°32.97'W May 9-11, 1971 5415m (17,767')	10-1/8 Smith-Ext Insert Tungsten - 4 Cone - 94 #GT 957	12	6	50	96m 315'	12m 39'	13	238m 781'	T-8, B-5
170	11°48.0'N 177°37.02'E May 12-15, 1971 5792m (19,004')	10-1/8 Smith-Insert Compact Tungsten - 9C - 3 Cone #GR567	16	7	43	134m 440'	31m 102'	23	196m 643'	T-1, B-5
171	19°07.9°N 169°27.6'W May 20-22, 1971 2295m (7,530')	10-1/8 Smith-Ext Insert Tungsten - 9C - 3 Cone #GC281	33	27	82	355m 1,165'	173m 568'	48	473m 1,552'	T-1, B-5

CORE BIT SUMMARY - LEG 18

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
172	31°32.23'N 133°22.36'W June 5-6, 1971 4768m (15,644')	10-1/8 Smith-Ext Insert Tungsten - 94 #GB784	4	4	100	23m 75'	26m 85'	114	23m 75'	
172A	31°32.23'N 133°22.36'W June 5-6, 1971 4768m (15,644')	10-1/8 Smith-Ext Insert Tungsten - 94 #GB784	1	1	100	1m 3'	0	0	22m 72'	Rerun
173	39°57.71'N 125°27.12'W June 9-12, 1971 2985m (9,794')	11-1/4 Smith-Insert Compact Tungsten - 9C #58728	38	37	97	335m 1,099'	196m 643'	51	335m 1,099'	T-2, B-6
174	44°53.38'N 126°21.40'W June 14-18, 1971 2793m (9,164')	10-1/8 Smith Tungsten-Ext Insert #HG756	3	3	100	21m 72'	3m 10'	15	21m 72'	
174A	44°53.38'N 126°21.40'W June 14-18, 1971 2793m (9,164')	10-1/8 Smith Tungsten-Ext Insert #HG756	43	36	84	404m 1,326'	200m 656'	49	878m 2,881'	Rerun - T-2, B-7.
175	44°50.50'N 125°14.50'W June 19-20, 1971 1999m (6,559')	10-1/8 Smith Tungsten-Ext Insert #HG645	25	22	88	233m 764'	122m 400'	52	271m 889'	

CORE BIT SUMMARY - LEG 18

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
176	45°56.60'N 124°37.00'W June 21, 1971 193m (633')	10-1/8 Smith Tungsten-Ext Insert #GB784	5	5	100	41m 135'	41m 135'	100	41m 135'	Rerun - lost bottomhole assembly.
177	50°28.18'N 130°12.30'W June 24-26, 1971 2006m (6,582')	10-1/8 Smith Tungsten-Ext Insert #HG646	1	1	100	9m 29'	9m 29'	100	9m 29'	
177A	50°28.18'N 130°12.30'W June 24-26, 1971 2006m (6,582')	10-1/8 Smith Tungsten-Ext Insert #HG646	26	26	100	252m 827'	136m 447'	54	507m 1,663'	Rerun - lost bottomhole assembly.
178	56°57.38'N 147°07.86'W July 1-5, 1971 4218m (13,839')	10-1/8 Smith Tungsten-Ext Insert #HG647	59	53	90	519m 1,703'	211m 692'	41	794m 2,605'	T-1, B-2
179	56°24.50'N 145°59.32'W July 6, 1971 3788m (12,428')	10-1/8 Smith Tungsten-Ext Insert #HG645	13	13	100	109m 358'	70m 229'	64	109m 358'	Rerun - T-1, B-7
180	47°21.76'N 147°57.37'W July 8-10, 1971 4923m (16,152')	11-1/4 Smith Tungsten-Ext Insert #125480-3	25	25	100	237m 778'	81m 267'	34	470m 1,542'	

CORE BIT SUMMARY - LEG 18

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
181	57°26.30'N 148°27.88'W July 12-15, 1971 3086m (10,125')	10-1/8 Smith Tungsten-Ext Insert #HG 645	30	30	100	259m 850'	106m 348'	41	369m 1,211'	Rerun
182	57°52.96'N 148°42.99'W July 16, 1971 1419m (4,656')	9-7/8 Reed - Insert Compact Tungsten #8163	6	6	100	54m 177'	11m 35'	21	123m 404'	T-4, B-6

CORE BIT SUMMARY - LEG 19

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
183	52°34.30'N 161°12.33'W July 25-28, 1971 4718m (15,480')	10-1/8 Smith 94C #C757	40	35	88	361m 1,184'	150m 492'	42	516m 1,693'	T-1, B-4, IG. One broken insert. Cored 11m basalt.
184	52°42.64'N 170°55.39'W July 30-August 1, 1971 1920m (6,299')	9-7/8 Williams Diamond #Z962	23	22	96	186m 610'	123m 403'	66	603m 1,978'	20% salvage
184A	52°42.64'N 170°55.39'W August 2, 1971 1920m (6,299')	10-1/8 Smith 93CJS #HM619	0	0	0	0	0	0	669m 2,195'	T-1, B-1 - Ok for rerun. Siltstone and hard mudstone.
184A		Hycalog Center Bit #2371	0	0	0	0	0	0	0	Ok for rerun.
184B	52°42.64'N 170°55.39'W August 2-4, 1971 1920m (6,299')	10-1/8 Smith 93CJS #HM619	14	14	100	121m 397'	50m 164'	41	973m 3,192'	Rerun - T-2, B-8 - cones loose.
185	54°25.70'N 169°14.59'W August 5-7, 1971 2120m (6,956')	10-1/8 Smith 93CJS #HM621	27	25	93	216m 709'	98 321'	45	728m 2,388	T-1, B-1, IG. Drilled soft to firm.

CORE BIT SUMMARY - LEG 19

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
186	52°07.81'N 174°00.34'W August 9-12, 1971 4532m (14,869')	10-1/8 Smith 93CJS #HM620	28	28	100	245m 804'	141m 463'	58	926m 3,038'	Pulled to mudline. Moved to Site 187.
187	51°06.32'N 173°57.23'W August 12-13, 1971 4587m (15,050)	10-1/8 Smith 93CJS #HM630	4	3	75	36m 118'	7m 23'	19	370m 1,214'	T-1, B-2, IG. Bright wear on shirttail.
188	53°45.21'N 178°39.56'E August 15-16, 1971 2659m (8,724')	10-1/8 Smith 93CJS #HM621	18	16	89	146m 479'	57m 187'	39	638m 2,093'	T-1, B-3, IG. Ok for rerun
189	54°02.14'N 170°13.38'E August 18-22, 1971 3447m (11,210')	10-1/8 Smith 93CJS #HM621	20	19	95	175m 574'	74m 243'	43	871m 2,858'	T-2, B-8, IG. Hard sandstone and mudstone.
190	55°33.57'N 171°88.56'E August 22-24, 1971 3885m (12,747')	11-1/2 RSS 4-CTR # Unknown	16	15	94	142m 466'	85m 279'	60	627m 2,057'	T-1, B-1, IG. Ok for rerun.
191	56°56.70'N 168°10.72'E August 25-28, 1971 3864m (12,678')	10-1/8 Smith 4-CTR #GF644	16	13	82	130m 426'	44m 144'	34	919m 3,015'	Pulled to mudline. Cored mudstone and moved to Site 191A. 1-1/2m basalt.

CORE BIT SUMMARY - LEG 19

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
191A	100 ft., 090°T from Site 191 August 28, 1971 3870m (12,697')	10-1/8 Smith 9C #GF644	4	3	75	36m 118'	22 72'	60	50m 164'	Rerun - not pulled.
191B	200 ft., 090°T from Site 191 August 29, 1971 3870m (12,697')	10-1/8 Smith 9C #GF644	1	1	100	9m 29'	9m 29'	95	9m 29'	Rerun - T-3, B-5, OG.
192	53°00.57'N 164°42.8'E August 30-September 2, 1971 3024m (9,922')	10-1/8 Smith 93CJS #HM617	35	35	100	308m 1,010'	152m 499'	50	942m 3,091'	Pulled above mudline. Moved to Site 192A.
192A	300 ft., 200°T from Site 192 September 2-4, 1971 3024m (9,922')	10-1/8 Smith 93CJS #HM617	6	6	100	47m 154'	38m 125'	81	1057m 3,468'	T-2, B-8, OG - mudstone. 13m basalt.
193	45°48.19'N 155°52.11'E September 6-7, 1971 4821m (15,818')	10-1/8 Smith 9C - 3CTR #FK945	4	3	75	29m 95'	12m 39'	42	71m 233'	T-1, B-1. Ok for rerun.

CORE BIT SUMMARY - LEG 20

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
194	33°58.64'N 146°48.64'E September 22, 1971 5754m (18,879')	10-1/8 Smith 94CJS #H2022	5	5	100	40m 131'	15m 49'	38	256m 840'	B-5, T-2 - cut 20m of chert.
195	32°46.40'N 146°58.73'E September 24, 1971 5968m (19,581')	10-1/8 Smith SS942 #H2028	4	4	100	31m 102	14m 46'	45	307m 1,007'	Shirttail 15% of buttons gone.
195A	32°46.40'N 146°58.73'E September 26, 1971 5968m (19,581')	10-1/8 Smith SS942 #H2028	0	0	0	0	0	0	380m 1,247'	B-7, T-5, G.
195B	32°46.39'N 146°58.76'E September 28, 1971 5968m (19,581')	10-1/8 Smith 94CJS #HZ2014	3	3	100	7m 23'	1m 3'	6	389m 1,276'	B-2, T-4, G. Few buttons gone.
196	3-°06.97'N 148°58.76'E October 2, 1971 6194m (20,322')	10-1/8 Smith 94CJS #HZ023	6	5	83	40m 131'	9m 30'	21	377m 1,237'	B-8, T-8, OG.
197	30°17.44'N 147°40.46'E October 8, 1971 6153m (20,188')	10-1/8 Smith SS49C #HZ029	1	1	100	10m 32'	1m 3'	11	283m 923'	Lost in hole.

CORE BIT SUMMARY - LEG 20

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
198	25°49.54'N 154°35.05'E October 12, 1971 5858m (19,220')	10-1/8 Smith 9CJS #6R753	0	0	0	0	0	0	0	Lost in hole.
198A	25°49.54'N 154°35.05'E October 14, 1971 5858m (19,220')	10-1/8 Smith 4 CTR #GR568	0	0	0	0	0	0	0	Dropped in hole.
198A	25°49.54'N 154°35.05'E October 14, 1971 5858m (19,220')	10-1/8 Smith 4 CTR #GR552	6	5	83	51m 167'	26m 85'	51	258m 846'	B-5, T-2, G. Swivel locked.
199	13°30.78'N 156°10.37'E October 26, 1971 6100m (20,014')	10-1/8 Smith 4 CTR #HE200	12	12	100	124m 406'	59m 194'	48	457 1,499'	B-2, T-2, G. Ship rolling.
200	12°50.12'N 156°46.96'E October 27, 1971 1479m (4,853')	10-1/8 Smith 3 CTR #GR566	10	8	80	95m 312'	36m 118'	38	114m 374'	See Site 202.
200A	12°50.12'N 156'46.96'E October 27, 1971 1479m (4,853')	10-1/8 Smith 3 CTR #GR566	2	2	100	19m 62'	0 0	0	132m 433'	See Site 202.

CORE BIT SUMMARY - LEG 20

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
201	12°49.89'N 156°44.59'E October 28, 1971 1564m (5,131')	10-1/8 Smith 3 CTR #GR566	0	0	0	0	0	0	66m 217'	
202	12°48.90'N 156°57.15'E October 30, 1971 1515m (4,971')	10-1/8 Smith 3 CTR #GR566	6	3	50	57m 187'	3m 10'	4	154m 505'	Lost in hole.

CORE BIT SUMMARY - LEG 21

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
203	22°09.22'S 177°32.77'W November 17-19, 1971 2730m (8,957')	10-1/8 Smith 94CJS #HZ021	5	5	100	42m 138'	20m 65'	48	409m 1,342'	As new - good for rerun.
204	24°57.27'S 174°06.69'W November 20-21, 1971 5364m (17,599')	10-1/8 Smith 94CJS #HZ021	9	9	100	79m 259'	49m 161'	63	160m 525'	Rerun
204A	24°57.27'S 174°06.69'W November 21-22, 1971 5364m (17,599')	10-1/8 Smith 94CJS #HZ021	1	1	100	9m 29'	4m 13'	48	95m 312'	Rerun
205	25°30.99'S 177°53.95'E November 24-27, 1971 4330m (14,207')	10-1/8 Smith 94CJS #HZ021	32	24	75	288m 945'	135 443'	47	355m 1,165'	Rerun
206	32°00.75'S 165°27.15'E November 30-December 3, 1971 3206m (10,519')	10-1/8 Smith 94CJS #HG648	45	45	100	400m 1,312'	244m 800'	61	416m 1,365'	T-1, B-3, IG - worn.
206A	32°00.75'S 165°27.15'E December 17, 1971 3206m (10,519')	10-1/8 Smith 94CJS #HG648	0	0	0	0	0	0	100m 328'	

CORE BIT SUMMARY - LEG 21

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
206B	32°00.75'S 165°27.15'E December 17-18, 1971 3206m (10,519')	10-1/8 Smith 94CJS #HG648	1	1	100	9m 29'	0.7m	8	220m 722'	
206C	32°00.75'S 165°27.15°E December 18-21, 1971 3206m (10,519')	10-1/8 Smith 94CJS #HG648	21	19	91	189m 620'	89m 292'	47	734m 2,408'	T-1, B-1, IG - two broken teeth.
207	36°57.75'S 165°26.06'E December 12, 1971 1399m (4,590')	10-1/8 Smith S94C #HZ836	5	5	100	42m 138'	38m 125'	91	47m 154'	
207A	36°57.75'S 165°26.06'E December 12-15, 1971 1399m (4,590')	10-1/8 Smith S94C #HZ836	50	45	90	450m 1,476'	212m 696'	47	513m 1,683'	Lost in hole.
208	26°06.61'S 161°13.27'E December 23-24, 1971 1555m (5,102')	10-1/8 Smith 94CJS #HZ026	34	33	97	306m 1,004'	255m 836'	84	594m 1,949'	
209	15°56.19'S 152°11.27'E December 28-29, 1971 1438m (4,718')	10-1/8 Smith 94CJS #HZ026	34	30	88	301m 988'	77m 252'	26	344m 1,129'	

CORE BIT SUMMARY - LEG 21

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
209A	15°56.19'S 152°11.27'E December 29, 1971 1438m (4,718')	10-1/8 Smith 94CJS #HZ026	1	1	100	9m 29'	2m 7'	24	9m 29'	Not suitable for rerun.
210	13°45.99'S 152°53.78'E Dec 30, 1971-Jan 4, 1972 4653m (15,266')	10-1/8 Smith 94CJS #HZ024	50	50	100	450m 1,476'	262m 860'	58	711m 2,333'	Not suitable for rerun.

CORE BIT SUMMARY - LEG 22

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
211	09°46.53'S 102°41.95'E January 11-24, 1972 5535m (18,160')	10-1/8 Smith 94CJS #HZ015	15	15	100	143 469'	67m 220'	47	447m 1,467'	T-1, B-2
212	19°11.34'S 99°17.84'E January 24-February 1, 1972 6243m (20,483')	10-1/8 Smith 93CJS #JK192	39	39	100	366m 1,201'	174m 571'	48	521m 1,709'	T-1, B-2 - drilled 5m basalt.
213	10°12.71'S 93°53.77'E February 1-6, 1972 5611m (18,410')	10-1/8 Smith 94CJS #HZ015	19	19	100	173 568'	146 479'	84	172m 564'	
213A	10°12.71'S 93°53.77'E February 6-7, 1972 5611m (18,410')	10-1/8 Smith 94CJS #HZ015	3	3	100	25m	25m 83'	100	131m 429'	T-1, B-3 - 74m basalt drilled. No shirttail wear. Bit in gauge.
214	11°20.21'S 88°43.08'E February 7-12, 1972 1665m (5,463')	10-1/8 Smith 94CJS #HZ015	54	53	98	495m 1,624'	346m 1,135'	70	500m 1,641'	T-2, B-5
215	08°07.30'S 80°47.50'E February 12-15, 1972 5319m (17,452')	10-1/8 Smith 94CJS #HZ024	20	20	100	175m 574'	113m 371'	65	175m 574'	Drilled 38m basalt. Bit in gauge.

CORE BIT SUMMARY - LEG 22

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
216	01°27.73'N 90°12.48'E February 15-21, 1972 2247m (7,372')	10-1/8 Smith 94CJS #HZ024	38	38	100	353m 1,158'	171m 561'	48	478m 1,568'	T-5, B-5
216A	01°27.73'N 90°12.48'E February 21, 1972 2247m (7,372')	10-1/8 Smith 94CJS #HZ024	6	6	100	57m 187'	53m 174'	94	159m 521'	Drilled 70m chert, limestone, and hard sand. Left cones in hole
217	08°55.57'N 90°32.33'E February 21-27, 1972 3020m (9,909')	10-1/8 Smith 93CJS #JK192	37	36	97	346m 1,135'	183m 600'	53	615m 2,017'	T-6, B-4. Shirttail wear. Drilled 130m chert, hard sand, dolomite.
217A	08°55.57'N 90°32.33'E February 27-29, 1972 3020m (9,909')	10-1/8 Smith FS94C #HZ835	17	16	94	162m 532'	42m 138'	26	664m 2,178'	T-1, B-1
218	08°00.42'N 86°16.97'E February 29-March 4, 1972 3759m (12,333')	10-1/8 Smith 94CJS #HZ027	27	26	96	251m 824'	59 194'	24	773m 2,536'	

CORE BIT SUMMARY - LEG 23

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
219	09°01.75'N 72°52.67'E March 10-12, 1972 1779m (5,834')	10-1/8 Smith 94CJS #HZ025	27	27	100	235m 771'	173m 567'	73	273m 896'	Excellent for rerun. T-1, B-1.
219A	09°01.75'N 72°52.67'E March 12-13, 1973 1779m (5,834')	10-1/8 Smith 94CJS #HZ025	14	13	93	115m 377'	51m 167'	44	411m 1,348'	Rerun - T-1, B-1. Excellent for rerun.
220	06°30.97'N 70°59.02'E March 14-17, 1072 4043m (13,265')	10-1/8 Smith 93CJS, 3 CTR #JK190	21	21	100	177m 581'	101m 331'	57	350m 1,148'	T-3, B-8, BT, OG. Worn out.
221	07°59.18'N 68°24.37'E March 18-20, 1972 4679m (15,352')	10-1/8 Smith 94CJS, 4 CTR #HZ161	19	19	100	170m 558'	77m 252'	45	270m 886'	T-1, B-1 - ok for rerun.
222	20°05.49'N 61°30.56'E March 24-30, 1972 3570m (11,713')	10-1/8 Smith 94CJS, 4 CTR #HZ013	36	36	100	313m 1,027'	176m 577'	56	1300m 4,265'	T-3, B-1, BT, OG. Worn out.
223	18°44.98'N 60°07.78'E March 31-April 4, 1972 3654m (11,989')	10-1/8 Smith 93CJS, 4 CTR #JK241	41	41	100	369m 1,210'	204m 669'	55	740m 2,428'	T-1, B-2 - for rerun.

CORE BIT SUMMARY - LEG 23

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
224	16°32.51'N 59°42.10'E April 5-7, 1972 2523m (8,278')	10-1/8 Smith 93CJS, 4 CTR #JK241	11	11	100	99m 325'	31m 102'	31	792m 2,598'	T-1, B-5 - worn out.
225	21°18.58'N 38°15.11'E April 15-17, 1972 1240m (4,068')	10-1/8 Smith 94CJS, 4 CTR #HZ025	29	29	100	230m 755'	138m 452'	60	230m 755'	T-1, B-2 - rerun. Good condition for rerun.
226	21°20.51'N 38°04.93'E April 17-18, 1972 2208m (7,244')	10-1/8 Smith 94CJS #HZ025	2	2	100	14m 46'	9m 29'	64	14m 46'	Rerun - lost in hole.
227	21°19.86'N 38°07.97'E April 18-21, 1972 1821m (5,975')	10-1/8 Smith 94CJS #HZ161	45	45	100	344m 1,129'	124m 406'	36	359m 1,178'	T-1, B-2 - for rerun.
228	19°05.16'N 39°00.20'E April 22-24, 1972 1055m (3,461)	10-1/8 Smith 93CJS #JK195	39	39	100	315m 1,033'	185m 606'	59	325m 1,066'	T-1, B-3 - took severe pounding.
229	14°46.09'N 42°11.47'E April 27, 1972 861m (2,825')	10-1/8 Smith 94CJS #HZ488	4	4	100	33m 108'	29m 95'	88	108m 354'	T-1, B-1 - for rerun.

CORE BIT SUMMARY - LEG 23

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
229A	14°46.09'N 42°11.47'E April 27-28, 1972 861m (2,825')	10-1/8 Smith 94CJS #HZ488	18	17	95	162m 531'	119m 390'	74	212m 695'	T-1, B-1 - for rerun.
230	15°19.00'N 41°50.05'E April 28-29, 1972 851m (2,792')	10-1/8 Smith 94CJS #HZ488	2	2	100	18m 59'	13m 43'	75	9m 29'	T-1, B-1 - good condition for rerun.

CORE BIT SUMMARY - LEG 24

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
231	11°53.41'N 48°14.71'E May 5-8, 1972 2161m (7,090')	10-1/8 Smith 94CJS #HZ488	64	64	100	584m 1,916'	425m 1,394'	73	584m 1,916'	T-1, B-2 - in gauge. Cut 17.5m basalt, recovered 7.5m.
232	14°28.93'N 51°54.87'E May 10-13, 1972 1757m (5,768')	10-1/8 Smith 94CJS #HZ488	19	19	100	174 570'	127 416'	73	174m 570'	T-5, B-5 - in gauge. Cut 10m very hard sand.
232A	14°28.93'N 51°54.87'E May 10-13, 1972 1753m (5,751')	10-1/8 Smith 94CJS #HZ488	30	28	93	275m 902'	125m 410'	46	434m 1,424'	
233	14°19.68'N 52°08.11'E May 14-16, 1972 1860m (6,102')	10-1/8 Smith 94CJS #HZ161	19	19	100	176m 577'	135m 443'	77	176m 577'	T-2, B-5 - in gauge.
233A	14°19.68'N 52°08.11'E May 14-16, 1972 1860m (6,102')	10-1/8 Smith 94CJS #HZ161	13	9	69	103m 337'	37m 121'	34	271m 889'	Cut 11m basalt. Recovered 2.6m
234	04°28.95'N 51°13.48'E May 19-21, 1972 4738m (15,545')	10-1/8 Smith 94CJS #HZ250	15	15	100	143m 469'	90m 295'	63	247m 810'	

CORE BIT SUMMARY - LEG 24

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
234A	04°28.95'N 51°13.48'E May 19-21, 1972 4738m (15,545')	10-1/8 Smith 94CJS #HZ250	1	1	100	10m 32'	1m 3'	15	277m 909'	T-1, B-1 - in gauge. Drilling in clay. Cut 32.5m basalt, recovered 12.5m.
235	03°14.06'N 52°41.64'E May 22-26, 1972 5146m (16,684')	10-1/8 Smith 94CJS #HZ250	20	19	95	190m 623'	98m 321'	52	684m 2,244'	
236	01°40.68'S 57°38.85'E May 28-June 1, 1972 4504m (14,778')	10-1/8 Smith 94C #HC754	37	37	100	328m 1,076'	219m 718'	67	328m 1,076'	T-2, B-7 Cut 21.5m basalt, recovered 10.6m
237	07°04.99'S 58°07.48'E June 5-9, 1972 1640m (5,381')	10-1/8 Smith 94CJS #JZ254	67	63	94	627m 2,057'	312m 1,023'	50	694m 2,277'	T-3, B-7 Cut 214m chert and limestone.
238	11°09.21'S 70°31.56'E June 15-21, 1972 2845m (9,334')	10-1/8 Smith 94CJS, 4 Cone #JZ251	64	63	98	587m 1,925'	425m 1,394'	72	587m 1,925'	T-3, B-7 Cored 80.5m basalt, recovered 40.6m.

CORE BIT SUMMARY - LEG 25

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
239	21°17.67'S 51°40.73'E June 30-July 3, 1972 4971m (16,310')	10-1/8 Smith 4 CTR #GR569	21	19	91	175m 574'	106m 348'	61	326m 1,070'	T-1, B-8 Bearings loose - one cone locked - out of gauge - core throat bent. Drilled basalt approximately 6 hours.
240	03°29.28'S 50°03.42'E July 9-10, 1972 5082m (16,674')	10-1/8 Smith 3 CTR, 94C #HC755	8	5	63	53m 174'	25m 83'	48	195m 640'	All 3 cones missing .
240A	03°29.28'S 50°03.42'E July 11-12, 1972 5082m (16,674')	10-1/8 Smith 3 CTR, 94C #HC755	4	3	75	34m 112'	3m 10'	9	202m 663'	T-8, B-8
241	02°22.24'S 44°40.77'E July 13-18, 1972 4054m (13,301')	10-1/8 Smith 4 CTR, 93CJS #JK950	29	29	100	252m 827'	137m 449'	54	1174m 3,852'	T-2, B-6 - 1 tooth missing, 1 tooth chipped, 3 seals gone, 1 bearing appears broken, in gauge.
242	15°50.65'S 41°49.23'E July 23-26, 1972 2275m (7,464')	10-1/8 Smith 4 CTR, 94CJS #JZ252	19	18	95	134m 440'	103m 338'	77	676m 2,218'	T-1, B-2 - bit bald - good for rerun.
243	22°54.49'S 41°23.99'E July 28-29, 1972 3879m (12,727')	10-1/8 Smith 4 CTR, 94CJS #JZ252	1	1	100	6m 20'	0.3m	5	32m 105'	Site 243 abandoned early due to hole instability.

CORE BIT SUMMARY - LEG 25

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
244	22°55.87'S 41°25.98'E July 29, 1972 3847m (12,622')	10-1/8 Smith 4 CTR, 94CJS #JZ252	1	0	0	3m 10'	0	0	27m 89'	Punch cores washed only - no rotation. Bit lost in hole
245	31°32.02'S 52°18.11'E August 2-6, 1972 4857m (15,936')	10-1/8 Smith 4 CTR, 94CJS #JZ255	19	17	89	151m 495'	82m 269'	54	397m 1,302'	T-5, B-4 - bearing fair - 19 teeth either missing or badly chipped.
245A	31°32.02'S 52°18.11'E August 6-7, 1972 4857m (15,936')	10-1/8 Smith 4 CTR, 94CJS #JZ255	7	7	100	63m 207'	47m 154'	75	149m 489'	Chipped
246	33°37.21'S 45°09.60'E August 9-10, 1972 1030m (3,379')	10-1/8 Smith 3 CTR, 94CJS #JZ243	11	6	55	94m 308'	24m 79'	25	203m 666'	T-1, B-2 - in gauge. Good for rerun.
247	33°37.53'S 45°00.68'E August 10-11, 1972 944m (3,097')	10-1/8 Smith 3 CTR, 94CJS #JZ243	1	0	0	8m 26'	0	0	26m 85'	T-1, B-2 - in gauge. Good for rerun.
248	29°31.78'S 37°28.48'E August 13-17, 1972 4994m (16,385')	10-1/8 Smith 3 CTR, 94CJS #JZ243	17	13	77	136m 446'	41m 134'	30	434m 1,424'	T-2, B-8 - out of gauge.

CORE BIT SUMMARY - LEG 25

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
249	29°56.99'S 36°04.62'E August 17-20, 1972 2088m (6,851')	10-1/8 Smith 4 CTR, 94C #HC759	33	33	100	285m 935'	222 728'	78	412m 1,352'	T-1, B-3 - in gauge. Good for rerun.

CORE BIT SUMMARY - LEG 26

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
250	33°27.67'S 39°22.20'E September 6-10, 1972 5129m (16,828')	10-1/8 Smith F94C #KK998	3	3	100	28m 92'	21m 72'	76	65m 212'	New - bent bottomhole assembly.
250A	33°27.74'S 39°22.15'E September 10-14, 1972 5129m (16,828')	10-1/8 Smith F94C #KK998	26	25	96	241m 790'	125m 410'	52	739m 2,424'	T-1, B-2 Cored 13m basalt.
251	36°30.25'S 49°27.15'E September 14-18, 1972 3499m (11,480')	10-1/8 Smith F94C #KK998	10	9	90	88m 288'	67m 220'	77	88m 288'	Loss of power - pulled out of hole.
251A	36°30.26'S 49°29.08'E September 18-21, 1972 3499m (11,480')	10-1/8 Smith F94C #KK998	31	29	93	277m 908'	158m 518'	57	499m 1,637'	T-4, B-3 - cored 10m basalt.
252	37°02.44'S 59°14.33'E September 21-24, 1972 5042m (16,543')	10-1/2 Smith F94C #KK989	7	7	100	57m 188'	42m 137'	73	247m 810'	Abandoned site because of weather.
253	24°52.65'S 87°21.91'E September 24-October 5, 1972 1972m (6,470')	10-1/8 Smith F94C #KN025	58	56	96	536m 1,758'	270m 885'	50	559m 1,834'	T-1, B-2, 1. Drilled one meter basalt. Hole abandoned when center bit hung in the support housing.

CORE BIT SUMMARY - LEG 26

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
254	30°58.15'S 87°53.72'E October 5-9, 1972 1263m (4,144')	10-1/8 Smith F94C #KN025	38	38	100	329m 1,079'	151m 495'	46	344m 1,129'	T-2, B-2, 1 - Cored 18m basalt.
255	31°07.87'S 93°43.72'E October 9-12, 1972 1154m (3,786')	10-1/8 Smith F94C #KN025	11	11	100	99m 325'	8m 26'	8	109m 357'	Lost in hole.
256	23°27.35'S 60°46.46'E October 12-17, 1972 5371m (17,622')	10-1/8 Smith 94CJS, 3 Cone #JZ238	11	11	100	99m 325'	78m 256'	79	270m 886'	Lost 2 cones. Heat flow probe locked cones. 19m basalt cored.
257	30°59.16'S 108°20.99'E October 17-23, 1972 5288m (17,350')	10-1/8 Smith F94C #KN026	17	17	100	156m 511'	77m 252'	49	325m 1,066'	T-5, B-2, 1 - drilled 63.5m basalt. Inside teeth, cone off cones.
258	33°47.69'S 112°28.42'E October 24-28, 1972 2803m (9,197')	10-1/8 Smith F94C #KN024	25	24	96	231m 757'	116m 380'	50	525m 1,722'	
258A	33°47.69'S 112°28.42'E October 28-29, 1972 2803m (9,197')	10-1/8 Smith F94C #KN924	9	9	100	95m 312'	67m 220'	71	124m 406'	T-1, B-1, 1 - drilled streaks of chert.

CORE BIT SUMMARY - LEG 27

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
259	29°37.05°S 112°41.78'E November 2-7, 1972 4712m (15,460')	10-1/8 Smith 94CJS, 3 CTR #JZ239	41	40	98	346m 1,135'	249m 816'	72	346m 1,135'	T-2, B-8, 6, 7 Cored 38.5m basalt. Shirttail wear.
260	16°8.67'S 110°17.92'E November 7-14, 1972 5709m (18,731')	10-1/8 Smith 94CJS, 4 CTR #JZ246	20	19	95	170m 559'	57m 187'	34	331m 1,085'	T-5, B-3, G-0 Cored 8m basalt.
261	12°56.83'S 117°53.56'E November 14-22, 1972 5687m (18,659')	10-1/8 Smith F94C, $ CTR #KN037	39	38	97	342m 1,122'	126m 413'	37	580m 1,902'	T-2, B-4, G-0. Cored 47.5m basalt.
262	10°52.19'S 123°50.78'E November 22-26, 1972 2315m (7,596')	10-1/8 Smith 93CJS, 3 CTR #JK194	47	47	100	442m 1,450'	366m 1,200'	83	442m 1,450'	T-2, B-1, B-0. For rerun.
263	23°19.43'S 110°57.81'E Nov 26-Dec 6, 1972 5065m (16,618')	10-1/8 Smith F94C, 4 CTR #KN072	29	29	100	271m 889'	164m 538'	60	746m 2,448'	T-1, B-2, G-0. Drill pipe dropped when overrunning clutch failed. One cone cracked.

CORE BIT SUMMARY - LEG 28

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
264	34°58.13'S 112°02.68'E December 22-23, 1972 2883m (9,459')	10-1/8 Smith F94C #KN104	15	11	73	143m 469'	65m 212'	46	216m 708'	
264A	34°58.13'S 112°02.68'E December 23-24, 1972 2883m (9,459')	10-1/8 Smith F94C #KN104	4	4	100	38m 125'	33m 118'	87	159m 521'	T-1, B-6 - drilled 40m conglomerate. One cone locking. 3-cone bit.
265	53°32.45'S 109°56.74'E December 24-January 1, 1973 3592m (11,785')	10-1/8 Smith 94CJS #JZ247	18	17	94	169m 554'	108m 354'	64	462m 1,516'	T-1, B-2 - cored 18m basalt.
266	56°24.13'S 110°06.70'E January 1-4, 1973 4183m (13,724')	10-1/8 Smith 94CJS #JZ247	24	24	100	220m 721'	145m 476'	66	384m 1,260'	T-5, B-6, G-3/8 Cored 13m basalt - one cone loose - 7 broken.
267	59°15.74'S 104°29.30'E January 4-6, 1973 4574m (15,007')	10-1/8 Smith 94CJS #JZ249	7	6	85	58m 190'	26m 85'	45	220m 721'	Cored 16m basalt.
267A	59°15.74'S 104°29.30'E January 6-7, 1973 4574m (15,007')	10-1/8 Smith 94CJS #JZ249	3	2	66	29m 95'	11m 35'	41	71m 232'	

CORE BIT SUMMARY - LEG 28

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
267B	59°14.55'S 104°29.94'E January 7-8, 1973 4559m (14,958')	10-1/8 Smith 94CJS #JZ249	10	10	100	95m 312'	54m 177'	56	314m 1,030'	T-7, B-7 - cored 3m basalt. All cones wove loose. 30% of the teeth gone.
268	63°56.99'S 105°09.34'E January 8-12, 1973 3554m (11,661')	10-1/8 Smith F93C #KN151	20	20	100	190m 623'	66m 216'	35	475m 1,558'	T-2, B-3 - 1 tooth missing in the core area.
269	61°40.57'S 104°04.21'E January 12-18, 1973 4295m (14,092')	10-1/8 Smith F93C #KN145	11	11	100	103m 338'	38m 125'	38	417m 1,368'	
269A	61°40.57'S 104°04.21'E January 18-21, 1973 4295m (14,092')	10-1/8 Smith F93C #KN145	13	13	100	124m 406'	55m 180'	45	958m 3,143'	T-2, B-5 - drilled clay and mudstone. One loose cone and one tooth missing.
270	77°26.48'S 178°30.19'W January 21-February 3, 1973 644m (2,113')	10-1/8 Smith 93CJS #JK242	49	48	98	423m 1,387'	264m 866'	62	423m 1,387'	All cones locked.
271	76°47.21'S 175°02.86'W February 3-5, 1973 579m (1,900')	10-1/8 Smith F93C #KN221	24	11	45	223m 732'	15m 49'	7	265m 869'	One cone almost off. Drilled rocks, boulders, clay and sand. Bit wear was a surprise.

CORE BIT SUMMARY - LEG 28

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
272	77°07.62'S 176°45.61'W February 5-9, 1973 629m (2,064')	10-1/8 Smith F93C #KN150	48	39	82	439m 1,440'	162m 531'	37	443m 1,453'	B-4, T-2 - drilled clay and sand. Had shirttail wear.
273	74°32.29'S 174°37.57'E February 9-10, 1973 505m (1,657')	10-1/8 Smith F93C #KN261	9	9	100	76m 249'	28m 92'	37	76m 249'	
273A	74°32.29'S 174°37.57'E February 10-13, 1973 505m (1,657')	10-1/8 Smith F93C #KN261	29	24	83	266m 873'	56m 183'	21	346m 1,135'	B-5, T-2 - clay, sand and siltstone.
274	68°59.81'S 173°25.64'E February 13-19, 1973 3326m (10,913')	10-1/8 Smith 94C #HC758	45	44	97	421m 1,381'	279m 915'	66	421m 1,381'	B-7, T-4 - cored some chert streaks in soft clay. Cored 5m basalt.

CORE BIT SUMMARY - LEG 29

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
275	50°26.34'S 176°18.99'E March 2-6, 1973 2837m (9,308')	10-1/8 Smith SS94C, 3 CTR #HZ487	5	4	80	43m 141'	18m 59'	41	62m 203'	Lost in hole.
276	50°48.11'S 176°48.40'E March 6-9, 1973 4677m (15,345')	10-1/8 Smith 94CJS, 3 CTR #JZ237	1	0	0	1m 3'	0	0	24m 79'	T-1, B-1 - suitable for rerun.
277	52°13.43'S 166°11.48'E March 9-13, 1973 1232m (4,042')	10-1/8 Smith 94CJS, 3 CTR #JZ237	46	46	100	435m 1,427'	259m 849'	60	473m 1,551'	T-1, B-2 - suitable for rerun.
278	56°33.42'S 160°04.29'E March 13-17, 1973 3708m (12,166')	10-1/8 Smith 94CJS, 3 CTR #JZ237	35	35	100	325m 1,066'	278m 912'	86	439m 1,440'	
278A	56°33.42'S 160°04.29'E March 17, 1973 3708m (12,166')	10-1/8 Smith 94CJS, 3 CTR #JZ237	2	2	100	19m 62'	8m 26'	40	44m 144'	T-1, B-3 - throat flared. Cored 10.5m basalt.
279	51°20.14'S 162°38.10'E March 17-21, 1973 3381m (11,093')	10-1/8 Smith 94CJS, 3 CTR #JZ563	1	1	100	1m 3'	0.6m	60	1m 3'	

CORE BIT SUMMARY - LEG 29

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
279A	51°20.14'S 162°38.10'E March 21-22, 1973 3378m (11,083')	10-1/8 Smith 94CJS, 3 CTR #JZ563	13	13	100	110m 361'	80m 262'	73	202m 663'	T-1, B-1 - cored 5m basalt. For rerun.
280	48°57.44'S 147°14.08'E March 23-27, 1973 4191m (13,751')	10-1/8 Smith 94CJS, 3 CTR #JZ563	1	1	100	6m 20'	6m 20'	92	10m 32'	Lost in hole.
280A	48°57.44'S 147°14.08'E March 23-27, 1973 4191m (13,751')	10-1/8 Smith 94CJS, 3 CTR #KN146	23	23	100	201m 659'	97m 318'	48	524m 1,719'	T-1, B-2 - cored 5m basalt. For rerun.
281	47°59.84'S 147°45.85'E March 31-April 1, 1973 1601m (5,252')	10-1/8 Smith F93C, 4 CTR #KN146	19	16	84	169m 554'	106m 347'	63	169m 554'	T-1, B-2
281A	47°59.84'S 147°45.85'E April 1-2, 1973 1601m (5,252')	10-1/8 Smith F93C, 4 CTR #KN146	3	2	67	29m 95'	7m 23'	25	46m 151'	
282	42°14.76'S 143°29.18'E April 2-8, 1973 4217m (13,836')	10-1/8 Smith F93C, 4 CTR #KN146	20	18	90	168m 551'	64m 209'	38	311m 1,020'	T-2, B-4 - cored 15.5m basalt. Shirttail wear.

CORE BIT SUMMARY - LEG 29

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
283	43°54.60'S 154°16.96'E April 8-12, 1973 4766m (15,637')	10-1/8 Smith 93CJS, 3 CTR #JK191	19	19	100	156m 512'	61m 200'	39	592m 1,942'	
283A	43°54.60'S 154°16.96'E April 12-13, 1973 4755m (15,604')	10-1/8 Smith 93CJS, 3 CTR #JK191	2	2	100	11m 35'	11m 35'	96	21m 72'	T-1, B-1 - cored 3.5m basalt. For rerun.
284	40°30.48'S 167°40.81'E April 13-16, 1973 1078m (3,537')	10-1/8 Smith 93CJS, 3 CTR #JK191	22	21	96	208m 682'	167m 547'	80	208m 682'	
284A	40°30.48'S 167°40.81'E April 16, 1973 1078m (3,537')	10-1/8 Smith 93CJS, 3 CTR #JK191	3	3	100	29m 95'	22m 72'	79	75m 246'	Suitable for rerun.

CORE BIT SUMMARY - LEG 30

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
285	26°49.16'S 175°48.24'E April 29-May 1, 1973 4674m (15,335')	10-1/2 Smith F94C, 3 CTR #KK989	5	5	100	46m 150'	42m 138'	93	93m 305'	Rerun - lost in hole. Little or no rotation.
285A	26°49.16'S 175°48.24'E May 2-4, 1973 4674m (15,335')	10-1/8 Smith F94C, 3 CTR #KN103	10	10	100	86m 282'	47m 154'	55	584m 1,916'	Lost one cone - remaining 2 cones tight. Many inserts broken.
286	16°31.92'S 166°22.18'E May 7-11, 1973 4484m (14,712')	10-1/8 Smith F94C, 3 CTR #KN102	41	41	100	383m 1,257'	170m 557'	45	706m 2,316'	T-1, B-8, 10 BT, 1/2" OG Seal gone on two cones. Balls nearly gone on one cone.
287	13°54.67'S 153°15.93'E May 15-17, 1973 4654m (15,270')	10-1/8 Smith 94CJS, 3 CTR #JZ244	18	18	100	157m 515'	72m 236'	46	252m 827'	T-1, B-4, 1/8" OG Seal gone on one cone. No broken teeth.
288	5°58.3'S 161°49.57'E May 21-22, 1973 3030m (9,941')	10-1/8 Smith 94CJS, 3 CTR #JZ244	11	11	100	98m 321'	50m 164'	51	238 781'	Rerun - T-1, B-4, 1/8" OG Seal gone on one cone. No broken teeth.
288A	5°58.3'S 161°49.57'E May 22-28, 1973 3030m (9,941')	10-1/8 Smith FS9C, 4 CTR #JS521	30	29	97	285m 935'	61m 200'	22	989m 3,245'	T-2, B-8, 16 BT, 1/16" OG Two seals gone.

CORE BIT SUMMARY - LEG 30

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
288A	5°58.3'S 161°49.57'E May 22-29, 1973 3030m (9,941')	10-1/8 Smith FS9C, 4 CTR #JS522	0	0	0	0	0	0	0	T-2, B-4, 1/16" OG - all bearings.
288B	5°58.3'S 161°49.57'E May 29, 1973 3030m (9,941')	10-1/8 Smith 9C, 4 CTR #KC071	1	1	100	3m 10'	3m 10'	97	3m 10'	As new - side tracks hole in soft ooze.
288C	5°58.3'S 161°49.57'E May 30, 1973 3030m (9,941')	10-1/8 Smith 9C, 4 CTR #KC071	1	0	0	5m 16'	5m 16'	100	5m 16'	As new - side tracks hole in soft ooze.
289	00°29.92'S 158°30.69'E May 31-June 8, 1973 2224m (7,297')	10-1/8 Smith 94CJS, 4 CTR #JZ248	133	133	100	1271m 4,170'	713m 2,339'	56	1271m 4,170'	T-4, B-8, 1G Many broken teeth. Two cones had begun skid.

CORE BIT SUMMARY - LEG 31

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
290	17°44.85'N 133°28.08'E June 18-20, 1973 6057m (19,873')	10-1/8 Smith-Sealed Bearing F93C, 3 CTR #KN304	9	8	89	80m 262'	39m 128'	49	255m 837'	Core throat bent. Evidence of tooth interference. Six teeth missing - several cracked and chipped. Ports plugged.
290A	17°45.05'N 133°28.44'E June 20-21, 1973 6057m (19,873')	10-1/8 Smith-Sealed Bearing F93C, 3 CTR #KN304	2	1	50	19m 62'	2m 7'	10	140m 459'	T-3, B-8 Stabilizer hard facing worn.
291	12°48.43'N 127°49.85'E June 23-24, 1973 5217m (17,117')	10-1/8 Smith-Sealed Bearing 94CJS, 4 CTR #JZ253	5	5	100	41m 135'	10m 32'	24	127m 417'	Much scaring on body and stabilizers. Evidence of cones locking on bent core throat. Ports open.
291A	12°48.45'N 127°49.98'E June 24-25, 1973 5217m (17,117')	10-1/8 Smith-Sealed Bearing 94CJS, 4 CTR #JZ253	2	1	50	17m 56'	1m 3'	9	115m 377'	T-2, B-4 - in gauge.
292	15°49.11'N 124°39.05'E June 26-30, 1973 2943m (9,656')	10-1/8 Smith-Sealed Bearing F94C, 3 CTR #KN081	47	46	98	444m 1,457	243m 797'	55	444m 1,457	T-1, B-2 - in gauge.
293	20°21.25'N 124°05.65'E July 1-4, 1973 5601m (18,376')	10-1/8 Smith-Sealed Bearing F94C, 3 CTR #KN107	23	20	87	203m 666'	79m 259'	39	564m 1,850'	T-8, B-8 - many teeth missing Core throat bent. Shank cracked. Out of gauge. Two ports plugged. Stabilizers worn.

CORE BIT SUMMARY - LEG 31

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
294	22°34.74'N 131°23.13'E July 6-9, 1973 5784m (18,977')	10-1/8 Smith-Sealed Bearing 94CJS, 3 CTR #JZ241	7	6	86	52m 170'	23m 75'	45	118m 387'	T-1, B-1 - in gauge. One tooth chipped. Bearing and throat in good condition. Ports open - good for rerun.
295	22°33.75'N 121°22.04'E July 7-8, 1973 5802m (19,036')	10-1/8 Smith-Sealed Bearing 94CJS, 3 CTR #JZ241	3	3	100	29m 95'	20m 65'	69	158m 518'	Core throat shortened prior to running.
296	29°20.41'N 133°31.52'E July 10-14, 1973 2920m (9,580')	10-1/8 Smith-Sealed Bearing 94CJS, 3 CTR #JZ240	65	64	99	612m 2,008'	312m 1,024'	51	1087m 3,566'	T-4, B-4 - in gauge. Core throat modified and in good condition. Several inside teeth missing. One port plugged.
297	30°52.36'N 134°09.89'E July 15-18, 1973 4458m (14,627'	10-1/8 Smith-Sealed Bearing F94D, 3 CTR #KN084								T-1, B-1 - in gauge. Core throat modified. Core throat and parts ok. One cone has 14 cracks between T.C. inserts.
297A	30°52.36'N 134°09.89'E July 18-20, 1973 4458m (14,627')	10-1/8 Smith-Sealed Bearing F94D, 3 CTR #KN084							201m 659'	
298	31°42.93'N 133°36.22'E July 19-22, 1973 4628m (15,184')	10-1/8 Smith-Sealed Bearing 94CJS, 3 CTR #JZ242	16	16	100	146m 479'	67m 219'	46	611m 2,005'	Core throad modified

CORE BIT SUMMARY - LEG 31

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
298A	31°42.93'N 133°36.33'E July 22-23, 1973 4628m (15,184')	10-1/8 Smith-Sealed Bearing 94CJS, 3 CTR #JZ242	1	1	100	10m 32'	0.4m	0	98m 321'	Bit lost in hole.
299	30°29.69'N 137°39.72'E July 26-28, 1973 2583m (8,475')	10-1/8 Smith-Sealed Bearing F94C, 3 CTR #KN106	38	36	95	361m 1,184'	173m 564'	48	532m 1,745'	T-1, B-1 - in gauge. In good condition. Core throat modified. Suitable for rerun
300	41°02.96'N 136°06.30'E July 29-30, 1973 3427m (11,244°)	10-1/8 Smith-Sealed Bearing F94C, 3 CTR #KN106	2	0	0	11m 35'	0	0	117m 384'	T-1, B-1 - in gauge. Core throat modified. Suitable for rerun. Everything in good condition.
301	41°03.75'N 134°02.86'E July 30-August 1, 1973 3520m (11,549')	10-1/8 Smith-Sealed Bearing F94C, 3 CTR #KN106	0	0	0	0	0	0	497m 1,631'	T-1, B-1 - in gauge. Good for rerun in hole of shallow basement penetration.
302	40°29.13'N 136°54.01'E August 2-3, 1973 2399m (7,871')	10-1/8 Smith-Sealed Bearing F943, 3 CTR #KN085	18	16	89	165m 541'	91m 298'	55	532m 1,745'	T-1, B-1 - in gauge. Core throat modified. In good condition for rerun.

CORE BIT SUMMARY - LEG 32

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
303	40°48.50'N 154°27.08'E August 18-22, 1973 5625m (18,456')	10-1/8 Smith F94C, 3 CTR #KN105	6	4	66	54m 177'	26m 85'	48	229m 751'	B-1, T-1 - stuck core barrel in drill pipe.
303A	40°48.50'N 154°27.08'E August 22-24, 1973 5625m (18,456')	10-1/8 Smith F94C, 3 CTR #KN105	10	8	80	820m 263'	6m 19'	7	293m 961'	B-8, T-2 - 7.5m chert, 8m basalt.
304	39°20.27'N 155°04.19'E August 24-27, 1973 5640m (18,505')	10-1/8 Smith F94C, 4 CTR #PC188	17	14	82	131m 430'	30m 98'	23	347m 1,138'	B-8, T-5 - cored 12m basalt. Two cones were locked.
305	32°00.13'N 157°51.00'E August 29-September 3, 1973 2921m (9,584')	10-1/8 Smith F94C, 4 CTR #PC188	58	48	82	631m 2,070'	211m 689'	33	641m 2,103'	B-8, T-8 - penetrated 450m chert. Left 2 cones and one shank in hole.
306	30°52.02'N 158°28.71'E September 3-8, 1973 3416m (11,208')	10-1/8 Smith 9C,4 CTR #KC071	43	39	90	381m 1,250'	27m 88'	7	475m 1,558'	B-8, T-8 - drilled 470m chert streaks. Left 4 cones in hole.
307	28°35.26°N 161°00.28'E September 9-13, 1973 5708m (18,728')	10-1/8 Smith F94C, 4 CTR #PC203	13	13	100	111m 364'	19m 62'	18	317m 1,040'	B-4, T-7 - 275m chert. 7m basalt. Inside teeth broken.

CORE BIT SUMMARY - LEG 32

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
308	34°58.94'N 172°08.98'E September 16-17, 1973 1346m (4,416')	10-1/8 Smith F94C, 4 CTR #PC189	5	4	80	31m 102'	7m 23'	24	69m 226'	B-1, T-1 - same as new.
309	34°54.32'N 171°33.67'E September 17-18, 1973 1470m (4,823')	10-1/8 Smith F94C, 4 CTR #PC189	1	0	0	2m 7'	0	0	12m 39'	Broke bottomhole assembly. Bit lost in hole.
310	36°52.15'N 176°54.06'E September 20-21, 1973 3524m (11,562')	10-1/8 Smith F94C, 4 CTR #PC192	21	21	100	194' 636'	146' 479'	75	94m 308'	Cleared mudline. Wait on weather.
310A	36°52.15'N 176°54.0°'E September 23-24, 1973 3524m (11,562')	10-1/8 Smith F94C, 4 CTR #PC192	18	20	95	164m 538'	28m 92'	16	353m 1,158'	
311	28°07.06'N 179°44.25'E September 27-28, 1973 5280m (17,324')	10-1/8 Smith F94C, 4 CTR #PC191	5	5	100	37m 121'	19m 62'	51	46m 151'	Lost in hole.
312	25°34.70'N 178°08.00'W September 29-30, 1973 5355m (17,570')	10-1/8 Smith F94C, 4 CTR #PC187	0	0	0	0	0	0	0	Bad weather. Hole was not drilled.

CORE BIT SUMMARY - LEG 32

HOLE NO.	POSITION	CORE BIT	CORES			TOTAL AMOUNT CORED				REMARKS
	Latitude/Longitude Dates of Operation Water Depth - Meters (Ft)	Size Make Type S/N	Attempts	With Recovery	% With Recovery	Total Amount Cored Meters(Feet)	Total Amount Recovered Meters(Feet)	% Recovery	Total Penetration Meters(Feet)	
313	20°10.52'N 170°57.15'W October 3-6, 1973 3492m (11,457')	10-1/8 Smith F94C, 4 CTR #PC187	44	44	100	395m 1,296'	220m 722'	56	606m 1,988'	B-3, T-3 - drilled 400m chalk, limestone and chert - 12m basalt.