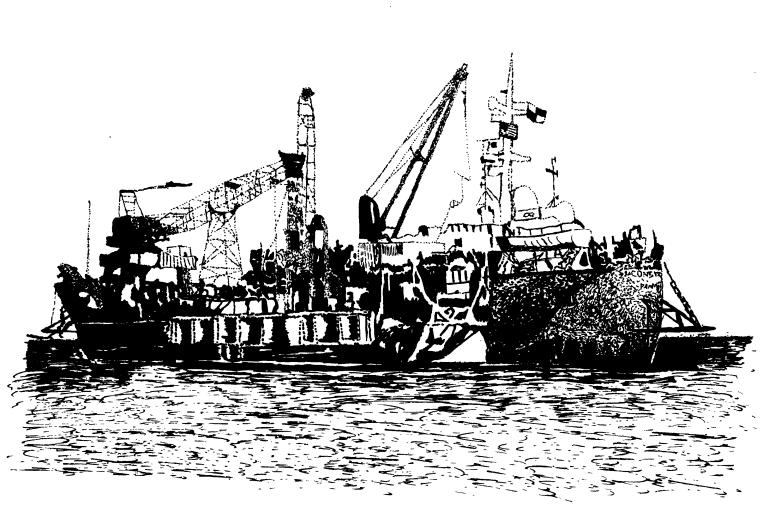
PACIFIC ENEWETAK ATOLL CRATER EXPLORATION (PEACE) PROGRAM,

ENEWETAK ATOLL, REPUBLIC OF THE MARSHALL ISLANDS

Part 1: Drilling operations and descriptions of bore holes in vicinity of KOA and OAK craters



U.S. Geological Survey Open-File Report 86-419 1986



UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Pacific Enewetak Atoll Crater Exploration (PEACE) Program Enewetak Atoll, Republic of the Marshall Islands

Part 1: Drilling operations and descriptions of boreholes in vicinity of KOA and OAK craters

by

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U.S. Geological Survey

Open File Report 86-419

Prepared in cooperation with the Defense Nuclear Agency

This report is preliminary and has not been reviewed for conformity with $U_{\bullet}S_{\bullet}$ Geological Survey editorial standards and stratigraphic nomenclature.

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Use of trade names is for identification only and does not constitute endorsement either by the U.S. Geological Survey or by the Defense Nuclear Agency.

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PACIFIC ENEWETAK ATOLL CRATER EXPLORATION (PEACE) PROGRAM ENEWETAK ATOLL, REPUBLIC OF THE MARSHALL ISLANDS

Part 1: Drilling operations and descriptions of boreholes in vicinity of KOA and OAK craters

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U.S. Geological Survey

INTRODUCTION

From mid-1984 through mid-1985, the United States Geological Survey (USGS) engaged in an investigation of two craters formed from high-yield, near-surface nuclear bursts in the Marshall Islands at Enewetak Atoll (figures 1 and 2). Supported by the Defense Nuclear Agency (DNA), this cooperative venture is referred to by the acronym PEACE, derived from its official name, Pacific Enewetak Atoll Crater Exploration Program.

The craters studied, KOA and OAK, resulted from 1.4- and 8.9-megaton, near-surface bursts detonated near the northern perimeter of the Enewetak lagoon on May 12 and June 28, 1958, respectively. At that time, Enewetak was administered by the United States Government under the auspices of the Trust Territories of the Pacific Islands (TTPI) and formed a part of the Pacific Proving Grounds (PPG). OAK and KOA are among the only high-yield nuclear craters available for studies of cratering processes and crater-related effects.

General Objectives of PEACE Program

The objectives of the PEACE Program were: (1) to identify major crater dimensions, morphology, and structures; (2) to provide a data base for material-properties, shock-metamorphic, and other types of related studies; and (3) to gain a better understanding of both the proceses that formed the excavational crater and that altered that initial feature to its present form. These data from the Enewetak craters are needed for verification of cratering prediction models (code validation), which is important to the analysis of survivability of various strategic defense systems.

Overview of USGS Role in PEACE Program

The major role of the U.S. Geological Survey in the PEACE Program was conduct multidisciplinary geologic and geophysical investigations of the present—day crater features and to collaborate with the Defense Nuclear Agency and its contractors on certain aspects of the material—properties studies (i.e., mineralogic data, borehole gravimetry) and the analysis of the downhole geophysical logging.

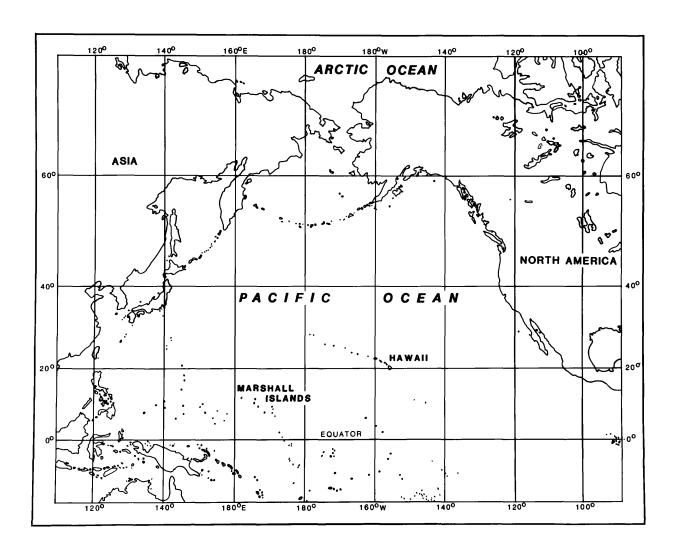


FIGURE 1. -- Location map of the Marshall Islands.

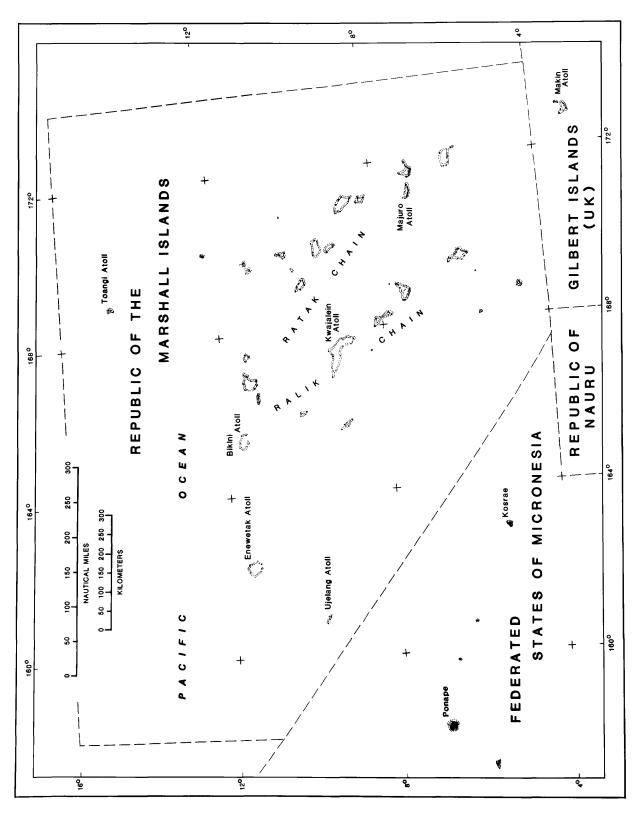


FIGURE 2. -- Map of the Republic of the Marshall Islands, showing primary atolls, including Enewetak and Bikini. Geopolitical outlines (shown as dashed lines) do not constitute recognized national or territorial boundaries; they group islands that are under the same political jurisdiction.

Participation of the USGS in field work for the PEACE Program on Enewetak was divided into two major phases. Phase I, the so-called Marine Phase, was conducted from June 17 to September 20, 1984, and consisted of a geophysical /geologic assessment of surface and subsurface characteristics of the craters and environs. (The Phase I field work actually was preceded by a successful pilot borehole-gravimetry study conducted by the USGS and a DNA contractor on one of the southern islands of the atoll in April of 1984.) Phase II, also known as the Drilling Phase, ran from January 14 through July 25, 1985, and consisted of complementary geologic/geophysical assessments of borehole data.

The Marine Phase was conducted principally by personnel from the Office of Energy and Marine Geology (OEMG) of the USGS, but involved onsite observers from DNA and substantial logistic support from the Pacific Area Support Office (PASO) of the Department of Energy (DOE). Phase I was designed to study both seafloor and subbottom characteristics of KOA and OAK by using overwater geophysical techniques and scuba and submersible surveys. Most of the Phase I analyses are reported in Folger (1986a) which includes chapters by various investigators on (1) the bathymetry, physiography, and character and distribution of bottom or near-subsurface materials and (2) the depth, distribution and extent, continuity, and seismic velocity of acoustic reflectors in the craters and their proximity. These geophysical studies incorporate data from sidescan-sonar, single- and multichannel-seismic, and refraction surveys; the geologic studies include data from seafloor observations, benthic samples (in part), and six shallow (<40 ft deep) boreholes drilled by scuba teams.

The information obtained during Phase II from the deep boreholes provided the stratigraphic or geologic framework for the program and the ground-truth or verification for the subbottom single— and multichannel seismic profiles and other complementary investigations conducted during Phase I. Phase II had two primary objectives: (1) to obtain samples of rock and sediment in as undisturbed condition as possible for litho— and biostratigraphic (geologic) analysis and for material—properties (engineering) studies and (2) to conduct downhole geophysical logging to provide additional geologic, material—properties, and radiologic information on the two craters. In addition to the integrated suite of conventional geophysical logs that was run, the first successful shallow overwater borehole—gravimetry study was executed in a selected number of boreholes on the southwestern transect of OAK crater.

Due to the highly successful operation of the submersible Delta during the first phase of the PEACE Program, this vessel was recontracted for additional seafloor investigations during the summer of 1985.

USGS Reports

The data and some of the conclusions for the PEACE Program will be presented by the USGS and DNA in a series of reports. As mentioned previously, most of the investigations included in Phase I are summarized in USGS Bulletin 1678, edited by Folger (1986a). The component chapters (capital letters designate chapters), authors for these sections, and reference citations used in the current USGS Open-File Report are:

- Introduction -- by D.W. Folger [cited as Folger (1986b)].
- A: Bathymetry of OAK and KOA craters -- by D.W. Folger, J.C. Hampson, J.M. Robb, R.A. Woellner, D.S. Foster, and L.A. Tavares [cited as Folger, Hampson, and others, 1986];
- B: Side-scan-sonar survey of OAK and KOA craters -- by D.W. Folger, J.M. Robb, J.C. Hampson, P.A. Davis, P.M. Bridges, and D.J. Roddy [cited as Folger, Robb, and others, 1986];
- C: Single-channel seismic survey of OAK and KOA craters -- by J.M. Robb, D.S. Foster, D.W. Folger, J.C. Hampson, and R.A. Woellner [cited as Robb and others (1986)];
- D: Multichannel seismic-reflection survey of KOA and OAK craters —— by J.A. Grow, M.W. Lee, J.J. Miller, W.F. Agena, J.C. Hampson, D.S. Foster, and R.A. Woellner [cited as Grow and others (1986)];
- E: Seismic-refraction survey of OAK crater -- by H.D. Ackermann, J.A. Grow, and J.M. Williams [cited as Ackermann, Grow, and Williams (1986)];
- F: Observations of OAK and KOA craters from the submersible -- by R.B. Halley, R.A. Slater, E.A. Shinn, D.W. Folger, J.H. Hudson, J.L. Kindinger, and D.J. Roddy [cited as Halley, Slater, and others, 1986];
- G: Preliminary analyses of OAK debris samples -- by R.B. Halley, R.P. Major, K.R. Ludwig, Z.L. Peterman, and R.K. Matthews [cited as Halley, Major, and others, 1986];
- H: Scuba observations of OAK and KOA craters -- by E.A. Shinn, J.L. Kindinger, R.B. Halley, and J.H. Hudson [cited as Shinn and others, 1986].

The current Open-File Report is the first of an anticipated sequence of companion reports by the USGS presenting the geologic and geophysical portions of Phase II. The results of the material-properties studies and investigations of the crater-development processes and dynamic phenomena associated with the nuclear explosions will be published separately by the DNA and its contractors.

Three major USGS Open-File Reports on Phase II are planned. The **first report** is the current one, the purpose of which is threefold: (1) to discuss the procedures and drilling operations conducted during phase II on Enewetak Atoll; (2) to present the lithic descriptions of the core and samples obtained from the boreholes drilled from the <u>Knut Constructor</u> during Phase II; and (3) to make available to the public those drilling statistics and related data that are relevant to current and future investigations of the core and sample materials. The **second report** (Cronin and others, 1986) is the paleontologic and the biostratigraphic analysis of these boreholes. The **third report** (Henry and Wardlaw, eds., in preparation) will present (1) the lithostratigraphic framework;

(2) analysis of the downhole geophysical logs; (3) the results of the borehole-gravimetry studies, including the pilot study conducted in April of 1984 on the southern part of the atoll; (4) the studies on the isotopic dating of the Enewetak stratigraphic section and selected material from the crater region; (5) the mineralogic analyses; (6), the results of the radiation-chemistry studies; (6) the results of the organic analyses of selected boreholes; (7) additional seafloor and subbottom characteristics of the two craters concentrating on the information obtained during Phase II of the PEACE Program; (8) an analysis of the bottom (benthic) samples collected during Phase I; and (9) a comprehensive summary and geologic interpretation of the craters.

Phase II Participants and Roles

Phase II was a cooperative effort between three Federal agencies, the U.S. Geological Survey, the Defense Nuclear Agency (and its contractors), and the Department of Energy (and its contractors). Most of the USGS personnel involved in Phase II are from the Office of Regional Geology (ORG)

Lt. Col. R.F. Couch, Jr., Defense Nuclear Agency (PEACE Program Manager for DNA); B.L. Ristvet and E.L. Tremba, S-Cubed Division of Maxwell Laboratories; and S.L. Melzer, Science Applications International, all acted as program coordinators and chief scientists for the DNA during various stages of the active drilling operations (table 1). Ristvet also was an active participant in the borehole-gravimetry program (including the pre-Phase I pilot study) and assisted in reestablishing the navigational network onsite prior to arrival of the drill ship. Melzer was DNA's borehole logging specialist and coordinator between the drilling operations and the material-properties community. Couch, Ristvet, and Tremba were also observers and consultants during the field work for Phase I. Tour dates on Enewetak for these individuals for Phase II of the program is shown in Table 1.

Although the USGS essentially played a scientific role during Phase II, the Survey supported and assisted the DNA in the development of the drilling plan and was involved with DNA and DOE in constant onsite decisions modifying that plan, including borehole siting, sampling, and downhole geophysical logging and borehole gravimetry. Scientifically, the USGS was solely responsible for the stratigraphic analysis of the borehole data, including the description and paleontologic analysis of the core and samples, and was jointly responsible with DNA for the interpretation of the downhole geophysical logging and the borehole gravimetry. USGS personnel who served tours of duty on Enewetak during Phase II of the PEACE Program, their responsibilities, and their tour dates are included in Table 2. In addition, T.W. Henry and B.R. Wardlaw collected benthic samples from the Enewetak lagoon during Phase I from September 4 - 19, 1984; R.B. Halley, E.A. Shinn, and J.J. Miller were extensively involved in Phase I field work as well.

The role of the Department of Energy is explained in detail in DOE Publication (NVO-294), released in September 1985. Through DOE's contractors Holmes and Narver, Inc. (H&N), and Fenix and Sisson (F&S),

DEFENSE NUCLEAR AGENCY FIELD PERSONNEL

NAME	AFFILIATION/ADDRESS	RESPONSIBILITY	TOUR DATE(S)	
R. F. Couch, Jr.	Headquarters, Defense Nuclear Agency, Alexandria, VA	DNA PEACE Program Manager	Feb. 05 - Mar. 15 May 24 - Jun. 21 Jul. 17 - Jul. 27	
B. L. Ristvet	S-Cubed Albuquerque, NM	Science Advisor, Gravimetery and Navigation Specialist, Historian	Jan. 10 - Feb. 01 Feb. 16 - Mar. 03 Apr. 10 - Apr. 24 Jun. 18 - Jul. 25	
E. L. Tremba	S-Cubed Albuquerque, NM	Science Advisor, Geophysicist, Geochemist	Mar. 14 - Apr. 10	
L. S. Melzer	Science Applications International Midland, TX	Science Advisor, Geophysical Logging & Material-Properties Specialist	Apr. 10 - May 24	

TABLE 1. -- DNA field personnel, affiliation, onsite responsibilities, and tour dates (Enewetak time) for Phase II of PEACE Program.

U. S. GEOLOGICAL SURYEY FIELD PERSONNEL

NAME	AFFILIATION	RESPONSIBILITY	TOUR DATE(S)
E. H. Roseboom	ORG, Reston, VA	USGS PEACE Program Manager	Jun. 19 - Jun. 20
T. W. Henry	ORG, Reston, VA	DRG Program Coordinator, Chief Geologist, Petrographer	Feb. 10 - Mar. 07 Apr. 10 - May 11 Jun. 19 - Jul. 18
3. R. Wardlaw	P&S Washington, DC	Chief Geologist, Petrographer	Feb. 10 - Apr. 13 May 10 - Jun. 20
Betty Skipp		Petrographer	Mar. 13 - Apr. 13 May 10 - Jun. 05
J. I. Tracey, Jr.	ETR, Reston, VA	Petrographer	Apr. 10 - May 11
R. P. Major	OGR, Denver, CO	Petrographer	June 05 - Jul. 25
T. M. Cronin	P&S, Reston, VA	Chief Paleontologist	Feb. 14 - Mar. 04 Jun. 05 - Jun. 20
R. Margerum	P&S Washington, DC	Paleontologist	Mar. 13 - Apr. 13
E. M. Brouwers	P&S, Denver, CO	Paleontologist	Apr. 10 - May 11 Jun. 19 - Jul. 22
T. G. Gibson	P&S, Reston, VA	Paleontologist	May 10 - Jun. 05
R. Z. Poore	P&S, Reston, VA	Paleontologist	Jun. 05 - Jun. 20
N. E. Martin	P&S Washington, DC	Physical Science Technician, Petrographer, Mobilization- Demobilization Specialist	Feb. 10 - Mar. 02 Jun. 05 - Jul. 25
R. G. Stamm	P&S Washington, DC	Physical Science Technician, Paleontologist	Mar. 02 - Mar. 27 Apr. 24 - Jun. 05
E. E. Compton	P&S, Reston, VA	Physical Science Technician, Paleontologist	Mar. 27 - Apr. 24
R. B. Halley	OGR, Denver, CO	Geologist, Submersible Operations Specialist	Jun. 19 - Jul. 03
1. W. Lee	OGR, Denver, CO	Geophysicist, Observer for Downhole Logging Operations	Feb. 22 - Mar. 07
J. J. Miller	OGR, Denver, CO	Geophysicist, Observer for Downhole Logging Operations	Feb. 22 - Mar. 07
E. A. Shinn	OGR, Fisher Island Sta., FL	Geologist, Documentary Film Producer	Jul. 03 - Jul. 10

TABLE 2. -- USGS field personnel, affiliations, onsite responsibilities, and tour dates (Enewetak time) for Phase II of PEACE Program. Abbreviations as follows: ORG (Office of Regional Geology), P&S (Branch of Paleontology and Stratigraphy), OGR (Branch of Oil and Gas Resources), ETR (Branch of Eastern Technical Reports). The drill ship, Knut Constructor, actually departed Kwajalein Atoll on Feb. 12, and arrived in Enewetak Lagoon on Feb. 17, 1985.

the drilling, downhole geophysical logging, borehole gravimetry, navigation, submersible, and communications were subcontracted. The DOE also arranged for the radiologic monitoring, contracted the logistics (supply/ resupply, personnel transportation, and core shipment) and provided both Government and DOE-contractor personnel to the program. H.U. Brown, DOE Pacific Area Support Office (PASO) in Honolulu, was the Project Manager for the DOE. Petroleum engineers R.D. Clarke and F.R. Huckabee, Nevada Operations Office (NVO) of the DOE, served as program monitors for the DOE and technical advisors aboard the drilling ship. E.L. Herbst and J.H. Matthewman (both H&N) acted as site managers aboard the Knut Constructor.

McClelland Engineering, Inc. (MEI), was the drilling subcontractor and provided the multinational drilling and drilling-support crews, the drilling equipment, and the drill ship, the Knut Constructor. C. Rivette and Leon Holloway served as Chief Engineers, and Glenn Mooney and Charlie Peltier were the Chief Drillers during operations on Enewetak. The Captains of the Knut Constructor were Magne Loevland and Odd Stenersen; the First Officer was Roberto Escaro. The drilling crew and ships crew provided continuous support throughout the program, including crane operations and machine-shop work.

The conventional downhole geophysical logging was subcontracted to BPB Instruments, Inc., and the borehole gravimetry to EDCON, Inc. Logging operators were Andrew Reynolds, Al LeBreton, Michael Beales, and Charles Novinskie for BPB and Douglas Joiner and L. Prado for EDCON.

Meridian Ocean Systems, Inc. (MOS), was awarded the subcontract for the Phase II navigation by the DOE. The same equipment and navigation towers, emplaced by MOS for the USGS during Phase I, were used during the summer of 1985. Phase I returnee R.F. Johnson and newcomer Steven Petersen were navigators for MOS during Phase II.

Additional geodetic surveys were requested by the DNA (1) to properly locate four MOS transponder towers relative to the original IVY-grid and Enewetak-Wake datum (1960) and to the World Geodetic System datum (1972) and (2) to position five underwater points (cultural features) that had known positions prior to the atomic-test explosions. These surveys were performed in January of 1985 by H.V. Woodworth and B.W. Crothers of the Defense Mapping Agency (DMA). The results of these surveys are reported in Woodworth and Crothers (1985). The submersible (two-man submarine) Delta, also under contract to the USGS during Phase I, returned to Enewetak during Phase II. D.N. Privitt and Leroy Johnson of MARFAB, Inc., and R.A. Slater of GEOCUBIC, Inc., operated this vessel from mid-June to early July. Additional dives and observations particularly in the vicinity of OAK crater were conducted, and many observers from the Defense and cratering communities made orientation dives in the submersible during the middle part of June.

Acknowledgments

We owe a profound debt of gratitude to T.R. Clark, Manager of the Nevada Operations Office (NVO) of the DOE, to R. Ray, Deputy Manager for Pacific Operations, NVO, to their staff, to W.J. Stanley, Director of the

Pacific Area Support Office (PASO) of the DOE in Honolulu, and to his staff, particularly H.U. Brown DOE Program Manager for this project, for letting the drilling and other Phase II contracts, for arranging for support from a number of Government and subcontractor personnel to manage the onsite operations and logistics, and for obtaining necessary permission and approval from the U.S. military authorities at Hickam Field (U.S. Air Force) in Honolulu, HI, at the U.S. Army facility at Kwajalein Atoll (Republic of the Marshall Islands, RMI), and from the Government officials of the RMI and the Trust Territory of the Pacific Islands (TTPI).

E.L. Herbst (H&N, Las Vegas) and George Krosnbein, Judy Honda, J.H. Matthewman, and P.R. Haggerty (all H&N, Honolulu) especially were responsive to transportation and supply logistics throughout Phase II. In addition to these and other people cited in the previous section, we would like to thank S.S. Miyasato (H&N) and his staff at the University of Hawaii/DOE Mid-Pacific Research Laboratory on Enewetak Island for providing every assistance throughout the drilling/logging operations, including the orchestration of resupply from the island to the ship in all kinds of weather.

We also acknowledge the support by the officials of the Republic of the Marshall Islands and by the people of Enewetak, many of whom piloted the whalers and LCM6 landing craft used as resupply vessels between the islands and the drill ship and assisted in many other project operations, and all of whom freely and warmly extended their hospitality.

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Location and Setting

Enewetak and Bikini are "coral" atolls that lie in the equatorial Pacific Ocean roughly 2,500 nautical miles (nmi) southwest of the Hawaiian Islands (figures 1 and 2). Until very recently a part of the Trust Territories of the Pacific Islands (TTPI), administered by the United States Government, both now are now part of the Republic of the Marshall Islands (RMI), the capitol of which is Majero. The approximate center of Enewetak Atoll is 11 degrees, 30 minutes north latitude and 162 degrees, 15 minutes east longitude; Bikini's center is about 11 degrees, 35 minutes north and 165 degrees 23 minutes east. Enewetak is about 220 nmi west of Bikini.

Primarily, the Marshall Islands are composed of two subparallel chains of atolls, guyots, and islands that trend southeast-northwest (figure 2). The framework of these chains consists of volcanic islands and guyots that formed as the Pacific tectonic plate moved northwestward over a "hot spot" in the earth's crust (known as the Darwin Rise). Coral-coralgal reefs were established on the volcanic bases and, in the cases of atolls such as Enewetak and Bikini, reef growth generally kept pace with subsidence and/or eustatic sea-level changes.

Enewetak Atoll is shaped like a slightly elliptical acorn with a longer axis that is approximately 22 nmi long and is oriented in a northwesterly direction; the shorter axis is about 17 nmi long (figure 3).

Like most of the Marshall Islands, Enewetak's approximately 40 islands are very low-lying (maximum elevation about 13 ft above sea level) and restricted to the atoll margin. Enewetak thus is dominated by the lagoon, which has three principal outlets to the open ocean (figure 3). The islands constitute only about 2.75 square nautical miles (sq nmi) of the atoll's almost 300 sq nmi and are concentrated primarily on Enewetak's northeastern margin facing the prevailing trade winds. The islands have been called by different names. For some, as many as four "native" names

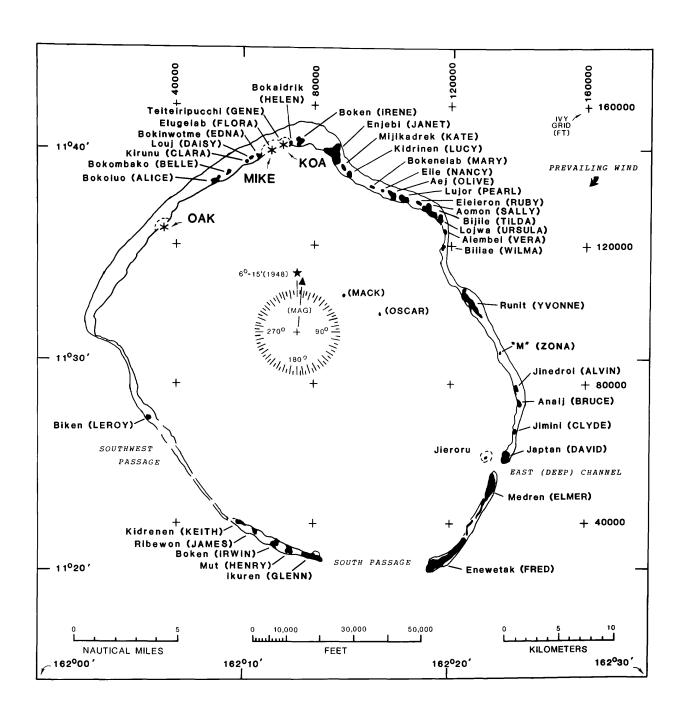


FIGURE 3. -- Map of Enewetak Atoll, showing location of KOA, OAK, and MIKE craters, native names of principal islands as used in current report, with alphabetically arranged, military site names assigned during period of nuclear testing shown in parentheses, and coral pinnacles MACK and OSCAR (phototower).

or variations of English spelling have been applied. To alleviate this potentially confusing situation, most of the islands were given a military site name. In both Folger's (1986b) report and the current one, the native Marshallese names identified by Tobin (1973) and reported in Freisen (1982) are utilized to the maximum extent possible (see Folger, 1986b, table 1). In succeeding discussions, the military site names also are cited in parenthesis in capital letters after the preferred island name. In cases where a specific cited report refers to a different name or spelling, the preferred spelling is given first outside of the parenthesis, and both the spelling used in the cited reference and the site name follow inside the parenthesis—e.g., Enewetak (Enewetok, FRED).

The lagoon attains a maximum depth of about 210 ft and is divisible into two major physiographic features (Emery, Tracey, and Ladd, 1954; Folger, Robb, and others, 1986), as follows: (1) a wide terrace that rims the lagoon and that attains a maximum width of about 2.6 nmi on the western side of the atoll; (2) and an elliptical, flat-floored basin. About 2,300 pinnacle reefs or coral knolls rise often abruptly from the floor of the lagoon. According to Emery (1948) and Emery, Tracey, and Ladd (1954), most of these rise to depths shallower than 120 ft. Several break water at lowest tides. Two prominent pinnacle reefs that do break the surface are called OSCAR and MACK on many of the military and navigation maps (figure 3), and a photographic observation tower stood for many years on OSCAR. OSCAR was established as the origin (100,000 ft North, 100,000 ft East) of the planar IVY-grid by Holmes and Narver and the U.S. Coast and Geodetic Survey early in the period of nuclear testing. As a result of satellite observations requested by Folger (1986b), OSCAR was relocated geodetically by the Defense Mapping Agency (DMA) at 11 degrees, 32 minutes, 7.432 seconds north and 162 degrees, 16 minutes, 49.408 seconds east.

Brief History of Enewetak

The native peoples of Enewetak, the rest of the Marshall Islands, and the other islands of Micronesia, are descendants of the people who, centuries ago and over hundreds of years, migrated from the Malayasian-Indonesian area into Oceania and the more remote areas of the Pacific Ocean. Several atolls of the Marshall Islands including Enewetak were "discovered" by the Spanish explorers in the early to mid-1500's. Enewetak Atoll apparently was first sighted in 1526, and the Spaniard Alvaro de Saavedra is credited with being the first westerner to land there (1529). After the Englishman's Drake's historic voyage on the Golden Hind in 1579, almost two centuries elapsed before the tiny islands and atolls began to be widely noted and accurately placed on western maritime charts. Enewetak was resighted in 1794 by Captain Thomas Butler, who commanded the British sloop Walpole, which was engaged in the China trade. Bikini was resighted in 1825 by Otto von Kotzebue, an officer in the Russian navy.

Until the latter part of the ninteenth century, the peoples of the Marshall Islands effectively had little contact with westerners; they were self-governing with each individual atoll or island ruled by one or more hereditary chiefs. In 1886, Germany established a formal protectorate over the Marshall Islands during her brief period of colonial expansion, introduced copra production, and established a whaling base.

In 1914, Japan seized Enewetak and Bikini, the remainder of the Marshall Islands, and all of the rest of the German Micronesian possessions. At the end of World War I, the newly formed League of Nations awarded Japan a mandate to rule the former German Pacific possessions located north of the equator. Several years later, contrary to the terms of that mandate, Japan began to fortify Enewetak and a number of the other atolls of the Marshall Islands as strategic bases for their planned conquest of the Pacific.

In early 1944, the United States military forces attacked Japanese bases on Kwajalein and Enewetak. Enewetak was captured in February after a bloody three-day battle, and Japanese rule of the Marshall Islands was effectively ended. The Marshall Islands were governed by the U.S. Navy from then until 1947. In April of 1947, the United Nations Security Council established the Trust Territory of the Pacific Islands (TTPI) and authorized the United States to govern as a strategic area trusteeship the islands that Japan had administered under the League of Nations mandate. Under the terms of this agreement approved by the President of the United States on July 18, 1947, the U.S. was authorized to establish military bases in the TTPI.

In August of 1986, with the approval of the United Nations Security Council, the TTPI will be dissolved, and the new Republic of the Marshall Islands (RMI) will be formed from part of the TTPI. The new republic will be independent except for maters of defense.

Pacific Proving Grounds and Enewetak Nuclear Testing

The U.S. Government conducted atmospheric nuclear tests in the Pacific from 1946 through 1962, before the Limited Test-Ban Treaty (1963) with the Soviet Union mandated all further nuclear testing be conducted underground. Enewetak and Bikini Atolls together constituted the western part of the Pacific Proving Grounds, created in 1948. The PPG and Amchitka in the Aleutian Islands were the only sites where the U.S. Government tested megaton-range nuclear devices. After the native Enewetak and Bikini peoples were moved to nearby atolls, twenty-six nuclear shots were conducted on Bikini Atoll from 1946 through 1958, and 43 were detonated on or in the vicinity of Enewetak Atoll from 1948 through 1958 (Hines, 1962; Bliss, 1982, DNA, 1981). On October 31, 1958, the United States and the Soviet Union began a joint moratorium on atmospheric testing of nuclear weapons. In the fall of 1961, however, the Soviets resumed nuclear testing. The United States responded with a series of 34 nuclear tests in the vicinity of Johnston Atoll and Christmas Island in the central Pacific in 1962.

The first nuclear tests on Bikini Atoll in 1946 were conducted under Operation Crossroads. According to Hines (1962, p. 31-40) and Bliss (1982, p. 1), these tests were to determine the effects of the explosion of nuclear weapons on military hardware. The first nuclear test on Enewetak Atoll was on April 14, 1948, as a part of Operation SANDSTONE, a three-shot program staged from 200-ft tall, island-based towers. The nuclear tests on Enewetak were primarily weapons-related, although attempts were made to understand explosion phenomenon and the blast effects on various types of manmade structures. Additional studies were conducted to measure biologic

exposure and responses, to evaluate detection instruments, to compare nuclear-yield determinations, etc. (Bliss, 1982, p. 1).

Table 3 is a list of the nuclear tests conducted on Enewetak Atoll. All but three of the Enewetak detonations occurred on or in the vicinity of the northeastern band of islands on the atoll (figure 4), and most of the nuclear testing was concentrated on or near the islands of Runit (YVONNE; 16 shots), Enjebi (JANET; 10 shots), Aomon (SALLY; 3 shots), and Eleleron (RUBY, 2 shots). Of the forty-three nuclear experiments, thirteen were detonated from towers, two were airdrops, two others were submarine shots, and the remainder were detonated from barges or landing craft (LCU's) in the lagoon (table 3). One of the two submarine shots was conducted in the ocean outside of the main reef on the southwestern part of the atoll, and the other (UMBRELLA) was shot in the lagoon near Ikuren (GLENN). Most of the surface and barge shots produced craters. A number of these explosions had common or approximately common surface ground zeros (figure 4 and table 3).

History of Previous Geologic Investigations

Sporadic scientific studies were conducted in the Marshall Islands prior to the end of World War II (for details, see Emery, Tracey, and Ladd, 1954, p. 3-8, and Hines, 1962). Extensive geologic and other scientific investigations of the Marshall Islands essentially began with the nuclear age.

Studies from 1946-1952

Operation Crossroads was initiated by the U.S. Government in 1946 just before atmospheric nuclear testing began in what was to become the Pacific Proving Grounds (PPG). To paraphrase Hines (1962, p. 31-32), Operation Crossroads was unquestionably the most thoroughly documented, reported, and publicized peacetime military/scientific program in history. Operation Crossroads set the stage for the extensive scientific investigations that rapidly followed. Those of geologic and geophysical importance are: Bikini Resurvey (1947), the Mid-Pacific Expedition (1950), the Atomic Energy Commission (AEC) Drilling Program (1950-51), and the USGS/AEC Drilling Program (1951-52). Under these programs from 1946 to 1952, extensive geologic, paleontologic, geophysical, biologic, radiologic, and oceanographic studies were conducted by the the Department of Defense, the USGS, the U.S. Fish and Wildlife Service, the Atomic Energy Commission (AEC), the Los Alamos Scientific Laboratory (LASL), the Woods Hole Oceanographic Institution, the Scripps Instution of Oceanography, the Smithsonian Institution, other Federal agencies, the Bishop Museum, and various American universities. Summaries of these investigations were published as the 35component USGS Professional Paper 260, beginning in 1954 (Emery, Tracey, and Ladd, 1954, Professional Paper 260-A) and ending in 1969 (Leopold, 1969, Professional Paper 260-II).

<u>First Boreholes. --</u> The first geologic boreholes in the Marshall Islands were drilled on Bikini Island in 1947 (published in Ladd, Tracey, and Lill, 1948; in Ladd and others, 1948; and in Emery, Tracey, and Ladd,

NUCLEAR EVENTS AT ENEWETAK ATOLL

EVENT NAME	DATE (GMC)	BURST TYPE/HEIGHT	YIELD	GENERAL LOCATION	IVY-GRID COORDINATES
X-RAY	04/14/1948		37 kt	JANET	147,330 N; 083,569 E
YOKE	04/30/1948	Tower 200 ft	49 kt	SALLY	130,907 N; 111,993 E
ZEBRA	05/14/1948	Tower 200 ft	18 kt	YVONNE	106,120 N; 124,364 E
DOG	04/07/1951	Tower 300 ft	Class.	YVONNE	106,178 N; 124,318 E
EASY	04/20/1951	Tower 300 ft	47 kt	JANET	147,382 N; 083,515 E
GEORGE	05/08/1951	Tower 200 ft	Class.	RUBY	130,947 N; 111,929 E
ITEM	05/24/1951	Tower 200 ft	Class.	JANET	148,985 N; 086,450 E
MIKE	10/31/1952	Surface	10.4 mt*		147,754 N; 067,789 E
KING	11/15/1952	Airdrop 1,500 ft	500 kt	ANONNE	108,150 N; 124,130 E
NECTAR	05/13/1954	Barge	1.69 mt	MIKE crater area	
LACROSSE	05/04/1956	Surface	40 kt	YVONNE n. end	106,885 N; 124,515 E
YUMA	05/27/1956	Tower 200 ft	Class.	SALLY	130,603 N; 112,155 E
ERIE	05/30/1956	Tower 300 ft	Class.	YVONNE	102,060 N; 127,930 E
SEMINOLE	06/06/1956	Surface	13.7 kt	IRENE	149,897 N; 075,237 E
BLACKFOOT	06/11/1956	Tower 200 ft	Class.	YVONNE	104,435 N; 126,080 E
KICKAPOO	06/13/1956	Tower 300 ft	Class.	SALLY	132,295 N; 114,018 E
OSAGE	06/16/1956	Airdrop	Class.	YVONNE	102,851 N; 126,647 E
INCA	06/21/1956	Tower 200 ft	Class.	PEARL	133,540 N; 105,300 E
MOHAWK	07/02/1956	Tower 300 ft	Class.	RUBY	132,165 N; 109,737 E
APACHE	07/08/1956	Barge	Class.	MIKE crater area	148,063 N; 069,227 E
HURON	07/21/1956	Barge	Class.	MIKE crater area	148,304 N; 070,015 E
CACTUS	05/05/1958	Surface	18 kt	YVONNE n. end	106,370 N; 124,215 E
BUTTERNUT	05/11/1958	Barge	Class.	YVONNE 4,000 ft N	100,812 N; 123,319 E
KOA	05/12/1958	Surface	1.37 mt*	GENE	149,360 N; 071,120 E
WAHOO	05/16/1958	Underwater 500 ft	Class.	HENRY, Ocean-side (9,000 ft SSW of IRW	
HOLLY	05/20/1958	Barge		YVONNE 2,075 ft SW	101,834 N; 124,943 E
YELLOWWOOD	05/26/1958	Barge	Class.	JANET 6,000 ft SW	143,994 N; 078,161 E
MAGNOLIA	05/26/1958	Barge	Class.	YVONNE 3,000 ft SW	101,344 N, 124,161 E
TOBACCO	05/30/1958	Barge	Class.	JANET 4,000 ft SW	145,137 N; 079,779 E
ROSE	06/02/1958	Barge	Class.	YVONNE 4,000 ft SW	100,811 N; 123,315 E
UMBRELLA	06/08/1958	Underwater**	Class.	GLENN, 1.4 mi N	042,615 N; 076,029 E
WALNUT	06/14/1958	Barge	Class.	JANET 6,000 ft SW	143,996 N; 078,168 E
LINDEN	06/18/1958	Barge	Class.	YVONNE 2,000 ft SW	101,877 N; 125,012 E
ELDER	06/27/1958	Barge	Class.	JANET 4,000 ft SW	145,136 N; 079,790 E
OAK	06/28/1958	Barge	8.9 mt*	ALICE 3 mi SW	124,981 N; 036,108 E
SEQUOIA	07/01/1958	LCU	Class.	YVONNE 2,000 ft SW	101,871 N; 125,000 E
DOGWOOD	07/05/1958	LCU	Class.	JANET 4,000 ft SW	145,135 N; 079,786 E
SCAEVOLA	07/14/1958	Barge	Class.	YVONNE 560 ft SW	102,638 N; 126,227 E
PISONIA	07/17/1958	Barge	Class.	YVONNE 12,000 ft W	
OLIVE	07/22/1958	LCU	Class.	JANET 4,000 ft SW -	145,138 N; 079,790 E
PINE	07/26/1958	Barge	Class.	JANET 8,500 ft SW YVONNE, middle	142,549 N; 076,110 E
QUINCE	08/06/1958	Surface	Class.	YVUNNE, middle	103,950 N; 126,185 E
FIG	08/18/1958	Surface	Class.	YVONNE, middle	103,950 N; 126,185 E

TABLE 3. -- List of Enewetak nuclear events cited in text and other island-surface and lagoon (barge or landing-craft, LCU shots, including date (Greenwich Mean Time) of detonation, shot type, yield (where not classified), and location. Note that MI KE/NECTAR, TOBACCO/ELDER/DOGWOOO/OLIVE, and YELLOWWOOD/WALNUT had common ground-zero points. Yield given in kt (kiloton, defined as energy equivalent to 1,000 tons of TNT) and mt (megaton, equals 1,000 kt), except where classified (Class.). Modified from Bliss (1982, tbl. 1), DNA (1981, p. 56, fig. 1-54, and Freisen (1982; tbl. 1-3); IVY-grid locations from B.L. Ristvet and E.L. Tremba (oral communication, 04/16/1986). See Figure 3B for location map.

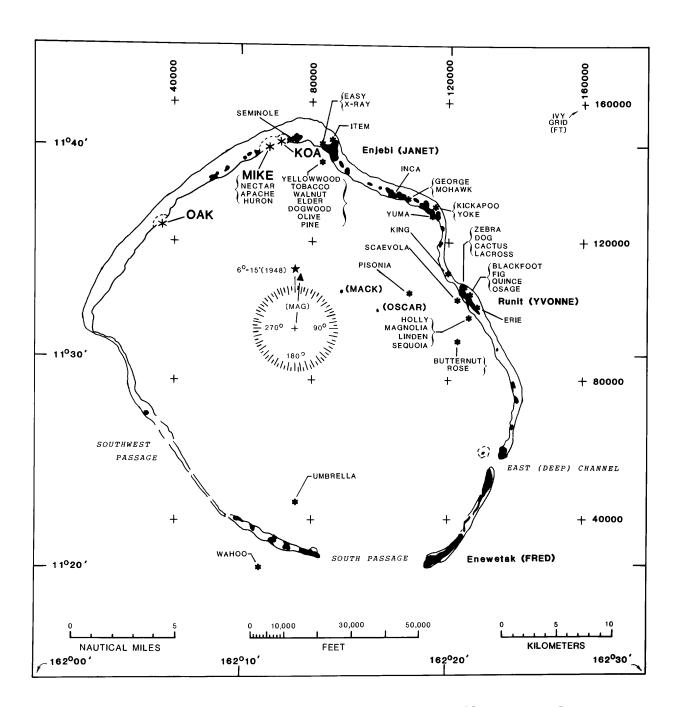


FIGURE 4. -- Nuclear-detonation sites on Enewetak Atoll. The nuclear shots with the same or approximately the same ground-zero location are grouped together with brackets; detail of sites in the MIKE and KOA area (from Louj through Enjebi) is shown in Figure 22 of current report. The data are from Table 3. (Figure modified from DNA, 1981, fig. 1-53.)

1954). The deepest two of these (2-A and 2-B) were drilled to 1,346 and 2,556 ft, respectively. In 1950, a few deep-sea cores were obtained from the southeastern flank and lower slope of Bikini and one of the adjoining guyots.

AEC-LASL Drilling (1950-51). -- Drilling on Enewetak Atoll also commenced in 1950, with four very shallow boreholes (maximum depth 15.9 ft) drilled under the sponsorship of the AEC and LASL and supervision of the USGS. These holes were drilled on the seaward side of Enjebi (Engebi, JANET) to determine the degree and extent of cementation beneath the reef plate (figure 5). The following year, 29 boreholes were drilled to depths ranging from 43 to 200 ft on Bokoluo (Bogallua, ALICE), Enjebi (Engebi, JANET), Mijikadrek (Mujinkariikku, KATE), Eleleron (Eberiru, RUBY), Aomon (Aranit, SALLY), and Runit (YVONNE) on the northern side of the atoll (figure 5). Seventeen of these holes were described in Ladd and Schlanger (1960).

USGS-AEC Drilling (1951-52). -- Three deep holes were drilled on Enewetak Atoll in 1951 and 1952 by the USGS and the AEC (figure 5) from heavy, truck- and trailer-mounted rotary rigs: K-lB was drilled on Enjebi (JANET) to a depth of 1,280 ft; F-l penetrated to 4,630 ft on Elugelab (FLORA); and E-l was drilled to 4,222 ft on Medren (Parry, ELMER) (Ladd and others, 1953; Ladd and Schlanger, 1960). Boreholes E-l and F-l penetrated through the limestone cap of the atoll into the volcanic, olivine-basalt "basement" at depths of 4,610 and 4,158 ft, respectively (figure 6). About 15 ft of the basalt was recovered in the latter borehole. In general, recovery was poor in these boreholes (see figure 6), and only relatively small portions of F-l and E-l were actually cored. However, cuttings were carefully evaluated and provided invaluable information on the stratigraphy. Of these three deep holes, only E-l was not destroyed by the direct effects of nuclear testing (Couch and others, 1975).

E-1 and F-1 were the first boreholes to reach the volcanic "basement" of any Pacific atoll, providing confirmation of a major tenet of Charles Darwin's (1837, 1842) theory of atoll origin and evolution as a function of volcanism and subsequent sea-floor instability and subsidence. The three deep Enewetak holes and the two deep Bikini holes, mentioned in a preceding section, provided the first general litho- and biostratigraphic framework for these atolls and demonstrated that they had remarkably similar geologic histories. The subsurface sedimentary geology of both Enewetak and Bikini is characterized by relatively thick intervals of leached, altered, cemented, calcite-rich carbonate rock (predominantly limestone) alternating with generally thick intervals of unleached, unaltered, uncemented (unlithified), aragonite-rich carbonate sediments (figure 6). The cemented, altered zones grade downward into unaltered, uncemented zones that in turn sharply overlie another cemented interval. Because the tops of the leached and cemented zones are sharp and rocks immediately underlying them commonly contain dissolution features, they were referred to by Schlanger (1963, p. 994) as "solution unconformities", formed during periods when sea-level was lower and the atolls emergent (Ladd, Tracey, and Lill, 1948; Emery, Tracey, and Ladd, 1954; Schlanger, 1963). That these unconformities generally coincide with major microfaunal breaks (figure 6) indicated to these geologists that periods of

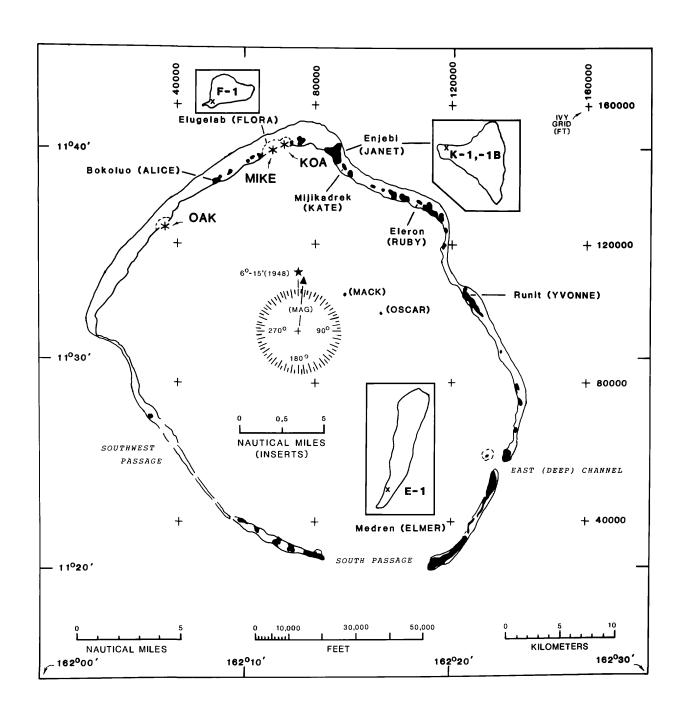


FIGURE 5. -- Map of Enewetak Atoll, showing islands and reef-flat areas where boreholes were drilled from 1950 through 1952. Deep boreholes are designated E-1, F-1, and K-1/1B on inserts (data from sources cited in text). Note that Elugelab (FLORA) was obliterated by MIKE.

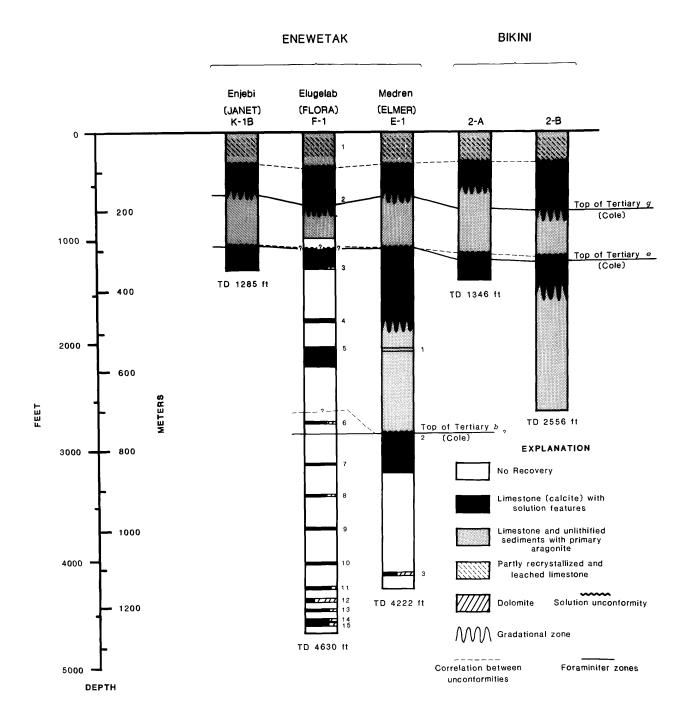


FIGURE 6. -- Generalized stratigraphic sections and correlation of deep boreholes drilled on Enewetak and Bikini Atolls in 1951-1952 and 1947, respectively, showing zones of unaltered material and recrystallized and partly dolomitized intervals (from Schlanger, 1963, fig. 308). Location of Enewetak boreholes shown on Figure 5 of current report.

nondeposition or perhaps even erosion had interrupted the formation of the carbonate section.

Interim Period (1952-1970)

Between 1952 and 1970, after the flurry of geologic studies in the early post-World War II period, several major problems surfaced that required additional geologic information from the PPG. Specifically, additional data were needed to better understand crater geometry, material properties (including geologic heterogeneity in a coral atoll), and ground-shock phenomena associated with high-yield explosions (see Circeo and Nordyke, 1964; Henny, Mercer, and Zbur, 1974a, Couch and others, 1975; Ristvet and others, 1978; Tremba, Jones, and Henny, 1981; Tremba, Couch, and Ristvet, 1982; and Tremba, 1984).

Fewer geologic environments are more heterogenous than a "coral" atoll. The analogy between a Pacific atoll and a bucket of sand is appropriate. The reef facies is a hard, competent, cemented exterior formed by an organic framework dominated by coralline algae and corals. The backreef environment, where the islands are generally located, consists of a spectrum of materials ranging from uncemented to well-cemented; in the backreef environment, a set of generally inorganic (marine) processes acts to cement the sediment in selected areas and form what generally is referred to as "beachrock". Thus, the reef and backreef environments act as the rim of the bucket. The inside of the bucket is filled with finer-grained, lagoonal sediment that is generally much less cemented and competent than the rim. Also scattered at any time throughout the lagoon of any atoll the size of Enewetak or Bikini are as many as two-thousand patch reefs or pinnacle reefs. Many of these rise hundreds of feet from the lagoon floor to near sea level, and a few actually will break water at low tide. These lagoonal reefs are structurally competent edifices.

Even within the material inside the bucket that is dominated by the finer-grained sediments are layers that have been more or less cemented by nonmarine (groundwater) geochemical processes during periods of atoll emergence. These layers extend some distance inward toward the center of the lagoon. This heterogeneity needed to be understood better before widely applying the results of computer modeling to crater phenomenology.

In addition to the geological concerns mentioned above, concern also was focused partly on the major problem that the PPG high-yield nuclear craters appear anomolously broad and shallow scaled to their counterparts formed by high-explosives and by low-yield nuclear devices at other test sites and with some meteor-impact craters (e.g., Barringer Crater in Arizona) (see particularly figs. 5 and 6 of Cooper, 1977). It was postulated by some investigators that some of these deviations result from fundamental differences in the material properties of the test-site environment. The PPG craters were formed in generally water-saturated, carbonate sediments and rock, whereas the craters at the other test sites were formed in predominantly non-water-saturated, silicate sediments and/or rock. Other workers favored explaining the deviations primarily as functions of the yield of the source, the manner in which the energy source was coupled to the ground, massive wash back of water excavated by the explosion in the lagoon, or failure of the weak geologic matrix induced by the ground shock.

New studies were envisioned to not only improve the knowledge of the material-properties differences between the two major types of media just mentioned but also to better understand the geologic heterogeneity inherent in any explosion or impact site of strategic interest.

Studies from 1970 - 1981

The concerns outlined in the preceding section resulted in the PACE, EXPOE, and EASI Programs (see Pyrz, 1973; Henny, Mercer, and Zbur, 1974a, 1974b; Couch and others, 1975; Tremba, 1984), funded by the DNA and directed by the Air Force Weapons Laboratory (AFWL).

PACE Program (1970-72). -- As originally formulated, the PACE Program consisted of two interrelated subprograms, termed PACE 1 and PACE 2 (Tremba, Couch, and Ristvet, 1982). PACE 1 was designed to examine the nuclear craters at Enewetak and to provide information on the near-surface geology of the atoll and the physical and structural characteristics of selected craters and related ejecta fields. PACE 2 was to concentrate on the cratering and ground-motion response of the water-saturated carbonate sands to a series of high-explosive (TNT) tests. However, the overall program was terminated prematurely through legal and political action before all of the objectives of the program were attained (see Tremba, Jones, and Henny, 1981, for discussion). Consequently, PACE 2 yielded little valuable new geologic information.

Field work for PACE 1 was conducted in 1971 (Couch and others, 1975) when 128 shallow boreholes (total of 8,200 linear ft of hole) were drilled on the islands of Runit (YVONNE), Lojwa (Rojoa, URSULA), Bijile (Biijiri, TILDA), Aomon (Aranit, SALLY), Eleleron (Eberiru, RUBY), Bokaidrik (Bogairikk, HELEN), and Boken (Bogon, IRENE) (figure 7). Most of the boreholes were concentrated on the islands of Runit (35 holes) and Aomon (80 holes). In addition to the drilling program, 60 shallow trenches were dug to determine the extent and distribution of the beachrock beneath six of the islands, and 50,000 ft of land-based, seismic-refraction surveys were run, mainly in the Aomon (SALLY) area and on Runit Island (YVONNE) (Henny, Mercer, and Zbur, 1974a, 1974b).

EXPOE Program (1973-74). -- To model the geologic and material-properties heterogeneity of the subsurface of Enewetak Atoll, the strategy of EXPOE (the successor of PACE 1) was to (1) delimit the general geologic differences between the leeward, windward, and transitional islands (figure 8) and (2) to drill sets of holes both parallel and perpendicular to the reef front in the areas of interest to the craters. According to Couch and others (1975, p. 23), (1) the general lack of lithofacies variation in the transects parallel to the reef front and (2) the marked lateral facies changes between the transects perpendicular to the reef front indicated the validity of modeling the entire atoll subsurface on the basis of a few sections perpendicular to the reef trend and by comparing reefward to lagoonward geologies.

During the EXPOE Program, 46 additional shallow boreholes were drilled (8,413 linear ft of hole) in 1973 and 1974 with truck-mounted, rotary rigs on the islands of Enewetak (Eniwetok, FRED), Medren (Parry, ELMER), Japtan

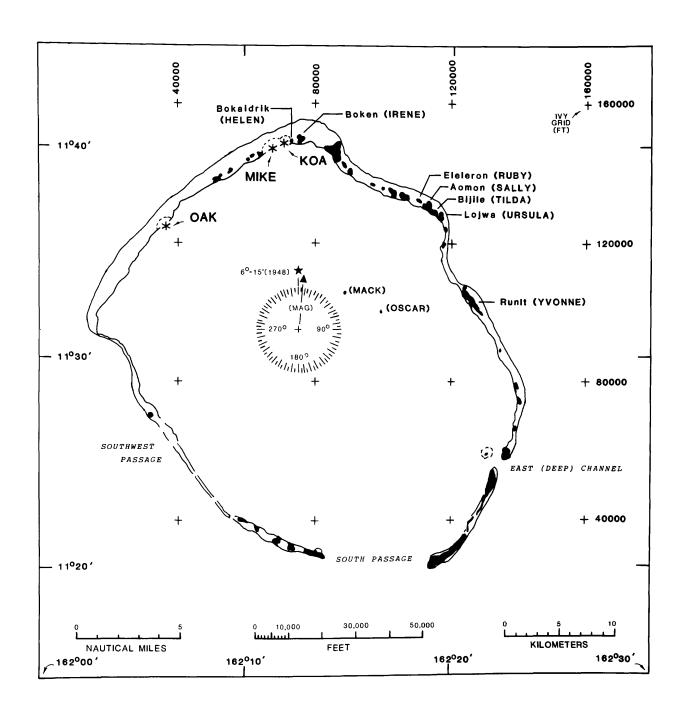


FIGURE 7. -- Map of Enewetak Atoll, showing islands and reef-flat areas where boreholes were drilled during PACE Program (modified from Couch and others, 1975, fig. 4).

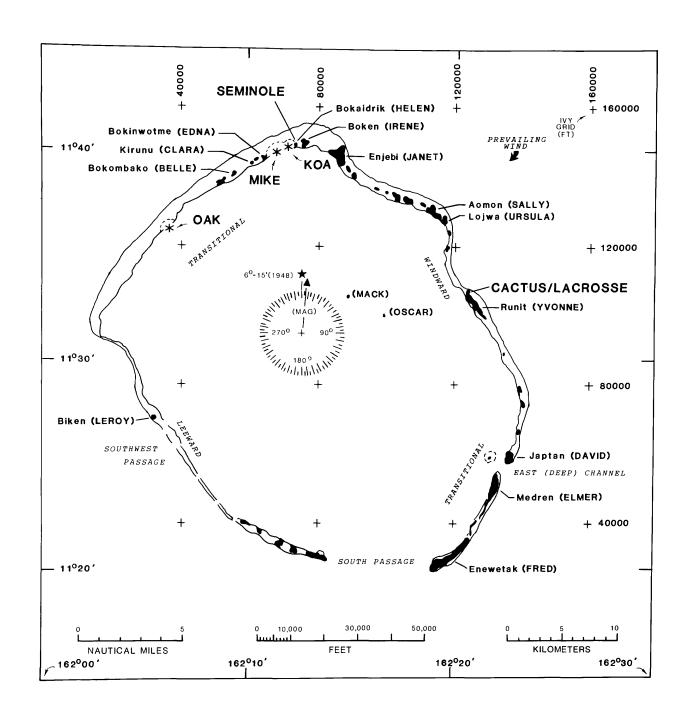


FIGURE 8. -- Map of Enewetak Atoll, showing islands on which boreholes were drilled during EXPOE Program, major passages, selected nuclear craters, and relationship to prevailing trade winds. (Modified from Couch and others, 1975, fig. 24.)

(DAVID), Rumit (YVONNE), Lojwa (Rojoa, URSULA), Aomon (Aranit, SALLY), Enjebi (Engebi, JANET), Boken (Bogon, IRENE), Bokaidrik (Bogariik, HELEN), Sanildefowso (Sanildefonso, EDNA), Kirunu (Ruchi, CLARA), Bokombako (Bogombogo, BELLE), and Rigili (LEROY) (figure 8). The deepest of these holes, 298 ft, is XEN-3, located on Enjebi Island, and is a part of the first reefward to lagoonward, geologic cross-section of an atoll island extending to depths of about 300 ft below sea level (figure 9). Similar lagoon-to-reef cross sections for Boken (Bogon, IRENE) and for Aomon (Aranit, SALLY) appear in Ristvet and others (1978, p. 167, fig. 6.5) and in Szabo, Tracey, and Goter (1985, p. 56, fig. 2), respectively.

Because of improved core and sample recovery (approximately 80%) and more detailed analysis, five major, gently lagoonward-dipping unconformities were identified in the upper 300 ft of section on Enewetak in the EXPOE/PACE stratigraphic synthesis (Ristvet and others, 1974; Tracey and Ladd, 1974; Couch and others, 1975). After analysis of subsequent seismic work, Ristvet, Couch, and Tremba (1980) were able to confirm a sixth solution unconformity, corresponding to a major one postulated by Schlanger (1963) and by Tracey and Ladd (1974) at a depth of about 300 ft. Like the earlier studies, these unconformities were interpreted as former subaerial—exposure horizons marked by terra—rosa types of paleosols (reddish—brown stain, reddish—brown fine silty clay, light—brown laminated crusts), black managanese coatings in pores and cavities, and dissolution features. The unconformities were thought to be correlatable with similar ones produced during glacial lowstands of sea level in other carbonate sections of late Cenozoic age elsewhere in the world.

The first attempts to drill overwater boreholes in nuclear craters also were made during EXPOE (Couch and others, 1975; Ristvet and others, 1978). Although sample recovery was poor, two small, water-filled craters were successfully probed to depths of 153.3 and 200.0 ft from a Failing-314 drilling rig mounted on an anchored pontoon barge. The craters, SEMINOLE and CACTUS (figure 8), resulted (respectively) from surface bursts of 13.7 and 18 kilotons (kt) on Boken (Bogon, IRENE) and Runit (YVONNE) in 1956 and 1958 (table 3). An attempt was made to drill the much larger crater KOA, which resulted from a 1.37 megaton (mt) device detonated in a water tank in 1958 (figure 8 and table 3). Although water-filled, SEMINOLE and CACTUS are essentially landlocked craters, but KOA is in (now) much deeper water and exposed to waves and currents generated in the open atoll lagoon. The EXPOE drilling barge in KOA proved to be unstable and unsafe a drilling platform, and the effort was abandoned after only setting surface casing (Couch and others, 1975, p. 38).

Geophysical studies also were an integral part of EXPOE (Pyrz, 1973). As summarized by Ristvet and others (1978), EXPOE obtained about 280,000 linear feet of seismic-refraction profiles for the near-surface (<200 ft) from the islands, about 100,000 ft of overwater seismic-refraction lines for the near-surface (<300 ft) areas of the large craters OAK, KOA, and MIKE, an overwater seismic-refraction and -reflection profile for the noncratered areas of the lagoon, and downhole geophysical logs for many of the boreholes drilled during the program. Unfortunately, the seismic-reflection data from the lagoon were not good quality due to high noise levels aboard the ship, the data-reduction techniques, and

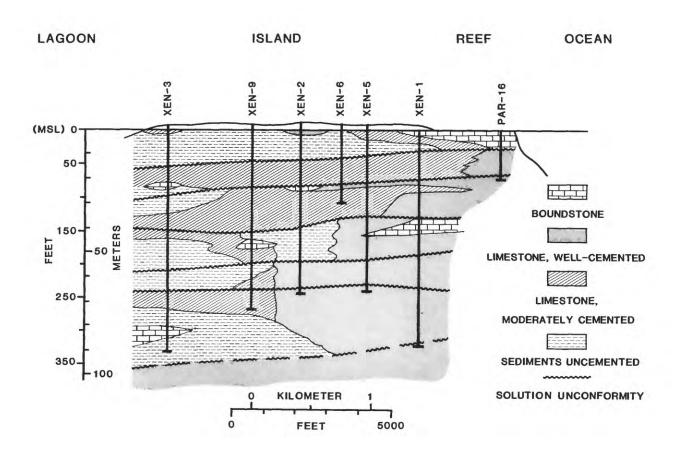


FIGURE 9. -- Geologic cross section from boreholes drilled perpendicular to reef front mainly on Enjebi Island (JANET) during EXPOE Project; section viewed looking toward northwest (modified from Couch and others, 1975, fig. 15). Boreholes XEN-1 through XEN-9 are located on Enjebi; borehole PAR-16 was drilled on reef plate near reef edge on Aomon (Aranit, SALLY) during PACE Project. PAR-16 is located on cross section as though it were drilled on Enjebi a comparable distance from outside edge of reef. Note general increase in cementation toward ocean side of cross section.

inaccuracies in navigation. Most downhole geophysical logs were likewise poor because of casing problems in the boreholes.

EASI Program (1979-81). -- Although EXPOE/PACE provided a greater understanding of the importance of geologic factors controlling crater formation on a coral atoll and definition of crater parameters and other features for the small craters SEMINOLE, CACTUS, and LACROSSE, these programs did not resolve fully the major questions regarding the very large craters, such as OAK, KOA, and MIKE and many of the material properties questions presented by the lagoonward location of OAK ground zero.

By 1979, nuclear-weapons-effects research funded by DNA generated renewed interest in resolving the remaining PPG cratering issues. Another two-phase seismic and drilling program was proposed by the AFWL in July and August of 1979. However, only the seismic and geophysical phase of this study received funding by the DNA as the EASI (Enewetak Atoll Seismic Investigation) Program. About 140 nmi of overwater, high-resolution seismic lines were run in 1980 (Tremba, Couch, and Ristvet, 1982; Tremba, 1984). These were mainly concentrated in grids over OAK, MIKE, and KOA craters but included profiles in areas of the lagoon not affected by the nuclear events. A limited number of dives and traverses in the OAK and KOA areas were made in 1981 with the submersible Makalii, sponsored jointly by the University of Hawaii and the National Oceanic and Atmospheric Administration (NOAA), the Bishop Museum, and the DNA.

The EASI seismic study and associated submersible observations, coupled with detailed direct and quantitative calculations of the results provided the DNA and DOE weapons-effects community the first direct evidence that the Pacific nuclear craters were dominated by late-time subsidence rather than excavation and ejection. According to Tremba, Couch, and Ristvet (1982, p. 74-80), the available evidence strongly suggested that a small, bowl-shaped excavational crater existed prior to the formation of the much larger, broader, dish-shaped crater for OAK and that the major factors in the difference between the excavational crater and the final crater could be explained plausibly by a combination of shock-induced liquefaction and subsidence responses, compaction, and slope failures. They stated also that it was essential to verify these tentative conclusions with an extensive drilling program.

Interim Events (1981-84) Leading to PEACE Program. -- According to R.F. Couch, Jr. (written communication February 24, 1985), the DNA embarked on a three-pronged program in 1981 to better understand near-surface nuclear events. This program consisted of computer-calculation efforts supporting underground nuclear events, high-explosive simulation, and a detailed site survey of two PPG craters, OAK and KOA, produced by megaton-sized events. The two craters were selected for study because of their differing high-yield nuclear-source characteristics, the relative isolation of one of them (OAK) from other nuclear blasts, accessibility by shallow-water drill ship, and support base at Enewetak Island. In 1983, an outline of the program was formulated by D.J. Roddy of the USGS and Maj. J.B. Jones of the DNA, with the assistance of the DNA contractors. This program included a drilling plan, and was presented to the DNA and later

to the USGS. Thus, the PEACE Program came into being. The first phase (Phase I or the marine phase) was fielded in June of 1984. When the drilling phase of the program was scaled down late in 1984, E.L. Tremba and B.L. Ristvet prepared a revised drilling plan for DNA and the USGS, which became the general guidelines for the Phase II portion of the PEACE Program. This drilling plan was adhered to more closely for KOA than for OAK. (More discussion is included in a subsequent section of the current report.)

DRILLING PROGRAM

The following is a discussion of the Phase II portion of the PEACE program, which consisted of drilling a sequence of 32 boreholes in the proximity of KOA and OAK nuclear craters to obtain samples and core for geologic and engineering analyses and to conduct downhole geophysical and gravimetry logging.

Drill Ship and Support Equipment

The Department of Energy (DOE) subcontracted the drilling to McClelland Engineering, Inc. (MEI), as mentioned earlier. McClelland in turn provided the drill ship the M/V Knut Constructor, the drilling equipment, and the drill and geophysical-support crews.

Ship, Facilities, and Crew. -- The Knut Constructor (figures 10A and 10B) is a 237-ft long, North-Sea type, Panamanian-flag vessel, owned by Knutsen 0.A.S. Shipping, Haugesund, Norway. The ship is a converted freighter that was refitted and commissioned in 1974; her home port is Singapore. The Knut is fitted to support the offshore oil and gas industry in both subsea operations and light marine construction and maintainance.

The <u>Knut Constructor</u> is a self-contained vessel that accommodated 76 persons, including 19 members of the ship's crew. The ship's captains, first officers, and chief stewards were all Norwegian citizens, and the first mate and crew consisted mainly of Phillipine nationals. The <u>Knut Constructor</u> was equipped with a galley, a 54-person messroom, offices for ship, USGS, DNA, and MEI personnel, and a small hospital cabin.

The propulsion system of the Knut Constructor (including tunnel bow thruster), her four-, five-, or six-point anchoring system, and her low draft (maximum draft of about 16 ft, fully loaded) made the vessel extremely maneuverable in tight places and permitted precise positioning over a designated point for anchoring and drilling. With judicious planning, it was feasible to drill two or more holes without reanchoring the vessel by merely moving her with the hydraulic winches on the anchor lines.

The <u>Knut Constructor</u> was equipped with two large cranes (figures 10A and 10B) that covered the entire working area and were used extensively to handle drill pipe and other heavy drilling equipment, for on- and offloading supplies and equipment, and for offloading the crates in which the core and samples were packed for shipment stateside.

Two steel-mesh decks were installed above the ship's midship section or top deck to hold the drilling rig, mud tanks and pumps, and other drilling and sample-handling facilities. On one of these steel-mesh decks, two modular units (trailers) were installed for laboratories, one primarily for petrographic and the other for paleontologic processing and investigation (figures 11A and 11B). These modular units also were used for housing one of the two microcomputers for processing geologic data aboard ship, for housing some of the borehole-gravimetry computer and data-processing instruments, for

FIGURE 10. -- Aerial views of drill ship Knut Constructor drilling in OAK crater in early June of 1985. (A). Port view; ship is outfitted with a Failing-2000 rotary drill rig, located amidship. (B). Starboard view, looking westward; reef plate and main reef tract appear as light-colored area; open Pacific Ocean is in background. (Photographs courtesy of B.L. Ristvet and R.F. Couch, Jr., respectively.)





housing MEI's shipboard material-properties testing equipment, and for other miscellaneous uses.

The geophysical downhole logging equipment was installed in and operated from a small shed or "doghouse" which in turn was mounted on the top of the trailers mentioned above (figures 12A and 12B).

One of the principal advantages of having the <u>Knut Constructor</u> as the drill ship for the PEACE Program was her ability to accomodate all of the scientific, engineering, and administrative personnel, the official visitors, the sample-preparation facilities and laboratories, and the data-processing equipment in one place rather than having to split them between the drill ship and other facilities on Enewetak Island or some other area on the atoll. With these personnel in the same general quarters, the response to constantly changing programmatic needs was more rapid, and far more synergism was developed than would have been possible otherwise.

Additional specifications regarding the drill vessel are given in Appendix II.

Drill Equipment. -- MEI equipped the Knut Constructor with a Failing-2000, rotary drill rig (figures 10 and 13) mounted on one of the two steel-mesh decks mentioned previously. The drill rig was situated amidship about 15 ft above the main-deck level over the roughly 16 by 20 ft working well or "moon pool". A heave compensator was used during most of the drilling operations to dampen the effects of wave action while drilling in the open lagoon, and two mud tanks were used to mix and hold the mud used in the drilling operations. The types of drilling mud and additives are shown in Table 4. Additional information about the drilling/sampling equipment, heave-compensating system, drilling mud, tanks, and operations is found in Appendix II of the current report.

Determination of Location (Navigation)

The navigation network used during Phase II of the PEACE Program was essentially the same as that used during Phase I. Meridian Ocean Systems (MOS), which was the contractor for the navigation for Phase I, was also the contractor for Phase II and employed shipboard the same Government-owned Motorola Miniranger Falcon-IV receiver used during Phase I. Four of the five previously used tower and transponder stations were reassembled in January of 1985 on the islands of Biken (LEROY), Bokoluo (ALICE), Enjebi (JANET), and Lojwa (URSULA) in their same Phase I locations by MOS personnel. These four transponder-tower locations were selected to give complete navigation coverage while operating in the KOA and OAK crater areas without reorienting the transponder antennae. Because of the more localized operations of Phase II on the northern part of Enewetak Atoll, it was not necessary to reconstruct the one remaining Phase I tower on Enewetak Island (FRED).

The Motorola navigation-system receivers, computers, and antenna were installed in the wheelhouse and on the main radio mast of the Knut

TYPES OF DRILLING MUDS AND ADDITIVES

Weighting agent	
Viscosifier	
Surface-Active Defoamer	
Viscosifier	
Viscosifier	
Lost Circulation Materials	
Viscosifier	
Lubricant/Penetrant Viscosifier	
Base Mud	
Base Mud	

TABLE 4. — Types of drilling mud and additives used in boreholes during

PEACE Program. Abbreviations are those used in Descriptions

of Boreholes section.

FIGURE 11. -- (A). View of modular structures used for petrographic and paleontologic laboratories aboard the M/V Knut Constructor shown in background; sample-preparation area in foreground.

(B). View, looking sternward toward wheelhouse, of sample-preparation area and rock saw. (Photographs by T.W. Henry and W.E. Martin, respectively.)





FIGURE 12. -- Views of BPB's "doghouse" or logging shed. (A). View looking sternward toward wheelhouse (shown in right midground); dome-like IMARSAT antenna located to left of closed logging shed. (B) Close-up view of shed taken during logging operations. (Photographs courtesy of W.E. Martin and B.L. Ristvet, respectively.)



FIGURE 13. -- Failing-200 rotary drill rig used in PEACE Program in center background; sample-preparation area in fore-ground. View looking bowward. (Photograph by T.W. Henry.)





<u>Constructor</u> by MOS personnel during the mobilization phase at Kwajalein. The distance and the bearing (relative to the ship's centerline) from the Miniranger's receiving antenna to the kelly on the drill rig were entered into the navigation system's computer.

At Enewetak, movement from borehole to borehole was controlled by continual input from the Motorola navigation system. [Note: see p. 390 for qualification of this statement for siting borehole OLT-14]. After the borehole site was selected and the most favorable anchoring patterns and sites were plotted, the drill ship was moved to the general area. The anchors were then dropped and set, and the ship was winched on the anchor lines to an acceptably close position for each borehole, generally within 15 to 20 ft of the preselected hole location.

For each reading, the heading of the <u>Knut Constructor</u> was noted and entered into the navigation system's computer. The final IVY-grid positions for each borehole was plotted on the navigation charts and onsite working maps. These locations are summarized in Tables 12 and 13 in the section of this report entitled Description of Boreholes.

Determination of Water Depth

The tidal datum used in the PEACE Program, like the planar coordinate system, was established in 1952 during Operation IVY jointly by the U.S. Coast and Geodetic Survey (USC&GS) and Holmes and Narver (H&N). According to B.L. Ristvet (written communication, October 1, 1985), the only permanent tidal station established on the atoll was on the marine pier on Enewetak Island (FRED), where tidal records were made for 17 years until a typhoon destroyed the station in October of 1972. The NOAA tidal predictions for the entire atoll are based on these records. The datum used for these records is 0.5 ft below the mean-low-water-spring-tide level (MLWS), which is the datum used on the navigation charts produced by the U.S. Navy Hydrographic Office. Individual tidal datums for several of the northern islands were established by H&N in 1951 and 1952. These datums are 0.5 ft below approximate mean lowwater spring (AMLWS) because they are not based on long-term records from a permanent tidal station; they frequently are referred to as the "H&N datum(s)". Both Phases I and II of the PEACE Program utilized the H&N datum.

During Phase II, McClelland Engineers, Inc. (MEI), was responsible for making the water-depth measurements at each borehole location. These measurements were made by two independent techniques at each site, both conducted through the "moon pool" and represent measurements from the top of the rotary table to the lagoon bottom (seafloor) (fide B.L. Ristvet, written communication, October 1, 1985).

For the first method, an 80-1b, cylindrical steel weight was attached to the drill-rig wireline. A calibrated wireline odometer was attached about 4 ft above the rotary table, and the steel weight, 8 in. in diameter and 5.5 in. in height, was lowered slowly on the wireline through the rotary table of the drill rig to the sea bottom. When tension ceased on the wireline, the length of the wireline was noted from the odometer and became the basis for the measurement of the distance from the rotary table

to the seafloor. This wireline length was recorded intermittently for several minutes to average the effect of the heave of the ship. To calculate the MEI water depth, the distance between the rotary table and the top of the water surface in the moon pool, the distance between the wireline odometer and the rotary table, and the calibration factor for the odometer were utilized. The time of measurement also was noted in the MEI records. This MEI water depth is <u>not</u> corrected to the Enewetak tidal datum.

The second method was to measure the depth to the seafloor when lowering the riser or drill pipe. This generally was accomplished from 30 min to 4 hrs following the wireline measurement, depending on the water depth and the consequent length of the drill string. The time of the measurement of the length of the riser or drill pipe also was recorded by MEI. Again, MEI established this value as a non-tide-corrected water depth. Both measurements use the top of the rotary table as the shipboard reference datum.

Each of the two MEI-determined water depths was converted to the Enewetak tidal datum by subtracting the tide height, as determined by prediction from the NOAA tide tables for the time of the particular MEI measurement. Discrepancy between the two tide-corrected measurements was generally less than 0.1 ft. In the few instances where a larger discrepancy was noted, a careful review of the measurements and calculations was conducted. few cases where close agreement was not reached after this review, a second wireline measurement was made before moving the ship from the borehole site. The reported tide-corrected water depth is an average of the two measurements showing the best agreement and rounded to the nearest 0.1 ft. This is the water-depth measurement shown on Tables 12 and 13, Figures 27 and 29, and in the introductory material presented for the lithic description of the individual boreholes in the section Borehole Descriptions. Precision of the water-depth measurements is estimated to be approximately 0.15 - 0.20 ft (Ristvet, written communication, October 1, 1985). The greatest uncertainty in this reported value is from the estimation of the tide level.

Note that two water depths are given in the DOE Completion Report (NVO-294, September 1985); the first of these is the non-tide-corrected McClelland figure, and the second is the tide-corrected figure using as datum 0.5 ft below approximate mean low-water spring (AMLWS)--the H&N datum.

Coring/Sampling Techniques

Two major types of sampling and drilling equipment were used during Phase II in order to obtain core and samples in as undisturbed condition as possible and to follow the drilling schedules as closely as possible. These are percussion ("hammer") sampling and rock coring (table 5). Both techniques permitted wire-line sample recovery through the 3-3/8-in.-inside-diameter drill pipe, thus avoiding the time-consuming requirement of advancing casing immediately behind the sampler advance. In unconsolidated and uncemented materials characteristic of both the materials within the crater and much of the normal stratigraphic section, the drill pipe could be employed as the temporary casing while sampling operations were conducted internally. The wire-line rock-coring procedure also used an analogous procedure with the drill pipe acting as a temporary casing for parts of the stratigraphic section where hole stability would have been a problem and would have required placing

casing through them. Contamination from fall-in from uphole also thus was minimized.

The details of the equipment used by MEI and an an elaboration of the procedures followed is included in the introduction to Appendix II of this report. A general discussion of the techniques and procedures follows.

Sampling in Soft Materials. -- A combination of "soil-sampling" percussion tools generally was employed for the uncemented, relatively poorly cemented, and highly brecciated portions of the stratigraphic succession. These consisted of Shelby tubes and split-spoon (split-barrel) samplers generally used with a 300-lb or, less commonly, with a 175-lb hammer dropped 3 or 5 ft (table 5). This equipment was used almost exclusively in the ground-zero holes and in the transition holes within the crater boundaries, providing the most reasonable compromise between sample quality and recovery and hole advancement rate. Two types of split-spoon samplers equipmped with a core catcher were available, a 2-in.-outsidediameter and a 3-in.-outside-diameter sampler (table 5). Of the tools available, the 3-in. split-spoon sampler was most effecient in mud-supported sediments that contained little coarse-grained material. Consequently, this split spoon was utilized most commonly in the very fine grained sediments in the upper part of the craters. The 2-in. split-spoon sampler was not used extensively.

Three types of Shelby tubes were put aboard the <u>Knut Constructor</u> during mobilization (table 5). Of these, the 3-in. thick-walled Shelby tube was employed most commonly. It was the principal sampling device in the rubble zone of the crater, in highly brecciated zones in the craters, and in the brecciated, vuggy and cavernous zones associated with the major karst surfaces both inside and outside the craters.

Percussion sampling was generally not continuous. Sample-drive intervals from 1 to 2 ft in length (for example) were followed by 3 to 5 ft of rotary drilling and washdown to ream the previously sampled interval, clean out matrerial that had fallen into the hole, and advance the hole another 1 to 3 ft below the bottom of the last sample taken. This was done to minimize the risk of sampling fall—in and to assure recovery of in—place material.

Rock Sampling. -- For rock coring, the 3-in.-inside-diameter Christensen System initially was planned as the primary sampling tool in the more cemented and competent portions of the section, although a 4-in. Christensen was available (see Appendix II for further discussion). However, the 3-3/8-in.-inside- diameter Longyear System, normally considered a "hard-rock" tool, consistently provided better recovery and was successfully employed throughout most of the program. Coring generally was done in 5-ft runs (or less), although, occasionally, 10-ft runs were made within intervals where conditions were favorable.

<u>Combination Sampling.</u> -- The Longyear System also proved extremely adaptable for use in combination with percussion sampling in the following manner. With the Longyear bit resting on the bottom of the borehole, the

SAMPLING TECHNIQUES

CECHNIQUE	TYPE	ABBREV- IATION	SAMPLE DIAMETER (in.)	MAX. SAMPLE LENGTH	HAMMER WEIGHT (1bs)
Core	Longyear CHD-134	LY	3-3/8	10 ft	N/A
Core	Christensen MK-II	Сн	3	10 ft	N/A
Core	Christensen (Conventional)*	CH	4	20 ft	N/A
Hammer	2-1/4-in. Thin-Walled Shelby Tube*	SH	2-1/8	30-1/2 in.	175
Hammer	3-in. Thin-Walled Shelby Tube	SH	2-7/8	30 in.	300
Hammer	3-in. Thick-Walled Shelby Tube	SH	2-1/2	30 in.	300
Hammer	2-in. Split-Spoon*	SS	1-1/2	18-1/2 in.	175
Hammer	3-in. Split-Spoon	SS	2-1/2	23-1/2 in.	300

^{*} rarely used.

TABLE 5. -- Summary of bore hole sampling techniques used for PEACE Program with sample diameters, maximum sample length, and hammer weight (if applicable). The diameters used as descriptors with the Shelby tubes and split-spoon (split-barrel) samplers are outside diameters. The abbreviations used in the section on Borehole Descriptions are also given.

^{**} equipped with core catcher.

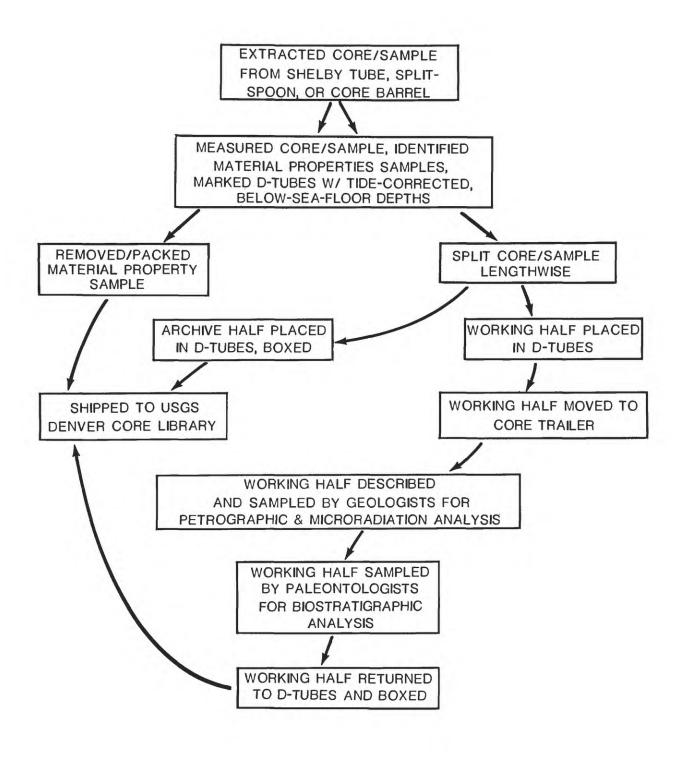
inner (core) barrel was removed, the Shelby tube or split spoon was lowered to the bottom of the hole inside the Longyear tool, and the hammer sample was driven. Exploiting this innovation, the most common technique for hole advancement below the softer, uncemented, near-surface sediments was to core ahead with standard Longyear coring procedures. When recovery became poor and/or coring was not feasible, the inner barrel was removed, the Shelby tube or split-spoon inserted, and the hammer sample taken. The sample was removed, and the hole was then advanced 2 ft, 5 ft, or more by drilling with the Longyear bit. Then, another percussion sample was taken and the process repeated. When a hard, corable layer was encountered, the inner barrel was reinserted, and coring resumed in the normal fashion. This permitted interchanging sampling techniques from coring to hammering and vice versa quickly without tripping-out (pulling the drill string), normally a time-consuming procedure.

Procedures for Shipboard Core and Sample Handling

Figure 14 is a flow chart showing the general procedures for handling and processing the geologic and material-properties core and samples aboard the Knut Constructor. The following is a discussion of the handling and sampling procedures for the geologic core and samples. The special handling requirements of the material-properties samples, including the dedicated material-properties boreholes, will not be addressed in this section; a brief discussion of this aspect of the program is presented in Appendix II and will be elaborated on further in the DNA reports.

Personnel from MEI were responsible for most of the physical, onsite handling of the core/sample taken from the boreholes during this program. After a trip was made out of the hole, the rock and sediment samples and core were extracted carefully from the core barrel, Shelby tube, or split spoon in order to minimize the disturbance of the samples. For the core and Shelby tube samples, hydraulic-assisted extrusion onto a long, half-cylinder, PVC tray was used (figures 15A and 15B). For the split-spoon, the containment rings at the ends of the tube were unscrewed, and the split-tube was opened. The contained material was then carefully placed in a similar PVC tray before further handling. Next, all recovered material was moved from the drilling-platform area to the sample-preparation area.

If appropriate, the core/sample then was examined briefly by the USGS geologists and/or DNA representatives to identify material-properties samples and samples for special onsite material-properties testing (figure 16A). After this examination, the MEI geologists and soils technicians would measure the core/samples (figure 16B), mark them with tide-corrected footages below the sea floor, and visually produce an "soil-stratigraphic" or engineering description of the recovered material. The discussion of the procedures used and standards followed in creation of these logs appears in Appendix II of the current report, prepared by MEI and entitled Geotechnical Investigations, Phase II of PEACE Program. Also included in this appendix are the detailed soil/rock-engineering logs, onsite material-properties test results, recoveries, and related drilling information for each of the boreholes in Appendix II.



FLOW CHART - SHIPBOARD CORE HANDLING

FIGURE 14. -- Flow chart showing standard core- and sample-handling procedures used aboard the <u>Knut Constructor</u> during Phase II of PEACE Program.

At this point, any selected material-properties samples would be removed from the recovered material by MEI and either placed in special packages with as little handling as possible or moved inside the laboratory for the limited onsite material-properties testing. Those samples identified for stateside analysis were inserted into appropriately marked styrofoam packages and placed in the specially constructed plywood crates for subsequent shipping.

Next, each of the remaining geologic cores/samples was split vertically (lengthwise) with a rock saw (if cemented) or a putty knife or spatula (if uncemented) into two equal parts, referred to as the "working" and "archive" halves of the core (see figure 17). Both splits were packaged immediately into separate PVC D-tube sleeves and D-tubes marked with the borehole number and depth below the sea floor (not below the tide-corrected H&N sea-level datum) on both the D-tube and end-cap. Each split was designated clearly archive (AR) or working (WK).

Throughout Phase II of the PEACE Program, the convention was used to correct the footage of all of the recovered material to the top of the drill run, unless there was compelling evidence to do otherwise from the driller's records. This convention is similar to the one used during the Deep-Sea Drilling Program (1968-1981), sponsored by the National Science Foundation. Thus, for the PEACE Program core/samples, most of the recovered material appears on the logs and D-tubes as coming from the upper part of the individual runs.

During packaging of the working and archive sets into the D-tubes, an appropriately marked, styrofoam, half-cylinder block was taped in the D-tubes between samples/core from subsequent drill runs. Additional styrofoam blocks were placed in both the working and archive sets where material properties samples were taken. Both the archive- and working-half D-tubes in turn were packaged into labeled cardboard boxes. At this time, the archive half of the core was placed into marked plywood boxes (figure 17) and moved aside for shipment stateside.

The working half of the core was moved into one of the two modular laboratories located next to MEI's core-preparation area. The core/sample on the PVC sleeve was removed from the D-tubes, placed on specially constructed racks, and described lithically by USGS petrographers. These descriptions are hand-sample descriptions using standard field methods, including hand lenses and low-power, stereoscopic binocular microscopes, dilute hydrochloric acid, and selected carbonate stains. Some petrographic, sedimentologic, x-ray (mineralogic), macropaleontologic, isotopic-dating, and microradiation samples were taken during or just after the initial geologic description. USGS personnel transferred their hand-written lithic descriptions from field notebooks to a word-processing system (Multimate*) on microcomputers and constructed continuous borehole logs of each hole soon

^{*} Multimate is a trade-mark of Multimate International Corporation.

FIGURE 15. -- (A and B). Views on drilling deck showing MEI personnel removing core from barrel into half-cylindrical, PVC sleeve prior to taking core to sample-preparation deck for measurement and description. (Photographs courtesy of T.W. Henry and B.L. Ristvet, respectively.)



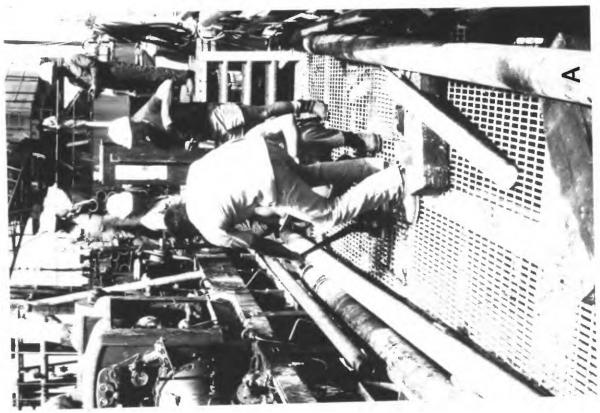


FIGURE 16. -- Views of sample-preparation area. (A). USGS, DNA, and MEI geologists and technicians looking at core placed in PVC tray prior to slabbing. (B). MEI technician handling core before marking. Note marked D-tubes on table in foreground. (Photographs courtesy of W.E. Martin and B.L. Ristvet, respectively.)







FIGURE 17. -- Activity on sample-preparation deck. MEI technician (right) slabbing core with rock saw; USGS technician repacking cardboard core box into wooden box for offloading and shipment stateside. (Photograph courtesy of B.L. Ristvet.)

after each description session. This information was the basis for the physical stratigraphic framework used during the Enewetak field program. The geologic descriptions of the boreholes are included in the section Borehole Descriptions in the current report.

Next, the working half of the core was sampled by USGS personnel (figure 14) both for onsite micropaleontologic investigation and to obtain samples for subsequent processing and biostratigraphic analysis in the USGS facilities in Reston, Virginia (for a more detailed discussion of the paleontologic procedures and analyses, refer to Cronin and others, 1986).

Wherever petrographic, radiation, paleontologic, and other types of geologic samples were taken, appropriately marked styrofoam blocks were inserted into the D-tubes of the working half of the core/sample for future identification purposes and to protect the integrity of the core by preventing it from shifting around and mixing in the D-tubes during subsequent handling and shipping.

After shipboard sampling was completed, the sleeves of the working half of the core/samples were reinserted into to their D-tubes, the end caps placed over the open end and sealed with tape, the D-tubes were replaced in their marked cardboard boxes, the boxes inserted into their wooden shipping crates (figure 17), and the crates moved to a staging area and loaded onto pallets for shipment (figure 14).

Shipment of the core/sample material stateside was the responsibility of H&N. The core was shipped from Enewetak to the U.S. Army facility at Kwajalein Atoll by a variety of means described in detail in DOE publication NVO-294 (1985). From Kwajalein, it was routed either directly to San Diego, CA, or to Honolulu, HI, for transshipment to San Diego. From there, all core and sample materials was trucked to the USGS Core Library in Denver, CO, for subsequent analysis.

Downhole Geophysical Logs

The geophysical logging was conducted by BPB Instruments, Ltd., subcontracted by MEI for the PEACE Program. A more detailed discussion of the borehole logging conducted on Enewetak will be presented in Part 3 of the current set of reports. The borehole logs were obtained for geologic (stratigraphic) correlation, refinement of the processing of the single- and multichannel-seismic data gathered during Phase I of the program, material-properties studies, and for drilling and engineering purposes. A selected set of holes was drilled specifically for borehole-gravimetry measurements. A combination of conventional downhole logs was run in most of the boreholes drilled in both OAK and KOA, including the gravimetry boreholes. These log types and their abbreviations used in this report are given in Table 6; the same set of abbreviations also is used in Table 7, which is a log summary for the boreholes, and in the introductory sections for each of the boreholes given in the section on Borehole Descriptions in this report.

ABBREVIATIONS FOR DOWNHOLE GEOPHYSICAL LOGS

LOG TYPE	ABBREVIATION
Borehole Gravimetry	BHG
Gamma-Ray / Caliper	GR/CP
Gamma-Ray / Density / Caliper	GR/DN/CP
Gamma-Ray / Neutron-Neutron	GR/NU
Multi-Channel Sonic *	MCS
Seismic Reference Survey **	SRS
Three-Arm Caliper	TAC

TABLE 6. -- Types of downhole geophysical logs and abbreviations used in section <u>Description of Boreholes</u>. * The multi-channel sonic log also is called a sonic or accoustic log; ** the seismic reference survey also is commonly referred to as a downhole velocity survey or check-shot velocity survey log.

TABLES OF DOWNHOLE GEOPHYSICAL LOGS

DODELIOL E			LOG T	YPE			
BOREHOLE -	MCS	GR/NU**	GR/DN/CP	TAC	SRS	GR/CP	BHG
KAR-1	x	x	x	_	x	_	_
KAM-2	-	-		-	-	-	_
KAM-2A/KAP-3	_	x	-	_	_	_	_
KBZ-4	Х	x	X	_	Х	_	_
KCT-5	X	X	X	-	Х	-	_
KDT-6	_	х	X	-	Х	_	_
KET-7	_	-	-	_	_	_	_
KFT-8	-	X	x	-	X	-	_
 OAM-1/OAR-2		X	X	×	×		
0AR-2A	х	×	X	_	_	_	_
0AM-3	_	x	×	_	_	_	_
0BZ-4	х	x*	X	_	X	_	-
0CT-5	X	x*	X	_	X	_	_
0DT-6	_		_	_	_	_	_
OET-7	х	x	x	_	_	-	_
0FT-8		* X	-	_	_	_	_
0GT-9	_	x	_	_	_	_	-
0HT-10	_	X	_	-	_	_	_
0IT-11	х	x	X	-	_	_	_
0JT-12	_	X		_	_	_	_
0KT-13	х	x*	X	_	_	-	_
0LT-14	-	-	-	-	_	-	_
0MT-15	_	x	-	_	_	-	-
ONT-16	_	X	-	_	_	-	_
00R-17	Х	X	X	-	Х	-	х
0PZ-18	_	x*	X	_	-	_	×
0QT-19	Х	x*	X	_	-	_	×
0RT-20	-	-	X	-	-	_	X
0SR-21	_	_	X	-	-	-	X
0SM-22	-	-	-	-	-	-	_
0TG-23	_	_	-	-	-	x +	×
0UT-24	_	X	-	_	_	_	_

TABLE 7. -- Types of downhole geophysical logs used in Enewetak boreholes; abbreviations as used in Table 6. Symbol "x" denotes presence of log, "-" absence.

Borehole Nomenclature

A standard nomenclature was established for the boreholes drilled during Phase II of the PEACE Program on Enewetak. This borehole code was used on all cores/samples, on all material-properties, geologic, and paleontologic samples, and on other types of samples as well. The code consists of three letters, followed by a hyphen, succeeded by a one- or two-digit number, and (in two instances) completed by an "A". This scheme works as follows. Boreholes OAM-1, OAR-2, OAR-2A, OAM-3, OBZ-4, and OCT-5 are used to illustrate this code.

The three characters preceeding the hyphen are all alphabetic. The first character in this code is the crater-reference key, either a "K" for KOA or an "O" for OAK. Thus, the examples given above were all drilled in the vicinity of OAK crater. The second character ("A" through "F" in KOA and "A" through "U" in OAK) designates a general location or site from which the borehole was drilled. In several instances, two or three boreholes were drilled at one general site to replicate samples/core or geophysical measurements from "the same strata" a very short distance (i.e., a few tens of feet) away from a previously drilled borehole or -holes. As mentioned previously, with careful selection of heading and anchoring position, two or more boreholes could be drilled by winching the ship laterally on the anchor lines. Thus, such a set of holes could be drilled a few feet apart from the same general anchoring configuration and would have the same second character in the code (e.g., OAM-1, OAR-2, OAM-3). The third character refers to the type of borehole or primary purpose for the borehole. Four basic types of boreholes were drilled on Enewetak during this project; these and their code letters are shown in Table 8. Thus, in the sample OAM-1 and -3 were material properties boreholes, OAR-2 and -2A were reference holes, OBZ-4 was a ground-zero borehole, and OCT-5 a transition-zone borehole.

The set of characters succeeding the hyphen indicate the following. The numeric characters represent the order (beginning with "1") in each crater area that the boreholes were drilled. Thus, OBZ-4 was the fourth hole (of any type) drilled in OAK crater. In two instances, the final attachment to this code is an "A", used to represent an offset hole drilled when hole-stability problems developed (as in the case of KAM-2 and KAM-2A in the KOA crater area) or when the lower part of a given borehole was used for a purpose other than intended when the hole was spudded. Thus, OAM-1 was started as a dedicated material-properties hole, and samples taken from the seafloor to 400 ft below the seafloor (bsf) were packaged for this purpose. However, because the upper 400 ft of this borehole was extremely stable and free of drilling problems, the decision was made to extend the hole as the lower part of the geologic reference hole on the northeastern flank of OAK crater. Thus, samples taken from 400 ft bsf to total depth were designated OAR-2. Then, to get a complete stratigraphic picture of the upper 400 ft of section, the ship was winched a few feet laterally, and a second hole, designated OAR-2A, was drilled from the surface to slightly below 400 ft bsf to provide overlapping reference information for the upper part of the section. Because the material property hole OAM-1, although stable, did not have high sample recovery, and because it was too late in the evening when OAR-2A was completed to safely unanchor and move the Knut Constructor, the decision was made to winch the ship slightly farther over

BOREHOLE TYPES

Character	Type of Borehole
R Z T M G P	Geologic Reference Ground Zero Transition Material Properties Gravimetry Cone Penetrometer

TABLE 8. -- General types of boreholes drilled during Phase II of PEACE Program. Note that OAK is an asymmetric crater. The ground-zero point and the bathymetric center of the crater do not coincide; thus, borehole OPZ-18 is actually not a true ground-zero hole. KAP-2 was the only cone-penetrometer hole drilled during the PEACE Program.

and make a second materials-properties boring. This hole was designated OAM-3.

Borehole Statistics

To accomplish the objectives of Phase II of the PEACE Program, 32 borings were drilled from the <u>Knut Constructor</u> from February 17 through July 25, 1985. The drill ship was actually on site for 157 days. Eight boreholes were drilled in the proximity of KOA crater (figure 18) and 24 in OAK (figure 19).

Detailed drilling data, locations, distance and bearing from ground zero, downhole logs completed, and other data for the Enewetak boreholes are presented in two tables (tables 12 and 13) near the front of the section <u>Borehole Descriptions</u>. The total drilling program included 27 geologic, four material-properties, and one cone-penetrometer hole, for a total linear footage of 14,188.7 ft. The total footage recovered from geologic boreholes (R, T, and Z holes only) was 5,229.8 ft, representing a recovery slightly less than 40 percent (geologic samples only) for both crater areas. Boring penetrations ranged from 41.1 ft (KET-7) to 1,605.2 ft (OBZ-4) below the sea floor (subsequently abbreviated "bsf"). The borehole drilled in the shallowest water (from the H&N datum) was KET-7 (51.1 ft), and that drilled in the deepest water was OPZ-18 (201.9 ft).

KOA Crater. --Field work in KOA started on February 15 and ended on April 9, 1985, for a total of 50 days onsite. Six general anchoring sites were occupied in the proximity of this crater (figure 18), and eight holes were drilled, for a total footage of 3,545.3 ft. One of these holes was the solitary cone-penetrometer boring attempted during the PEACE Program (KAP-3), and one was a dedicated material-property hole (KAM-2/2A). Total footage drilled for geologic purposes (R, T, and Z holes only) was 2,981.6 ft, and total footage recovered (geologic samples only) was 1,428.1 ft, for a recovery of 47.9 percent. Summary statistics for KOA boreholes are shown in Table 9.

OAK Crater. -- The Knut Constructor began drilling in OAK crater on April 10, 1985, and field work terminated on July 23, 1985, for 107 days onsite in this crater. Twenty-one general drilling sites were occupied (figure 19), from which 24 boreholes were drilled for a total footage of 10,643.4 ft. Twenty of these borings were geologic holes; three were dedicated material-properties holes (OAM-1, OAM-3, and OSM-22); and one was rockbitted solely for borehole-gravimetry measurements (OTG-23), although borehole-gravimetry surveys were made in boreholes OOR-17, OPZ-18, OQT-19, ORT-20, and OSR-21 as well. The borehole-gravimetry holes were all drilled on the southwestern transect of the crater (figure 19). In addition to the ground-zero hole OBZ-4, which was the deepest hole drilled during the program, a second "central-crater" hole, OPZ-18, was drilled at the bathymetric center of the crater, 335 ft south of ground zero (see figure 18A).

The total footage of OAK-crater geologic holes (R, Z, and T holes) was 9,835.6 ft, with a total recovery (geologic samples only) of 3,801.7 ft (38.7 percent). Table 10 shows summary data from which these statistics were derived.

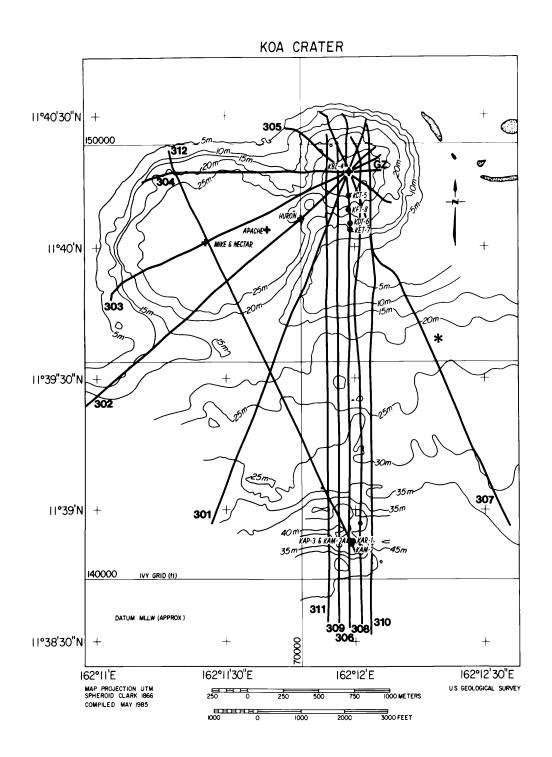


FIGURE 18. --Bathymetric map of KOA-MIKE crater area with borehole sites and USGS multichannel seismic-reflection tracklines (from Grow and others, 1986, fig. 2). Ground-zero positions shown for MIKE and NECTAR, APACHE, HURON, and KOA events by dark plus ("+") symbol; the preferred, pre-field program drilling site for KOA reference hole is shown by asterisk ("*"); and the borehole sites are shown as dark dots.

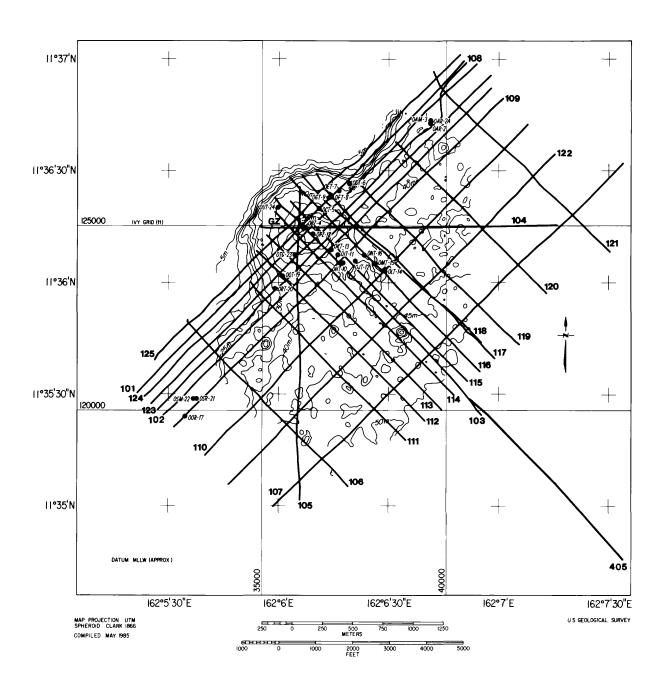


FIGURE 19. -- Bathymetric map of OAK crater with borehole sites and USGS multichannel seismic-reflection tracklines (from Grow and others, 1986, fig. 3). Borehole locations shown as dark dots.

SUMMARY FOR KOA-CRATER BOREHOLES

Borehole	Water Depth Hole Depth (ft below (ft		Reco	overy
borellore	H&N datum)	bsf)	Footage	Percentage
KAR-1	105.1	1,146.3	710.0	62%
KAM-2	105.7	80.8	**	**
KAP-3/KAM-2A*	111.1	482.9**	**	**
KBZ-4	109.1	1,045.9	388.8	37%
KCT-5	98.9	306.6	135.0	44%
KDT-6	56.2	123.8	55.1	45%
KET-7	51.1	41.1	13.1	32%
KFT-8	77.8	317.9	126.1	40%

*KAP-3 = 0.0 - 78.0 ftKAM-2A = 78.0 ft - TD

** Figures not used in summary for geologic total footage and recovery.

TABLE 9. -- Selected data for boreholes drilled in proximity of KOA crater during PEACE Program.

SUMMARY FOR OAK-CRATER BOREHOLES

Borehole	Water Depth (ft below	Hole Depth (ft	Recovery		
borenore	H&N datum)	bsf)	Footage	Percentage	
0AM- 1*	114.2	**	**	**	
OAR- 2*	114.2	885.6	366.3	76	
OAR- 2A	110.5	410.5	188.1	76 46	
0AK- 2A 0AM- 3	111.0	93.0 **	** 100*1	+v **	
OBZ- 4	198.7		967.8	60	
06Z- 4 0CT- 5	163.7	1,605.2 851.5	260.6	31	
	90.1			53	
ODT- 6		164.2	86.8	49	
0ET- 7	106.9	231.7	113.4		
0FT- 8	130.8	283.5	104.0	37	
0GT- 9	134.8	75.0	28.3	38	
OHT-10	137.3	162.5	64.5	40	
0IT-11	155.0	286.5	111.5	39	
0JT-12	143.8	97.3	53.4	57	
0KT-13	164.7	765.3	248.5	32	
OLT-14	139.7	49.2	27.1	55	
OMT-15	110.9	76.6	36.7	48	
ONT-16	135.1	152.3	73.1	48	
00R-17	75.1	1,091.1	563.5	52	
0PZ-18	201.9	748.6	188.1	26	
0QT-19	117.5	701.5	126.0	18	
ORT-20	101.4	491.8	73.3	15	
OSR-21	84.0	354.3	63.9	18	
0SM-22	76.0	127.5**	**	**	
0TG-23	164.0	587.3**	**	**	
OUT-24	147.0	351.4	56.8	16	

^{*} OAM-1 / OAR - 2 are same hole; OAM-1 is from 0.0 to 401.6 ft. **Not used in summary for geologic total footage and recovery.

TABLE 10. -- Selected data for boreholes drilled in proximity of OAK crater during PEACE Program.

PEACE-Program Drilling Strategy

General Comments

Individual borehole site locations and depths along radials in both craters were chosen initially in the pre-fieldwork drilling plan by (1) relationship to the major crater "physiographic" features, as identified by Folger, Hampson, and others (1986) and Folger, Robb, and others (1986) (see figures 20A-B and 21A-B); (2) by the limits of safe maneuvering of the drill ship; (3) by the position of the Phase I seismic-reflection tracklines and multichannel-seismic stacks (figures 18 and 19); and (4) by the characteristics of the seismic records (i.e., reflector strength, termination, deformation, etc.)*. For a discussion of the "physiographic" features and their implications to the formation of the crater as it currently exists, see Folger, Robb, and others (1986). In the post-Phase I drilling plan, one radial was to be drilled for KOA and two radials (one diameter) for OAK. For OAK, both profiles parallel to the reef trend or "geologic strike" of the atoll. The KOA radial was not taken parallel to the reef trend. The general rationale for siting each type of borehole drilled during the PEACE Program follows.

One reference (R) hole, sometimes referred to as a "control hole", was planned for each crater, and they were to be the first drilled in each area. A site was needed that would be typical, both geologically and in terms of material-properties and cratering characteristics, of the pre-shot ground-zero site. Thus, based on the geologic trends established by earlier studies of Enewetak Atoll (see particularly Couch and others, 1975), the reference holes ideally should be selected at comparable distances from the outer edge of the reef as the ground zero holes. If possible, it was important to select the reference-hole sites at the interesection of two (or more) seismic lines to optimize geologic interpretation of the geophysical profiles and extrapolation beyond the area of control defined by the boreholes.

It was also necessary to take precautions that the reference-hole site be selected outside the area affected by the nuclear detonation that created the crater selected for study or by other nuclear events. This was not a problem for OAK, the ground-zero point of which is 6.5 nmi away from the nearest other crater, MIKE (see figure 3). KOA, in contrast, was not in a pristine blast environment (figures 3 and 22) and presented a formidable challenge in selecting a suitable reference-hole location.

The reference holes were to be drilled deep enough to have geologic control to assess the degree and depth of the disturbance of the strata beneath the crater. Although the reduction of the USGS single- and multichannel-seismic lines was in a preliminary stage, these multichannel seismic profiles and distribution maps of the shallow accoustic units from

^{*} Although the seismic data from Phase I of the PEACE Program primarily were used, a considerable amount of information was available from the previously run, EASI, PACE, and EXPOE records.

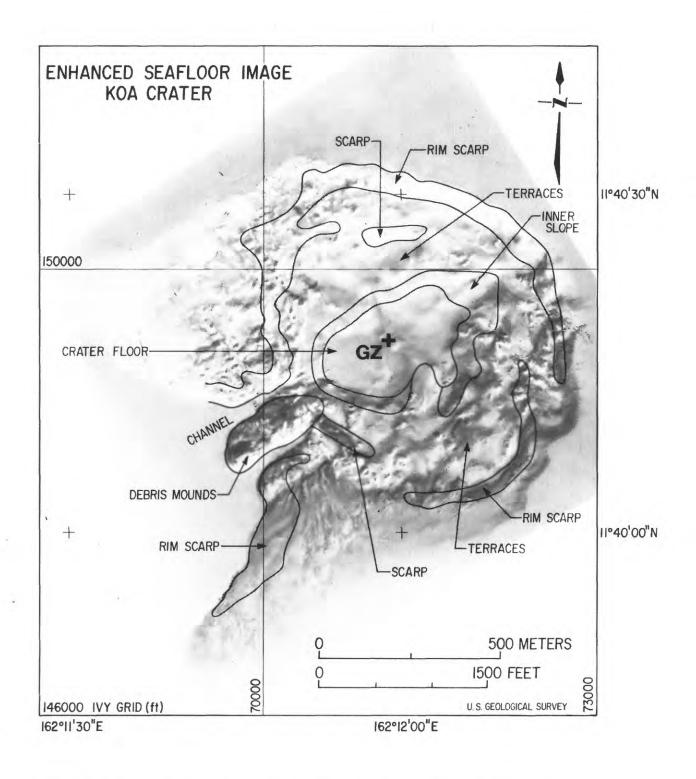
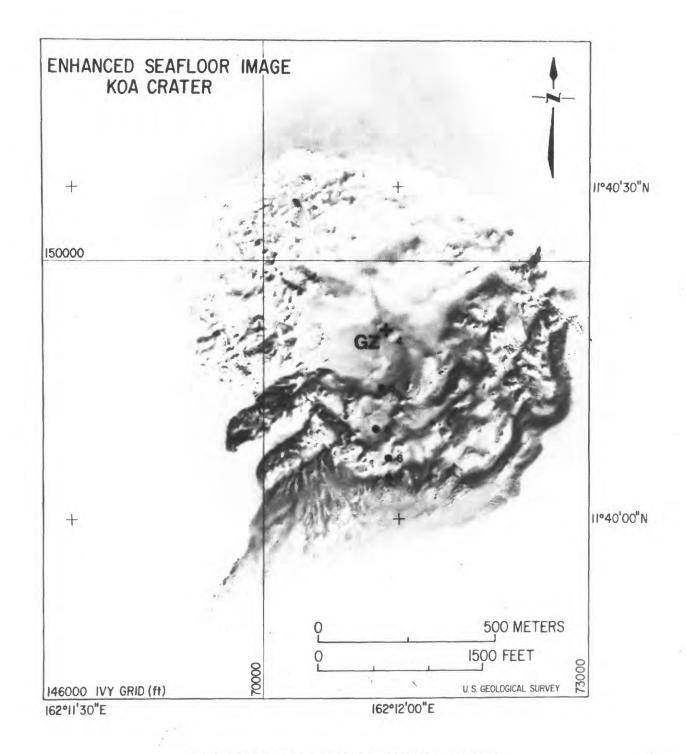


FIGURE 20A. -- Airbrush map from sidescan-sonar data of KOA crater (lighting from southeast) with overlay showing crater provinces, derived from bathymetric and side-scan sonar data (from Folger, Robb, and others, 1986, fig. 6C).



BOREHOLE LOCATION MAP

FIGURE 20B. -- Airbrush map from sidescan-sonar data of KOA crater with PEACE-Program borehole locations. (Base from Folger, Robb, and others, 1986, fig. 6A).

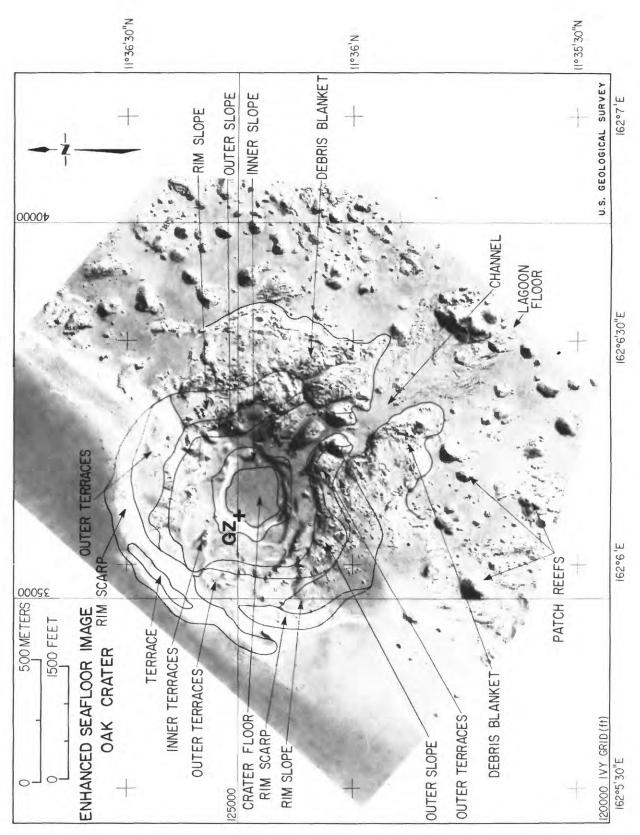


FIGURE 21A. -- Airbrush map from sidescan-sonar data of OAK crater (lighting from southeast) with overlay showing crater provinces, derived mainly from bathymetric and sidescan sonar data (from Folger, Robb, and others, 1986, fig. 5C).

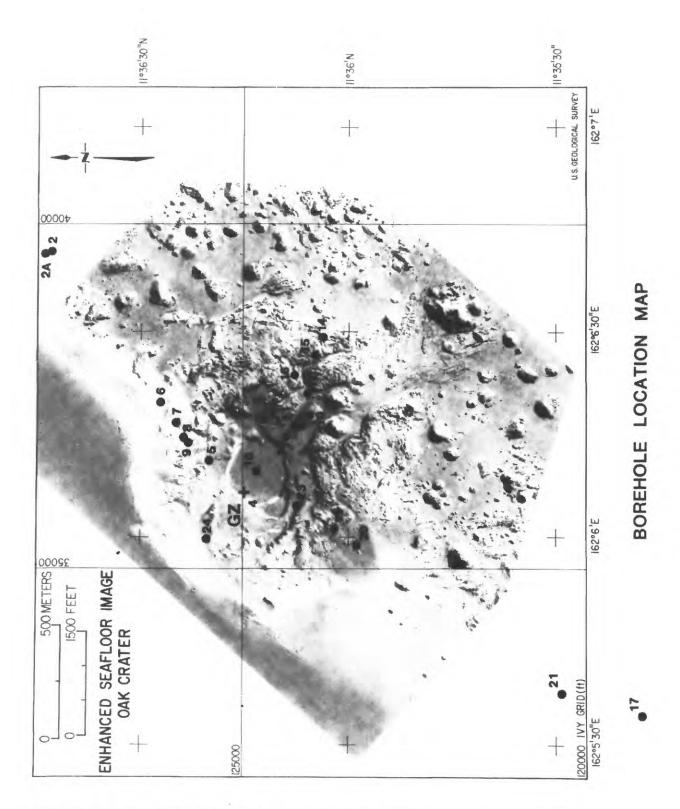


FIGURE 21B. -- Airbrush map from sidescan-sonar data of OAK crater with PEACE-Program borehole locations. Base from Folger, Robb, and others, 1986, fig. 5A).

the single-channel data and the multichannel-seismic stacks from the EASI Program were useful between Phases I and II in establishing reasonable lateral limits and approximate vertical depths for crater disruption for both KOA and OAK (see discussions by Folger, Robb, and others, 1986, and Grow and others, 1986).

The material-properties (M) holes were bored to acquire materials representative of the pre-event ground-zero area. The material-properties boreholes were to be drilled very close to the geologic reference holes. This also would ensure that they would correlate closely with the reference holes and not be greatly affected by lateral facies changes. Since the crater-modeling and material-properties investigators are more concerned about the effects and response of the upper 400 ft of section in the area of the craters than with the material below, the material-properties boreholes were planned to be terminated at roughly 400 ft bsf*.

The cone penetrometer was to be used (1) as a supplementary tool to obtain material-properties data and (2) as a backup system if it proved technically infeasible to obtain quality material samples from shalow, uncemented material from within the crater itself. A combination of operational difficulties with the cone penetrometer and the actual acquisition of acceptable samples resulted in only one cone-penetrometer (P) borehole being drilled during the program.

The ground-zero (Z) holes provide the down-axis control for the crater. to ensure geologic correlatability with the undisturbed reference holes, to identify the various zones of deformation within and below the crater, and to ascertain the depth to strata that were undisturbed by the event.

Crater-transition (T) boreholes are drilled to delimit the outer boundary of the excavational crater. The transition holes drilled within the proposed excavational crater (figures 27 and 30) were to penetrate units that were stratigraphically undisturbed (i.e., to a set of strata in normal stratigraphic sequence) and to depths that would permit characterization of the shallow crater-deformation zones. The T-holes drilled outside the proposed excavational-crater limits were to penetrate deep enough to define the contact between the debris blanket and the stratigraphically undisturbed strata beneath it.

The rationale for siting the dedicated borehole-gravimetry (G) holes will be discussed in a following section on OAK crater.

The operational plan for Phase II of the PEACE Program was designed to be dynamic — one that could be changed quickly in response to newly acquired field or newly refined Phase I data. Both USGS and DNA personnel were chosen to facilitate this flexibility, and full authority was given to the DNA technical director to implement necessary changes. As anticipated, the preliminary drilling plan developed just prior to the beginning of field work on Enewetak (see section on Interim Events Leading to PEACE

^{*} Limited numbers of material-properties samples were to be retained as well from deeper portions of the geologic boreholes.

<u>Program</u>) was modified heavily once drilling and sampling was underway. These modifications were driven by five major factors: (1) the ongoing geologic analysis of the field data, (2) the input of concurrent data reduction from Phase I (particularly the single- and multichannel-seismic profiles), (3) the technical feasibility or engineering constraints imposed both by the nature of the sedimentary section and by the availibility of equipment and materials in the remote field area, (4) the limitations of the drill ship itself, particularly with respect to safety and maneuvering, and (5) the overall program time and cost limitations. The preliminary drilling plan was followed more rigorously for the KOA crater than for OAK.

KOA was selected to be the first of the two nuclear craters drilled during the PEACE Program. Approximately one-third of the drilling time was allocated to the KOA-crater area, the remainder to OAK. This was for the following three reasons, discussed below.

First, KOA is located in the northeastern corner of the atoll on its windward side just inside the reef leeward of a series of small islands (see figure 3). Thus, this crater is better protected than OAK from the late-winter squalls and sudden wind shifts, minimizing the potential number of days lost to bad weather. OAK lies about eight nmi downwind, and relatively large waves commonly are generated in the late-winter months because of the fetch of the lagoon. OAK would be more safely drilled during the summer months when winds are calmer and wave heave is minimized. In the late summer, the lagoon surface is mirrorlike at times.

Secondly, also because of its geographic position, the number of radials that could be drilled in KOA by a vessel the size of the M/V Knut Constructor is limited. Its location places severe logistic restrictions not necessarily on the maneuvering but on the safe anchoring of the vessel.

Thirdly, KOA had more limited objectives than OAK and a lower data priority because of its "nonpristine" nature due to the other events detonated in the vicinity.

KOA was the key to learning both which drilling and sampling techniques and which types of geologic and paleontologic analyses would be most useful. KOA, which became the first high-yield nuclear crater successfully drilled overwater, was the guinea pig.

In the following discussions, the terminology for the "crater physiography" is the same as that used in Folger, Hampson, and others, 1986) and Folger, Robb, and others (1986). These physiographic regions are shown on Figures 20A and 21A of the current report.

KOA Drilling Rationale

KOA boreholes were drilled along a single crater radial. The line drilled was very close to a true north-south profile along USGS seismic-reflection line 306-V1, extending through the KOA-reference hole drill site and KOA ground zero, as shown in Figure 19 (see also Grow and others, 1986, p. 14-16, figs. 12 and 13). This radial is oriented approximately 30 degrees clockwise from the one chosen in the original (pre-fieldwork)

PEACE-Program drilling plan for KOA and consequently does not run parallel to the geologic strike of the reef. The reasons for moving this radial are explained in the succeeding paragraphs.

A land-based drill rig or one mounted on a barge with shallow draft would be necessary to drill a geologically ideal reference hole for KOA. This hole would be on the lagoonward edge of the reef plate just south or south-southeast of the island of Boken (IRENE) (see star on figure 22).

The site in the area of KOA that fits some of the geologic requirements of a reference hole and yet might be accessible by a shallow-draft drill ship is at IVY-grid position 145,420 ft N and 73,009 ft E (see asterisk on figures 18 and 22), roughly the intersection of EASI seismic-lines 10 (through KOA ground zero) and 28 (through MIKE ground zero) (see Tremba, 1984, p. 60, fig. 4). A radial thus defined would have had an azimuth of about 145 degrees from ground zero rather than 180 degrees as drilled. Although this "preferred" point is in about 40 ft of water, it is in an area in which large patch reefs abound, many of which come to within 12 ft of the surface and some of which are awash at lowest tides. Given this situation, the Egabrag II, which ran the seismic lines, could not maneuver safely in this area during Phase I of the PEACE Program; although USGS seismic-line 307 is in roughly the same position as EASI line 10, there is no analogue to 28, because the streamer could not be laid out safely farther to the east-southeast. Furthermore, although the two have comparable drafts, the Knut Constructor is a much longer vessel than the Egabrag II and would have more difficulty in maneuvering and anchoring safely in the patch-reef-laden area.

Two other reasons required moving the KOA radial farther lagoonward than originally chosen. First, KOA crater is in an area of heavy concentration of other nuclear shots, all of which had high yields (table 3, figure 22). The KOA reference hole needed to be situated as far away as possible from the other nuclear sites (MIKE, PINE, TOBACCO/ELDER/DOGWOOD/OLIVE, and YELLOWWOOD/WALNUT)* located to the east of the geologically "preferred" reference—hole site (figure 22), discussed previously. These were high—yield events, most of which were detonated after KOA (table 3). Second, the EXPOE program did not attempt to drill a lagoon hole necessary to complete the geologic modeling of the atoll for cratering analysis [see discussion under section EXPOE Program (1973-74)]. Although lesser consideration, a reference hole at KAR-1 would at least enhance this modeling.

Thus, the selection of the position of KAR-1 was primarily a major compromise between being close enough to KOA ground zero to be representative of the geologic and material-properties parameters of that point and the safety and maneuvering requirements of the drill ship.

KOA Site A. -- The KOA reference hole, **KAR-1**, is located at the approximate intersection of USGS multichannel-lines 306 and 312 (figure

^{*} Nuclear events separated by slash (/) were shot at approximately the same ground zero (see figure 22).

KOA-MIKE AREA NUCLEAR SHOTS

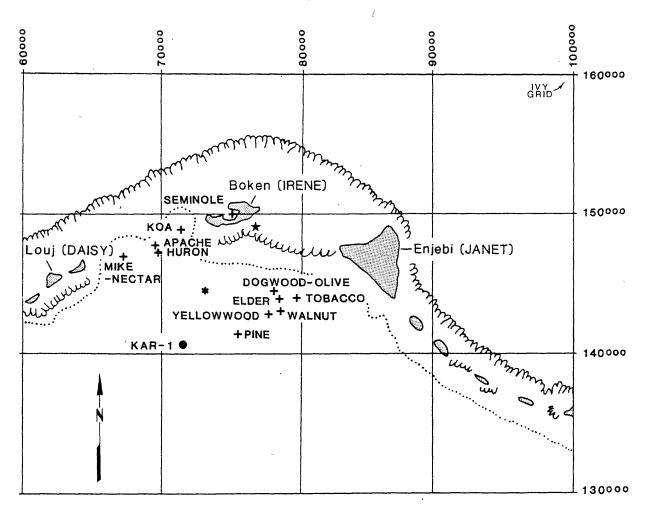




FIGURE 22. -- Map of KOA-MIKE area of Enewetak Atoll showing nuclear-shot sites. Geologically "ideal" reference-borehole location shown by star south of Boken (IRENE); pre-drilling phase "preferred" reference-borehole site shown by asterisk (*); location of borehole KAR-1 shown by solid dot.

18). This borehole was targeted to be drilled to at least 1,000 ft bsf and was completed at a total depth of 1,146.3 ft (bsf). The targeted depth was based in part on the results of the EASI seismic-reflection profiles, the preliminary USGS Phase I profiles, and the deep borings (F-1 and K-1/1B) drilled on Elugelab (FLORA) and Enjebi (JANET). respectively, in the early 1950's (see figure 5 and 22). A full suite of downhole logs was run in this borehole (table 7). The data from the downhole velocity-survey log were for incorporation into the subsequent processing of the KOA multichannel lines.

KAM-2, the first dedicated material-properties hole, was drilled to gather samples in the upper part of the stratigraphic section and to find the sampling methods(s) that would least disturb the material. The hole was abandoned at 80.8 ft because of twisted-off casing that was left in the hole.

The vessel was winched over on the anchor lines, and the cone-penetrometer hole **KAP-3** was drilled to 78 ft to assess the applicability of the Dolphin cone-penetrometer system to this program. The cone penetrometer worked well and the data were good quality, but it was very time consuming and had difficulty in penetrating the thin cemented layers below the uppermost disconformity (R-10 of Grow and others, 1986, and of Robb and others, 1986). Based on the extremely slow progress of the cone penetrometer into the strata and the loss of KAM-2, an operational decision was made to continue this borehole below 78 ft as a dedicated material-properties hole, and samples from below 78 ft were labeled **KAM-2A**. This hole was completed at 482.9 ft bsf.

Activities at KOA Site A consumed approximately one-half of the time allocated for drilling in the KOA area. Part of this time consumption was due to start-up of the field program, being at a low point on the learning curve, and several days of severe weather that curtailed drilling operations.

KOA Ground-Zero Hole. -- The KOA device was detonated within a water tank a few feet above sea level on Lidilbut Island (GENE) at IVY-grid location 149,360 ft N and 071,120 ft E (see table 3). Borehole KBZ-4 was drilled 12 ft southeast of ground zero in 109.1 ft of water near the center of the crater-floor physiographic province of Folger, Hampson, and others (1986) and Folger, Robb, and others (1986) (see figures 20A and 20B). The objectives of KBZ-4 were to extend the drilling and sampling to below the deepest identifiable nuclear-event effects and to below a deep seismic reflector/refractor identified by Grow and others (1986) at approximately 1,000 ft below the sea floor. This depth should penetrate rock below the major mid-Miocene unconformity identified in KAR-1, and within the upper part of the prograding reef inferred from the multichannel-seismic records (see Grow and others, 1986, fig. 13).

Drilling of this borehole took slightly longer than anticipated partly because of the care that was taken to obtain the best sample recovery possible and because of major wall-instability problems that developed at about 385 ft bsf and that required reaming the hole and setting casing to that depth. The sampling above 600 ft bsf was nearly continuous to minimize stratigraphic error due to large sampling intervals in thin zones.

This was done with a combination of percussion and coring techniques, including the first use of the percussion sampling technique developed by McClelland through the Longyear coring tool. With time becoming a critical factor, the sampling interval was increased considerably below 600 ft bsf, where the zones were thicker and the section more readily correlatable with KAR-1.

Drilling was terminated at 1045.9 ft bsf on March 14, 1985. KBZ-4 was the first overwater borehole successfully drilled in a high-yield nuclear crater.

The full suite of geophysical logs also was run in KBZ-4 (table 7). The downhole velocity-survey log- was needed particularly to refine the conversion of the multichannel-seismic data from two-way time to depth in the disturbed region of the crater. These raw data were transmitted immediately to the USGS in Denver, Colorado.

Another major operational decision was made feasible at this point in the program. It was decided to forego use of the Dolphin cone-penetrometer system because of the excellent sample recovery within the crater itself using the combination of split-spoon and Shelby-tube percussion samplers. The reaction mass would be dropped in shallow water in a easily recoverable point soon after the Knut Constructor moved to the OAK-crater area. This not only would enhance the effeciency of the sampling effort itself, it would also minimize the chances of damaging the drill rig when trying to retrieve the reaction mass after each hole was drilled.

KOA Transition Boreholes. --Upon completion of logging KBZ-4, approximately nine days remained to drill the rest of KOA. This would be roughly enough time for one 500-to-800-ft hole or several shallow holes. Because of the high degree of confidence in the geologic analyses, it was decided to target drilling several shallow holes on the pre-selected crater radius to determine the lateral limit of the excavational crater.

Borehole **KCT-5** was the first transition borehole drilled. It was sited 546 ft south of ground zero, on the inner-slope province near its boundary with the crater floor (figures 20A and 20B) well within the proposed excavational crater (figures 18 and 27). Sampling was spaced closely because of the thinness of the geologic marker intervals likely to be encountered. Onsite geologic analysis confirmed that this borehole was within the limits of the excavational crater. When several units were identified in normal stratigraphic order below the limits of the excavational crater, drilling was terminated (TD 306.6 ft bsf), and a full suite of downhole logs was run.

The vessel reanchored and borehole **KDT-6** was spudded 1,182 ft south of ground zero on a broad terrace (figures 20A and 20B). Geologic analysis confirmed the pre-drilling contention that this borehole was just outside the excavatrional crater. Unfortunately, both the primary and secondary sonic logging tools were inoperational and remained thus for the rest of the KOA drilling program. However, the rest of the suite of logs was run for KDT-6.

With four drilling days remaining for this crater, the ship moved southward by winching to 1,326 ft from ground zero and began drilling KET-7 (figures 20A and 20B). This shallow borehole was drilled to confirm that KDT-6 was indeed outside the periphery of the excavational crater and to determine the extent of permanent downward displacement of the shallow stratigraphic markers. KET-7 was sited at the maximum distance from ground zero that the Knut Constructor could be safely anchored north of the shoal area, shown on Figure 18. This hole also was located about the same distance from KOA ground zero as the closest deep rail described by Shinn and others (1986) from the scuba operations. The hole was too shallow (41.4 ft bsf) for downhole logging. The normal stratigraphic succession encountered in the borehole confirmed that no excavational process had occurred at this site.

Borehole KFT-8 was drilled between KCT-5 and KDT-6 (figures 20A and 20B) to further delimit the excavational-crater boundary and to enhance confidence in data trends. Located on a break in slope near a scarp delineated by the bathymetric and sidescan data (Folger, Hampson, and others, 1986; and Folger, Robb, and others, 1986), the site was chosen by onsite Phase II geologists as most likely to include the present edge or rim of the crater. It is located in an area where the the USGS analyses (Grow and others, 1986; and Robb and others, 1986) show that the shallow reflectors R-10 (corresponding to the first disconformity downhole at the Holocene/Pleistocene boundary) and R-20 (corresponding to the first disconformity below that) are truncated. The EASI seismic tracklines (Tremba, Couch, and Ristvet, 1982) show similar truncation of shallow reflectors in this region. Geologic analysis confirmed that KFT-8 was just inside the periphery of the excavational crater.

Lessons Learned from Drilling KOA. -- From a technical or engineering point of view, drilling KOA was extremely successful. It was discovered that the best way to sample many of the boreholes, particularly within the crater and brecciated zones, was not with the core barrel but rather with the percussion samplers through the Longyear system, as described in a preceeding section. Furthermore, hammer sampling combined with hole advancement by drilling provided adequate samples for the geologic analysis. This was possible only because of the rapid and innovative response of the onsite management and the technical expertise of the MEI engineering and drilling personnel.

From an onsite geologic and program-management perspective, it was learned that the depth of most of the key geologic marker beds could be predicted confidently. Thus, it was possible to modify continually the drilling and sampling plan both within a borehole and between boreholes to adjust for the updated predicted depths to important stratigraphic contacts. This was feasible only because of the rapid rate at which the shipboard litho- and biostratigraphic analyses of the sample and core material was accomplished.

In addition to the lessons learned from drilling KOA, drilling OAK was more effective than KOA because of the (1) generally better quality of the Phase-I USGS data in OAK and (2) continual feedback of information from USGS and DNA personnel in the Washington, DC, area, Woods Hole, MA, Denver,

CO, and elsewhere. Continually upgraded processed and reprocessed singleand multichannel data and bathymetric and sidescan-sonar information for OAK were furnished rapidly to onsite personnel.

OAK Drilling Rationale

The drilling plan that was formulated before the field work for Phase II began would have drilled two crater radials (on the same diameter) across OAK crater parallel to the "geologic strike" of the atoll, as stated earlier. original EASI seismic data (Tremba, Couch, and Ristvet, 1982) and the USGS reprocessing of the original EASI seismic data (Grow and others, 1986) from OAK crater revealed a series of shallow reflectors that appeared closely correlatable parallel to the reef trend, thus strengthening the geologicdriven decision to concentrate on a stratigraphic section with a profile parallel to the reef trend. According to the pre-field plan, the first radial was to be the northeastern radial, and the first hole drilled was to be the geologic reference hole at the end of that radial; only one reference hole was envisioned. The geologists argued that the reference hole and northeastern radial should be drilled first because of the shorter distance between the reference holes for the two craters and, indeed, the other shallow borehole control from the EXPOE program. Thus, correlation between the KOA and OAK craters should be facilitated.

Once the reference hole and ground-zero hole were drilled, the plan was to bore one hole outside the excavational-crater margin. Once this distal hole was verified geologically, the plan was to drill a successive set of holes craterward to determine or at least closely bracket the present crater margin. Preliminary Phase I maps showing the extent of the single-channel seismic horizons R-10 and R-20 (Robb and others, 1986) were used extensively throughout the remainder of the program in this quest.

The preliminary USGS multichannel-seismic profiles (Grow and others, 1986) showed that the depth of OAK may be greater than KOA and that deeper strata may have been involved in permanent downward displacement in OAK. For these reasons and for other scientific objectives, the geologic reference hole was to have extended well below 1,000 ft perhaps to (if feasible and deemed necessary) as deep as the Failing-2000 drill rig could safely penetrate and sample (as configured and with the Longyear drill pipe available on Enewetak, this would have been about 1,900 ft below sea level).

OAK Site A. -- OAK Site A was to have been at the intersection of USGS seismic-lines 101, which passes through OAK ground zero, and 121 (figure 19). However, because of the proximity of the inner edge of the main reef and the sharp submarine escarpment along the lagoonward edge of the reef, the drill ship could not deploy at this intersection a stable five-point anchoring pattern both to keep the ship off the reef and to provide a stable heading into the prevailing wind, thus minimizing heave problems. Thus, site A was moved several hundred yards closer to ground zero and farther lagoonward from line 101. The final position was just off seismic-line 108 rather than on line 101 and unfortunately not at the intersection of multichannel lines (see figure 19).

Because of a major crew change at this point in the program, the first hole drilled at site A was OAM-1, a material-properties hole, rather than the geologic reference hole. The USGS geologists briefly examined the core/sample as it was being brought up but did not log it in detail. This hole is located 4,458 ft from ground zero on an azimuth of 051 degrees; it was projected to be drilled to only about 400 ft bsf. Although continuous sampling was attempted, the recovery was only 49 percent. Nevertheless, the hole was very stable throughout the drilling of OAM-1.

At the projected total depth of OAM-1, the decision was made to extend the hole for geologic information rather than risk encountering unstable conditions in the upper part of the stratigraphic section in an offset hole. Thus, below 401.6 ft bsf, OAM-1 became OAR-2. When the hole reached the depth of 885.6 ft bsf, severe problems developed in what was believed to be a zone of large-hole wash-out and caving that was located about 30 ft uphole. The hole closed, and the drill string became stuck in the hole and was almost lost. Once the drill string was freed, rather than expending a considerable amount of program time to alleviate the caving problems, the hole was flushed out with mud, downhole logs were run to maximum depth possible (about 860 ft bsf), and the hole was abandoned rather than attempting to proceed deeper. It was hoped that the crater effects at OAK ground zero would not extend to strata this deep. Considering the apparent depth to maximum displacement below ground zero on the preliminary USGS seismic lines, abandonment was considered a major but worthwhile gamble.

The <u>Knut Constructor</u> was repositioned on the anchor spread as short a distance laterally as possible to minimize the likelihood of local facies differences between the sites. OAR-2A was drilled 58 ft closer to ground zero than borehole OAM-1/OAR-2. The offset reference hole was cored and sampled continuously to 410.5 ft bsf to overlap with the upper few feet of OAR-2 and thus provide continuous geologic control on the stratigraphic section in this area.

Because of the low sample recovery particularly of the upper 100 ft in OAM-1, the DNA representative chose to offset on the anchor cables again on site A and employ a different sampling strategy on the new borehole to compensate for poor sample recovery in upper part of OAM-1. OAM-3 was bored and sampled to a total depth of 108.1 ft. Numerous samples were obtained from intervals and materials not represented in the samples from OAM-1. The geologists logged this hole onsite, particularly since the Holocene/Pleistocene boundary in borehole OAR-2A was so shallow; however, the geologic log is not included in the subsequent section, Borehole Descriptions. The ends of each material property sample were sampled paleontologically to supplement sparse paleontologic data from upper part of OAR-2A. This is the only dedicated material-properties hole that was sampled paleontologically.

A full suite of downhole geophysical logs was run in OAR-2A, including a sonic log the tool for which was repaired while drilling this hole. Only a gamma-ray/density/caliper log was run in OAM-1/OAR-2 and OAM-3 (table 7).

OAK Ground-Zero Hole. -- The OAK thermonuclear device was detonated on a barge securely anchored in 14 ft of water a few yards lagoonward of the

inner edge of the reef plate. The IVY-grid location is 124,981 ft N and 036,108 ft E (table 3). Today, this site is in about 200 ft of water in the crater-floor province of Folger, Hampson, and others (1986) and Folger, Robb, and others (1986) (see figures 21A and 21B of the current report). Borehole OBZ-4 was drilled only 7 ft from true OAK ground zero (table 13) very close to the intersections of USGS seismic-lines 101 and 103V2, 104V2, and 105V2 (figure 19).

This borehole was chosen as the substitute hole for deep scientific objectives because of the inability to safely drill deeper in the lower part of OAR-2. Because of concerns that the onsite mud supply could fall below the quantity needed to maintain continuous drilling operations, the hole was terminated at a depth where the mud returns were lost with little hope of recovery of circulation. The total depth of OBZ-4 is 1,605.2 ft bsf, roughly only 100 ft shallower than could have been drilled with the available Longyear drill pipe.

OBZ-4 was sampled continuously in the crater-affected region, and overall core/sample recovery was 60 percent. Most of the upper part of the hole was percussion sampled, giving an excellent data base for analysis.

A complete suite of downhole logs, including a downhole-velocity survey log, was run in the ground-zero hole (table 7). These data also were transmitted to the USGS in Denver for the refinement of the conversion of the two-way travel time into footage in the multichannel-seismic profiles.

Northeastern-Radial Transition Boreholes. -- Boreholes OCT-5, ODT-6, OET-7, OFT-8, and OGT-9 are the transition holes drilled on the northeastern radial of OAK to delimit the periphery of the excavational crater. All of these boreholes were located either on or just lagoonward of USGS multichannel seismic-line 101, oriented at an azimuth of roughly 45 degrees from ground zero and nearly parallel to the reef trend (figure 19). OCT-5 is located at the intersection of this seismic line with line 116; ODT-6 is near the intersection of line 101 with 119; OET-7 is just off 101 and halfway between 118 and 119; OFT-8 is at the intersection with line 118, and OGT-9 is just craterward from the previous borehole.

The first transition hole, OCT-5, is located inside the postulated excavational-crater on the inner-terrace physiographic province (figures 21A and 21B). Located in 163.7 ft of water, this hole was drilled to a depth of 851.5 ft (table 13), well below the zone of crater disturbance and within strata readily correlatable with OBZ-4 and OAR-2/2A. A complete suite of downhole logs was run (table 7).

Borehole **ODT-6** was sited outside the postulated excavational crater in what was a normal stratigraphic sequence (figure 21). This was an area in which the seismic reflectors R-10 and R-20 were identifiable on the preliminary USGS maps (Robb and others, 1986; Grow and others, 1986). Logistically, the site also was chosen at the base of a topographic slope at a point that would avoid talus blocks of the reef plate (figures 19, 21A and 21B). It was confirmed geologically that the borehole was indeed outside the limits of the excavational crater and that the stratigraphic horizons are displaced downward from their inferred pre-event elevations.

The hole was terminated at 164.2 ft (table 13).

The next borehole, **OET-7**, was drilled 380 ft craterward from ODT-6 on the same gentle slope and at a point just several hundred feet outside the proposed excavational-crater margin (figures 21A, 21B, and 29). The hole was targeted near the line of downturn and termination of seismic-reflector R-10 and within an area where reflector R-20 is present (see Robb and others, figures 13 and 17). Drilling to 231.7 ft confirmed that the borehole was outside the excavational crater, because strata representing reflectors R-10 and -20 were both present in the borehole and paleontologic and lithostratigraphic analysis revealed no mixing. The strata were displaced downward below their estimated pre-event elevations a greater distance than in ODT-6.

OFT-8 was drilled on the slope break suspected from the EASI observations and USGS bathymetric information to be the excavational-crater rim (figures 19, 21A, and 21B). This borehole is within an area where reflectors R-10 and -20 are missing and the multichannel-seismic stacks become complex. It was confirmed geologically that the borehole was located just inside the excavational crater.

Borehole **OGT-9** was drilled only 75 ft from OFT-8 on the same northeastern crater radial. It was sited on a suspected ring-fault system (figures 21A and 21B), identified by Robb and others (1986, fig. 18). Sampling was designed to search for evidence of sand dikes ("pipes") containing material (i.e., brown coral fragments) from deep within the stratigraphic section, and to provide geologic evidence of rim-margin slumps.

Drilling on the northeastern radial was terminated when OGT-9 was completed. The ship moved to the southeastern radial.

Southeastern-Transect Boreholes. -- OHT-10 through ONT-16 constitutes a series of shallow holes located on the southeastern side of OAK ground zero (figures 19, 21A, and 21B). The southeastern transect was not planned prior to initiation of field work, although it was given consideration as an alternate transect to assess the crater asymmetry, provided sufficient time was available in the program. Information from this area of OAK became possible only because of the time saved in the program by the continuous percussion-sampling techniques that evolved for use with the Longyear drilling tools. No deep geologic reference hole was drilled on this transect.

The seven boreholes drilled on the southeastern transect were targeted to acquire two discrete kinds of data. (1) OHT-10, OIT-11, and OKT-13 were sited to find the excavational-crater perimeter lagoonward from OAK ground zero. These boreholes are on a crater radial between USGS seismic-lines 103-V2 and 115 (figure 19). (2) All of the remaining boreholes were drilled farther out from ground zero than OHT-10 (figures 19 and 21B) to explore a suspected lagoonward ejecta-flap region and positive-relief features suspected of being debris and slump deposits from the bathymetric data (Folger, Hampson, and others, 1986), the sidescan-sonar data (Folger, Robb, and others, 1986), and the submersible observations (Halley, Slater, and others, 1986) (see figures 21 and 21B of the current report). OJT-12

is between USGS lines 115 and 116; OLT-14, OMT-15, and ONT-16 are just off line 116 (figure 19).

Borehole **OHT-10** was the first hole drilled on the southeastern radial. It was drilled outside the postulated excavational-crater margin (figures 21A, 21B, and 29) to determine the thickness of the debris blanket overlying the "undisturbed" Holocene section, the nature of the mixing within this blanket, and the extent of downward displacement of key markers in the upper part of the stratigraphic section. Specifically, this hole was drilled on a low, bottom topographic rise suspected to be a debris mound. Sampling was continuous. Geologic analysis identified the thickness of the debris blanket and confirmed that the borehole was located in a structurally depressed region lagoonward from the crater margin.

The drill ship then moved toward ground zero and drilled <u>OIT-11</u> at the postulated rim of the excavational crater (figures 21A, 21B, and 29) and inside ahe debris pile noted near the 45-m bathymetric contour from the submersible (Halley, Slater, and others, 1986). A biostratigraphic horizon predicted at slightly less than 300 ft bsf was the primary geologic target. The borehole was terminated at 286.5 ft within the paleontologic target zone. Geologic analysis confirmed that the borehole was just outside the crater and that the debris blanket in this borehole is very thin.

The <u>Knut Constructor</u> was winched a maximum safe distance on the anchor spread of OHT-10 to explore the thickness of the potential ejecta flap or blanket and to drill borehole **OHT-12** into the stratigraphically undisturbed section underlying the same. The hole was completed at 97.3 ft bsf, and a gamma-ray / neutron log was run.

The drill ship weighed the anchors and moved to OKT-13, well within the proposed excavational crater (figure 29). Borehole OKT-13 is located on the inner-terrace crater province (figures 21A and 21B) and is the lagoonward equivalent of OCT-5 and OTG-23, drilled on the northeastern radial and southwestern transect, respectively. Borehole OKT-13 was continuously percussion sampled and drilled to a depth of 765.8 ft bsf, penetrating into paleontologic zone L of Cronin and others (1986). Downhole velocity-survey, gamma-ray/density/caliper, and gamma-ray/neutron logs were run in this borehole (table 7), which was cased for possible reentry with the borehole gravimetry tool. Unfortunately, the casing later toppled, thus preventing reentry.

After this radial was completed, the drill ship was moved to explore the distal margin of the debris blanket overlying the supposedly intact Holocene and upper Pleistocene section and seismic reflectors R-10 and R-20 (see Robb and others, 1986, fig. 18). The remaining three short boreholes drilled on the southeastern transect were offset from the OBZ-4 -through-OHT-10 crater radial to avoid a large, positive topographic feature (figures 19, 21A, and 21B). Because of their shallowness, OLT-14 was not logged, and only gamma-ray/neutron logs were run in OMT-15 and ONT-16 (table 7). OLT-14 was drilled in the area where both the upper two seismic reflectors (R-10 and -20), as determined by Robb and others, 1986, fig. 18) are present. This borehole was terminated at 49.2 ft bsf, after penetrating seismic horizon R-20. OMT-15 was targeted within an area where seismic horizon R-10 was absent but R-20 was present. And ONT-16 was

drilled in a bathymetric low to compare the debris-blanket thickness with that of OHT-10 and OJT-12, both drilled on bathymetric highs, and with that of OMT-15. ONT-16 is located in the area where both upper seismic markers are missing.

Borehole ONT-16 was terminated at 152.3 ft bsf when the geologists identified paleontologic zone E (see Cronin and others, 1986). There was enough daylight left to move the ship to start reference hole OOR-17 at the end of the southwestern crater transect.

Southwestern-Transect (Gravimetry) Boreholes. -- The following is a summary of the rationale for the location, hole depth, logging, and sampling plan of the PEACE Program boreholes on the southwestern transect (figures 19, 21A, 21B, and 29). With the exception of OSM-22, they were completed in support of the borehole-gravimetry program. Consequently, the strategy for the sampling and conventional logging of these holes differs somewhat from that of the previous boreholes.

At a meeting of the borehole-gravimetry advisory committee on May 22, 1985, the decision was made to drill the borehole-gravimetry line as a chord with respect to OAK ground zero rather that a crater radial. One end would be a borehole at the bathymetric center of the crater (ultimately OPZ-18), approximately 300 feet west-southwest of the true ground zero, and the other would be the reference hole (OOR-17) at a point about 6,000 ft south-southeast of ground zero. According to B.L. Ristvet (written communication, March 14, 1986), the reasoning to drill the "chord" rather than a true radial on the southwestern flank was basically twofold: (1) it allowed the drilling of the bathymetric crater center for comparison with borehole OBZ-4 and to obtain data for analysis of the marked asymmetry of OAK crater, and (2) it placed the borehole-gravimetry holes at a greater distance from the inner edge of the reef than a true radial would (see figure 16), thus reducing the potentially marked terrain effect that the solidly cemented reef facies may have had on the measurements.

Reference Hole OOR-17. -- The location of borehole OOR-17, as with any reference hole, was dictated by the need to be far enough from the OAK ground zero to avoid most shock effects (figure 19) and yet be close enough to ground zero to have representative geology. For the gravimetry survey, however, it must still be within an area of good bathymetric coverage so that for terrain corrections for the borehole-gravimetry data reduction could be made. In addition, the decision was made to locate the borehole on seismic-line 124 at least two fix points from the end. Final siting of OOR-17 accomplished these objectives.

The depth of OOR-17 was determined by the needs of the borehole-gravimetry survey and to penetrate strata below 1,040 ft bsf a sufficient distance to analyze suspected facies changes in this part of the sequence. In addition, it was necessary to evaluate in an undisturbed area the thickness of one of the uncemented and apparently thinned biostratigraphic intervals beneath the crater. The apparent thinning of one of these intervals under the crater relative to OAR-2/2A was particularly marked in the ground-zero hole. It would have been geologically desirable to have penetrated deeper, but, with

time running out, the hole was terminated at 1,091.1 ft bsf.

The upper 700 ft of borehole OOR-17 was percussion sampled nearly continuously. Following setting the casing for the gravimetry, the remaining 400 ft of this hole was cored and drilled with the Longyear. Because this was a reference hole and the first overwater hole in which the borehole-gravimetry survey was to be tried, an attempt was made to obtain a complete suite of good conventional, open-hole geophysical logs, including a downhole-velocity survey (table 7). Casing requirements caused the logging to be effected in two stages, 0 - 400 ft and 520 - 1,079 ft. It was only possible to log from 400 - 520 ft through the casing, thereby providing only gamma-ray/neutron data for this part of the borehole. The open-hole logs, in addition to the downhole-velocity survey, included gamma-ray/density/caliper, and gamma-ray/neutron. The borehole-gravimetry survey was completed from 156 - 692 ft bsf. Unfortunately, use of 10-3/4-in. casing in the upper 117 ft of the borehole precluded extending the gravimetry survey from 156 ft bsf to the top of the hole. This incident necessitated drilling an additional reference hole (OSR-21) on the southwestern chord to cover the upper part of the section with essential gravimetry data from the undisturbed region of the crater.

Bathymetric-Center Borehole. -- Borehole OPZ-18 was drilled at the bathymetric center of OAK crater, not at true ground zero (figures 19 and 21B) for the reasons mentioned in a previous section. OPZ-18 was drilled in 201.9 ft of water, in the deepest water of any borehole in the program.

From analysis of the data from the true ground-zero hole, OBZ-4, it was concluded that the optimal depth for the borehole-gravimetry survey in this portion of the crater was 700 ft bsf; hence, the minimum hole depth to accomplish this survey was to be around 720 ft. OPZ-18 was hammer sampled continuously to 80 ft bsf, on 3-ft intervals from 80 to 290 ft bsf, and on 5-ft intervals from that point to total depth of 721.6 ft.

Open-hole gamma-ray/density/caliper and gamma-ray/neutron logs were run from 186.5 - 699 ft bsf, and the gamma-ray/neutron log was run in the casing from the surface to 186.5 ft bsf. Because of the nearness of the two ground-zero holes and because of their geologic and crater-stratigraphic similarity, a downhole velocity-survey log was not run in OPZ-18. The caliper log showed a potential problem for the borehole-gravimetry tool. Because of a casing-tally error, 6-5/8-in. casing was driven to 141.5 ft, leaving a 29-ft gap between 187 - 216 ft in the casing string. In spite of running the risk of losing the gravimetry tool in this uncased interval, the survey was run and completed. The lowest part of the hole was drilled with the casing, and not adequate time was permitted to clean out the hole adequately before the gravimetry was run. Because of suspended silt in the casing in the lower part of the borehole, gravimetry data was obtained only from 30 - 660 ft bsf.

Borehole OQT-19. -- The decision was made also in the May 22, 1985, meeting of the borehole-gravimetry advisory group (discussed above) that a 500 to 700 ft-bsf-deep gravimetry hole would be required just beyond the proposed excavational crater (figure 29) to optimize the modeling. Similarly, a second, 350- to 500-ft-deep hole would be required approximately 500 ft farther out from ground zero than the first one to optimize the

modeling of the subsidence and other effects in the crater wings. Before moving to the site of borehole OQT-19, the decision was made shipboard to deploy an anchoring pattern such that, if schedule allowed, both holes could be drilled from one anchoring site. Unfortunately, the Knut Constructor's hydraulic system failed on the move from OPZ-18, resulting in 14 hours of unexpected downtime. Because of the time loss, it was then decided that it was feasible to drill only one hole to 700 ft depth and that the second hole would not be drilled.

OQT-19 was drilled in record time with hammer samples taken on selected 3- and 4-ft intervals to 220 ft bsf, then on 5-ft intervals from 220 to 450 ft, and on 10-ft intervals to total depth of 701.5 ft bsf. This sampling plan was based upon and continually modified to accommodate updated predicted depths to important stratigraphic contacts. The total depth of the hole, as mentioned above, was dictated by the needs of the borehole-gravimetry program. The drilling confirmed that the entire section was present and that the units had not been thinned appreciably, although key stratigraphic horizons were depressed.

Open-hole downhole velocity-survey, gamma-ray/neutron, and gamma-ray/density/caliper logs were run from 130 to 663 ft bsf. The borehole gravimetry survey also was completed in record time from 20 to 680 ft bsf. Thus, a full day was gained on this hole over that originally allocated, and the decision was made to go ahead and drill the second corehole, ORT-20, on the same chord but approximately 400 ft farther from ground zero than the first, as had been planned before the hydraulic-system breakdown.

Borehole ORT-20. -- This hole was spudded only 2 hrs after the completion of OQT-19 after a short move on the anchors. The purpose of the hole was to provide a second hole within the wing of the apparent crater to enhance the gravimetry modeling. Minimum depth for the borehole-gravimetry modeling was 350 ft bsf with optimum at 500 ft bsf. Drilling was again at record rates with percussion sampling taken on 3- and 5-ft intervals to 120 ft depth, and 10-ft intervals to the bottom of the hole at 491.8 ft bsf. The sampling philosophy was the same as for OQT-19 and was very successful in sampling the predicted key stratigraphic contacts. Like OQT-19, the hole showed that all stratigraphic units were present but depressed (i.e., subsided or downfaulted) relative to their predicted preshot depths.

An open-hole gamma-ray/density/caliper log was run from 6 to 482 ft bsf. The borehole-gravimetry survey was completed with little difficulty in excellent weather from 35 to 540 ft bsf.

Borehole OSR-21. -- The primary purpose of this borehole was to provide a borehole-gravimetry survey of the near-surface undisturbed stratigraphy not obtained in the OOR-17 borehole due to casing incompatability with the borehole-gravimetry tool. Secondary objectives were to provide a significant overlap with the OOR-17 stratigraphy and borehole-gravimetry survey to evaluate the variabilities within the reference stratigraphy and in situ densities. Due to schedule constraints, it was decided that the hole would be 350 ft deep at a site on the "chord" between OOR-17 and OPZ-18, approximately 550 ft craterward from OOR-17.

This borehole was percussion sampled on 3-, 5-, and 10-ft intervals using the same strategy as that of the previous two boreholes. Again, most key stratigraphic horizons were sampled successfully at their predicted depths. The hole was drilled to a total depth of 354.3 ft bsf with few difficulties.

A gamma-ray/density/caliper log was run in the open hole from 41 to 334 ft bsf. The borehole-gravimetry survey was completed between 50 to 340 ft bsf but took about two days longer than anticipated, primarily due to a combination of bad weather and human error. In order to expedite the move, the casing was cut by explosives at 15 ft bsf. However, this borehole was not completed in time to allow for a daylight move to the OTG site as scheduled.

Borehole OSM-22. -- The OSM-22 hole was a "filler" hole dedicated to material-properties sampling of the upper 100 ft of section while waiting for daylight to safely weigh anchors and move to the OTG-23 site. The ship was moved on its anchor lines from OSR-21 approximately 50 ft toward OOR-17, and OSM-22 was drilled and sampled to a total depth of 127.5 ft bsf shortly before sunrise.

Borehole OTG-23. -- OTG-23 was a dedicated gravimetry-survey borehole. The location was in accordance with the plan resulting from a May 29, 1985, meeting of the borehole-gravimetry steering group. OTG-23 was located on inner terrace of the crater (figure 18) on the OPZ-18 -to- OOR-17 "chord" approximately 800 ft from OPZ-18. Because of the loss of nearly two days on OSR-21, not completing OSR-21 with sufficient daylight to safely reanchor, and the geologic need to attempt to drill the OUT-24 hole, detailed geologic sampling was not done on OTG-23. This borehole was drilled directly with 8-5/8-in. casing to 300 ft bsf and then with 6-5/8-in. casing to a planned total depth of 600 ft bsf. Sampling was limited to a 3-ft percussion sample taken every 30 ft at a casing joint from 300 ft to the total depth of 587.3 ft bsf.

A gamma-ray/caliper log was run from 0 to 575 ft in the casing. unfortunately, high spring tides and poor weather coupled with difficulties with the borehole-gravitmetry tool resulted in obtaining borehole-gravimetry measurements only from 150 to 570 ft bsf. Heavy seas caused severe casing motion and noise and prevented getting measurements above 150 ft. Like the OSR-21 hole, the casing for the OTG-23 hole was cut by explosives to accomodate the move to the OUT site at daybreak.

Borehole Northwest of Ground Zero (OUT-24). -- The location of the last borehole drilled during the PEACE Program was chosen to provide a geologic- and crater-interpretation data point on the reefward side of OAK ground zero. It is on the inner-crater terrace (figures 21A and 21B). A large bite of the reef plate was taken out by the detonation of the OAK device, and borehole OUT-24 was drilled in a area occupied pre-shot by the lagoonward part of the reef plate (figure 21). Geologically, except possibly KBZ-4. it was the reefward-most borehole drilled by the M/V Knut Constructor.

Following a long discussion with the Captain of the <u>Knut Constructor</u>, careful charting, and reconnaissance with a supporting whaler, it was decided to drill this hole 850 ft reefward of the OAK ground zero with the ship's bow into the reef and her stern into the wind. After some difficulty in getting two of the bow anchors to hold securely, a good anchorage was obtained for OUT-24. Drilling commenced in 147.0 ft of water with approximately 32 hrs of drilling time remaining in the contract.

The hole was percussion sampled on 5- to 10-ft intervals, and a total depth of 351.2 ft bsf was reached at 0225 hrs on July 25, in time to allow for securing the drill rig to meet the 0600-hrs completion time of the contract. A gamma-ray/neutron log was run inside the drill stem from 0 to 339 ft bsf. Again, the casing was cut explosively at approximately 15 ft bsf to expedite coming out of the hole.

At 0930 hrs on July 25, 1985, all anchors were weighed, thus successfully completing all of the work for PHASE II of the field program on Enewetak Atoll.

LITHIC NOMENCLATURE

The following is a discussion of the lithic or rock nomenclature used during the Phase II of the PEACE Program on Enewetak Atoll and in the written presentation of the descriptive geologic logs of all of the geologic boreholes (R, Z, and T holes) drilled during the spring and summer of 1985 from the M/V Knut Constructor.

As discussed in a previous section, the USGS geologists (Henry, Wardlaw, Skipp, Major, and Tracey) described the working half of each core/sample aboard the ship shortly after it was drilled. At least two USGS geologists were onsite during the drilling of each of these holes. Although care was taken to produce an initially accurate geologic log, occasionally the MEI drilling crews would drill more hole than could be described easily.

The senior USGS geologists, Henry and Wardlaw, subsequently redescribed all of the geologic cores/samples during periods between September of 1985 and the end of January of 1986 at the USGS Core Library in Denver, Colorado. This redescription was considered necessary to ensure standardization of the lithic logs themselves, to take advantage of what was learned geologically during the course of the drilling program, and to have sufficient time to examine carefully each core inch-by-inch. In addition, each entire core could be laid out at once in this warehouse facility, whereas aboard the Knut Constructor only about 50 ft of core could be examined in the modular laboratory at any one time. In Denver, several cores also could be compared at the same time.

The descriptions in this chapter are a combination of the original shipboard descriptions and the subsequent redescriptions.

The geologists of MEI also produced an engineering and soil-stratigraphic description of all of the boreholes as they were drilled. The MEI description of each borehole, presented in Appendix II of the current report, is a complement to each geologic log presented in this chapter.

Format and Nomenclature

Enewetak is a typical Pacific coral atoll consisting of a slowly sinking volcanic foundation upon which coral-coralgal reefs have grown and reef-related carbonate sediments have been accumulating since the Eocene (Ladd and others, 1953). The total sedimentary section on Enewetak is about 4,500 ft thick. The material sampled from this sedimentary cap during the PEACE Program is almost exclusively calcium carbonate, either aragonite or calcite.

For this report, the depth of each core unit is recorded in **feet and tenths** below the seafloor (bsf) or the water-sediment interface; various types of samples taken from each borehole were labeled with the same type of bsf information.

The descriptions of the samples and core taken during the PEACE Program employ the basic carbonate-rock nomenclature developed by Dunham (1962) and expanded by Embry and Klovan (1972) with minor additional modifications

discussed below. Couch and others (1975) also used the basic Dunham classification in their description of the PACE and EXPOE boreholes. With the format employed in this report and that used in the PACE/EXPOE report, the modified Dunham system is applicable to "rock" in the strictest geologic sense — i.e., either uncemented (unlithified) carbonate sediment or cemented (lithified) material.

The descriptions of the borehole logs presented in this report are field descriptions, i.e., are determined by macroscopic, hand-lens, and low-powered, binocular-microscope observation of the core and sample. Estimations of various sedimentologic parameters and percentages of various components was aided by comparison with charts produced for sedimentary and particularly carbonate rocks by a number of different workers, including Terry and Chilingar (1958), Krumbein and Sloss (1963), Baccelle and Bosellini (1965), Pilkey, Morton, and Luternauer (1967), Schäfer (1969), Anstey and Chase (1974). Most of these are presented in Flügel (1982).

The format for the geologic borehole descriptions consists of the rock name (in CAPITAL LETTERS), followed by a set of primary descriptors, a set of secondary descriptors, miscellaneous notes, comments on the stratigraphic relationships (given relative to the contact with the underlying unit), and a readout of sample types and depths. The discussion of these components follows.

Rock or Geologic-Unit Name

Dunham (1962) developed a system of nomenclature for carbonate rocks according to their depositional texture or fabric (figure 23). The Dunham system was constructed originally for ancient, well-cemented carbonate rocks. This system divides carbonates into two major genetic classes: (1) rocks that are formed and "bound" together in place by biologic action (boundstones), and (2) those composed of biogenic particles, either (a) whole shells or tests or (b) fragments or clasts formed from the mechanical and/or biologic breakdown (degradation) of these materials. Category 1 can be thought of as composed of autochthonous materials, and category 2 allochthonous materials.

Distinctions within the second, or particle-fabric category, are made between rocks that have mud-supported fabrics (<u>mudstones</u> and <u>wackestones</u>) and those that are grain-supported (<u>packstones</u> and <u>grainstones</u>). In Dunham's system (and in most geologic carbonate classifications), "mud" is defined as silt-sized and finer material. Thus, grains are sand-sized and coarser materials. Dunham uses names that combine the names of fabric or rock types with the names of the grain types (e.g., foraminifer-lithoclast packstone).

Embry and Klovan (1972), who were investigating ancient reef limestones, expanded Dunham's (1962) nomenclature in two important ways. First, to facilitate dealing with rocks composed of appreciable percentages of grains greater than 2 mm in diameter (i.e., granule- or larger-sized components), they added two major fabric or textural classes: <u>floatstones</u> and <u>rudstones</u> (figure 24). The difference between the two rock types is that the particles larger than 2 mm form the supporting framework (i.e., are in contact with one another) in a rudstone, whereas grains larger than 2 mm do not touch each

DUNHAM'S CLASSIFICATION OF CARBONATE ROCKS

MUDSTONE	WACKESTONE	PACKSTONE	GRAI NSTONE	BOUNDSTONE
Less than 10 percent grains	More than 10 percent grains			questionably organic matter and are too large to be interstices.
Mud-supp	orted	Grain-su	pported	sediment-floored cavitie that are roofed over by organic or
(particles of	deposition, as shown by intergrown skeletal matter, lamination contrary to gravity, or			
Original Co	Original components bound together during			
	DEPOS	ITIONAL TEXTURE REG	COGNIZABLE	1

DEPOSITIONAL TEXTURE NOT RECOGNIZABLE

CRYSTALLINE CARBONATE

(Subdivide according to classifications designed to bear on physical texture or diagenesis.)

FIGURE 23. -- Dunham's (1962) classification of carbonate rocks according to depositional texture. (From Dunham, 1962, tbl. 1.)

CLASSIFICATION OF CARBONATE ROCKS USED IN PEACE PROGRAM

(According to Depositional Texture)*

	гол	BOUND TO	GETHE	R DURING DEPOS	ITION	
Generally smaller grains (arenite and silt size)					More than 10 grains (rud	percent larger lite size)
Contains (micrite	s mud e matrix)			acks mud rite matrix)		
Less than 10 percent grains	More than 10 percent grains				Matrix- supported	Grain- supported
Mud-supported Grain-sup		 				
MUDSTONE	WACKESTONE	PACKSTO	NE	GRAINSTONE	FLOATSTONE	RUDSTONE

BOUND TOGETHER DURING DEPOSITION							
Organisms act as sediment bafflers (e.g., dendroid corals, fene- strate bryozoans)	Organisms act as sediment binders (e.g. algal mats, encrust- ing bryozoans, stromatoporoids)	Organisms act as frame- builders (e.g., inter- grown reef corals, coral- line algae)					
в о	U N D S T O	N E					
BAFFLESTONE	BAFFLESTONE BINDSTONE						

^{*} Dunham (1962) and Embry and Klovan (1972)

CORAL HEAD

FIGURE 24. -- Classification of carbonate rocks used in PEACE Program borehole descriptions.

other and "float" in a finer-grained matrix in a floatstone. Thus, a rudstone is a coarse-grained analogue of Dunham's grainstone and packstone; a floatstone is analogous to a coarse-grained wackestone. Second, they subdivided Dunham's "boundstones" into <u>bafflestones</u> (i.e., rocks formed where living organisms, such as dendroid corals, acted as sediment baffles to entrap smaller particles), <u>bindstones</u> (i.e., material "glued together" by sediment binders, such as algal mats, etc.), and <u>framestones</u> (e.g., intergrown reef corals).

The first of these Embry and Klovan (1972) modifications (floatstones and rudstones) permits more easily dealing with supra-sand-sized detritus derived from nonbiogenic sources as well as biogenic sources. Such natural examples would include conglomerates or breccias of pre-existing lithified rock material (lithoclasts) and other detritus in a lag deposit just above an erosional unconformity or at the base of a surge or tidal channel cut into the reef. The floatstone and rudstone categories also can accomodate non-naturally formed rubble such as that produced by nuclear explosions in a carbonate terrain. Examples would be the coarser-grained deposits in the debris blanket or in the crater flap or the coarser-grained material within the crater fill.

Splitting the Dunham boundstone into three categories (figure 24) gives greater geologic and ecologic resolution in dealing with a reef environment, such as found on Enewetak. The PEACE-Program geologists added a fourth category (coral head) to simply describe a large chunk of coral (whether or not inferred to be in its natural or normal stratigraphic setting and whether or not it might be in natural growth position) brought up in the core barrel or in the percussion sampler that is 0.5 ft or greater in thickness.

This or any other classification system is an attempt to artificially divide a lithic continuum. All categories are gradational, and certainly it becomes a question of the scale at which one makes the application as to whether a given section of rock is called a framestone, a coral head, or something else. Obviously, the classification used in this program was applied to small-diameter core and percussion samples. At this scale, it is difficult to determine whether or not a single coral head is part of a larger-scale framestone. In this report, the term framestone designates a rock consisting of intergrown reef corals, generally of several kinds, commonly encrusted with other types of organisms, such as coralline algae. Thus, if a large coral head (one species) was sampled by itself in the absence of any other taxon of coral or an intergrown network of coral, coralline algae, bryozoans, etc., the geologic unit simply was classified as a coral head.

For this program, the main rock types consist of MUDSTONES, WACKESTONES, PACKSTONES, GRAINSTONES, FLOATSTONES, RUDSTONES, BAFFLESTONES, BINDSTONES, FRAMESTONES, and CORAL HEADS (figure 24). To this list is added LAMINATED CRUST (part of a paleosol) for a rock type, and the "filler" terms NO RECOVERY, POOR RECOVERY, and WASH-IN. These "fillers" are self-explanatory.

Units of no recovery occurred either because (1) a sample-recovery attempt was not successful; (2) an interval was deliberately rock-bitted or otherwise drilled-out when advancing the hole; or (3) the hole was cleaned out prior to setting casing and had to be advanced slightly to effect seating

the casing. In one instance, a unit of no recovery was created when the sections of drill pipe were miscounted when reintering the hole. The policy was followed that no geologic unit would terminate at an interval of no recovery.

Wash-in, as implied by the name, consists of material that has fallen downhole from an uncased or otherwise unprotected interval. Wash-in is generally easy to identify because it occurs at the top of a given sample run and almost invariably consists of coarser-grained material from which the fines have been washed out by the circulating drilling fluid. Most of these washed-in materials were noted by the driller when the core was extruded from the barrel or the percussion tubes emptied of their contents. Many of the more obvious of these were discarded by the MEI personnel after inspection by the USGS and DNA geologists; others that were less obvious were retained in the D-tubes but were designated as wash-in or suspected wash-in.

Primary Descriptors

For purposes of this report, the term primary descriptor includes the (1) major grain constituents, (2) degree of cementation, (3) degree of alteration or recrystallization, (4) rock color, (5) grain characteristics, (6) porosity, and (7) rock-fabric structures.

Additional primary descriptors for Embry and Klovan's (1972) floatstones, rudstones, and "boundstones" are included also. As mentioned previously, floatstones and rudstones may be thought of as coarser-grained equivalents of the wackestones and packstones/grainstones, respectively. Instead of being limited to a finer-grained or mud matrix (i.e., silt- and clay-sized particles), rudstones and floatstones can have matrices composed of up to sand-sized particles (i.e., mudstone, wackestone, packstone, or grainstone). Thus, the different Dunham catagories can be used both as rock names as well as textural modifiers for describing the matrix of a floatstone, rudstone, or boundstone. An example is a FLOATSTONE with a wackestone matrix. In this sense, floatstone is the rock name, and wackestone is a textural modifier. Similarly, a "boundstone" could be described as a FRAMESTONE with a packstone matrix.

The modifiers "sparse" and "tight" also occasionally were used for this program in modifying a floatstone -- sparse meaning consisting of between 10 and about 30 percent particles greater than 2 mm in diameter and tight referring to greater than 30 percent.

Grain Constituents or Biotic Modifier. -- For the detrital rocks, the type of grain or grains ("allochems") that dominate the rock forms the leading modifier in the rock-unit description. In the reference boreholes and other holes outside the craters, the Enewetak grain constituents consist primarily of biotic material such as whole and broken shell material (e.g., gastropods, pelecypods, ostracodes), tests (e.g., foraminifers), and colonial organisms (e.g., corals). Less commonly encountered are clasts of pre-existing cemented rock (lithoclasts).

The two or three types of dominating grains are generally given in the

lithic descriptions. If two grain types are equally or subequally common, a hyphen is used to separate the names (e.g., foraminifer- ostracode); if one of the forms clearly dominates the qualitative percentage estimate, it is stated first, succeeded by a comma and the second grain type (e.g., foraminifer, mollusc). Thus, a foraminifer-ostracode, mollusc packstone would be co-dominated by foraminifer tests and ostracode valves and contain a significant but subordinate amount of mollusc material. The grain components themselves are generally broken down into major organism groups rather than down to a generic taxonomic level.

Within the craters themselves, lithoclasts are more common grain types. The term rubble is applied to modify the rudstones and floatstones that are encountered. As defined by the American Geological Institute (Bates and Jackson, 1980, p. 547) and used in the current report, <u>rubble</u> is a loose (i.e., uncemented) mass of angular rock fragments. The term rubble has been extended for the purposes of this report to include (probably shock-induced) fractured and broken fragments of larger colonial corals. <u>Mixed-rubble</u> is material (either consisting of lithoclasts or brecciated, colonial-coral fragments) that is inferred from mode of preservation and/or other criteria to have come from more than one stratigraphic unit. Where the term mixed-rubble is used, it is generally explained further in the description.

For the boundstones, the major biotic components also become the primary modifiers (e.g., coral-coralgal FRAMESTONE). The bafflestones generally have an appreciable amount of matrix, also noted in the descriptions.

<u>Cementation</u>. — Cementation is the process by which clastic sediments become lithified or consolidated into "hard" rocks, generally through the deposition or precipitation of minerals in pore spaces between the individual component grains. Cementation of a carbonate rock occurs through a complex combination of organic and inorganic processes that operate both in the marine and nonmarine environments and that constitute a part of the diagenetic changes that a sediment undergoes after it is deposited. The degree of cementation is a major factor in determining the behavior of a material during a nuclear explosion.

The material encountered in the stratigraphic section on Enewetak represents a complete spectrum from completely uncemented to very densely cemented. For the geologic description, qualitative terms were employed. These are: uncemented, very poorly cemented, poorly cemented, moderately cemented, moderately well-cemented, well-cemented, and very well cemented. Most of the PEACE-Program material falls within the range of very poorly to moderately cemented. Least encountered was very well cemented rock. The uppermost section in each of the boreholes was uncemented.

Since the degree and type of cementation more commonly varies within a geologic unit than not, an attempt was made to describe further the mode and range of cementation and the intervals affected.

Alteration. -- Accompanying the diagenetic processes that cement the particles of a sediment together are changes in the mineralogy and/or appearance (preservation) of the grain components themselves. These are referred to as alteration of the grains. These would include, for example,

the etching or dissolution of the grains, the production of a chalky appearance, staining and color, recrystallization, the formation of spar-cement in what were originally intraparticle pore spaces, etc.

Different types of biotic grains react differently during diagenesis. Since sclerectinian corals and Halimeda (a green alga) are composed of the mineral aragonite, which is unstable in a fresh-water environment and will readily dissolve, these types of organisms are particularly sensitive to any change in the chemical environment, and a particular effort was made to note their appearance in each unit where they occur. Because of the small size of the individual Halimeda blades and the high degree of porosity and permeability within the blades themselves, this material is among the first to be affected by the introduction into a fresh-water system. As one would expect, there is also a tremendous difference in the response of different types of corals to diagenesis. This is generally related to the density of the walls and other structures of the coral. Thus, the very open and lightly calcified forms such as Bikiniastrea are readily dissolved, whereas a very dense, closely packed, small corallite form such as Porites lutea is the last of the corals to be dissolved in a given stratigraphic unit.

Rock Color. -- Most of the rocks on Enewetak are very light colored and form a monotonously colored sequence ranging from white to very pale orange. Color differences are generally subtle. Several stratigraphic intervals within the sequence, nevertheless, consist of stronger and darker hues and are characterized by a distinctive color or set of colors. Color can be an important tool in correlating from one section to the next and is used as one of the primary descriptors for the geologic units in each borehole.

The color names used in this report are from the "Rock-Color Chart", published by The Geological Society of America (1975). This chart presents a standard set of color chips and associated rock-color names based on the Munsell color system. This system is closely related to the standard set of colors adopted by the National Bureau of Standards. The Rock-Color chart colors are used widely by geologists, soils specialists, and other professional scientific and engineering groups throughout the United States and Canada, including the PEACE Program drilling contractor, McClelland Engineers, Inc.

Most of the names that are used in the "Rock-Color Chart" are unique—that is, they appear in this chart only once. The color name by itself is sufficient for such colors for describing each geologic unit in the borehole descriptions. Other color names are not unique in the chart (e.g., there are three grayish greens), and the name alone for these is not sufficient. These nonunique color names are followed in this report by the hue/value/chroma code in parenthesis. The nonunique names used in this report and their codes are as follows (the commonly used color is followed by an asterisk):

dusky yellowish green (5GY5/2) and (5G5/2) grayish green (10GY5/2)* and (5G5/2) and (10G4/2) grayish red (5R4/2) and (10R4/2) greenish black (5GY2/1) and (5G2/1) greenish gray (5GY6/1)* and (5G6/1) light brown (5Y6/4) and (5YR5/6)

light greenish gray $(5GY8/1)^*$ and (5G8/1) light olive gray (5Y5/2) and (5Y6/1) moderate brown (5YR4/4) and (5R3/4) moderate red (5R5/4) and $(5R4/6)^*$ olive gray $(5Y4/1)^*$ and (5Y3/2) pale red $(5R6/2)^*$ and (10R6/2) yellowish gray $(5Y7/2)^*$ and (5Y8/1)

Standard practice for a rock color not matching one of the color chips is illustrated by the following example. To say that a rock color is white to very pale orange indicates that the color is intermediate between the two standard colors denoted by the color names. Because white is given first, it was the judgement of the describer that the rock color was at least somewhat closer to the white chip than to the very pale orange one. Conversely, had the color been described as very pale orange to white, the true rock color would have been closer to very pale orange than to white.

<u>Grain Characteristics.</u> — Under the general heading of texture are grain size, shape, sorting, and other sedimentologic parameters. These are referred to as grain characteristics. Because the borehole core/samples were field described, determination of these characteristics was based on a visual estimate, not on rigorous sedimentologic or petrographic analysis.

Grain size is given as a visual estimate of the "mean" value and a common range of values in this report. The grade scale used in the segment Borehole Descriptions in the current report is the standard logarithmic Wentworth-Udden grain-size scale (figure 25)*. In the section Borehole Descriptions, the terms silt, very fine grained sand, fine-grained sand, medium-grained sand, coarse-grained sand, very coarse grained sand, granule, pebble, cobble, and boulder are visual estimates using comparative grain-size charts conforming to the Wentworth-Udden size classification.

Grain shape, degree of rounding or roundness, and degree of sorting are also derived from qualitative, visual estimates of each sample/core.

<u>Porosity. --</u> Enewetak carbonate rocks are characterized by extremely high porosities. This property is extremely important in the computer modeling of material behavior during the formation of nuclear craters.

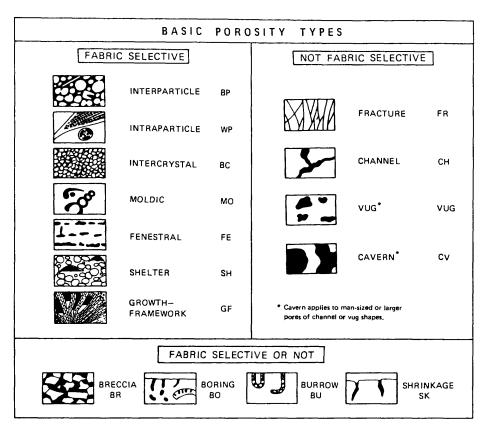
Many classifications have been proposed for porosity in carbonate rocks. Of these various schemes, the one which was most useful for the purposes of this program is that proposed by Choquette and Pray (1970) and shown in Figure 26. An excellent discussion of the Choquette/Pray porosity classification appears in Flügel (1982, p. 442-447).

^{*} It should be noted that a geologist will divide sand from silt at a 230-mesh screen (U.S. Standard Sieve size) or at 4.0 phi (Ø); an engineer will break sand from silt at a 200-mesh screen or at 3.75 Ø (compare figure 25, on the next page, with plate 1 of Appendix II of this report). Thus, the geologist's silt is finer grained than that of an engineer.

STANDARD GRAIN-SIZE CHART

U.S. Standard Sieve Mesh # Mil	limeters M	licrons	Phi (Ø)	Wentworth Size Class	3
_	4096 1024		-20 -12 -10	BOULDER (-8 to -120	5)
wire			8 6	COBBLE (-6 to -8Ø)	_
— squares ——— — 5 ————	64 16		- 4	PEBBLE (-2 to -6Ø)	-
6 7 8	3.36 2.83 2.38 2.00		- 2 - 1.75 - 1.5 - 1.25	GRANULE	
12 14 16 18	1.68 1.41 1.19		- 1.0 - 0.75 - 0.5 - 0.25	VERY COARSE SAND	
20 25 30	0.84 0.71 0.59	500	0.0 — 0.25 0.5 0.75	COARSE SAND	
35 — 1/2 — 40 45 50	0.42 0.35 0.30	420 350 300	1.0 — 1.25 1.5 1.75	MEDIUM SAND	
- 60 1/4 70 80 100	0.210 0.177 0.149	- 250 210 177 149	2.0 — 2.25 2.5 2.75	FINE SAND	
- 120 1/8 140 170 200	- 0.125 0.105 0.088 0.074	125 —— 105 88 74	3.0 — 3.25 3.5 3.75	VERY FINE SAND	
230 — 1/16 — 270 325	0.0625 0.053 0.044 0.037	53 44 37 - 31	4.0 4.25 4.5 4.75 5.0	COARSE SILT	
Analyzed 1/64 1/128	- 0.031 0.0156 0.0078 - 0.0039	15.6 7.8 — 3.9 —	- 5.0 6.0 7.0 8.0 9.0	MEDIUM SILT FINE SILT VERY FINE SILT	
Pipette or	0.0020 0.00098 0.00049 0.00024 0.00012	2.0 0.98 0.49 0.24 0.12	10.0 11.0 12.0 13.0	CLAY	~

FIGURE 25. -- Wentworth-Udden grain-size chart used by geologists. (From Folk, 1974.)



	м	DIFYIN	G TER	M	S				
GE	NETIC MO	DIFIERS			SIZ	E*	MODIFI	ERS	
PROCESS		DIRECTION	OR STAGE		CL	.ASS	SES		mm*
SOLUTION	s	ENLARGED			MEGAPORE	mg	large small	lmg smg	- 256 - - 32 -
CEMENTATION INTERNAL SEDIA	c IENT i	REDUCED FILLED	r f		MESOPORE	ms	large smail	lms sms	- 4 - - 1/2 - - 1/16-
T	ME OF FO	RMATION			MICROPORE	mc			716
SECO e n	ARY re-depositional lepositional NDARY ogenetic nesogenetic alogenetic	P Pp Pd S Se Sm St	1		Use size prefixes mesovug smail meso microinters * For regular-shape * Messures refer to single pore or the For tubular pore platy pores use w	mold partic ed poi avera e rang	m sr le sr res smaller age pore di je in size of average cro	sVUG msMO mcBP than caver ameter of a a pore ass ss-section.	a emblage.
	SS + DIREC : solution-enl	TION + TIN arged arced primary led eogenetic			percent p	poros	or sity types or	(15 % (15 % (1:2) (1:2)	6)

FIGURE 26. -- Classification of porosity in sedimentary carbonate rocks. (From Choquette and Pray, 1970.)

The Choquette/Pray classification involves 15 basic types of porosity. The <u>fabric-selective</u> porosity types are interparticle, intraparticle, intercrystal, moldic, fenestral, shelter, and growth-framework (figure 26). The <u>non-fabric-selective</u> types are fracture, channel, vug, and cavern. Those types that may or may not be fabric selective are breccia, boring, burrow, and shrinkage. The genetic modifying terms ("Process" and "Direction or Stage") shown on Figure 26 are also used in the borehole logs, although the abbreviations are not used.

<u>Structures</u>. -- A heterogeneous set of primary descriptors is included herein under the term structure. These involve both primary sedimentologic (or "crater-sedimentologic") and secondary characteristics.

Primary features include cross-bedding, laminated beds, graded bedding*, and burrows, to name the more important ones. Cross-bedding is rare but nevertheless encountered in the sediments on Enewetak. Graded bedding is formed in a number of atoll environments (e.g., at the base of surge channels, on top of disconformities, etc.); it is also an extremely feature of the beds that fill craters and yields important information about the evolution of the crater-filling phase.

Laminations can be primary or secondary features. Their formation generally involves fine-grained materials, and, as primary features, generally reflect very quiet, nonagitated conditions where there is fluctuating water energy. As secondary features, they can be produced by diagenetic processes particularly in soil-forming environments. Both types are present in the Enewetak boreholes.

Secondary features included under the category "structures" include bioturbation ("burrowing") or boring by organisms (both extremely common mottling-producing features in Enewetak sediments), desiccation or shrinkage features (e.g., mudcracks), so-called "birds-eye" structures and "gas tracks" (formed in many very fine grained carbonate sediments by the upward migration of hydrogen-sulfide and other gases produced by organic decay), nodular structures (that at least in part are formed during diagenesis by differential cementation and that impart a mottled appearance to the rock), so-called "geopetal structures" (former voids such as vugs or interiors of shells partially or completely infilled by fine-grained sediment and/or spar cement), and various types of laminated crusts.

Secondary Descriptors

Included in the geologic log, where appropriate, is an estimate of the constituent grains, a field identification of the macrobiota, and an array of

^{*} Graded bedding is defined by Bates and Jackson (1980, p. 269) and used in this report as a type of bedding in which each layer displays a gradual and progressive change in particle size, usually from coarse at the base of a bed to fine at the top.

other miscellaneous comments. Notes regarding sample recovery, hole difficulties, and similar things also are presented.

Sample Types

Near the end of the description of each appropriate geologic unit is a list of various types of samples taken to date from the appropriate units. A footage figure for each sample succeeds the sample type. Abbreviations used for each type of sample are shown in Table 11. Samples taken for micropaleontologic analysis (P-samples) are not presented in the current report. For details and a complete listing of the micropaleontologic samples, refer to Cronin and others, (1986, Appendix I--TRACK Files).

Stratigraphic and Other Contacts

The nature of stratigraphic contacts between geologic units is fundamentally important. Stratigraphic contacts between geologic rock units are of two natural types: gradational or nongradational. A third type of contact is a fault contact, which is not a stratigraphic contact but result when one set of rock is physically moved against another or when a material is forcibly intruded into another, such as when a dike or pipe is amplified. A fourth type of contact is imposed on the geologist wherever a section of rock cannot be seen, be it buried in naturally outcropping strata or not recovered in the process of coring and sampling. A fifth type is sometimes used, particularly in thick, monotonous stratigraphic intervals; this type is arbitrarily chosen generally as a matter of convenience, for example to facilitate sample collecting. This last type was not employed often during this program.

For the PEACE Program, the procedure was adopted that the lower observable stratigraphic contact of each geologic unit was described. A geologic unit was not divided at the base of a no-recovery interval in the borehole log. Because of the sometimes disruptive nature of the sampling, some of the contacts within a continuously recovered interval of core/sample could not be determined. Such contacts were generally not mentioned, although they are occasionally described as indeterminant.

Gradational contacts reflect a more or less gradual change in some physical or biologic environmental parameter through the time that a given section of sediment was deposited. For the purposes of the geologic logs in this report, we make the following modifications to this type of contact: abruptly gradational (changes occurring within 0.1 ft or less vertically), gradational (changes occurring between 0.1 and 1.0 ft vertically), imperceptibly gradational (potentially more applicable in thicker units, changes occurring over thicknesses greater than 1.0 ft). The term apparently gradational is used also; its application is self-explanatory.

In many instances, bedding surfaces can be observed in hand specimens and/or in thin section that represent some type of interruption in the normal sedimentation process, periods of non-deposition, or periods of erosion and removal of stratigraphic section from the rock record. Such surfaces are commonly referred to as discontinuities or discontinuity structures. These

ABBREVIATIONS FOR SAMPLE TYPES

Symbol	Description
S	Polished petrographic slab
T	Petrographic thin section
X	X-ray
M	Material properties
D	Onboard density
I	Strontium isotope
R	Microradiation

TABLE 11.-- Abbreviations for types of samples taken from PEACE- Program boreholes for various types of geologic and engineering analyses.

structures and criteria for their recognition and interpretation are discussed in great detail in Flügel (1982, p. 227-232). Disconformities are special types of discontinuity surfaces where there is a significant hiatus or break in the section. For Enewetak, the most common type is the "solution unconformity" of Schlanger (1963), where an irregular microkarstic surface formed during periods of atoll emergence, paleosols developed upon it, and pockets within the older rock were later infilled by younger sediments.

For description of these discontinuities, the following terminology is used in the current report: sharp, sharp and even, sharp and undulatory, and apparently sharp. These terms are also self-explanatory. The attitude of a discontinuity surface relative to the core (if other than horizontal) and the magnitude of the undulatory contact is also noted in the descriptive log. The following symbols are used to divide each geologic unit in the borehole descriptions and to facilitate their differentiation:

Question marks are also used with the symbols given above between the appropriate geologic units.

BOREHOLE DESCRIPTIONS

The geologic descriptions for PEACE-Program boreholes KOA and OAK craters follow. For convenience, Figure 27, showing the borehole anchoring sites for KOA crater, is presented on the next page, followed by Table 12, which gives the detailed borehole drilling, logging, and other data for each of the KOA boreholes. Figure 29 and Table 13 present the same information for the OAK boreholes and are located at the beginning of the OAK borehole descriptions.

A set of graphic geologic logs accompanies each of the descriptive logs. Standard symbols used in these graphic logs are shown in Figure 28.

In the description headings for each of the geologic boreholes, the <u>Location</u> in latitude/longitude is corrected to the revised geodetic position for phototower OSCAR noted in the discussion in the text section <u>Location</u> and <u>Setting</u>. Also, unconventional abbreviations used are found in the following tables:

Sampling:	Table 5	Page 42
Logs:	Table 6	Page 52
Drilling Mud / Additives	Table 4*	Page 33

For purposes of this section of the report, the term <u>recovery</u> is defined simply as the accumulative footage of core/sample obtained divided by the total footage of the borehole, expressed as a percentage. This definition is the same as one of the two definitions of this term used in Appendix II of the current report.

^{*} The abbreviation sx is used for sacks.

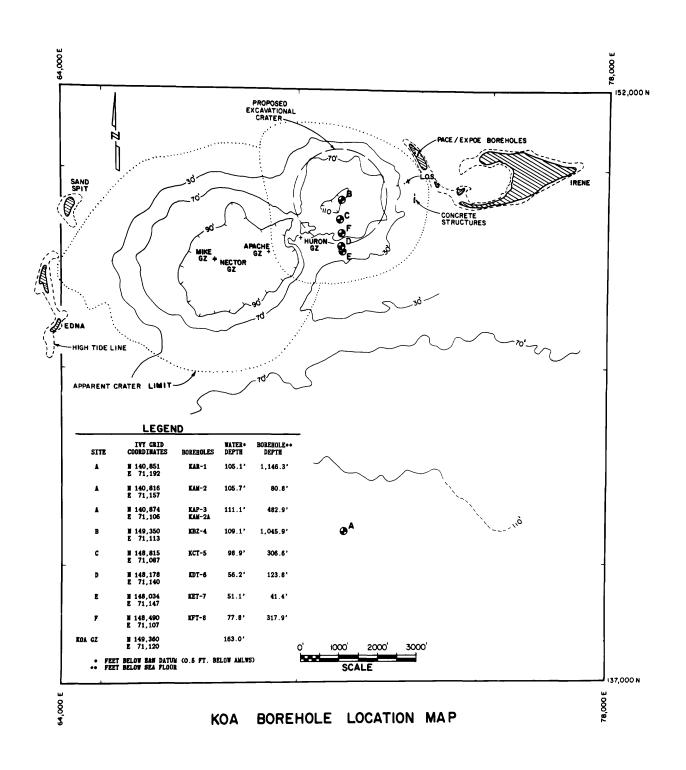


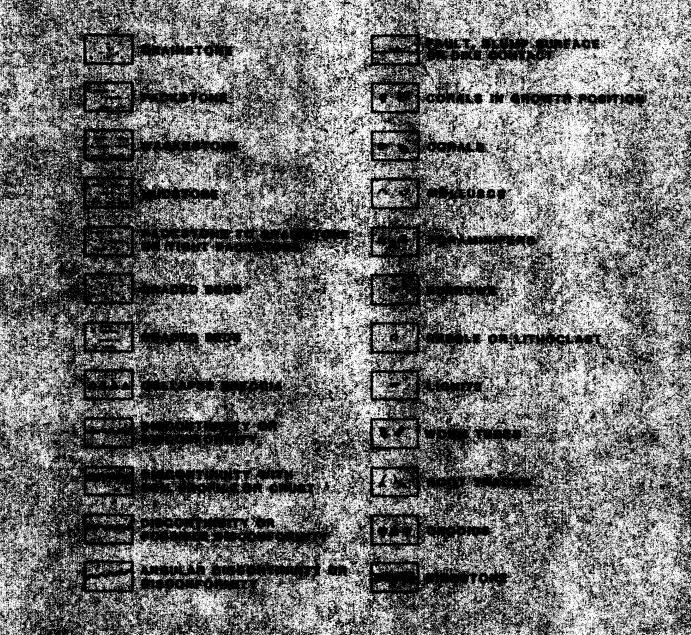
FIGURE 27. -- Map of KOA crater showing borehole sites (depicted by letters) and general bathymetric contours (contour interval equals 5 m). (Map courtesy of B.L. Ristvet and E.L. Tremba.)

SUMMARY OF PHASE II BOREHOLES KOA CRATER - PEACE PROGRAM

	WATER	HOLE	RECOVERY	VERY	FROM GROUND ZERO	ND ZERO	IVY-GRID	RID			DATE	HOLE
BOREHOLE	(H&N)	DEPTH (ft bsf)	FOOTAGE	PERCENT	DISTANCE	BEARING	FT NORTH	FT EAST	SAMPLE TYPE	LUG TYPES	DRILLING STARTED/ENDED	COMPLETION DATE
KAR-1	105.1	1,146.3	710.0	62%	8,509	181	140,851	071,192	SS, SH, LY, CH	MCS GR/DN/CP GR/NU SRS	2-18 3-03	3-06
KAM-2	105.7	80.8	;	ì	8,544	180	140,816	071,157	SS, SH	None	3-03 3-04	3-08
KAP-3/ KAM-2A*	111.1	482.9	:	;	8,486	180	140,874	071,106	۵.	GR/NU	3-04	3-15
18Z-4	109.1	1,045.9	388.8	37%	12	145	149,350	071,113	SS, SH LY, CH	MCS GR/DN/CP GR/NU	3-15 3-29	3-31
KCT-5	98.9	306.6	, 135.0	4 4%	546	177	148,815	071,087	SS, SH	MCS GR/DN/CP GR/NU	4-01 4-04	4-05
₩1-6	56.2	123.8	55.1	45%	1,182	181	148,178	071,140	SS, SH LY	GR/DN/CP GR/NU	4-05 4-06	4-06
KET-7	51.1	41.4	13.1	32%	1,326	181	148,034	071,147	SS, SH	None	4 -07 4 -07	4-07
KFT-8	77.8	317.9	126.1	4 0%	870	179	148,490	071,107	SS, SH	GR/DN/CP GR/NU	4-07 4 -09	4-10

* Upper 78 ft was a cone penetrometer hole; lower part was dedicated to material properties.

TABLE 12. -- Summary of borehole data for KOA crater. Dates given in Enewetak time; sample-type abbreviations explained in Table 5; abbreviations for downhole logs given in Table 6.



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KOA Crater Borehole Descriptions

BOREHOLE KAR-1

Lat/Long (E/W-1960): 11°38′52.7" N, 162°11′59.5" E

Lat/Long (WGS-1972): 11°38′52.6" N, 162°11′59.5" E

Location (IVY-grid, ft): 140,851 N and 071,192 E

Distance/Bearing from KOA GZ: 8,509 ft, 180.5 deg

Water Depth (H&N): 105.1 ft Hole Depth (bsf): 1,146.3 ft

Hole Spudded: 02/17/1985 Drilling Ended: 03/03/1985

Sampling: SS, SH, LY*, CH* Recovery: 62% (710 ft)

Logs: MCS, GR/DN/CP, GR/NT, GR/LSSNT, CSV Dates Logged: 03/03-06/1985

Deviation: 2.0 deg @ 60 ft, 2.3 deg @ 140 ft, 2.0 deg @ 200 ft, 3.0 deg @

300 ft, 4.3 deg @ 400 ft, 5 deg @ 500 ft, 4.8 deg @ 600 ft, 5 deg @ 700

ft, 4.8 deg @ 765 ft, 4.0 deg @ 868 ft, 3.9 deg (S 41 deg W) @ 1,130 ft

Casing: 8-5/8-in. @ 84.9 ft* Drilling Mud/Additives: SGL (936 sx), HEC (103 sx)

Geologists: T.W. Henry, B.R. Wardlaw Drillers: G. Mooney, D. Mooney

Paleontologist: T.M. Cronin Loggers: C. Novinskie, J. Miller,

M. Lee

Redescribed: 10/10-14/1985

* Cored intervals: Christensen (73.3 - 82.5 ft); Longyear (83.0 - 481.0, 482.0 - 537.4, 550.5 - 568.9, 570.5 - 584.3, 585.5 - 603.8, 606.8 - 613.3, 614.4 - 626.4, 626.9 - 644.5, 645.6 - 654.7, and 644.4 - 1,146.3 ft).

** All casing recovered

Depth Description

[TOP OF SEDIMENT PACKAGE 1.]

0.0 - 40.3 WACKESTONE: skeletal, <u>Halimeda</u>; uncemented; <u>Halimeda</u> grains unaltered, moderate-red <u>Homotrema</u> grains throughout unit; upper 0.5 ft, greenish gray (5GY6/1),

remainder of unit yellowish gray (5GY6/1); very poorly sorted. From 34.3 - 35.1 ft, becoming yellowish gray (5Y8/1) to white, mollusc, skeletal, sparse WACKESTONE. Contains several types of small gastropods scattered throughout, <u>Halimeda</u> grains less common below 8.8 ft, <u>Acropora</u> sticks very common from 8.8 to 12.6 ft, sparse from 28.8 to 34.3 ft, <u>Bikiniastrea</u> at 30.9 ft, scattered other coral fragments throughout including <u>Porites</u> <u>lutea</u> at 1.9 ft; scattered large foraminifers throughout. Lower contact abruptly gradational. SAMPLES: T @ 35.5, 36.1; X @ 12.8, 22.9, 35.2, 35.5, 36.1; D @ 17.3 - 17.8, 35.3 - 35.8; I @ 9.5; R @ 40.2.

40.3 - 45.6

PACKSTONE WITH WACKESTONE: muddy skeletal PACKSTONE with WACKESTONE from 41.8 - 42.4 ft; unaltered Halimeda grains, very sparse moderate-red Homotrema throughout coarser-grained subunits and in subunit at base; yellowish gray (5Y8/1); PACKSTONE fine- to very coarse grained, very poorly sorted; contains sparse medium-gray, sand-sized ("salt and pepper") grains in lower 2.0 ft. Contains scattered Acropora sticks. Lower contact apparently sharp. [Note: run from 42.3 - 44.3 ft is in D-tube #9; correct stratigraphic position is within D-tube #8. The D-tubes are labeled correctly.]

[TOP OF SEDIMENT PACKAGE 2. Disconformity indicated by increase in alteration of skeletal grains and cementation and change in color, and presence of phosphatic(?) grains in underlying unit and reworked phosphatic(?) material (cement) in lower part of overlying unit.]

CORAL HEAD: large Porites(?) head, recrystallized, with moderately well cemented GRAINSTONE(?) matrix; very light gray to light gray with areas of medium dark gray (in both fossil and cement); minor moldic porosity in coral and in aragonite layer of large pelecypod; unit contains worm-tubes up to 4 mm in diameter; possible greenish-gray (5GY6/1) "vadose silt" partially infilling some molds in both coral and in skeletal components of matrix; unit contains relatively common sand- to granule-sized phosphate(?) particles. [Note: lower 0.4 ft not recovered in sampling; driller states that it was as hard as the upper 0.3 ft of unit recovered.]

SAMPLES: T@ 45.6; X@ 45.6, 45.7.

WACKESTONE AND PACKSTONE (alternating): skeletal, mollusc; uncemented; unaltered, gastropods throughout unit with original shell-color in muddy subunits; colors as follow: 46.3 - 46.9 ft, light gray to yellowish gray (5Y7/2); 46.9 - 47.7 ft, yellowish gray (5Y7/2) to light gray; 47.7 - 48.3 ft, medium light gray to light gray; 48.2 - 48.3 ft, light gray to yellowish gray (5Y7/2);

48.3 - 49.5 ft, yellowish-gray (5Y7/2); 49.5 - 50.0 ft, yellowish gray (5Y7/2) to light olive gray (5Y6/1); 50.0 - 50.3 ft, yellowish gray (5Y7/2) to light olive gray (5Y6/1); 50.3 - 52.3 ft, yellowish gray (5Y7/2). PACKSTONE contains up to granule-size shell fragments and whole shells, very coarse grained sand-sized phosphate(?) particles, very poorly sorted. SAMPLES: T @ 46.3, 47.7; X @ 47.5.

- 52.3 54.7 INDETERMINATE: material recovered from interval consists of fine mollusc gravel washed in from overlying section. Some drilling mud infiltered this sample as well.
- 54.7 56.8 PACKSTONE: mollusc, skeletal; uncemented; unaltered, containing numerous mollusc shells with original coloration; yellowish gray (5Y8/1); granular, very poorly sorted, abraded, generally broken shell material. Contains 40% pelecypod/gastropod fragments and whole shells. SAMPLE: X @ 56.2.
- PACKSTONE: Halimeda, skeletal; generally uncemented, containing small, irregular moderately cemented to poorly cemented areas at 57.5, 60.3, and 61.2 ft; sparse gastropods with color retention, Halimeda grains chalky; generally yellowish gray (5Y8/1); upper 0.4 ft light gray to yellowish gray, basal 0.4 ft, very pale orange; medium-to very coarse grained, very poorly sorted. SAMPLES: T @ 58.3; X @ 58.3, 65.1; D @ 64.9 65.5; I @ 62.7.
- WACKESTONE: (tight) Halimeda, skeletal; uncemented; slightly altered; very pale orange; fine-grained. SAMPLES: T @ 66.3.
- 67.3 70.3 PACKSTONE: Halimeda-mollusc, skeletal; generally uncemented except for small poorly cemented areas at 67.5 and 68.8 ft, containing sparse "tea-brown" micrite; chalky Halimeda grains; very pale orange; medium- to very coarse grained, poorly sorted. SAMPLES: T @ 67.5, 69.8; X @ 69.8.

[Disconformity at 70.3 indicated by increase of alteration of <u>Halimeda</u> grains below this level, by occurrence of moderately well cemented ("tea-brown") clasts in wash and cuttings from about 70.3 ft, and by presence of same cement in intact material recovered just below this level. Driller noted thin hard layer at 70.0 ft.]

70.3 - 70.5 PACKSTONE: skeletal-Halimeda; upper part of unit wellcemented; containing chalky, partially dissolved Halimeda grains; very pale orange with abundant paleyellowish-brown ("tea-brown") micrite; rhizolith(?) largely filled with pale-yellowish-brown micrite. part of unit represented only by gravel-sized pieces in recovered material.] Unit becoming poorly to moderately cemented downward; Halimeda grains slightly less chalky downward; very pale orange; containing abundant micromolluscs. SAMPLES: T @ 70.0 (ca.), 70.3. 70.5 - 72.3 NO RECOVERY. 72.3 - 72.5 PACKSTONE: foraminifer-skeletal, Halimeda; poorly to moderately cemented, generally poorly cemented; Halimeda grains moderately chalky; white to very pale orange; generally very fine grained with sparse very coarse grained sand, very poorly sorted; moderate interpartical porosity. SAMPLE: T @ 72.3; I @ 72.3. 72.5 - 73.3 NO RECOVERY. 73.3 - 75.0 WACKESTONE: (sparse) skeletal; uncemented; slightly altered skeletal components; very pale orange to white; very fine grained, moderately sorted. Lower contact gradational. SAMPLES: T @ 73.6, X @ 73.6. 75.0 - 80.5 WACKESTONE TO PACKSTONE(?): skeletal, Halimeda, coral; uncemented; Halimeda grains moderately chalky; very pale orange; very fine to very coarse grained sand. Contains rounded, medium-gray to dark-greenish-gray (5G4/1), granule-sized, Heliopora(?) grains. 80.5 - 82.5 NO RECOVERY.

[Disconformity somewhere between 83.0 and 91.8 ft is indicated by presence of "tea-brown" micrite cement in upper part of unit below interval of no recovery, and by marked changes in cementation and preservation of Halimeda grains and corals.1

82.5 - 82.7

PACKSTONE: Halimeda, skeletal; moderately cemented; chalky

Halimeda grains; very pale orange with very pale orange
to pale-yellowish-brown matrix, containing grayishorange spar-lined burrow or tube; very minor moldic
porosity, interparticle porosity low. SAMPLE: T @
82.5.

82.7 - 91.8 NO RECOVERY; driller reports soft material to end of run.

91.8 - 95.5

FLOATSTONE(?): coral; skeletal PACKSTONE TO WACKESTONE
matrix; moderately well cemented to well-cemented, minor
"tea-brown" micrite, irregularly cemented; one coral
type highly recrystallized, preserved only as "ghosts,"

Halimeda preserved as molds and gastropods as steinkerns
in upper part of unit; matrix very pale orange mottled
with very pale orange to pale yellowish brown; linings
of coral molds in upper part of unit moderate yellowish

of coral molds in upper part of unit moderate yellowish brown; moldic porosity in upper part of unit very high, becoming less so downward. From 94.8 to 95.4 ft, contains <u>Bikiniastrea</u> with some grayish-orange sparry calcite infilling and lining some interseptal areas;

contains <u>Fungia</u> at 95.4 ft. SAMPLES: T @ 91.8, 95.4; X @ 95.5; I @ 95.0.

PACKSTONE WITH FLOATSTONE: mollusc-skeletal, coral
PACKSTONE with coral FLOATSTONE from 99.8 - 100.7 ft;
moderately to moderately well cemented in upper part of
unit, becoming poorly cemented downward; corals in upper
part of unit highly recrystallized, becoming less so
downward; yellowish-gray (5Y8/1) in upper part, becoming
yellowish gray (5Y8/1) to white downward; porosity
moldic in upper part of unit, becoming interparticle in
lower part. Contains common small Porites heads from
99.8 - 100.7 ft, scattered Acropora sticks in upper
part, common larger gastropods and pelecypods,
Cardium(?) at 99.9 ft, gastropod with some original
shell color at base of unit. Lower contact gradational.

SAMPLES: S @ 95.9 - 96.3; X @ 95.9.

[Surface characterized by increase in "tea-brown" micrite in underlying unit.]

101.4 - 105.0 CORAL HEADS: large heads of Porites lutea; partially recrystallized; very pale orange. Matrix, skeletal PACKSTONE; moderately to poorly cemented with light-brown ("tea-brown") micrite particularly common on edges of coral colonies below 103.1 ft. Coral heads bored by Lithophagus; interior of these shells and borings filled with light-brown skeletal PACKSTONE matrix. SAMPLE: I @ 103.5.

PACKSTONE: skeletal, mollusc; uncemented; gastropods with chalky, <u>Halimeda</u> grains chalky; very pale orange.

Contains several types of gastropods, small <u>Porites</u> fragment at top.

brown" micrite cement, and marked increase in alteration of skeletal grains below surface.] 105.9 - 107.0 PACKSTONE: mollusc-skeletal; moderately well cemented; Halimeda grains chalky; very pale orange with common patches of dark-yellowish-brown ("tea-brown") micrite cement. SAMPLES: S @ 105.9 - 106.2; X @ 106.3. 107.0 - 115.3 NO RECOVERY. INDETERMINANT: recovery consists of only scattered 115.3 - 116.4 moderately cemented fragments, coarse mollusc shells, including oysters and coral (Acropora) sticks, probably fallen from uphole. 116.4 - 117.8 PACKSTONE TO FLOATSTONE: coral, mollusc; uncemented; corals partly recrystallized; very pale orange. Contains several types of small coral heads, including Porites lutea fragment at 117.1 ft, Favia(?) from 116.4 - 116.8 ft. 117.8 - 125.7 NO RECOVERY. 125.7 - 127.3 FLOATSTONE: coral, with skeletal WACKESTONE matrix; uncemented; moderately altered skeletal components; very pale orange. Contains several types of small massive corals, including Porites sp. heavily bored by Lithophagus; molluscs less pronounced than in overlying recovered unit. SAMPLES: T @ 125.9; X @ 126.2; I @ 127.1. 127.3 - 130.5 NO RECOVERY. 130.5 - 131.6 FLOATSTONE: coral, with mollusc, skeletal PACKSTONE(?) matrix; skeletal fragments moderately altered but no sparry cement or infillings; unit probably uncemented. Some fine-grained material probably washed-out in drilling. [Increase in cementation, presence of spar infilling of mollusc shells and

[Disconformity indicated by marked increase in cementation, presence of "tea-

131.6 - 133.0 PACKSTONE TO WACKESTONE: skeletal, mollusc; upper 0.6 ft moderately cemented, becoming uncemented downward; some pelecypod shells with sparry-calcite infilling; very pale orange. SAMPLE: S @ 132.0 - 132.3; X @ 131.9.

corals, increase in alteration of skeletal components below this point suggest

disconformity at this approximate horizon.]

133.0	-		NO RECOVERY.
140.2	-		CORAL HEAD: large head of <u>Porites lutea</u> heavily bored with <u>Lithophagus</u> ; coral contains large nodular, irregularly shaped masses completely recrystallized with sparry calcite; coral generally grayish orange, recrystallized masses grayish orange to pale yellowish brown. SAMPLE: S @ 141.0 - 141.4; I @ 140.7.
141.7	_	142.2	PACKSTONE: mollusc-skeletal; moderately cemented, containing "tea-brown" micrite; very pale orange and pale yellowish brown; interparticle porosity moderate. Basal part of unit particularly rich in molluscs. SAMPLES: T @ 141.9; X @ 141.0.
142.2	-		CORAL HEAD: large head of Astreopora; very pale orange.
142.5	-	143.7	PACKSTONE AND WACKESTONE: skeletal, mollusc; upper 0.4 ft PACKSTONE, moderately cemented with trace moderate-brown ("tea-brown") micrite; from 142.5 - 142.6 ft, PACKSTONE, poorly cemented; from 142.6 to 143.1 ft, WACKESTONE, moderately cemented with minor "tea-brown" micrite; from 143.1 - 143.7 ft, PACKSTONE, moderately cemented with "tea-brown" micrite; unit generally very pale orange. SAMPLES: S @ 143.2 - 143.7; X @ 142.6, 143.0, 143.2.
143.7		150.5	
150.5	_	153.0	FLOATSTONE: coral; matrix, skeletal WACKESTONE TO MUDSTONE: poorly cemented to uncemented; minor alteration of skeletal components; very pale orange. Contains abundant large gastropods, pelecypods, and finger corals, including Acropora sp. sticks, not in growth position; large pelecypod (oyster) attached to Acropora stick at 151.5 ft. SAMPLES: X @ 152.1; I @ 152.9.
153.0		157.3	NO RECOVERY.
157.3		157.7	FLOATSTONE: coral; matrix skeletal WACKESTONE; poorly cemented to uncemented; skeletal components slightly altered; very pale orange. Contains Acropora sticks and other corals, several types of gastropods.

[Disconformity indicated by changes in color and cementation, including some "tea-brown" micrite below but not above surface, and by slight increase in alteration of skeletal components, particularly pelecypod shells which tend to spall more easily below this horizon.]

157.7 - 158.3 PACKSTONE: (tight) skeletal-mollusc; moderately well cemented with "tea-brown" micrite; skeletal components chalky; very pale orange to pale yellowish brown.

Contains several types of gastropods, including small whelk. SAMPLES: T @ 157.8; X @ 157.8.

158.3 - 162.1 NO RECOVERY.

162.1 - 164.6

PACKSTONE: mollusc-skeletal; moderately well cemented in upper part, containing minor light-brown ("tea-brown") micrite cement dispersed from top to 164.0 ft, becoming moderately cemented to poorly cemented downward; nature of recovery indicating cementation from 163.0 ft downward probably very poor and in patches; molluscs slightly more altered than in overlying unit; very pale orange to light pinkish gray. Contains large molluscs (10 - 20%), myalinids (10%), scattered small coral heads throughout, abundant micromolluscs, common foraminifers. SAMPLES: X @ 163.2; I @ 164.5.

164.6 - 171.8 NO RECOVERY.

171.8 - 177.0

PACKSTONE: skeletal; generally poorly cemented alternating with moderately to poorly cemented zones, decreasing cementation downward in basal 1.0 ft; sparse small areas with light-brown ("tea-brown") micrite in upper part; contains grayish-orange, partially spar-replaced Favia(?) and Porites fragments at 173.5 - 173.7 ft; remaining corals recrystallized and chalky; unit very pale orange; interparticle porosity moderately high. Molluscs not as abundant as in overlying unit, containing scattered small corals. SAMPLES: X @ 172.7; T @ 173.6 (spar-replaced coral); D @ 174.6 - 175.0.

[Discontinuity indicated by slight increase in cementation with some "tea-brown" micrite below this surface.]

177.0 - 179.0 PACKSTONE: mollusc-skeletal; moderately cemented in upper 0.7 ft, becoming poorly cemented to uncemented downward, containing minor light-brown ("tea-brown") micrite cement; very pale orange to pale-yellowish-brown.

Contains about 15% large gastropod and pelecypod shells, commonly broken. SAMPLES: S@177.1 - 177.3; D@174.6 - 175.0.

179.0 - 189.0

FRAMESTONE AND BAFFLESTONE: coral. About 60% of unit is coral-coralgal FRAMESTONE, rest of unit coral BAFFLESTONE with matrix of skeletal, mollusc PACKSTONE; poorly to moderately cemented; corals slightly recrystallized, chalky; very pale orange. Corals include small heads of Acropora cuneata at 108.5 and 183.0 ft, Porites lutea at 181.4 ft, and common Favia(?), particularly from 186.7 - 189.0 ft; most heads commonly bored with Lithophagus; several heads with encrusting coralline algae. SAMPLES: X @ 182.9; I @ 181.1, 182.0.

189.0 - 206.1

PACKSTONE WITH FLOATSTONE: skeletal, mollusc PACKSTONE alternating with coral FLOATSTONE and small CORAL HEADS; moderately to poorly cemented; corals slightly recrystallized, chalky, and disaggregating (Favia?); very pale orange; fine- to medium-grained matrix. Contains several types of small coral heads, including Porites sp. at 196.1 and 197.0 ft, Porites lutea at 201.6 ft, heavily bored with Lithophagus; Favia(?) at 204.1 - 204.8 ft and 205.5 - 206.1 ft. SAMPLES: R @ 202.0; T @ 198.3; X @ 193.7.

206.1 - 215.8

PACKSTONE: coral, mollusc, skeletal; moderately to poorly cemented in upper part, becoming poorly cemented downward; corals slightly recrystallized; very pale orange; fine- to medium-grained matrix. Contains scattered small coral heads, including Favia sp., and small Porites Jutea head at 207.3 ft; large gastropod at 212.5 ft with color retention; scattered granule- to small pebble-sized pieces of coralline algae scattered in unit (e.g. 208.7 ft); contains several types of large pelecypods, scattered large gastropods throughout. SAMPLES: T @ 207.3; X @ 207.2.

[Disconformity indicated by increase in cementation, presence of "tea-brown" micrite below surface, and slight increase in recrystallization of corals just below surface.]

215.8 - 217.9

PACKSTONE: coral PACKSTONE in upper part of unit, becoming fine- to medium-grained, mollusc-skeletal PACKSTONE from 216.9 ft to base; unit moderately to well-cemented from top to 217.6 ft with light-brown ("tea-brown") micrite on edge of corals and lining burrows(?) from 217.2 to 217.6 ft; lower part of unit poorly cemented; upper part grayish orange with pale-yellowish-brown areas, becoming very pale orange downward; interparticle porosity moderate, moldic porosity sparse. Contains Porites sp. head at 216.3 ft, several large gastropods. SAMPLES: T @ 215.9; X @ 216.2; I @ 216.5.

217.9	- 221.2	NO RECOVERY.
221.2	- 221.7	WACKESTONE: skeletal, mollusc; muddy; uncemented; very pale orange. Lower contact gradational. SAMPLES: T@ 221.4; X @ 221.4.
221.7	- 222.5	PACKSTONE: skeletal; poorly cemented; skeletal components chalky; very pale orange to white; very fine to medium-grained, poorly sorted.
222.5	- 223.5	WACKESTONE: mollusc-skeletal; poorly cemented to uncemented; molluscs chalky; very pale orange to white. Large gastropods and pelecypods make up 10 - 20% of unit. Lower contact disturbed by drilling.
* * * *	? * * * *	* * ? * * * * * ? * * * * ? * * * * ? * * * * ? * * * * ? * * * * * ? * * * * * * ? *
		ndicated by marked increase in cementation, presence of abundant te, increase in coral alteration, and color change.]
223.5	- 224.6	FLOATSTONE AND PACKSTONE: coral FLOATSTONE; interbedded with and matrix of skeletal PACKSTONE; moderately well cemented, containing moderately abundant light-brown ("tea-brown") micrite; some small corals extremely altered, recognizable as "ghosts" others slightly recrystallized; very pale orange with moderately abundant pale-yellowish-brown mottling. Contains scattered small colonies of Porites lutea. SAMPLE: S @ 223.7 - 224.0; X @ 223.7.
224.6	- 226.4	CORAL HEADS: large Porites lutea heads with common Lithophagus borings; matrix skeletal, mollusc PACKSTONE; moderately cemented with moderate-brown ("tea-brown") micrite along coral edges; coral head slightly recrystallized with growth bands enhanced; very pale orange to light yellowish brown. SAMPLE: X @ 225.2.
226.4	- 228.3	NO RECOVERY.
228.3	- 231.8	FLOATSTONE: coral; matrix mollusc, skeletal PACKSTONE; moderately cemented, irregularly cemented, containing sparse light-brown ("tea-brown") micrite throughout unit; very pale orange to pale yellowish brown. Contains rounded, dusky-blue- to medium-dark-gray-stained (oxidized?) fragments of branching Acropora spand pebble-sized lithoclast(?) of pale-yellowish-brown, well-cemented PACKSTONE, with moderate-brown ("tea-brown") micrite, 0.6 ft above base of unit. Contains

about 15 - 20% small heads of <u>Porites</u> sp. and other small coral fragments, including <u>Acropora</u>; <u>Tridacna</u> shell growing on finger coral projecting up from underlying unit. Lower contact sharp, possibly slightly undulatory. SAMPLE: X @ 231.5.

[Evidence for minor disconformity is slight increase in cementation, marked increase in "tea-brown" micrite below surface, oxidized finger coral (dusky-blue-to medium-dark-gray rind on finger coral, evidence for slight reworking with pebble-sized lithoclast(?) of well-cemented packstone and stained, rounded coral fragments in lower part of overlying unit.]

RUDSTONE: coral, both Acropora sticks and small Porites
sp., not rounded or abraded but toppled; matrix skeletal
PACKSTONE; moderately cemented in upper part, with
abundant light-brown ("tea-brown") micrite; very pale
orange with pale-yellowish-brown mottling. Finger coral
(Acropora cuneata?) at top of unit that projects 0.6 ft
up into overlying unit has only surface stain of "teabrown" micrite within this unit proper; it is upper
extension of this coral that has the dusky-blue to
medium-light-gray "oxidized" surface in overlying
unit. Contains scattered gastroods. Lower contact
gradational. SAMPLES: X @ 232.1, 323.1.

232.9 - 240.6

PACKSTONE: skeletal, mollusc, coral; moderately to poorly cemented, irregularly cemented, nodular, becoming generaly less cemented downward, lower part uncemented; upper part very pale orange, becoming very pale orange to white in lower part of unit. From 238.7 ft to base of unit, large mollusc (mainly pelecypod) shells constitute 20 - 30% of unit; upper part contains small Porites heads and other corals, including some finger corals. Lower contact sharp, gently undulatory. SAMPLES: T @ 240.3; X @ 233.4; I @ 236.0.

[Disconformity marked by preservation of part of paleosol(?), including small "tea-brown" micrite-filled rhizoliths in upper 0.05 ft of underlying unit. Additional evidence of disconformity includes physical nature of contact, marked increase in both cementation of matrix and recrystallization particularly of corals, striking color change, and appearance of moldic and slightly vuggy porosity (some molds/vugs spar-lined) below surface.]

240.6 - 278.9

PACKSTONE: unit generally foraminifer-skeletal PACKSTONE; moderately well cemented to poorly cemented; containing recrystallized skeletal components throughout; generally orange to yellowish gray (5Y8/1) in upper part, becoming very pale orange to pale yellowish brown downward. Upper 0.3 ft is small Favia? head with 0.05-ft-thick laminated crust on upper surface containing small rhizoliths(?); crust well-cemented, light-brown (5YR6/4); Favia? partially recrystallized with pale-

yellowish-brown sparry calcite. Subunits as follows: from 240.9 - 246.6 ft, PACKSTONE, skeletal, coral (highly recrystallized), foraminifer, mollusc; from 246.6 ft to base, PACKSTONE with possible minor GRAINSTONE, foraminifer, skeletal, containing scattered small corals, sparse bryozoans, gastropods. Upper 2.0 ft of unit well-cemented, containing light-brown (5YR6/4) ("tea-brown") micrite; same interval with minor moldic, vuggy porosity, becoming less prominent downward; from 246.6 ft to base, alternating zones of moderately well cemented foraminifer PACKSTONE and irregularly shaped, pebble-sized nodules of same, indicating irregular patches of poor cementation. Unconsolidated, washings(?) of medium- to coarse-grained foraminifer sand occur at 260.2 - 260.4 ft and 273.7 -274.4 ft. Lower part of unit contains sparse large gastropods preserved only as molds, lined with grayishorange calcite spar; in same interval, microgastropods appear recrystallized but not preserved as steinkerns; minor vuggy and moldic porosity from 268.1 ft to base. Possible recrystallized Tridacna fragment at 254.3 ft. SAMPLES: S @ 240.6 - 241.0, 262.9 - 263.2, 268.4 -268.6; T @ 240.6, 254.9, 256.1, 260.6, 262.9, 268.4; X @ 240.6, 245.6, 255.0, 256.1, 262.9, 267.8, 278.7; I @ 253.0.

[TOP OF SEDIMENT PACKAGE 3. Major disconformity indicated at about this horizon in the core. Cementation does not dramatically increase downward, but it is more pervasive (i.e., occurs throughout the rock rather than confined to irregular patches or zones); consequently, the integrity of the rock increases markedly below this surface. The most dramatic change downward is the marked increase in spar-lined vugs and small caverns in the rock. The rock type also changes from foraminifer PACKSTONE above to PACKSTONE/WACKESTONE below this surface. This surface was karsted, and some of the underlying unit may contain infilling from overlying unit (see explanation below). Note: The following interval (278.9 - 318.1 ft) was a constant source of hole instability during subsequent drilling/logging operations.]

components heavily altered, sparsely moldic; mottled very pale orange and pale yellowish brown throughout; porosity exclusively vuggy and cavernous [from 279.9 - 281.2 ft, driller encountered void and almost lost Kelly]. From 278.9 - 279.9 ft, unit apparently consists of two different rock types in about 60/40 ratio: (1) WACKESTONE WITH MUDSTONE(?) and (2) PACKSTONE.

PACKSTONE AND WACKESTONE: foraminifer, ostracode WACKESTONE TO PACKSTONE; well-cemented; skeletal

278.9 - 318.1

WACKESTONE: ostracode, foraminifer; well-cemented; very pale orange; containing partly spar-filled microfractures; planktic and benthic foraminifers scattered throughout. PACKSTONE: foraminifer; very similar to dominant lithic type of overlying unit; containing in upper 1.0 ft of unit fairly common, angular, granule-size clasts of

light-covered WACKESTONE/ MUDSTONE [microbreccia]; wellcemented; pale-yellowish-brown. From 281.2 - 316.3 ft, skeletal, foraminifer WACKESTONE with minor skeletal MUDSTONE; burrowed, pellet; mottled very pale orange and pale yellowish brown; interval contains scattered Acropora sticks; no apparent distinction between color and rock type in this interval that may exist in upper part of unit to 286.0 ft. Basal 1.8 ft of unit contains 5% large molluscs (pelecypods and gastropods). Vugs throughout upper part of unit to 286.0 ft commonly lined with thick, grayish-orange sparry calcite, sparsely completely infilled with same and with dusky-yellowishbrown spar; below 286.0 ft, vugs smaller and only sparsely spar-lined. Unit generally recovered as entact core, but intervals where recovery consists of pebbleand cobble-sized pieces of rock probably represent vuggier intervals that may have been coral-rich and may have been coral FLOATSTONE badly broken up by karsting/drilling Contains small coral heads preserved as molds from 298.0 ft to base, making up about 10 - 15% of unit. SAMPLES: S @ 279.0 - 279.6, 279.6 - 279.9, 292.3 - 292.5, 304.9 - 305.6, 316.3 - 317.1; T @ 292.3, 305.3; X @ 279.0, 279.6, 282.3, 292.3, 292.6, 302.7, 305.1, 312.2, 316.2, 316.3; D @ 304.9 - 305.6; I @ 285.5, 309.3.

318.1 - 318.9 NO RECOVERY: barrel contained only coarse-grained foraminifer sand, probably fallen in from uphole.

318.9 - 319.8 WACKESTONE: skeletal, foraminifer, pellet(?), (locally only sparsely skeletal); well-cemented to very well cemented; mottled pale yellowish brown (50%) and very pale-orange (50%), with lighter-colored areas also containing smaller yellowish-brown vermiform mottled patches; some moldic porosity, small vugs, with scattered dusky-yellowish-brown spar infilling. SAMPLES: S @ 319.2 - 319.7; X @ 319.2.

319.8 - 320.6 FLOATSTONE: coral; matrix pellet(?), skeletal WACKESTONE; moderately well cemented to well-cemented; very pale orange mottled with pale yellowish brown; highly moldic with minor moderate-yellowish-brown calcite spar lining molds and small vugs. Unit preserved in core almost exclusively as cobble-sized fragments. Coral is predominantly slender, unabraded sticks of Seriatopora, not present above in core. SAMPLES: D@ 314.2 - 314.8.

320.6 - 321.3 FLOATSTONE: (sparse) coral with skeletal, pellet

WACKESTONE matrix; well-cemented; corals preserved as molds; pale yellowish brown mottled with pale yellowish brown to very pale orange. Contains <u>Seriatopora</u>.

321.3 - 322.0	WACKESTONE: skeletal, foraminifer, pellet(?); well-cemented; mottled very pale orange (70%) and pale-yellowish-brown (30%), vermiform mottling; porosity sparse molds, very sparse small vugs. Contains sparse unabraded pieces of Seriatopora. Similar to unit from 318.9 - 319.8 ft.
322.0 - 326.6	FLOATSTONE: (sparse) coral, with foraminifer, skeletal, burrowed, pellet WACKESTONE matrix; very well cemented to well-cemented; upper 3.0 ft very pale orange (50%) coarsely mottled with pale yellowish brown (50%), becoming 70/30% downward; darker areas slightly better cemented, with non-chalky pellets(?); lighter areas slightly less well-cemented, with common pellet molds and moldic microfossils; molds and small vugs common, increasing slightly downward. Basal 0.8 ft containing common large pelecypod molds; scattered molds of unabraded pieces of Seriatopora throughout unit. Lower contact gradational. SAMPLE: S@ 325.6.
326.6 - 335.3	FLOATSTONE: coral, with skeletal, foraminifer, pellet WACKESTONE matrix; with intervals of coral FLOATSTONE, containing same matrix; well-cemented; pale yellowish brown (60%), mottled with pale yellowish brown (30%) in upper part of unit, becoming 70/30% downward; porosity moldic, minor small vugs; below 328.0 ft, molds partly spar-filled. Containing 20 - 25% molds of unabraded sticks of Seriatopora. Lower contact abruptly gradational. SAMPLES: S@330.1 - 330.6; X@330.1.
335.3 - 336.2	PACKSTONE TO WACKESTONE(?): PACKSTONE, skeletal, foraminifer; well-cemented; very pale orange with minor pale-yellowish-brown mottling; very fine to medium-grained; most microfossil molds filled with sparry calcite, imparting slight pale-yellowish-brown cast to small areas of core; moldic porosity moderately common. Contains scattered small, highly recrystallized coral. SAMPLES: S @ 335.4 - 335.8; X @ 335.4, 335.8.
336.2 - 377.5	FLOATSTONE: coral, generally with skeletal, pellet, WACKESTONE matrix generally throughout, but becoming sparsely skeletal MUDSTONE from 352.1 - 353.4 ft; unit generally moderately well cemented to very well cemented; fossils generally preserved as molds, with minor spar-infilling; very pale orange mottled with light yellowish brown. Several intervals contain abundant large pelecypods, generally preserved as molds, including a large Tridacna (339.0 - 339.5 ft) filled

with MUDSTONE also containing scattered small sponges(?); coals predominately molds of unabraded pieces of Seriatopora; large head of Acropora(?) sp. from 364.0 - 364.4 ft preserved as mold. Lower contact gradational. SAMPLES: S @ 350.1 - 350.6, 353.2 - 353.4, 355.3 - 355.9; X @ 346.5, 350.1, 352.9, 353.2, 362.9, 372.5; D @ 366.9 - 367.4; I @ 339.0, 367.5.

377.5 - 385.7

WACKESTONE: mollusc, coral, skeletal; very well cemented; corals generally preserved as molds, molluscs generally recrystallized, partly moldic; very pale orange mottled with light yellowish brown. Contains <u>Seriatopora</u> and several types of large pelecypods. Contains some geopetal structures.

[Discontinuity marked by "tea-brown" calcite cement below surface and absence of same above. Overlying unit contains generally only molds and scattered shelter porosity; unit below contains molds that are partly to completely spar-filled.]

385.7 - 398.9

PACKSTONE WITH FLOATSTONE: subunits as follows: From 385.7 - 390.0 ft, coral-pelecypod, skeletal FLOATSTONE with skeletal PACKSTONE matrix; very well cemented with abundant moderate-brown ("tea-brown") micrite scattered throughout subunit to 387.9 ft, becoming less prominent to base of subunit; very pale orange with patches of pale yellowish brown; abundant dark-yellowish-brown to dusky-yellowish-brown sparry calcite partially to completely filling former areas of shelter porosity below pelecypod shells and coral fragments; from 390.0 -391.2 ft, FLOATSTONE, (tight) coral (Seriatopora unabraded fragments); with mollusc-skeletal PACKSTONE matrix; very well cemented; very pale orange; moldic porosity; from 391.2 - 398.9 ft, coral (Seriatopora, unabraded fragments) FLOATSTONE with skeletal PACKSTONE matrix; well-cemented; predominantly very pale orange (70%) mottled with pale yellowish brown (30%) from 393.8 - 397.1 ft, becoming about 50/50% from 397.1 - 399.1 ft with moderately common dusky-yellowish-brown sparinfilling, and becoming pale yellowish brown to very pale orange (60%), mottled with very pale orange (40%) to base of unit. Lower contact sharp. Mottling, which apparently represents diagenetic nodules and differential cementation/ alteration, superficially looks like conglomerate in interval from 393.0 - 397.0 ft; arguments against this being a conglomerate are: the lithology is the same in nodules and matrix and not like the Halimeda WACKESTONE below; 2) the "conglomerate" interval is separated from the unit that it may have been derived from and the nodules do not appear to be in depositional contact with each other (a trianglular shaped nodule is "resting" on the peak of similary shaped triangular nodule); and 3) geopetal

structures in the nodules all point up and one gastropod that straddles the boundary of nodule to matrix exhibits a geopetal structure and the mud infilling shows a continuation of the diagenetic nodule-matrix contact. SAMPLES: S @ 385.7 - 387.2, 397.6 - 398.1, 399.1 - 399.5; X @ 385.7, 397.6, 399.1; I @ 397.1, 398.2.

398.9 - 420.9

WACKESTONE TO FLOATSTONE: generally Halimeda, skeletal, pellet WACKESTONE with sparse coral FLOATSTONE; very well cemented to well-cemented in upper part; highly altered, with Halimeda grains preserved as spar-filled molds in upper part, only as molds downward; corals preserved as molds or highly recrystallized and replaced with grayish-orange to pale-yellowish-brown spar, particularly below 407.7 ft; unit pale yellowish brown to very pale orange mottled with 30% very pale orange from top to 402.0 ft, becoming pale yellowish brown to very pale orange below 402.0 ft, alternating with very pale orange to pale yellowish brown to base; porosity moldic, constituting about 20 - 30% of rock, minor small vugs; burrowed. Contains scattered unabraded Seriatoopora fragments from top to 407.7, smll Favia(?) and Porites sp. heads common below 407.7 ft. SAMPLE: X @ 414.0; I @ 399.2, 403.5.

420.0 - 441.0

FLOATSTONE: coral, with matrix of skeletal WACKESTONE well-cemented; Halimeda and acroporoids preserved only as molds, Favia(?) replaced with grayish-orange spar; unit grayish orange to pale yellowish brown; moldic and vuggy porosity, approaching 30 - 40% between 434.5 - 437.0 ft. Corals include several types of small heads, including Acropora sp., Porites sp, Favia(?), and broken, unabraded sticks of Seriatopora and Acropora. SAMPLES: S @ 435.2 - 435.9; X @ 435.1, 435.2; I @ 430.3.

441.0 - 451.3

WACKESTONE(?): pellet(?), (sparse) skeletal; moderately to well-cemented; pervasively altered, locally highly friable and easily disaggregated; very pale orange with minor very pale orange to pale-yellowish-brown mottling; containing sparse, well-cemented diagenetic nodules; moldic porosity throughout unit, small vugs in upper part. From 447.0 - 448.4 ft, unit approaches coral FLOATSTONE with matrix of WACKESTONE(?), containing molds of unabraded sticks of Seriatopora. Contains large gastropod mold at 446.4 ft, scattered molluscs from 446.4 ft to base. SAMPLES: S @ 446.6 - 445.0; X @ 444.6.

451.3 - 460.1 FLOATSTONE: coral, matrix of pellet, skeletal WACKESTONE; moderately to well-cemented, much less altered than overlying unit; very pale orange to pale yellowish brown, slightly mottled with pale yellowish brown to very pale orange in upper part, becoming more strongly mottled with pale yellowish brown downward; contains scattered diagenetic nodules; porosity moldic, scattered small vugs. Corals consist mainly of molds of unabraded sticks of Seriatopora; unit contains scattered sparfilled, large molluscs in lower part. Lower contact gradational. SAMPLE: I @ 452.3.

460.1 - 468.9 WACKESTONE WITH FLOATSTONE: coral-mollusc, skeletal, pellet(?) WACKSTONE with intervals of sparse coral FLOATSTONE; well-cemented; slightly less altered than overlying unit, with some of fossils (pelecypods) retaining some of original shell structure, mainly moldic porosity throughout; partial infilling of fossil molds with dark-yellowish-brown to dusky-yellowish-brown spar, some geopetal structures in upper 5.0 ft of unit; very pale orange (70%) mottled with pale-yellowish-brown (30%); burrowed. From 467.5 - 468.9 ft, unit approaches coral FLOATSTONE. Contains several types of large gastropods (including large turretelid at 465.2 ft) and pelecypods, molds of unabraded sticks of Seriatopora and Acropora. SAMPLES: S @ 464.9 - 465.4; X @ 464.9; I @ 468.1.

468.9 - 481.0 NO RECOVERY: driller reports soft, unconsolidated material.

WACKESTONE(?): upper part recovered apparently cuttings of overlying material, consisting of sand-sized altered rock fragments, very pale orange; lower part of recovery [split-spoon] very pale orange to white, skeletal MUDSTONE(?), uncemented. Driller reports very soft interval.

[TOP OF SEDIMENT PACKAGE 4. Major disconformity indicated by marked increase in cementation, recrystallization of rock material below surface, pervasive replacement of corals by sparry calcite, and probable karsting.]

482.0 - 522.5 WACKESTONE TO PACKSTONE WITH FLOATSTONE: unit as whole generally moderately to well-cemented; recrystallized in upper part, containing vugs, possible small caverns [according to driller], making recovery poor. Recovery from 482.0 - 483.1 ft consists predominately of pebble-sized pieces of coral heads completely replaced by very coarse, moderate-yellowish-brown to dark-yellowish-brown sparry calcite; unit as whole becoming progressively

less altered downward, containing fossil molds with abundant sparry calcite to 490.6 ft; from 490.6 - 510.0 ft, corals represented by unlined molds; from 510.0 to to base, corals partially moldic with white to very pale orange, chalky infilling. Material from 483.1 to 483.3 ft consists of large, partly replaced pelecypod shall to which adhered pieces moderately cemented, very pale orange, skeletal WACKESTONE TO PACKSTONE. From 483.1 to 492.7 ft, WACKESTONE; foraminifer, skeletal; moderately cemented; altered; very pale orange mottled with paleyellowish-brown diagenetic nodules. From 492.7 - 493.7 ft, unit changes gradually from WACKESTONE TO PACKSTONE; skeletal; very pale orange; mottled pale-yellowishbrown. From 493.7 ft to base, PACKSTONE, skeletal, pellet; very fine to fine-grained; very pale orange; containing burrows filled with very pale orange to paleyellowish-brown, skeletal WACKESTONE; slightly better cemented than surrounding PACKSTONE. Upper part of unit containing common corals, several types of small heads, including Favia(?) and Astreoporea(?), and broken Acropora pieces; large gastropods and pelecypods scattered throughout unit. SAMPLES: S @ 5217 - 521.9; T @ 482.0 (ca.); X @ 487.6, 518.2, 521.7; M @ 482.0 -483.1; 519.0 - 520.0; I @ 518.1.

522.5 - 537.4 NO RECOVERY: driller says very soft material; probably like underlying unit.

WACKESTONE: muddy, skeletal, foraminifer; uncemented; unit contains slightly chalky mollusc fragments; color gradually darkening, changing downward as follows: from top to 542.6 ft, very pale orange to white; from 542.6 - 544.0 ft, pinkish gray to very pale orange. Contains slightly recrystallized coral fragments from 543.2 - 544.0 ft. SAMPLES: T @ 540.8, 541.6, 543.2; X @ 540.8, 541.6, 543.2; I @ 537.4.

544.0 - 548.5 NO RECOVERY.

548.5 - 555.7 MUDSTONE: skeletal; uncemented; pinkish gray to very pale orange from top to 554.6 ft with abrupt change to pale yellowish brown to very pale orange from 554.6 ft to base. Unit characterized by dearth of macrofossils.

SAMPLES: T @ 548.5, 550.8, 554.8; X @ 548.5, 550.8, 554.8, 555.6; M @ 552.8 - 553.8.

[Change in cementation marks contact.]

555.7 - 55	compon slight recrys	E: skeletal, foraminifer; well-cemented; skeletal ents slightly altered, including microgastropods, ly chalky Hamimeda grains; coral fragment slightly tallized; pale yellowish brown. SAMPLES: S @ - 556.0; T @ 555.7.
556.0 - 55	slight to dar part, highly graine macrof	E: skeletal, foraminifer; uncemented; containing ly altered mollusc fragments; pale yellowish brown k yellowish brown; more closely packed in upper becoming very muddy from 556.3 - 556.9 ft, more skeletal from 556.9 ft to base; very fine d, moderately well sorted. Contains sparse una, including Cypraea at 557.9 ft. SAMPLES: 7.2, 560.9; X @ 557.7.
558.3 - 56	51.4 NO RECOVE	RY.
561.4 - 56	fossil brown; recove	: skeletal, foraminifer, Halimeda; well-cemented; s unaltered to slightly altered; pale-yellowish-very fine to fine-grained. Upper part of ry contains large coral. SAMPLES: S @ 561.6 - T @ 561.6.
561.9 - 56	58.9 NO RECOVE	RY.
568.9 - 57	slight pale y	E: foraminifer-skeletal; uncemented, unaltered to ly altered skeletal grains; very pale orange to ellowish brown with pinkish-gray tones. SAMPLES: 9.4; X @ 569.4.
575.3 - 58	34.3 NO RECOVE	RY.
584.3 - 58	compon yellow	: foraminifer-skeletal; uncemented; skeletal ents unaltered; pale yellowish brown to moderate ish brown; very fine grained. SAMPLE: X @ 584.4.
585.3 - 59	90.1 NO RECOVE	
590.1 - 59	93.9 FLOATSTON PACKST to mod corals	E: coral; matrix muddy, skeletal, foraminifer, ONE; uncemented; unaltered; pale yellowish brown erate yellowish brown. Contains several types of, including Porites(?) sp. and fragments of ing Acropora. SAMPLES: X @ 591.7; I @ 593.9.

	NO RECOVERY: driller reports soft interval.
603.8 - 604.6	
604.6 - 605.8	
605.8 - 606.8	
606.8 - 613.3	NO RECOVERY: driller reports soft material.
613.3 - 617.4	WACKESTONE: skeletal, foraminifer; uncemented, poorly indurated; unaltered skeletal material, pale yellowish brown; very fine to fine-grained. SAMPLE: X @ 616.3.
617.4 - 626.4	NO RECOVERY: soft.
626.4 - 636.6	
636.6 - 644.5	NO RECOVERY: soft.
644.5 - 645.6	PACKSTONE: skeletal, foraminifer; uncemented, poorly consolidated to unconsolidated; unaltered shell material; yellowish gray (5Y7/2). Contains scattered gastropods, small corals, including Cycloseras(?) sp. SAMPLE: M @ 644.5 - 645.6.
645.6 - 654.7	NO RECOVERY: soft.

654.7 -	656.1	WACKESTONE: skeletal, foraminifer; uncemented, poorly consolidated; unaltered shell fragments; pale yellowish brown; containing scattered, rounded well-cemented, pebble-size burrows with unaltered Halimeda grains in matrix of closely packed WACKESTONE; fine- to very fine grained. Contains scattered large molluscs, coral sticks (Dictyaraea), large Strombus at 655.7 ft. Lower contact abruptly gradational. SAMPLES: T @ 655.5 (burrow); X @ 655.1.
656.1 -	657.0	PACKSTONE: skeletal, foraminifer; uncemented, unaltered; yellowish gray (5Y7/2); contains small, rounded, cemented burrows. SAMPLES: T @ 656.3.
657.0 -	664.9	NO RECOVERY.
664.9 -	670.6	FLOATSTONE: coral, with skeletal, foraminifer WACKESTONE matrix (muddier in top 1.0 ft); uncemented, unaltered; yellowish gray to pale yellowish brown; containing burrows (well-cemented, WACKESTONE-filled, cobble-size, containing slightly altered Halimeda grains). SAMPLES: T @ 60.5 (burrow); X @ 665.8, 670.5.
670.6 -	679.1	NO RECOVERY.
679.1 -	680.4	FLOATSTONE: coral (sparse), with muddy skeletal, foraminifer WACKESTONE matrix; uncemented, moderately consolidated; yellowish gray (5Y7/2) to pale yellowish brown; containing scattered well-cemented burrows. Contains several types of corals. SAMPLES: X @ 680.3; M @ 679.4 - 680.1.
680.4 -	688.4	NO RECOVERY.
688.4 -	689.4	PACKSTONE TO FLOATSTONE: very sparse coral FLOATSTONE to skeletal, foraminifer PACKSTONE; uncemented, poorly to moderately consolidated; containing unaltered shell material; yellowish gray (5Y7/2) to pale yellowish brown. Contains unabraded sticks of Seriatopora . Lower contact abruptly gradational. SAMPLES: T @ 689.3; X @ 689.3.

[Thick section above is uncemented and poorly consolidated and consists primarily of intervals of WACKESTONE, PACKSTONE, and coral FLOATSTONE, in descending order of importance. Although the rocks below are also uncemented,

they consist of a higher proportion of grain-supported and coarser-grained rocks (FLOATSTONE and PACKSTONE) and tend to be better consolidated indurated. The rocks below are generally more organic rich.]

689.4 - 691.9 FLOATSTONE: coral, gastropod; tightly packed, approaching RUDSTONE; matrix, skeletal, foraminifer PACKSTONE; uncemented, well-consolidated; gastropods with nacreous layer preserved; fossils yellowish-gray, matrix light olive gray (5Y6/1). Contains unabraded sticks of Seriatopora(?), abundant gastropods and other molluscs. Lower contact abruptly gradational.

FLOATSTONE: coral, gastropod; loosely packed generally in matrix of skeletal, foraminifer PACKSTONE; uncemented, moderately consolidated; unaltered aragonite in gastropod shells; light olive gray (5Y6/1). From 698.0 ft to base, contains thin intervals with closely packed skeletal WACKESTONE matrix; light olive gray (5Y6/2) to yellowish gray (5Y8/1). Contains common Porites andrewsi-type, small sticks of Seriatopora; small favia coral heads at 704.3 ft; scattered vertebrate fragments at 701.7 ft. SAMPLES: S@697.0 - 697.4; X@697.0, 697.5, 703.7; M@696.2 - 697.0; I@705.0.

705.5 - 710.8 NO RECOVERY.

710.8 - 711.9 FLOATSTONE: sparse coral with skeletal, mollusc PACKSTONE matrix; uncemented, well-consolidated; unaltered skeletal components; pale yellowish brown to dark yellowish brown; very fine to fine-grained matrix. Contains mainly Seriatopora sticks.

711.9 - 720.1 PACKSTONE: skeletal, foraminifer, coral; uncemented, moderately consolidated; unaltered; pale yellowish brown to dark yellowish brown throughout with small olive-gray (10Y4/2) areas at 720.2 ft. Contains scattered unabraded fragments of Seriatopora; small granule-sized piece of lignitic material at 717.0 ft. Lower contact arbitrarily drawn. SAMPLE: X @ 717.3.

[TOP OF SEDIMENT PACKAGE 5. The section below is considerably richer in organic material and is characterized by higher gamma-ray activity on downhole logs.]

720.0 - 722.1 PACKSTONE: skeletal, foraminifer, skeletal; uncemented, moderately consolidated; unaltered; pale yellowish brown to dark yellowish brown with small olive-gray (10Y4/2) areas at 720.2 ft. Contains Seriatopora sticks.

722.1 - 727.8

FLOATSTONE: coral; matrix skeletal, foraminifer PACKSTONE; uncemented, poorly to moderately consolidated; unaltered gastropod shells; pale yellowish brown to dark yellowish brown, very fine grained matrix. Contains fragments of finger corals, mainly Acropora(?) sticks, scattered Seriatopora; large molluscs in basal 1.0 ft.

727.8 - 738.5

FLOATSTONE: coral; matrix mainly skeletal, mollusc, foraminifer PACKSTONE with alternating thin layers of coral FLOATSTONE with matrix of same material; uncemented, well-consolidated; slightly altered to unaltered skeletal fragments; pale yellowish brown to dark yellowish brown. Contains scattered fibrils (plant fibers?) in intervals from 732.8 ft downward. Macrofauna consists of very small granule- to small pebble-sized coral fragments and sticks commonly not in growth position; several types of gastropods moderately common throughout unit (more common than in overlying unit); small Porites lutea(?) head from 736.4 - 737.0 ft. SAMPLES: X @ 728.7; I @ 736.8.

738.5 - 793.4

FLOATSTONE AND PACKSTONE: unit generally coral FLOATSTONE with skeletal, foraminifer, gastropod PACKSTONE matrix and interbedded with same throughout; unit uncemented, moderately to well-consolidated; gastropods and pelecypods retain naceous layer. PACKSTONE intervals as follows: from top to 739.1 ft, 769.5 - 770.8, 780.3 -781.4 ft. Colors follow: from 737.6 to 758.9 ft, pale yellowish brown to dark yellowish brown; from 758.9 to 760.3 ft, color similar to overlying subunit but with scattered, irregular olive-gray (5Y4/1) streaks, fossils pale yellowish brown; from 760.3 to 769.5 ft, fossils same color, generally olive-gray (5Y4/1) matrix, with scattered granule-size greenish-black pieces; from 769.5 to 773.6 ft, color gradually changing downward from that of overlying subunit to pale yellowish brown; from 773.6 - 778.7 ft, dark yellowish brown to olive gray (10Y4/2); from 778.7 - 780.9 ft, pale yellowish brown to olive gray (10Y4/2); from 780.9 - 793.4 ft, changing downward from that of overlying subunit to pale yellowish brown. Unit generally poorly consolidated, moderately consolidated from 758.9 to 763.2 ft. Contains abundant, diverse gastropods, scattered small colonies of Porites andrewsi-type and P. lutea, scattered Acropora(?) sp. A fragments throughout, very sparse Seriatopora and Dictyaraea; small Favia(?) heads at 778.1 and at 778.4 ft; brownish-black lignite fragments from 789.9 ft through base. SAMPLES: S @ 744.5 - 745.0, 760.8 -761.2, 779.7 - 780.3, 790.8 - 791.1; T @ 742.3; X @ 739.7, 744.5, 745.1, 754.5, 760.8, 761.3, 776.6, 790.8, 791.2; M @ 739.8 - 740.6, 758.0 - 758.9; D @ 779.7 -780.3.

793.4 - 793.8	CORAL HEAD: Porites <u>lutea</u> head, bored heavily with <u>Lithophagus</u> shells still preserved in borings; borings partially filled with brownish-black stain; coral slightly recrystallized; very pale orange to pale yellowish brown.
793.8 - 800.1	FLOATSTONE: coral; matrix skeletal, gastropod, foraminifer WACKESTONE TO PACKSTONE; uncemented, moderately consolidated, containing unaltered gastropod shells. Colors as follows: from top to 798.0 ft, light olive gray (5Y6/1); from 798.0 to base, light olive gray (5Y5/2) to olive-gray (5Y3/2). Contains Porites andrewsi-type and other corals, serveral types of small gastropods; very scattered lignitic fragments. SAMPLES: M @ 797.1 - 798.0.
800.1 - 801.4	CORAL HEADS: Porites sp. and favid-type coral; minor WACKESTONE TO PACKSTONE matrix, like overlying unit; coral slightly recrystallized; yellowish gray (5Y8/1). SAMPLE: I @ 801.0.
801.4 - 818.2	FLOATSTONE: coral; matrix skeletal, gastropod, foraminifer WACKESTONE AND PACKSTONE; uncemented; poorly to moderately consolidated; contains unrecrystallized gastropod shells. Colors as follow: from 801.4 - 802.7 ft, light olive gray (5Y5/2) to pale yellowish brown, grades downward; from 802.7 - 806.1 ft, grayish orange to pale yellowish brown; from 806.1 - 813.3 ft, pale yellowish brown; from 813.3 ft to base, yellowish gray (5Y8/1)to light olive gray (5Y5/2). Contains abundant, diverse small gastropods Porites andrewsi-type, Favia(?) head from 805.5 - 806.1 ft. Lower contact gradational. SAMPLE: X @ 809.7.
818.2 - 820.4	PACKSTONE: coral, mollusc (gastropod), foraminifer, skeletal; uncemented, moderately to poorly consolidated; fossil material well-preserved; pale yellowish brown.
820.4 - 823.0	FLOATSTONE: sparse coral, with mollusc, skeletal PACKSTONE matrix; uncemented, poorly consolidated; unaltered skeletal components; pale yellowish brown. Contains several types of small corals, abundant gastropods, including large Cypraea at 822.3 ft, scattered pelecypods.

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[Minor discontinuity marked by increase in alteration of skeletal components and in cementation.]

823.0 - 840.4

PACKSTONE TO WACKESTONE WITH FLOATSTONE: generally mollusc, skeletal, foraminifer PACKSTONE TO WACKESTONE; with sparse coral FLOATSTONE; unit moderately, irregularly cemented from top to about 826.2 ft, becoming uncemented downward; corals, molluscs in upper part slightly altered in upper part, becoming unaltered downward, moderately consolidated; pale yellowish brown to very pale orange to 840.0 ft, gradually changing downward to very pale orange to pale yellowish brown to grayish orange. Contains large, lined polychaete(?)—worm—tube from 836.2 - 837.1 ft; diverse molluscs, scattered corals including Porites andrewsi—type, sparse small favids. SAMPLES: S@823.9 - 824.1; X@823.8, 823.9; M@833.2 - 834.2.

840.4 - 846.0

FLOATSTONE: coral, matrix skeletal, mollusc, foraminifer PACKSTONE; uncemented, moderately consolidated; fossils moderately altered, nacreous layer preserved in some gastropods; pale yellowish brown to grayish orange and very pale orange, dusky-blue staining inside many Porites andrewsi-type corals. Contains unabraded fragments of Seriatopora, Porites andrewsi-type, abundant and diverse gastropods and pelecypods, particularly from 842.5 - 843.1 ft; worm tube at 842.8 ft. Lower contact abruptly gradational.

846.0 - 847.5

PACKSTONE: mollusc, skeletal, foraminifer; uncemented, well-consolidated; fossils slightly altered, nacreous layer on gastropods not preserved; pale yellowish brown to grayish orange and very pale orange. Contains scattered fragments of Seriatopora, abundant gastropods, scattered pelecypods. (Note: fossil fragments are not dusky-blue stained as overlying unit.] Lower contact gradational.

847.5 - 848.0

WACKESTONE: mollusc, skeletal, uncemented, moderately consolidated; pale yellowish brown to moderate yellowish brown. Lower contact gradational.

848.0 - 853.0

WACKESTONE TO PACKSTONE WITH FLOATSTONE: mollusc, skeletal, foraminifer WACKESTONE TO PACKSTONE grading into coral FLOATSTONE with WACKESTONE TO PACKSTONE matrix in intervals; uncemented, moderately consolidated; containing dusky-yellowish-brown spar questionably associated with mollusc shell at 848.5 ft, coral, mollusc pieces stained with dusky blue in upper

1.0 ft; pale yellowish brown to moderate yellowish brown. Contains fragments of <u>Seriatopora</u>, other coral fragments, and abundant pelecypods, gastropods. SAMPLE: X @ 848.5.

853.0 - 854.6

FLOATSTONE: (tight) coral, with matrix, mollusc, skeletal, foraminifer WACKESTONE TO PACKSTONE; generally uncemented, but with irregularly, moderately cemented nodules from 853.1 - 853.3 ft and from 854.7 - 854.9 ft, moderately consolidated; pale yellowish brown to grayish orange, containing sparse dusky-blue stain in gastropods and corals, including small Seriatopora sticks. Lower contact gradational.

854.6 - 855.6

FLOATSTONE: lithoclast(?); matrix of skeletal, gastropod, foraminifer PACKSTONE TO WACKESTONE; uncemented, moderately consolidated; skeletal material in matrix including small gastropods with nacreous layer preserved; pale yellowish brown to grayish orange; matrix very fine to medium-grained. Lithoclasts(?) are pebble- to small cobble-sized, subrounded; consisting of poorly to moderately cemented, silty, very fine grained; very pale orange to pale yellowish brown WACKESTONE; foraminifers in lithoclasts partly preserved as molds. Small high-spired gastropods common. SAMPLES: S@855.0 - 855.6; T@854.9; X@855.0, 855.5.

[Minor disconformity indicated by apparent reworking of lithoclasts(?) of lower unit into overlying unit and material from overlying unit infilling burrows(?) in lower unit.]

855.6 - 861.3

WACKESTONE(?): (tight) foraminifer skeletal; uncemented or partly poorly cemented(?), moderately consolidated; very pale orange to pale yellowish brown in upper part, becoming yellowish-gray (5Y7/2) downward; silty, very fine grained. Upper part of unit to 857.5 ft with irregularly shaped areas filled with gastropod, foraminifer, skeletal PACKSTONE TO WACKESTONE like overlying unit (burrows?). Unit contains microsparreplaced corals at 858.7 and 859.2 ft. Lower contact gradational. SAMPLES: S @ 855.5 - 856.0; T @ 856.0; X @ 856.1.

861.3 - 867.1

WACKESTONE: coral, mollusc; partly uncemented (60%) with moderately to well-cemented, granule- to small pebble-sized nodules (40%) throughout; moderately consolidated; yellowish gray (5Y7/2). Contains scattered small corals and small molluscs. SAMPLES: S @ 863.5 - 864.8.

867.1 - 870.6 WACKESTONE TO PACKSTONE: skeletal, mollusc; uncemented, moderately consolidated; yellowish gray (5Y7/2). Contains small Porites lutea head at top; mollusc-rich, mainly gastropods, including Cypraea at 867.9 ft with nacreous layer and shell coloration preserved. SAMPLES: X @ 870.5; I @ 867.2. 870.6 - 874.6 FLOATSTONE: coral heads in skeletal WACKESTONE matrix; generally uncemented, with scattered well-cemented nodules from 872.7 - 873.0 ft; well-consolidated; very pale orange to pale-yellowish-brown matrix. Coral heads (some inverted) consist of bored Porites lutea throughout, large Astreopora(?) head from 870.9 - 871.5 ft. Lower contact gradational. 874.6 - 876.2 WACKESTONE: mollusc, skeletal; generally uncemented, with scattered diagenetic nodules in upper part, becoming 30 to 40% in basal part; gastropods with nacreous layer preserved; very pale orange to pale yellowish gray; nodules very pale orange. Contains diverse gastropod fauna with several types of small forms, including small Cypaea and Oliva. Lower contact gradational. 876.2 - 879.6 CORAL HEADS: large heads of Porites lutea apprently not in growth position, matrix like overlying unit; very pale orange. 879.6 - 880.9 FLOATSTONE: coral; matrix skeletal WACKESTONE; generally uncemented, with scattered well-cemented nodules, moderately consolidated; skeletal components unaltered except in nodules; yellowish gray (5Y8/1) to very pale orange to pale yellowish brown. Contains fragments of

[This contact is characterized by a marked increase in cementation below this

surface and slight increase in recrystallization of corals below same.]

Seriatopora. Lower contact abruptly gradational.

PACKSTONE: mollusc, skeletal; moderately cemented, irregularly cemented from top to 881.4 ft; generally poorly cemented but with moderately cemented nodules from 881.4 to 884.7 ft, poorly cemented from 84.7 ft to base; uncemented portions containing unaltered skeletal material including gastropods with nacreous layer; yellowish gray (5Y7/2) to very pale orange. Contains diverse fauna of large and small gastropods including large Strombus (at 884.3 - 884.8 and 891.5 ft), Trochus (at 888.1 ft) scattered Cypraea, small neretids, small

high-spired gastropods, etc; scattered large pelecypods; corals generally sparse in unit except from 890.7 - 891.3 ft. Base gradational. SAMPLES: S @ 881.2 - 881.4; X @ 881.2.

- 892.2 895.1 FLOATSTONE: coral; matrix mollusc, skeletal PACKSTONE; poorly cemented, well-consolidated; yellowish gray (5Y7/2) to very pale orange. Contains small corals and small gastropods primarily. Base gradational.
- - 895.1 896.0 PACKSTONE: mollusc, coral, skeletal; generally poorly cemented but with well-cemented nodules in lower 0.4 ft. Macrofauna predominantly small gastropods. Base gradational.
 - 896.0 903.9 FLOATSTONE: coral; like unit from 892.2 895.1 ft but with moderate-yellowish-brown corals from 896.0 899.0 ft; unit generally poorly cementd but with moderately well cemented, irregular nodules increasing in abundance downward. Contains several types of corals, large molluscs in basal 0.8 ft. Lower contact gradational. SAMPLES: S @ 896.9 897.3; X @ 896.8, 896.9; I @ 896.8.
 - 903.9 904.4 PACKSTONE: gastropod, skeletal, foraminifer; well-cemented in upper 0.2 ft, moderately cemented in middle part, well-cemented in basal 0.1 ft, scattered moderate-brown ("tea-brown") micrite throughout; pale yellowish brown to pale brown (5YR5/2). SAMPLES: S @ 903.9 904.1;

T @ 903.9; X @ 903.9.

[TOP OF SEDIMENT PACKAGE 6.]

- 904.4 909.9 PACKSTONE: from top to 906.0 ft, pelecypod-skeletal PACKSTONE; from 906.0 to 909.9 ft, mollusc PACKSTONE with scattered corals; generally poorly to very poorly cemented, but with well-cemented, nodules from 905.8 907.3 ft; pale-yellowish-brown. Corals slightly recrystallized; contains large Tridacna at 906.1- 906.4 ft, large Strombus at 906.0 ft, diverse other gstropods and small pelecypods.
- 909.9 924.9 FLOATSTONE WITH PACKSTONE: skeletal, foraminifer PACKSTONE interbedded with FLOATSTONE of small heads of <u>Porites</u>

 <u>lutea</u>, partly in growth position; generally poorly cemented but moderately cemented from 916.9 918.5 ft, scattered well-cemented nodules; skeletal material slightly recrystallized; very pale orange to pale

yellowish brown, matrix pale yellowish brown. Contains large calcareous worm tube at 924.1 - 924.3 ft; P. lutea heavily bored with Lithophagus. PACKSTONE intervals from 911.2 - 911.7, 912.4 - 913.2, 914.8 - 915.2, 918.5 - 919.6, and 921.1 - 922.2 ft. Lower contact sharp, at slight angle to core. SAMPLES: S @ 918.2 - 918.5; X @ 918.1, 918.2, 924.6, 924.8; I @ 924.8.

[Disconformity indicated by change in fossil preservation below this surface, by physical nature of contact, and by increase in moldic porosity. A small <u>Porites</u> <u>lutea</u> appears to have been attached and growing on the disconformable surface, suggesting that the underlying stratum was a hard ground.]

924.9 - 935.7

WACKESTONE WITH PACKSTONE: upper part pelecypod, skeletal PACKSTONE, grading downward to tight gastropod, skeletal WACKESTONE from 927.7 ft to base; upper to 0.2 ft moderately well cemented, becoming generally poorly cemented downward but containing moderately well cemented nodules from 930.2 ft to base; minor sparinfilled molds in top of gastropods and pelecypods preserved as molds throughout unit; upper part very pale orange to pale yellowish brown, becoming pale yellowish brown from 927.0 - 930.2 ft, pale yellowish brown to very pale orange from 920.2 ft to base. Lower 2.0 ft has very poor recovery. Lower contact sharp, gently undulatory, welded. SAMPLES: S @ 924.8 - 925.1; T @ 932.6; X @ 925.2; I @ 926.0.

[Classic subaerial-exposure surface marked with laminated, dark-brown micrite crust, microrhizoliths, and a sharp, gently undulatory contact. A dramatic increase in cementation also occurs immediately below this surface, including enrichment in "tea-brown" micrite in the rock.]

935.7 - 936.2 PALEOSOL, INCLUDING LAMINATED CRUST: micritic, very well cemented; top to 2 mm, pale-brown (5YR5/2) to grayishbrown (5YR3/2) laminated micrite crust; from 2 - 8 mm, pale brown (5YR5/2) to pale yellowish brown laminated; from 8 - 32 mm, pale yellowish brown, laminated, containing small very light gray patches (glaebules?); 32 - 52 mm, pale yellowish brown to very pale orange; 52 - 72 mm, pale yellowish brown, mottled; 72 - 102 mm, pale yellowish brown to very pale orange, mottled, with pale-brown (5YR5/2) ("tea-brown") micritic layer inclined at about 30 degrees to axis of core. Zones from 32 mm to base subparallel upper laminated crust; upper 22 mm contains small pores (microrhizoliths). Zones from 32 - 52 and 72 mm to base mm slightly less cemented. Lower contact apparently gradational. SAMPLE: S @ 935.7 - 936.2.

936.2 - 938.1 PACKSTONE TO WACKESTONE: skeletal, foraminifer PACKSTONE; generally poorly cemented; containing sparse moderately well cemented nodules; pale yellowish brown; fossils preserved generally as molds. SAMPLE: I @ 937.6.

938.1 - 942.8 NO RECOVERY.

[Discontinuity marked by increase in cementation, probable presence of large vugs in underlying unit, and spar-linings in same below surface.]

942.8 - 952.4 PACKSTONE TO WACKESTONE: from 942.8 - 943.4 ft poorly recovered, containing rubble of moderately well cemented to well-cemented skeletal PACKSTONE; vuggy areas indicated, lined with moderate-yellowish-brown calcite spar. From 943.4 - 952.4 ft, skeletal PACKSTONE intergrading with skeletal WACKESTONE; containing sparlined gastropod molds; pale yellowish brown, becoming very pale orange to pale yellowish brown downward. Unit moderately well cemented in upper part, becoming progressively less cemented downward, cementation patchy; unit containing moderately well-cemented nodules throughout. Note: at 950.1 - 950.3 ft, moderate amount of pale-brown ("tea-brown") micrite cement in small concentric feature (burrow or root mold?) in moderately cemented WACKESTONE; minor spar-filling and pelleted internal sediment in mollusc molds (geopetal feature) throughout unit. Lower contact sharp, undulatory. SAMPLES: S @ 943.4 - 943.9, 950.0 - 950.3 (wellcemented); X @ 943.3, 943.4; M @ 944.6 - 945.6; I @ 943.5.

[Disconformity clearly indicated by physical nature of welded contact, by radical increase in cementation, and by classic, laminated crust on top of underlying unit.]

952.4 - 952.6

LAMINATED CRUST: upper 13 mm micritic; very well-cemented; pale-brown to moderate brown (5YR4/4), slightly mottled; containing microrhizoliths. Lower part of unit grades downward to well-cemented, pale-yellowish-brown, gastropod WACKESTONE(?); moldic and interparticle porosity moderate. Lower contact gradational. SAMPLE: S @ 952.3 - 952.5 [includes some of adjacent units].

952.6 - 956.1

PACKSTONE WITH WACKESTONE: pellet, mollusc, skeletal PACKSTONE with minor skeletal WACKESTONE; moderately cemented in upper 0.2 ft, becoming generally poorly cemented to uncemented downward, with moderately cemented nodules sparsely scattered through; pale yellowish brown; moldic porosity throughout, minor interparticle porosity.

956.1 - 968.7 PACKESTONE WITH WACKESTONE: from 956.1 - 961.3 ft, PACKSTONE, skeletal, mollusc, pellet(?), grading downward to skeletal WACKESTONE AND PACKSTONE; burrowed; generally moderately well-cemented to well-cemented (from 956.1 - 957.0, 957.7 - 958.3, 958.7 - 959.6, 960.9)- 960.2, 960.8 - 961.0, 961.3 - 961.5 ft containing zones of moderately cemented burrows from 961.5 ft to base; poorly cemented in other areas; fossils preserved exclusively as molds, with minor sparry-calcite infilling of gastropods; generally moderate brown (5YR4/4) in upper part, grading downward to yellowish gray (5Y8/1). Contains large pieces of branching Acropora sp. at 956.1 - 957.0 ft and another at 957.8 ft, preserved as large molds. Lower contact gradational. SAMPLES: S @ 956.1 - 956.3; T @ 956.1; X @ 956.1; I @ 962.5.

968.7 - 971.2 WACKESTONE: skeletal, burrowed(?), pellet(?); moderately well cemented, irregularly cemented; very pale orange to yellowish gray (5Y7/2); fossils preserved as molds.

Contains vertical, wavy laminae or veins (spar?). Lower contact gradational. SAMPLES: S @ 968.7 - 969.0, 969.6; I @ 969.9; T @ 969.4; X @ 968.7, 969.0, 969.5, 969.6; I @ 969.9.

971.2 - 995.3 WACKESTONE WITH PACKSTONE: upper part skeletal WACKESTONE, grading from WACKESTONE TO PACKSTONE from 979.2 - 987.0 ft, grading to WACKESTONE from 987.0 ft to base; cementation variable; from 971.2 - 973.2 ft, poorly cemented; from 973.2 - 973.5 ft, moderately well cemented; rest of unit generally poorly cemented but containing moderately well cemented nodules throughout; unit very pale orange to yellowish gray (5Y7/2); fossils preserved as molds. Macrofauna consists of very scattered large pelecypods and corals. SAMPLES: I @ 972.1, 982.0.

[Discontinuity marked by change in color, increase in cementation, and changes in rock type and biota.]

995.3 - 996.4 PACKSTONE: foraminifer, mollusc; moderately to wellcemented; molluscs preserved exclusively as molds;
contains sparse spar-lined steinkerns; upper 0.1 ft,
pale yellowish brown with small fragments of pale
yellowish brown to moderate yellowish brown laminated
crust(?), becoming yellowish gray (5Y8/1) to pale
yellowish brown downward; may contain mud chips.
Contains sparse large gastropods and pelecypods. Lower
contact apparently gradational. SAMPLES: S @ 995.4 996.0; X @ 995.3, 995.4.

996.4 - 999.1 FLOATSTONE: coral, coralgal(?); foraminifer, skeletal PACKSTONE matrix; moderately to well-cemented, irregularly cemented; corals recrystallized; yellowish gray (5Y8/1) to pale yellowish brown, mottled with pale yellowish brown. Contains several types of recrystallized corals possibly with minor coralgal coatings. Lower contact apparently gradational. SAMPLES: S @ 997.9 - 998.2; T @ 997.9; X @ 997.9;

I @ 996.7.

PACKSTONE AND WACKESTONE: skeletal; subunits as follows:
from top to - 1004.2, WACKESTONE AND PACKSTONE, from
1004.2 - 1011.8, skeletal WACKESTONE; unit generally
moderately to poorly cemented in upper part, becoming
irregularly cemented downward; pale yellowish brown;
fossils sparse, generally preserved as molds. Lower
contact gradational. SAMPLES: S @ 1000.7 - 1000.9
(cemented); 1007.0 - 1007.2; T @ 1000.7, 1007.0; X @
1000.7, 1007.0; M @ 1009.2 - 1010.2.

1010.2 - 1011.8 PACKSTONE: foraminifer, skeletal; poorly cemented; pale yellowish brown to moderate yellowish brown; very fine to medium-grained, moderately sorted. Lower contact gradational.

PACKSTONE TO WACKESTONE: subunits as follows: from top to 1018.3 ft, micromollusc-foraminifer, coral PACKSTONE, grading downward to foraminifer, skeletal WACKESTONE from 1018.3 ft to base; unit generally poorly cemented, but small areas containing moderately cemented nodules dispersed throughout; pale yellowish brown to grayish orange; moldic porosity throughout; generally fine- to medium-grained, poorly sorted. SAMPLES: S@ 1014.2 - 1014.5, 1015.9 - 1016.1 (both better-cemented pieces); T@ 1014.2; X@ 1014.2.

[Disconformity suggested by marked increase in cementation below contact, and presence of possible "tea-brown" micrite below surface.]

PACKSTONE: skeletal, foraminifer-mollusc; upper 0.6 ft very well cemented, containing small amount of moderate-brown ("tea-brown"?) cement in matrix, concentrated beneath a partially spar-replaced coral; unit becoming progressively less cemented downward, uncemented at base; pale yellowish brown to grayish orange; molluscs preserved as molds. May contain pelleted mud-chips at 1023.2 -1023.3 ft. Contains cobble-sized, recrystallized coral head at 1022.9 ft. SAMPLES: S@ 1022.6 - 1022.8; T@ 1022.6; X@ 1023.0, I@ 1023.0.

[Discontinuity indicated by increase in cementation below contact and by change in rock type.]

1025.4 - 1036.0

WACKESTONE AND PACKSTONE: upper part skeletal WACKESTONE, to 1029.0 ft, grading to micromollusc-skeletal PACKSTONE downward; pervasively very well cemented from top to 1028.6 ft, becoming poorly cemented to uncemented below; pale yellowish brown; fossils generally preserved as molds, minor shell material still preserved. Contains abundant small pelecypods, moderately abundant gastropods, some algal(?)-coated grains. SAMPLES: S@ 1025.4 - 1025.5; 1026.0 - 1026.2; T@ 1025.4, 1026.2; X@ 1025.6; I@ 1025.6.

1036.0 - 1040.4

NO RECOVERY: soft; driller said that cored like completely unconsolidated sand; drill-string descended much more rapidly than in overlying unit (did not act like void); when hard layer struck, driller removed barrel.

[Possible disconformity indicated by marked increase in cementation.]

1040.4 - 1045.4

PACKSTONE: mollusc, skeletal, foraminifer; containing algal(?)-coated grains; very coarse grained, poorly sorted in upper part, becoming slightly muddy, mediumto coarse-grained downward; well-cemented, pervasively cemented from top to 1041.9 ft, becoming generally very poorly cemented downward; yellowish gray (5Y7/2) to very pale orange to pale yellowish brown; moldic porosity moderately high, containing few areas with original shell material preserved in upper part. Contains several types of pelecypods and gstropods, sparse foraminifers. SAMPLES: S@1040.4 - 1040.6; T@1040.4; X@1040.8; SR@1040.8.

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[Minor discontinuity suggested by marked increase in cementation and presence of sparse "tea-brown"(?) micrite cement in underlying unit.]

1045.4 - 1048.6

PACKSTONE: mollusc, skeletal; medium— to very coarse-grained, very poorly sorted, becoming even coarser downward; upper 0.1 ft with sparse pale-brown ("tea-brown") micrite; well— to moderately well cemented throughout; yellowish gray (5Y8/1) to very pale orange to pale yellowish brown, with lower 0.6 feet grading downward to very pale orange; fossils preserved as molds, minor moderate-yellowish-brown calcite-spar lining molds; some molds enlarging to small vugs, several gastropod molds containing geopetal structures. Contains diverse forms of large pelecypods and gastropods, including large Trochus, algal(?)-coated grains. Lower contact sharp. SAMPLES: S @ 1045.4 - 1045.7, 1048.2 - 1048.6; T @ 1045.4; X @ 1045.4, 1048.1.

BINDSTONE: algal, laminated; poorly cemented; very pale orange to pale yellowish brown. SAMPLES: T @ 1049.2; X @ 1049.0.

1049.2 - 1052.4 PACKSTONE: skeletal, algal(?)-coated-grain, pelecypod;

PACKSTONE: skeletal, algal(?)-coated-grain, pelecypod;
fine- to coarse-grained; fossils all preserved as molds;
very poorly cemented to uncemented; very pale orange to
pale yellowish brown. Contains sparse foraminifers.
SAMPLE: T @ 1049.2.

[Contact marked by increase in cementation.]

PACKSTONE: mollusc, algal(?)-coated-grain, skeletal; very coarse to coarse-grained, poorly sorted, partly moderately cemented, partly poorly cemented, containing sparse areas with moderate-brown (5YR3/4) ("tea-brown") micrite(?); moldic porosity; very pale orange to pale yellowish brown. SAMPLES: S @ 1053.9 - 1054.1; T @ 1053.9; X @ 1053.9.

1054.1 - 1060.7 PACKSTONE WITH BINDSTONE: unit generally PACKSTONE, skeletal algal(?)-coated-grain; generally very fine grained, well-sorted; generally poorly cemented, with moderately cemented interval from 1056.9 - 1059.3 ft; moderately well cemented in lower part of unit; very pale orange to pale yellowish brown. Intervals of laminated, algal BINDSTONE from 1057.5 - 1057.9 and 1060.3 - 1060.4 ft. Containing moderately cemented nodules scattered in unit from 1055.8 ft to base; large burrow from 1059.7 - 1060.0 ft. Contains large molds of pelecypods at 1056.1 - 1057.1 ft; sparse foraminifers throughout. Lower contact gradational. Lower contact gradational. SAMPLES: S@1056.5 - 1056.6; 1059.7 -1060.0; T @ 1057.1 (pelecypod internal-mold); M @ 1055.9 - 1056.9.

PACKSTONE: algal(?)-coated-grain, skeletal; poorly cemented to uncemented; very pale orange; very fine to coarse-grained, with moderately-cemented nodules occuring sparsely throughout unit; moderately sorted; moldic porosity.

1062.7 - 1063.5 CORAL HEAD: small head of <u>Porites lutea</u> slightly recrystallized. SAMPLE: SR @ 1062.7.

1063.5 - 1064.1 PACKSTONE: like unit from 1060.7 - 1062.7 ft. SAMPLE: I @ 1063.6

[TOP OF SEDIMENT PACKAGE 7. Major disconformity indicated by dramatic increase in cementation below surface, increase in alteration of coral material, and increase in moldic/vuggy porosity, probable karsting, and facies change.]

1064.1 - 1068.8

PACKSTONE AND FLOATSTONE: PACKSTONE, skeletal, mollusc, with coral FLOATSTONE; pervasively well cemented; corals extensively replaced and recrystallized; moldic porosity, enlarged sparsely to small vugs with minor spar-coating. [Note: within interval, recovery was continuous to 1067.4 ft; driller had problems with lower part of run with pieces of rock blocking the barrel; recovery from 1067.4 - 1068.8 ft consists of fragments of material like major part of unit description above, plus recrystallized coral and pieces of pellet, sparsely skeletal WACKESTONE to MUDSTONE unlike matrix of bulk of unit. Unit probably contains large vugs.] SAMPLES: S @ 1064.8 - 1065.1; T @ 1064.8 - 1068.6; X @ 1064.8, 1068.6.

1068.8 - 1072.7

NO RECOVERY: probably karsted interval with large vugs or small caverns.

1072.7 - 1073.6

BINDSTONE WITH PACKSTONE: upper 0.2 ft algal, laminated BINDSTONE, grading downward to algal(?)-coated-grain PACKSTONE; uncemented to poorly cemented; upper part pale yellowish brown, becoming slightly lighter colored below. Possible fenestrae in laminated bed at top. Lower contact gradational. SAMPLES: S @ 1073.5 - 1073.6; T @ 1072.7.

1073.6 - 1077.2

PACKSTONE TO FLOATSTONE: badly recrystallized-coral FLOATSTONE with skeletal, mollusc PACKSTONE matrix, interbedded with same; moderately to poorly cemented to uncemented; skeletal material other than corals preserved only as molds, some spar-lining of molds, minor geopetal structures; very pale orange to pale yellowish brown; generally very coarse to mediumgrained, very poorly sorted. Probably contains some algal(?)-coated-grains. Contains small, overturned heads of Porites lutea at 1076.0 ft with algal crust on (now-inverted) top. Lower contact obscured by drilling. SAMPLES: I @ 1076.0, 1076.3

1077.2 - 1081.5 NO RECOVERY.

[Disconformity indicated by change in rock type, increase in cementation, and presence of sparse "tea-brown" micrite cement below surface.]

1081.5 - 1083.8

MUDSTONE TO WACKESTONE: gastropod, pelecypod, skeletal MUDSTONE grading to WACKESTONE locally; well-cemented to moderately well cemented; burrowed; fossils preserved as molds and steinkerns, generally yellowish gray (5Y7/2) to pale yellowish brown in upper 0.5 ft, becoming pale yellowish brown mottled with yellowish gray (5Y7/2) to pale yellowish brown downward; contains abundant fossil molds and possible moderately common degassing tracks from 1087.6 ft to base; contains possible microrhizoliths (especially the slightly darker-stained marks) and possible mudcracks at top of unit. Fossils consist of abundant small algae-browsing gastropods dominating lower half of unit, scattered large pelecypods in upper part. Lower contact abruptly gradational. SAMPLES: S @ 1081.9 - 1082.3, 1082.6 -1083.5, 1083.5 - 1083.9; T @ 1083.5, 1083.7; X @ 1082.6, 1083.5.

1083.8 - 1084.2

BINDSTONE WITH PACKSTONE: algal, laminated BINDSTONE in top one-third and lower one-third of unit, with skeletal, algal(?)-coated-grain PACKSTONE in middle; moderately well cemented to poorly cemented; pale yellowish brown with moderate-brown (5YR3/4) and pale-yellowish-brown laminae in BINDSTONE intervals. Contains molds of algae-browsing, small gastropods in packstone like in overlying unit. Lower contact abruptly gradational. SAMPLE: S @ 1084.1 - 1084.2; X @ 1084.1.

1084.2 - 1090.0

PACKSTONE: upper 0.8 ft, medium— to coarse—grained, skeletal PACKSTONE, grading downward to moderately well—sorted, very fine grained, skeletal, algal(?)—coated—grain PACKSTONE; containing thin muddy interval at 1084.5 ft; generally poorly cemented; upper part pale yellowish brown, becoming very pale orange downward; containing moderately cemented, nodules scattered throughout unit, concentrated from 1086.3 — 1087.9 ft; molluscs preserved as molds. Contains small, inverted Porites lutea head at 1084.6 ft. Lower contact abruptly gradational. SAMPLES: I @ 1084.8, 1086.6.

1090.0 - 1090.4

BINDSTONE: algal, laminated; moderately well cemented; generally pale yellowish brown with some pale-yellowish-brown to dark-yellowish-brown laminae. SAMPLES: S@ 1090.1 - 1090.4.

1090.4 - 1094.6

PACKSTONE: from top to 1092.4 ft, medium- to very finegrained, moderately sorted, algal(?)-coated-grain, skeletal PACKSTONE, becoming progressively more skeletal, coarse-grained, poorly sorted downward; generally poorly cemented, containing scattered moderately cemented nodules throughout; very pale orange; molluscs preserved as molds, and steinkerns except for corals. Contains slightly recrystallized, small <u>Porites lutea</u> head at 1093.8 ft, apparently in growth position.

[Discontinuity by increase in cementation, presence of "tea-brown" micrite below surface.]

1094.6 - 1096.6

PACKSTONE: skeletal, mollusc; well-cemented to moderately well cemented except for poorly cemented interval from 1095.4 - 1096.1 ft; containing moderate-brown (5YR3/4) ("tea-brown") micrite filling small tubes throughout; very pale orange to pale yellowish brown. Subunits as follows: from top to 1095.2 ft, medium- to coarse-grained skeletal PACKSTONE; from 1095.2 to 1095.3 ft, skeletal PACKSTONE containing angular lithoclasts; at 1095.3 ft, moderate-brown (5YR3/4) LAMINATED CRUST(?); from 1095.3 - 1096.2 ft, medium- to coarse-grained skeletal PACKSTONE. Fossils preserved exclusively as molds. Lower contact abruptly gradational. SAMPLES: S @ 1095.2 - 1095.5, 1096.1 - 1096.5; T @ 1095.2; X @ 1095.2, 1096.1.

1096.6 - 1111.8

PACKSTONE: foraminifer, skeletal, mollusc; very pale orange to pale yellowish brown, becoming very pale orange in lower part of unit; very fine to coarsegrained, poorly sorted; fossils preserved exclusively as molds; generally poorly cemented, containing sparse moderate-brown (5YR4/4) ("tea-brown") micrite; well-cemented intervals and nodules from 1098.4 - 1098.6, 1098.9 - 1099.2, 1099.7 - 1100.0, 1100.8 - 1101.0, 1103.4 - 1003.5, 1104.0 - 1104.3, 1106.3 - 1106.7 ft. Burrows generally filled with pellet, foraminifer PACKSTONE/WACKESTONE. Scattered pelecypods preserved only as molds; small recrystallized coral at 1099.7 ft. Lower contact sharp, welded, undulatory. SAMPLES: S@1098.9 - 1099.2; T@1098.9, 1104.1; X@1098.9, 1111.7; I@1107.5.

[TOP OF SEDIMENT PACKAGE 8. Disconformity indicated by marked increase in degree of cementation, marked increase in "tea-brown" micrite cement, apparent microkarstic surface, and by presence of infilling of overlying material in cavities in underlying unit.]

1111.8 - 1130.1

PACKSTONE: foraminifer skeletal, mollusc; pervasively very well cemented from top to 1113.3 ft, mostly well-cemented downward with poorly cemented intervals from 1113.3 - 1113.7, 1115.6 - 1115.8, 1116.2 - 1116.7, 1119.2 - 1119.3, and 1122.5 ft to base; pale yellowish brown to grayish orange with areas of pale-yellowish-

brown to dark-yellowish-brown ("tea-brown") micrite in upper part; becoming very pale orange to pale yellowish brown with pale-yellowish-brown mottling below from 1113.3 to about 1115.0 ft; grading downward to pale yellowish brown to grayish orange; medium- to coarse-grained; poorly sorted throughout; containing burrows scattered throughout. Contains sparse Lepidocyclina, molluscs preserved only as molds. Lower contact abruptly gradational. SAMPLES: S@1111.7 - 1112.2 (contains part of overlying unit), 1117.7 - 1118.1, 1118.1 - 1118.3, 1121.8 - 1122.2; T@1111.7, 1111.8, 1111.11, 1118.1, 1122.2; X@1112.2, 1114.3, 1117.7, 1118.1, 1121.8.

1130.1 - 1146.2

PACKSTONE TO GRAINSTONE(?): algal(?)-coated-grain, very fine to fine-grained, well-sorted; generally moderately cemented with areas poorly cemented; fossils preserved only as molds; very pale orange; contains vertical-tube-type and other burrows, commonly containing small areas of moderate-brown ("tea-brown") micrite. SAMPLES: S@ 1130.2 - 1130.5, 1133.6 - 1133.9; T@ 1130.2; X@ 1130.2, 1136.1; M@ 1141.1 - 1142.1; I@ 1132.2, 1145.0

-- TOTAL DEPTH OF HOLE 1146.2 FT --

BOREHOLE KBZ-4

Lat/Long (E/W-1960): 11°40′17.0" N, 162°11′58.7" E

Lat/Long (WGS-1972): 11°40′16.9" N, 162°11′58.7" E

Location (IVY-grid, ft): 149,350 N and 071.113 E

Distance/Bearing from KOA GZ: 12 ft, 145.0 deg

Water Depth (H&N): 109.1 ft Hole Depth (bsf): 1045.9 ft

Hole Spudded: 03/15/1985 Drilling Ended: 03/29/1985

Sampling: SS, SH, LY*, CH* Recovery: 37% (388.8 ft)

Logs: MCS, GR/DN/CP, GR/NT, CSV Date Logged: 03/18-31/1985

Deviation: 5.2 deg @ 708 ft; Casing: 8-5/8-in. @ 126 ft;

1.0 deg @ 1,000 ft 7-5/8-in. @ 386 ft

Drilling Mud/Additives: SGL (147 sx), BVS (105 sx), POP (10 sx), MLP (13 sx),

BAR (12 sx), GAL (154 sx), GGM (80 sx), PAD (52 gals)

Geologists: B.R. Wardlaw, B.A. Skipp Drillers: G. Mooney, R. Weber

Paleontologist: R. Margerum, E.E. Compton Logger: C.S. Novinskie, M. Beals

Redescribed: 10/14-16/1985

* Cored Intervals: Christensen (332.2 - 338.1, 956.6 - 965.6, and 983.7 - 1,045.9 ft). Longyear (259.6 - 267.9, 269.9 - 273.0, 275.8 - 279.4, 279.6 - 300.6, 301.0 - 304.0, 304.9 - 332.2, 338.1 - 352.4, 353.3 - 363.1, 364.1 - 370.3, 371.6 - 386.3, 745.6 - 956.6, and 965.6 - 983.7 ft).

Depth	Description

0.0 - 28.2 MUDSTONE: broken(?) skeletal; skeletal elements sparse from 0 - 11.0 ft, gradual increase in abundance from 11.0 - 20.9 ft, and gradual decrease from 20.9 ft to base of unit; uncemented; unaltered, nearly whole unaltered Halimeda plate at 20.6 ft; pinkish gray;

generally fine-grained; scattered medium-grained sand in skeletal interval (11.0 - 20.9 ft) commonly appears angular to broken, but a few unbroken grains are present. Contacts between intervals grade. Lower contact gradational. SAMPLES: T @ 6.0, 11.0, 15.5, 20.6, 21.2, 25.8; R @ 21.5.

28.2 - 58.6

PACKSTONE: skeletal (broken skeletal and skeletal), largely foraminifer, <u>Halimeda</u>; uncemented; mixed-alteration, moderate-red (5R5/6) octocoral fragments sparse moderate-red (5R5/6) <u>Homotrema</u> throughout; very pale orange; upper 1.0 ft grades downward from WACKESTONE to fine-grained PACKSTONE, entire unit coarsens downward; from 43.0 - 58.6 ft, very coarse grained <u>Halimeda</u> PACKSTONE. SAMPLES: T @ 28.8, 31.4, 34.5, 36.5, 39.2, 43.6, 48.6, 53.8.

58.6 - 63.0 NO RECOVERY.

63.0 - 64.7

MUDSTONE: (sparse) rubble, skeletal; uncemented; mixedalteration (unaltered to slightly altered); pinkish
gray; mud to pebble-sized grains (maximum size 4 cm),
angular, poorly sorted; appears homogeneous throughout.
Pebble-size Porites lutea fragments have thin, very pale
orange to light-brownish-gray alteration rinds,
indicating they were probably derived from 100 ft
Porites-marker interval. SAMPLES: T @ 63.3; T/P @ 63.3
- 63.5; I @ 63.6.

64.7 - 68.0 NO RECOVERY.

68.0 - 129.4

FLOATSTONE: mixed-rubble, tight; skeletal WACKESTONE to PACKSTONE matrix; uncemented; mixed alteration (unaltered to slightly altered); very pale orange, to pebble-size (maximum size 4.5 cm); less mud than in interval from 63.0 - 64.7 ft; angular, very poorly sorted; appears homogeneous throughout; from 103.0 to 119.2 ft, unit coarsens downward, percentage of matrix decreases, appears to be PACKSTONE. Contains pebblesize, slightly altered, angular Porites lutea fragments scattered throughout; most pebbles are coral fragments; granule of grayish-orange calcite spar at 73.7 ft; from 78.7 - 79.0 ft, two slightly altered(?) fragments of pale-brown coral; at 113.4 ft, pebble-size fragment of "tea-brown" micrite cemented limestone or piece of laminated crust; at 108.9 ft and scattered throughout interval from 100.0 - 120.0 ft are fragments coated, smeared, and sparsely intruded by dark-gray drilling mud; at 103.0 ft, spar partly fills vug in coral

fragment; coral fragment at 123.5 ft (5 cm in diameter) has molds and vugs; at 128.3 and 128.5 ft, large gastropod shell fragments are slightly altered. Lower contact gradational. SAMPLES: P @ 73.3, 78.5, 83.2; I @ 68.1, 89.8, 107.9, 119.0, 124.0, 129.4; R @ 74.3, 112.9, 118.0, 123.5, 127.6.

129.4 - 132.2 NO RECOVERY.

132.2 - 138.1

FLOATSTONE: rubble, tight; broken skeletal WACKESTONE matrix; uncemented; megafossils appear altered, corals with chalky exteriors and centers replaced with spar, gastropod fragments chalky; very pale orange to white; color transitional between grayish unit above and very pale orange unit below; mud to pebble-size clasts (4.5 cm maximum dimension), containing more mud near base; pebbles mostly coral fragments including abundant Acropora; angular, poorly sorted; some fragments have vuggy porosity. At 132.5 ft, apparent splinter of coral; at 137.5 ft, fragment of pale-red (5R6/2) Homotrema; at 137.1 ft, coral with vertical(?) fractures; at 137.3 ft, angular clast of soil horizon developed at disconformity (highest cemented rock fragment observed); at 137.5 ft, fragment of pale-red (5R6/2) Homotrema. Lower contact gradational. SAMPLES: T @ 137.3; P @ 133.1 - 133.3; I @ 137.5; R @ 132.2, 137.0.

138.1 - 142.0 NO RECOVERY.

142.0 - 157.1

FLOATSTONE: rubble, sparse; matrix skeletal PACKSTONE TO GRAINSTONE; matrix uncemented, containing chalky grains; very pale orange to pale yellowish brown, becoming pale yellowish brown to very pale orange in basal 0.9 ft; poorly sorted sand-size grains; lithic clasts consist of poorly to moderately cemented PACKSTONE to GRAINSTONE, similar to matrix. Contains relatively unaltered pelecypods and microgastropods; pelecypods partly broken, gastropods unbroken; abundant foraminifers from 151.6 ft. Lower contact preserved in core, probably sharp before disruption by blast. SAMPLES: I @ 146.0; R @ 142.0, 146.6, 151.8, 156.5.

157.1 - 177.0

FLOATSTONE: rubble, coral, matrix PACKSTONE; matrix uncemented; containing slightly altered, <u>Acropora</u> sticks with sparry calcite centers and slightly chalky molluscs; very pale orange, lighter than unit above, slightly darker than unit below; subangular, moderately well cemented pebble-size clasts. At 157.1 ft, contains slightly recrystallized <u>Acropora</u> stick above "tea-brown" calcite-cemented matrix with altered Halimeda plates

preserved; from 166.9 - 167.3 ft, abundant lithic clasts indicate discontinuity based on the presence of: (1) one small fragment of soil horizon; (2) one large fragment with spar-lined mold and abundant moldic porosity; and (3) several fragments containing rhizoliths lined with "tea-brown" micrite; at 172.0 ft, small fragment of "tea-brown" micrite with moldic and interparticle porosity, sparse chalky Halimeda plates, and mollusc shells with thin layer of micrite alteration; from 176.8 - 177.0 ft, large fragment of recrystallized coral with spar-filled molds and several Lithophagus borings, one boring filled with pale-yellowish-brown to moderate-yellowish-brown spar. Lower contact sharp. SAMPLES: T@167.2; I@157.2, 161.2; R@161.3.

177.0 - 207.1

FLOATSTONE: coral and coral rubble; sparse matrix indeterminate skeletal PACKSTONE; matrix uncemented; corals slightly altered throughout; gastropods show little alteration; at 182.3 and 201.5 ft, Cypraea (money cowry) slightly chalky; at 201.8 ft, high-spired gastropod with relict color band; very pale orange; poorly sorted, containing subangular to subrounded, pebble-size fragments. From 194.3 - 194.5 ft, large coral fragment shows partial spar-replacement of corallites (Acropora cuneta?). Lower contact gradational. SAMPLES: I @ 177.2, 200.0; R @ 201.2.

207.1 - 210.9 NO RECOVERY.

210.9 - 221.4 PACKSTONE: muddy, skeletal, mollusc; uncemented; slightly altered; very pale orange; fine- to coarse-grained; at 220.6 ft, one cemented pelecypod mold; at 216.4 ft, pelecypod shell with relict color band; at 212.1 ft,

Tridacna fragment.

221.4 - 224.8 NO RECOVERY.

224.8 - 234.0 PACKSTONE: skeletal, coral; uncemented; corals replaced with calcite; very pale orange; fine- to coarse-

grained. Lower contact probably sharp.

234.0 - 234.9 NO RECOVERY.

[Disconformity indicated by development of paleosol, including rhizoliths, and increase in cementation and skeletal alteration.]

MUDSTONE AND WACKESTONE: from 234.9 - 235.0 ft, skeletal MUDSTONE; well-cemented; slightly altered; white; very fine to medium-grained; sparse unabraded coral molds; laced with sinuous, branching rhizoliths filled with "tea-brown" micrite. From 235.0 to 236.0 ft, skeletal WACKESTONE; patchy well-cemented areas present, but largely uncemented; slightly altered; pinkish gray; moldic and vuggy porosity in cemented patches; vugs lined with thin calcite layer; possible fracture; abundant microfauna discernable. Lower contact sharp. SAMPLE: T @ 234.9.

WACKESTONE: generally skeletal; from 236.0 - 236.1 ft, skeletal, glaebule; well-cemented; slightly altered; largely moderate yellowish brown and grayish orange, with thin layers of pale brown and grayish brown; clotted micrite, common glaebule, probable caliche; preserved in core at 20 to 30 degree angle and fractured; may be related to soil horizon at 234.9 ft. From 236.1 - 247.1 ft, WACKESTONE: skeletal; uncemented, with rare patches poorly cemented; one well-cemented patch at 247.0 ft; very pale orange; at 241.1 ft, unbroken chalky high-spired gastropod; at 240.3 ft, well-cemented pelecypod steinkern; mostly fine-grained (may be phosphatic). Lower contact abruptly gradational. SAMPLE: T @ 236.0.

PACKSTONE: skeletal; well-cemented; slightly altered chalky <u>Halimeda</u> plates; very pale orange to pale yellowish brown; scattered micromoldic and vuggy porosity; vugs partly filled with spar at top of interval. Poor recovery, recovered fraction probably cemented burrows because "tea-brown" calcite is concentrated in centers and more diffuse toward edges of darker areas. Lower contact gradational. SAMPLE: T @ 247.1.

251.3 - 252.1 WACKESTONE: skeletal; generally uncemented, uppermost 0.1 ft slightly cemented; slightly altered, minor chalky Halimeda; very pale orange to white; generally fine-grained with sparse coral fragments. Lower contact probably gradational.

252.1 - 256.3 NO RECOVERY.

256.3 - 257.1 PACKSTONE: foraminifer, skeletal; uncemented; very pale orange; color slightly darker than unit below, noticeably darker than unit above. Contains small Mytilus fragments with color retention. Lower contact gradational.

WACKESTONE: skeletal; uncemented; altered, spar-filled, pelecypod steinkern at 257.5 ft; very pale orange; fine-

to medium-grained; some moldic porosity.

257.6 - 259.5 NO RECOVERY.

[TOP OF SEDIMENT PACKAGE 3. Major disconformity. Hard layer was encountered at 259.5 ft that bent Shelby tube and could not be drilled with modified bit.]

259.5 - 273.0

257.1 - 257.6

POOR RECOVERY. PACKSTONE, WACKESTONE, AND MUDSTONE: Drilling records indicates 2- to 3-ft thick hard layer at 259.5 ft; cuttings from this layer marked 259.5 -259.6 ft show mixed, well-cemented lithic type that include: "tea-brown" cemented mollusc PACKSTONE, skeletal PACKSTONE, grayish-orange WACKESTONE, pelletal MUDSTONE, and large recrystallized Tridacna(?) fragment. Material from 269.9 - 270.5 ft includes broken fragments of PACKSTONE, skeletal, foraminifer, mollusc, pellet; well-cemented; chalky Halimeda plates partially preserved, some pellets preserved as molds; mottled very pale orange to pale yellowish brown to white; "tea-brown" calcite scattered throughout, concentrated beneath burrow(?); contains spar-filled vugs. From 261.6 - 261.9 ft, fragments of mottled, skeletal WACKESTONE to PACKSTONE, pale-yellowish-brown, in very pale orange, pellet MUDSTONE; contains recrystallized corals partially replaced with spar, partly dissolved; some moldic, minor vuggy porosity. From 267.9 - 268.7 ft, MUDSTONE; skeletal, sparse pellet; well-cemented; very pale orange. Lower contact probably gradational.

273.0 - 288.6

POOR RECOVERY; PACKSTONE AND MUDSTONE: from 273.0 - 273.4 ft, cuttings of two types of well-cemented(?) pervasively recrystallized PACKSTONE: (1) fine grained, skeletal PACKSTONE with sparse moldic porosity and sparinfilling, very pale orange to white; and (2) medium- to coarse-grained, skeletal, Halimeda, foraminifer PACKSTONE, containing common "tea-brown" micrite, pervasive micromoldic porosity; pale yellowish brown in centers to very pale orange in outer rinds. Material from 280.4 - 288.6 ft, MUDSTONE; skeletal; wellcemented, pervasively recrystallized; very pale orange to white. Material from 279.4 - 280.4 ft may be fallin, but contains spar-replaced corals.

288.6 - 292.3 NO RECOVERY.

one diagonal fracture partly healed. Porites <u>lutea</u> head at top may have fallen downhole. SAMPLES: S @ 315.7 - 315.9; X @ 315.7.

316.4 - 317.8 NO RECOVERY.

318.0 - 318.6 CORAL HEADS: completely recrystallized fragments of corals, including Favia(?), large partially

recrystallized large Favia(?) head at base.

318.6 - 338.1

PACKSTONE TO WACKESTONE: foraminifer; skeletal; poorly to moderately cemented, containing well-cemented nodules, some "tea-brown" calcite at 325.0 ft; highly altered with some skeletal elements including corals completely recrystallized; very pale orange to white; fine- to coarse-grained; common pebble-size, irregularly shaped, patches of cemented material containing foraminifers may represent original matrix, and surrounding muddier uncemented material may be altered skeletal elements; cemented matrix gradually becomes less abundant in lower part of interval. From 333.6 - 336.0 ft, WACKESTONE has more mud than rest of interval. [Note: material from 322.6 - 323.0 may have fallen downhole from 315.4 - 316.4 ft.] Lower contact gradational.

338.1 - 371.6

PACKSTONE TO WACKESTONE: skeletal, poorly cemented to moderately cemented, irregularly cemented; partly altered; very pale orange; fine- to coarse-grained. [Note: Poor recovery from unit. Interval from 370.3 - 371.6 ft probably contains cemented WACKESTONE-filled burrows. Lower contact sharp.

[TOP OF SEDIMENT PACKAGE 4. Disconformity marked by increase in cementation, including "tea-brown" micrite below surface, in alteration of skeletal material, and in appearance of soil fabrics below.]

371.6 - 372.4

FLOATSTONE: coral; sparse skeletal, pellet WACKESTONE matrix; moderately to well-cemented; corals recrystallized; very pale orange with pale-yellowish-brown spar in molds and vugs, some very pale orange corals; mostly fine-grained; common moldic, vuggy, and, minor cavernous porosity; mollusc molds rarely filled with spar; thick spar crystals lining some vugs. Top of unit with highly recrystallized small Porites lutea(?) head with "tea-brown" micrite above, and "tea-brown" micrite; many rhizoliths penetrate the recrystallized

[Discon underly		-	ated by rhizoliths filled with "tea-brown" micrite in
292.3	<u>-</u>	292.6	MUDSTONE: skeletal, pellet; well-cemented; moderate altered; very pale orange; fine-grained; common micromoldic porosity and sparse vuggy porosity; common branching rhizoliths filled with grayish-orange calcite; vertical(?) healed fracture with lateral splay. Contains Marginopora vertebralis, unbroken small pelecypods and foraminifers.
292.6		295.7	NO RECOVERY.
295.7	-	301.0	PACKSTONE: skeletal; moderately to poorly cemented(?), slight cementation of matrix around recrystallized coral and calcareous algae; very pale orange; poorly sorted, fine-grained sand to pebble-size fragments; cemented parts have moldic porosity; small amount of "tea-brown" micrite filling beneath coral.
301.0	_	301.8	FLOATSTONE(?): coral, with skeletal PACKSTONE(?) matrix; well-cemented, pervasively recrystallized, corals completely spar-replaced; very pale orange to white.
301.8	_	304.0	NO RECOVERY.
304.0	-	307.2	PACKSTONE AND WACKESTONE: skeletal, foraminifer PACKSTONE; moderately to well-cemented; with minor "tea-brown" micrite; moderately altered; very pale orange from top to 304.9 ft, becoming very pale orange to pale yellowish brown in lower part; mostly fine-grained; minor moldic porosity. SAMPLE: M @ 306.7 - 307.2.
307.2	_	309.8	NO RECOVERY.
309.8	·	310.4	MUDSTONE: skeletal, pellet; well-cemented; minor "tea-brown" micrite; very pale orange to white. Contains fragment of highly recrystallized Porites lutea(?).
310.4		315•4	
315.4	_	316.4	WACKESTONE: skeletal, foraminifer; well-cemented "tea- brown" calcite sparse in upper half; generally very pale orange; fine-grained; moldic and interparticle porosity;

coral and are filled with "tea-brown" micrite. Lower contact abruptly gradational. SAMPLE: T @ 371.6 (matrix or recrystallized coral).

372.4 - 387.5	WACKESTONE: (may be sparse FLOATSTONE) skeletal, coral; poorly cemented, irregularly cemented with moderately to well-cemented nodules throughout; moderately altered; at 373.4 ft, coral completely recrystallized and surrounded by 0.1 ft-thick spar-layer; very pale orange to white; very fine grained, with pebble- to cobble-size coral fragments; some moldic porosity in corals and burrows; one well-cemented, pellet MUDSTONE burrow recovered. Fragments of grayish-orange spar present. Much of unit and overlying unit above broken up during drilling. Contains sparse Acropora(?)) and Seriatopora(?)) sticks. SAMPLE: M @ 388.6 - 387.2.
387.5 - 399.6	NO RECOVERY.
399.6 - 400.2	CORAL HEAD: completely recrystallized small head, badly broken up; very pale orange to grayish orange.
400.2 - 401.2	PACKSTONE: skeletal, coral(?); poorly cemented; altered, corals largely replaced by spar and broken or preserved as molds; very pale orange, with pale-yellowish-brown spar; poorly sorted, very fine to coarse-grained. Contains sparse Seriatopora .
401.2 - 429.7	NO RECOVERY.
429.7 - 431.3	PACKSTONE: mollusc, skeletal, coral; poorly cemented, irregularly cemented; slightly altered, pelecypod shells chalky; very pale orange with minor pale yellowish brown; poorly to moderately sorted, fine- to coarse-grained; large pelecypod shells broken.
431.3 - 458.7	
458.7 - 460.2	WACKESTONE: skeletal; generally uncemented, with sparse, moderately cemented nodules; slightly altered; may contain fragmented burrows as well as broken skeletal elements; very pale orange.
460.2 - 488.9	NO RECOVERY.

488.9 - 489.9	WACKESTONE: skeletal; generally uncemented, with poorly cemented nodules; slightly alterated; very pale orange; fine- to coarse-grained, mostly fine-grained. Possible small burrow and worm tube at 489.7 ft. SAMPLE: M @ 488.9 - 489.4.
489.9 - 520.5	·
520.5 - 522.4	
522.4 - 551.8	NO RECOVERY.
551.8 - 556.3	WACKESTONE: silty, skeletal; uncemented; slightly altered; sparse pelecypod shells with nacreous luster preserved; very pale orange; well-sorted, very fine grained sand to coarse silt, coarsening slightly downward. Lower contact gradational. SAMPLE: M @ 551.8 - 552.4.
556.3 - 558.2	NO RECOVERY.
558.2 - 558.8	WACKESTONE: skeletal; uncemented; slightly altered; very pale orange; fine- to coarse-grained, scattered coarse-grained sand, moderately sorted. Lower contact gradationally.
558.8 - 559.9	PACKSTONE: foraminifer, skeletal; uncemented; slightly altered; very pale orange; moderately sorted; slightly coarser in lower part; pelecypod fragments present. Lower contact gradational.
559.9 - 561.2	NO RECOVERY.
561.2 - 562.5	PACKSTONE: skeletal, coral; uncemented, but better consolidated than units above; slightly altered, pelecypods broken; very pale orange; poorly sorted, fine- to coarse-grained. Contains common coral sticks, foraminifers. Lower contact gradational.
562.5 - 564.6	NO RECOVERY.

564.6 -	565•7	WACKESTONE: silty, skeletal; uncemented, but well- consolidated; slightly altered, some chalky small pelecypods; very pale orange; moderately sorted, very fine sand to coarse silt dominant; small, well-cemented, rounded burrows with moldic porosity common.
565.7 -	568•2	NO RECOVERY.
568.2 -	576•2	WACKESTONE TO PACKSTONE: coral, skeletal; uncemented, poorly consolidated; slightly altered; very pale orange; very fine sand to coarse silt common, poorly sorted; scattered cemented burrows, one with partly exfoliated large foraminifers at 572.1 ft has sparse moldic porosity. Contains Porites lutea at 575.5 ft. SAMPLES: M @ 575.6 - 576.2.
576.2 -	591.5	NO RECOVERY.
591.5 -	592•2	WACKESTONE: silty, skeletal; uncemented, moderately consolidated; slightly altered; very pale orange; very fine sand to coarse silt, well-sorted skeletal fragments.
592.2 -	600.9	NO RECOVERY.
600.9 -	601.9	PACKSTONE: mollusc, coral, skeletal; uncemented, poorly consolidated; unaltered, whole gastropods retain nacreous luster, relict color, pelecypods slightly chalky, broken; very pale orange to pinkish gray; gastropods pinkish-gray; fine- to coarse-grained.
601.9 -	610.5	
610.5 -	611.6	PACKSTONE: description same as for interval from 601.9 - 602.9 ft.
611.6 -	621.4	NO RECOVERY.
621.4 -		WACKESTONE: mollusc, coral; uncemented; slightly altered; pinkish-gray to very pale orange; poorly sorted, mud to fine-grained sand with coarser skeletal debris;

	aragonite layer retaining luster. SAMPLE: M @ 621.9 - 622.6.
622.6 - 632.4	NO RECOVERY.
632.4 - 633.4	FLOATSTONE: coral with matrix skeletal WACKESTONE TO PACKSTONE; uncemented; slightly altered; pinkish gray to very pale orange; fine- to medium-grained sand matrix. Contains <u>Dictyarea</u> sticks.
633.4 - 643.9	NO RECOVERY.
643.9 - 644.8	PACKSTONE: mollusc, coral; uncemented, probably poorly consolidated; very slightly altered, broken pelecypods slightly chalky with some color retention, whole gastropods excellently preserved with some color retention; pinkish gray to very pale orange; dominantly very fine grained sand.
644.8 - 654.2	NO RECOVERY.
654.2 - 655.3	WACKESTONE: skeletal, coral; uncemented; slightly altered, sparse small pelecypod fragments slightly chalky; pinkish gray to grayish orange; moderately to poorly sorted; generally fine-gained. SAMPLE: M @ 654.6 - 655.3.
655.3 - 665.2	NO RECOVERY.
665.2 - 665.7	PACKSTONE: mollusc, skeletal, coral; uncemented; very slightly altered, broken pelecypod shell retains layering, aragonitic layer preserved in gastropods; pale yellowish brown to very pale orange; fine- to coarse-grained; large pelecypod fragments.
665.7 - 674.0	NO RECOVERY.
674.0 - 675.2	PACKSTONE: coral, mollusc; uncemented and poorly consolidated; very slightly altered, aragonite layer preserved in whole gastropod at 674.7 ft; pale yellowish brown; fine- to coarse-grained, mostly fine-grained. Contains several types gastropods.

gastropods with outer layer recrystallized, but inner

675.2 -	685.2	NO RECOVERY.
685•2 -	686.6	PACKSTONE: description same as for interval from 674.0 - 675.2 ft. Contains Acropora(?) sticks. SAMPLE: M@ 686.0 - 686.6.
686.6 -	695•8	NO RECOVERY.
695.8 -	696.5	FLOATSTONE: coral; matrix skeletal PACKSTONE; uncemented; unaltered skeletal components; pale yellowish brown to moderate yellowish brown. Contains small scab-like coral, Seriatopora sticks.
696.5 -	708.1	NO RECOVERY.
708.1 -	708•4	PACKSTONE: coral, mollusc; uncemented, unconsolidated; very slightly altered; dark yellowish brown to moderate yellowish brown; fine- to coarse-grained, mostly fine-grained. Contains small colonies of Porites lutea .
708.4 -	718.6	NO RECOVERY.
718.6 -	719.2	PACKSTONE: mollusc, skeletal; uncemented unconsolidated; slightly altered, layers preserved in broken pelecypod shells; moderate yellowish brown to pale yellowish brown; fine- to coarse-grained, mostly fine-grained; molluscs mostly broken pelecypods.
719.2 -	728.1	NO RECOVERY.
728-1 -	728•4	PACKSTONE: coral, mollusc; uncemented, unconsolidated; very slightly altered, subtle orange color preserved in ornamentation on small gastropod shell; dark yellowish brown; fine- to coarse-grained, mostly fine-grained.
728.4 -	737.9	NO RECOVERY.
737.9 -	738.4	PACKSTONE: coral, mollusc; uncemented and unconsolidated; very slightly altered; dark yellowish brown to dusky yellowish brown; fine- to coarse-grained. From 737.9 - 738.4 ft, contains lignitic material.

738.4 - 738.7 Porites lutea in growth position; pale-yellowish-brown. [TOP OF SEDIMENT PACKAGE 5; hot gamma activity from 739.0 to 745.0 ft.] 738.7 - 742.6 NO RECOVERY. LIGNITE: poorly to moderately consolidated; unaltered; 742.6 - 744.3 grayish-black; fine-grained. Driller noted at least one foot of very soft material (lignite?) above beginning of recovery at 743.6 ft. SAMPLE: T @ 743.8, 744.1 (to R. Stanton coals). Basal 0.3 ft with thick PACKSTONE laminae. 744.3 - 745.6 NO RECOVERY. LIGNITIC PACKSTONE AND LIGNITE: PACKSTONE, mollusc, 745.6 - 745.7 skeletal; uncemented, unconsolidated, dark yellowish brown to dusky yellowish brown; thickly interlaminated with lignitic layers. LIGNITE: grayish-black. Lower contact gradational. PACKSTONE TO FLOATSTONE: generally mollusc, coral 745.7 - 751.4 PACKSTONE, locally grading to sparse coral FLOATSTONE; interval from 750.0 - 751.4 ft muddier; upper 0.8 ft with sparse lignite streaks; uncemented; moderately altered; molluscs with dull luster, shells retain some color; corals partly replaced with spar (Porites lutea with Lithophagus borings at 748.5 - 748.6 ft has spar rind 0.01 - 0.02 ft thick); dark yellowish brown with dusky-yellowish-brown tones; fine- to coarse-grained, poorly sorted, upper 1.6 ft muddy. Contains sparse Oliva shells in upper part, scattered other gastropods, scattered small heads of Porites lutea(?), Acropora sticks. Lower contact gradational. SAMPLES: S @ 744.1; X @ 750.9. WACKESTONE WITH FLOATSTONE: generally coral, mollusc; 751.4 - 758.3 WACKESTONE, grading to coral FLOATSTONE with WACKESTONE matrix from 752.2 - 753.4 ft; uncemented; moderately altered, some corals slightly distintegrated; pelecypods broken; dark yellowish brown with dusky-yellowish-brown tones; fine- to coarse-grained, mostly very fine grained. Contains scattered small favid corals, small coral sticks; worm tube at 755.9 ft. Lower contact gradational. SAMPLE: X @ 758.2 - 755.9.

758.3 - 759.8 NO RECOVERY.

PACKSTONE WITH FLOATSTONE: generally mollusc, coral PACKSTONE, grading locally to sparse coral FLOATSTONE; uncemented; slightly altered; upper part dark yellowish brown, grading downward below 761.0 ft to pale yellowish brown; fine- to coarse-grained, abundant medium- to coarse-grains; muddy intervals from 763.0 - 763.6 ft and 764.8 - 765.5 ft. Contains abundant whole gastropods of several types, small Favia(?) head at 766.0 ft, scattered Acropora and Seriatopora sticks, other small corals. Lower contact gradational. SAMPLE: M @ 760.4 - 761.0.

767.2 - 772.3 NO RECOVERY.

WACKESTONE TO MUDSTONE: mollusc, coral; uncemented, poorly consolidated; slightly altered to unaltered, decreasing downward with some aragonite preserved in gastropods near base; corals that formed mottles in interval from 751.4 - 759.8 ft are intact; gastropods near top slightly recrystallized; pale yellowish brown to dark yellowish brown; very fine to coarse-grained, dominantly fine- to very fine grained molluscs, mostly broken.

MUDSTONE from 776.9 - 777.5 and 789.1 - 790.1 ft; interval becomes finer-grained in basal part. Contains Polynices at 773.1 ft, scattered Porites sp. and Porites andrewsi-type and small Acropora and Seriatopora sticks from 787.1 - 789.3 ft. Lower contact gradational.

SAMPLES: M @ 785.9 - 786.6.

791.8 - 794.5 WACKESTONE: very muddy, mollusc, coral; uncemented, and poorly to moderately consolidated, slightly altered, aragonite preserved in some mollusc fragments; gradational from pale yellowish brown in upper part to pale yellowish brown to very pale orange in lower part; very fine to coarse-grained, dominantly very fine grained; pelecypod filling slightly cemented at 793.3 ft. Contains small Favia(?) in lower part. Cemented lithoclasts at 793.7 and 794.4 ft derived from cemented layer in unit below; lithoclast at 794.4 ft has sparfilled rhizoliths. Lower contact sharp.

[Minor disconformity indicated by appearance of cementation and increase in alteration of corals in unit below and presence of rhizolith(?)-bearing lithoclast in overlying unit.]

794.5 - 794.7 MUDSTONE TO WACKESTONE: sparse skeletal, coral, pellet; well-cemented; moderately altered, coral replaced by dark-yellowish-brown spar; pale yellowish brown; very

fine grained with sparse coarse grains; sparse spar-filled rhizoliths(?). Lower contact abruptly gradational.

794•7	-	798•7	MUDSTONE TO WACKESTONE: coral; uncemented, poorly to moderately consolidated; moderately altered, corals replaced by pale-yellowish-brown spar in upper part; pale yellowish brown; very fine grained matrix; pelecypods have well-cemented fillings; sparse well-cemented, pelleted(?) burrows. Lower contact abruptly gradational.
798.7	_	800.0	NO RECOVERY.
800.0	_	809.5	FLOATSTONE: coral; matrix mollusc, skeletal, WACKESTONE; uncemented, poorly consolidated; slightly altered, gastropod at 809.5 ft retains color on spines, Porites lutea somewhat crumbly; pale yellowish brown; very fine grained to coarse-grained, poorly sorted, matrix generally very fine grained. Corals predominantly small heads of Porites lutea and Porites sp.; heads of Porites sp. from 805.8 - 806.8 ft contain grayish-orange to dark-yellowish-orange stain. Lower contact sharp.
809.5	_	811.7	NO RECOVERY.
811.7		830.0	WACKESTONE TO PACKSTONE: mollusc, coral; uncemented, and poorly to moderately consolidated; slightly to moderately altered, relict color banding on gastropod at 818.8 ft; from 824.1 - 825.8 ft, medium-gray corals slightly altered; unit pale yellowish brown; matrix very fine grained. Contains sparse cobble-size corals (Acropora sticks and small Porites heads, several types of small gastropods). SAMPLES: T @ 824.1; X @ 828.9; M @ 819.4.
830.0	_	833.1	NO RECOVERY. Top of unit below spun-off during drilling; hard.
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[[Disco materia		rmity sug	gested by increase in cementation and alteration of skeletal
833.1	-	835.1	WACKESTONE: sparse, skeletal; upper 0.2 ft well-cemented, remainder of unit poorly cemented to uncemented but containing well-cemented burrows(?); well consolidated; moderately to slightly altered, sparse corals heavily spar-replaced; pale yellowish brown; yery fine grained

spar-replaced; pale yellowish brown; very fine grained

sand to coarse silt, moderately well-sorted; abundant well-cemented skeletal, pellet WACKESTONE-filled burrows, containing more skeletal debris than matrix. Lower contact probably gradational. SAMPLE: X @ 834.8.

- FLOATSTONE: coral; matrix, skeletal, mollusc PACKSTONE; uncemented, well-consolidated; slightly altered,

 Acropora sticks have thin sparite rinds, small gastropod retains aragonitic layer; pale yellowish brown; biomodal, cobble- to pebble-size corals, matrix fine- to very fine grained; contains scattered sparse well-cemented burrows; burrows at 836.7 ft filled with pellet WACKESTONE. Contains Acropora sp. A sticks and scattered small Porites heads. Lower contact gradational. SAMPLE: M @ 836.9 837.6.
- 838.9 845.9 PACKSTONE: mollusc, skeletal; uncemented, wellconsolidated; unaltered, aragonitic layer preserved in

consolidated; unaltered, aragonitic layer preserved in molluscs, medium-light-gray to light-gray <u>Cardium</u> shells in interval from 842.8 - 843.8 ft; pale yellowish brown; very large (some larger than 0.25 ft) gastropods and pelecypods preserved among numerous smaller forms; fine-to very fine-grained matrix; sparse burrows, one at 845.1 ft filled with tight skeletal, pellet WACKESTONE; scattered well-cemented infillings of gastropods and pelecypods near base of unit. Contains large <u>Strombus</u> at 840.3, 841.7, 842.6, and 844.4 - 844.8 ft, several types of medium-sized gastropods and numerous small forms; including small <u>Cypraea</u> at base; large pelecypod at base, small forms scattered throughout; corals very sparse, generally <u>Acropora</u> sp. A sticks. Lower contact gradational.

845.9 - 847.2 PACKSTONE: skeletal; uncemented; unaltered; pale yellowish brown; resembles interval from 838.9 - 845.9 ft, generally very fine grained. Unit contains small molluscs. Lower contact gradational.

847.2 - 852.9 PACKSTONE TO FLOATSTONE: coral, mollusc PACKSTONE with

PACKSTONE TO FLOATSTONE: coral, mollusc PACKSTONE with alternating sparse coral FLOATSTONE; uncemented, moderately to well-consolidated; moderately altered, common disintegrated Porites lutea, pelecypod at 851.6 ft retains indication of color; pale yellowish brown; fine- to very fine grained matrix with large coral heads. Intervals from 848.2 - 848.9 and 850.3 - 851.6 ft sparse FLOATSTONE with overturned Porites lutea. Contains several types of large, thin-shelled pelecypods, small gastropods. Lower contact gradational.

852.9 - 857.9 FLOATSTONE: coral; matrix muddy, skeletal, mollusc PACKSTONE; uncemented and moderately well consolidated; slight to moderate alteration, Porites lutea intact; pale yellowish brown; fine- to medium-grained with moderate-sized coral heads; one cemented burrow at 853.3 ft, filled with medium-grained PACKSTONE with dark-yellowish-brown cement. Lower contact gradational.

PACKSTONE WITH FLOATSTONE: generally skeletal, mollusc PACKSTONE; uncemented, well-consolidated; slightly altered, pelecypods and corals apparently slightly recrystallized; pale yellowish brown; fine- to coarse-grained matrix, mostly fine-grained, poorly sorted. FLOATSTONE interval from 860.9 - 863.7 ft. Coral with borings at 857.0 ft, and large pelecypods present from 858.1 - 858.8 ft. SAMPLES: M @ 861.0 - 862.0. Lower contact sharp.

[Discontinuity indicated by increase in alteration of skeletal components just below surface and increase in cementation shortly below same.]

864.5 - 865.5 CORAL HEAD: coral; uncemented and well-consolidated; altered, in uppermost 1.2 ft, centers of corals completely replaced by spar; very pale orange; intertwining digitate Porites sp. in upper 1.2 ft; lower part massive (same coral); no observable matrix; outer rinds of corals in upper part altered to resemble sand.

FLOATSTONE: coral; matrix skeletal WACKESTONE; uncemented to poorly cemented(?), well-consolidated; altered, centers of coral fragments replaced by spar; very pale orange to pale yellowish brown; bimodal, generally silt and very fine grained sand and pebble-size coral fragments; moldic and sparse vuggy porosity in coral fragments. Contains small disintegrating Favia(?) head at base. Lower contact gradational.

WACKESTONE TO MUDSTONE: skeletal WACKESTONE from top to 869.4 ft, grading to skeletal MUDSTONE at base; uncemented, moderately well-consolidated, containing 30 - 40% small, well-cemented nodules throughout; altered; pinkish-gray; silt and very fine grained sand predominates; molluscs preserved as molds. Lower contact sharp.

[TOP OF SEDIMENTARY PACKAGE 6. Disconformity indicated by marked increase in cementation, nature of contact and change of facies.]

869.9 - 873.2 PACKSTONE: skeletal, foraminifer; well-cemented in upper part, becoming moderately cemented below 872.6 ft;

altered, corals near base recrystallized with partially dissolved centers and spar-replaced exteriors; common spar rinds; pinkish gray; light-yellowish-brown spar common in upper part, scattered through rest of interval; medium- to coarse-grained; small-scale moldic porosity common; upper 0.4 ft, well-cemented with spar; next 0.9 ft below recovered as rubble, possibly because of large-scale vuggy porosity; next 1.2 ft below (missing 0.5 ft) well-cemented PACKSTONE with recrystallized corals; basal 0.6 ft less well-cemented, sandy rubble. Contains Lepidocyclina. Lower contact sharp. SAMPLES: S @ 870.9 - 871.3; T @ 870.9; X @ 870.9.

873.2 - 874.8

MUDSTONE: indistinctly laminated; uncemented, moderately well consolidated; generally very pale orange to pale yellowish brown but with thin, weak laminae of pale yellowish brown at 873.4 and 874.3 ft; middle part from 873.4 - 874.3 ft pale yellowish brown to pinkish-gray; well-sorted silt to very fine grained sand. Laminae horizontal. Lower contact abruptly gradational.

874.8 - 877.4

WACKESTONE: skeletal, uncemented, with abundant small moderately cemented nodules, well-consolidated; altered, molluscs preserved as molds; very pale orange; dominantly silt to fine-grained sand; sparse pebble-sized coral fragments.

[Disconformity indicated by marked change in cementation.]

877.4 - 878.3

WACKESTONE TO PACKSTONE: skeletal, mollusc; moderately cemented in upper 0.1 ft, becoming poorly cemented, irregularly cemented downward; patchy granular cementation; highly altered; very pale orange; common moldic, some interparticle porosity in cemented portions. Lower contact abruptly gradational; marked by wavy banded color change oriented at 15 to 20 degrees to horizontal.

878.3 - 879.1

MUDSTONE: indistinctly laminated; uncemented except for single well-cemented, pebble-sized nodule; altered material; very pale orange except for indistinct, curving pale-yellowish-brown laminae alternating with very pale orange laminae in upper 0.2 ft. Lower contact gradational.

879.1 - 884.8

PACKSTONE: foraminifer, skeletal; generally poorly cemented with irregular areas moderately cemented; well-cemented from 881.4 - 881.7 ft; unit appears rubbly like

interval from 877.5 to 878.3 ft; moderately altered skeletal grains; very pale orange; fine- to coarse-grained, muddy matrix; abundant moldic and interparticle porosity. Spar-replaced <u>Porites</u> at 883.9 ft. SAMPLE: M @ 880.0 - 880.3. Lower contact abruptly gradational.

884.8 - 886.8 WACKESTONE: foraminifer, skeletal; uncemented, moderately well consolidated; probably altered; very pale orange; very fine to coarse-grained. Lower contact gradational.

886.8 - 888.2 MUDSTONE: foraminifer, skeletal; uncemented, well consolidated; altered, sparse gastropods moldic; mostly disintegrated; pale yellowish brown, poorly cemented burrows at 888.0 ft; very pale orange to white. Lower contact gradational.

888.2 - 889.2 WACKESTONE: coral, skeletal; uncemented, poorly to moderately consolidated; altered, corals completely micritized; very pale orange; bimodal, matrix mud and fine-grained sand, coral fragments pebble-sized. Lower contact sharp.

[Disconformity indicated by marked increase in cementation and appearance of "tea-brown" micrite below surface and by change in facies.]

GRAINSTONE TO PACKSTONE: skeletal, foraminifer, algalcoated grains(?); well-cemented, spar-cement in upper
0.3 ft and lower 0.2 ft, sparse "tea-brown" cement in
lower 0.2 ft; altered, corals poorly preserved, mostly
recrystallized and partially disintegrated; pale
yellowish brown to very pale orange; medium- to coarsegrained; tight in upper 0.5 ft; vuggy porosity common;
some gastropod molds filled with spar; irregular leached
crust on fragments near top of unit; less well-sorted
and coarse-grained toward base; corals near base in
lower spar zone. Lower contact abruptly gradational,
welded. SAMPLES: S @ 889.7 - 890.2 (includes lower
unit); X @ 889.7.

PACKSTONE: coral, coralgal, foraminifer; well- to poorly cemented; moderately altered, corals recrystallized, gastropods preserved commonly as molds; very pale orange, slightly darker in well-cemented intervals; fine- to coarse-grained, poorly sorted; common moldic porosity; from 889.9 - 892.5 ft, moderately well cemented, broken into large fragments; from 892.5 - 893.2 ft, poorly to moderately cemented, broken into sand-size and cobble-size fragments; from 893.2 - 893.9 ft, well-cemented and broken into large fragments; from

893.9 - 894.7 ft, well-cemented; from 894.7 - 895.2 ft, poorly to moderately cemented; spar cement throughout; "tea-brown" cement sparse throughout unit; large pelecypods replaced by spar at very top of unit. Lower contact abruptly gradational. SAMPLES: S @ 889.7 - 890.2 (includes part of upper unit), 894.0 - 894.5; X @ 894.0.

895.2 - 899.9

PACKSTONE: skeletal, coralgal, foraminifer; poorly to moderately cemented, moderately consolidated; strongly altered, much skeletal material reduced to molds, particularly small gastropods, other skeletal elements completely recrystallized, difficult to discern primary fabric; very pale orange to grayish orange; appears poorly sorted and fine- to very coarse grained, granular; from 899.3 - 899.9 ft, moderately well cemented with fabric preserved, coralgal PACKSTONE. Note: similar to overlying unit except less-cemented, containing more foraminifers and microgastropods and fewer corals. Lower contact abruptly gradational.

899.9 - 901.0

PACKSTONE: skeletal, algal(?)-coated-grain; moderately well-cemented in upper 0.1 ft of interval; remainder of unit probably PACKSTONE as in upper 0.1 ft, uncemented, moderately well consolidated; altered, sparse corals largely spar-replaced; very pale orange; fine- to coarse-grained; moldic porosity in upper part, one mold lined with spar. Lower contact gradational.

901.0 - 902.1

FLOATSTONE: coral; matrix skeletal WACKESTONE: skeletal; poorly cemented to moderately cemented, irregularly cemented, moderately consolidated; altered, corals recrystallized, and partially spar-replaced; very pale orange with some pale-yellowish-brown spar in corals. Lower contact gradational.

902.1 - 904.9

MUDSTONE: skeletal; generally poorly cemented with small well-cemented nodules or burrows(?); altered, corals completely recrystallized or moldic, one replaced with spar; very pale orange to white, lighter toward base; mostly very fine grained, silty; muddier in lower half. Lower contact sharp, faint color bands at angle to contact suggest low-angle cross bedding.

904.9 - 905.1

CRYPTOCRYSTALLINE LIMESTONE: rough-shaped object of paleyellowish-brown cryptocrystalline carbonate; upper layer 0.01 ft thick, darker than lower part; basal 0.3 ft lighter colored, consisting of skeletal grains; three small clear calcite-filled, en-echelon cracks in upper part; sharp, irregular contact with uncemented material below. (Probably a well cemented mud-infilling of a void or burrow.)

905.1 - 909.5 WACKESTONE: sparse skeletal, coral; generally uncemented and moderately well consolidated to moderately consolidated; skeletal components strongly altered; mottled white and very pale orange to white; rock generally seems to be uncemented MUDSTONE with cemented

burrows or nodules; burrows(?) with pelecypod molds at 908.7 ft. Lower contact apparently sharp.

[Disconformity indicated by increase in cementation and different rock type.]

909.5 - 913.9 FLOATSTONE: coral, coralgal; matrix skeletal WACKESTONE
AND PACKSTONE; well-cemented; highly altered, corals
partially recrystallized, partially dissolved, partially
spar-replaced, commonly form partial molds, generally
covered with coralgae; very pale orange. WACKESTONE AND
PACKSTONE: skeletal; well-cemented; altered, molluscs
replaced by spar or forming molds; fine- to coarsegrained, mostly medium-grained; common moldic porosity,
some small vugs; scattered grayish-orange, drusy spar
lining molds and vugs; degree of alteration of precludes
differentiation of lithic types. Lower contact probably

913.9 - 915.2 NO RECOVERY.

915.2 - 915.8 PACKSTONE: skeletal; poorly cemented, poorly consolidated; altered, molluscs form molds; very pale orange; fine- to coarse-grained, mostly medium-grained; moderately cemented burrow filled with material like matrix with abundant mollusc molds. Lower contact apparently sharp.

[Discontinuity indicated by increase in cementation and appearance of "tea-brown" micrite in lower unit.]

sharp. SAMPLE: T@ 910.5.

PACKSTONE AND GRAINSTONE: skeletal, foraminifer, coral, with algal-coated-grains; generally well-cemented; altered, skeletal components commonly recrystallized, partly dissolved; very pale orange, mottled with very pale orange to pale yellowish brown; mostly medium-grained; moldic and sparse vuggy porosity; "tea-brown" micrite sparse, concentrated in intervals from 916.7 - 916.9 and 918.7 - 918.9 ft; sparse spar cement. Lighter-colored areas may contain more mud. Contains sparse Lepidocyclina. Lower contact abruptly gradational. SAMPLES: S @ 917.5 - 918.1; X @ 917.5.

[Disconformity indicated by marked increase in cementation and presence of "tea-brown" micrite below, apparent karsted surface with infiltration of material from overlying unit into former voids in underlying unit.]

932.8 - 933.5 PACKSTONE: coral, skeletal; moderately to well-cemented with "tea-brown" micrite and spar cement; moderately altered, corals recrystallized, spar-replaced, molluscs preserved as molds; pale yellowish brown; fine- to coarse-grained, dominantly medium-grained; moldic porosity; "tea-brown" cement scattered throughout. Partly preserved laminated crust at top of unit, mostly not recovered. Lower contact gradational.

933.5 - 934.1 PACKSTONE AND WACKESTONE: PACKSTONE (about 50 percent of unit) like overlying unit; well-cemented, containing moderate-yellowish-brown ("tea-brown") micrite.

WACKESTONE, like unit from 919.9 ft - 932.8 ft; uncemented, apparently filling voids in karsted unit, very pale orange to white.

934.1 - 934.6 FLOATSTONE: coral, with skeletal WACKESTONE TO MUDSTONE matrix; well-cemented; corals preserved as molds; very pale orange mottled with pale yellowish brown to very pale orange. Contains large Acropora sticks. Badly broken by drilling. [Note: like unit from 935.1 - 939.0 ft.]

934.6 - 935.1 WACKESTONE: skeletal; uncemented; very pale orange to white. Like unit from 919.9 - 938.2 ft and uncemented material in unit from 934.1 - 934.6 ft; may represent void fill.

935.1 - 939.0 FLOATSTONE: coral, with skeletal WACKESTONE TO MUDSTONE matrix; generally well-cemented to moderately cemented; corals preserved exclusively as partial to complete large molds; very pale orange, mottled with very pale orange to pale yellowish brown. Recovery poor. Corals predominantly large Acropora sticks; small mollusc molds moderately common.

939.0 - 944.5 NO RECOVERY.

944.5 - 951.8

WACKESTONE TO MUDSTONE: generally, uncemented to poorly cemented, with scattered well-cemented nodules; some may be burrows; altered, mollusc molds; very pale orange to white; fine-grained silt to very fine grained sand. Burrows are WACKESTONE: pellet, mollusc; well-cemented; same color as matrix except for a few that have moderate-yellowish-brown, spar-cemented interiors; molluscs preserved as molds near margins of burrows; burrows more common near top of interval; at 949.1 ft, scattered foraminifers in large burrow. Lower contact imperceptably gradational.

951.8 - 955.9

WACKESTONE TO MUDSTONE: unit similar to interval generally cemented but with 30% well-cemented nodules; very pale orange mottled with pale yellowish brown to very pale orange. Nodule at top of unit has some "tea-brown" cement.

955.9 - 970.8

WACKESTONE WITH PACKSTONE: pellet, mollusc; WACKESTONE in upper part, becoming interbedded with WACKESTONE TO PACKSTONE below 963.2 ft. Cementation irregular. generally increasing downward, varies as follows: top to 956.6 ft, poorly cemented with 50% well-cemented nodules; from 956.6-962.8, unit 50% well-cemented, 50% moderately cemented; from 962.8 ft-base, wellcemented. Skeletal components altered, corals forming molds with ghosts in upper part, completely replaced with spar in lower part; molluscs are molds, spar-filled molds, and spar-replaced steinkerns throughout; mottled very pale orange and pale yellowish brown to very pale orange throughout with better-cemented areas darker; fine- to coarse-grained; mostly fine- to medium-grained; moldic porosity throughout, with some small vugs in middle or unit; apparently burrowed throughout. Above 963.2 ft, spar-filled mollusc molds confined to burrows; "tea-brown" calcite scattered throughout, and concentrated in PACKSTONE burrows below 963.2 ft. From 955.9 - 960.3 ft, coral molds and vugs common; from 960.3 - 962.5 ft, sparse corals; from 962.5 - 970.8 ft, common molluscs. WACKESTONE AND PACKSTONE-filled burrows common: fine-grained pellet, skeletal, paleyellowish-brown WACKESTONE burrows present throughout interval, but especially abundant from 955.9 - 963.2 ft; fine-grained burrows mixed with largely medium-grained, skeletal, mollusc PACKSTONE-filled burrows with common "tea-brown" calcite and pale-yellowish-brown spar cement from 963.2 ft to base of unit. From 963.4 - 970.8 ft,

corals sparse, filled and replaced with spar. At 965.8 ft, spar-filled coral extends across core. At 967.0 ft, large branching PACKSTONE-filled burrow present. Contains several types of corals, including Acropora sticks, several types of small gastropods and pelecypods, sparse Lepidocyclina. Lower contact abruptly gradational. SAMPLES: S @ 961.3 - 961.6, 967.0 - 967.4, 968.4 - 968.7; X @ 961.3, 967.0, 968.4.

970.8 - 980.5

WACKESTONE: skeletal, foraminifer, mollusc; generally moderately to poorly cemented, irregularly cemented, gradational from top to base; altered, spar-filled mollusc molds common; very pale orange to white, irregularly mottled with very pale orange to pale yellowish brown; fine- to coarse-grained, mostly very fine grained; moldic porosity; burrowed, burrows filled with well-cemented, mollusc foraminifer, pale-yellowishbrown PACKSTONE; spar makes burrows darker than matrix. Cementation as follows: from top to 971.9 ft, moderately to poorly cemented; irregularly cemented; from 971.9 - 973.5 ft, poorly cemented with small, sparse, moderately cemented nodules; from 973.5 - 975.0 ft, moderately cmeneted (50%) and poorly cemented; 975.0 ft to base, poorly cemented to uncemented with small, sparse, well-cemented nodules. Lower contact sharp, undulatory with 0.25 ft on relief on surface.

[TOP OF SEDIMENT PACKAGE 7. Disconformity indicated by nature of contact, marked increase in cementation, presence of rhizoliths, and micrite crust.]

980.5 - 983.4

WACKESTONE TO PACKSTONE: tight, mollusc WACKESTONE in upper and lower parts, becoming skeletal, formanifer PACKSTONE in middle; well-cemented; altered, molluscs, corals form molds, one mold spar-replaced; very pale orange to light yellowish brown; fine- to coarsegrained, moderately well sorted to poorly sorted; moldic and sparse vuggy porosity; vugs less abundant toward base; at 980.7 ft, vermiculate worm tubes; at 981.8 ft, rhizoliths in burrow; from 982.1 - 982.4 ft, and 983.1 -983.3 ft, "tea-brown" micrite lining rhizoliths and two crusts (at 983.1 ft and 983.3 ft) that bound tight pellet, faintly laminated WACKESTONE containing rhizoliths; from 983.3 - 983.4 ft, medium- to coarsegrained PACKSTONE. Contains abundant Lepidocyclina locally. Lower contact abruptly gradational. S @ 980.3 - 980.9(?), 982.8 - 983.3; M @ 980.9 - 981.5;X @ 980.5, 983.8.

983.4 - 985.3 PACKSTONE: foraminifer, skeletal; uncemented, except upper
0.3 ft moderately cemented, moderately well
consolidated, containing scattered "tea-brown" micrite;

altered, gastropods preserved as molds and steinkerns, corals poorly preserved; grayish orange to very pale orange at base; fine- to coarse-grained, mostly medium-to coarse-grained; moderately well sorted. From 983.9 - 984.2 ft, contains abundant larger Lepidocyclina; scattered cemented PACKSTONE TO GRAINSTONE burrows. Lower contact sharp, irregular, with 0.15 ft of relief on surface.

[Discontinuity indicated by marked change in rock type, laminiated crust(?) at top of underlying sequence, and nature of contact.]

985.3 - 985.6 CRUST: irregular laminae; microrhizoliths with some "teabrown" micrite linings; formed in tight pellet, well-cemented WACKESTONE, very pale orange to pale yellowish brown with pale-yellowish-brown rhizoliths; matrix difficult to distinguish. Lower contact grades abruptly. SAMPLES: S @ 985.3 - 985.6; X @ 985.3.

985.6 - 997.0 MUDSTONE AND WACKESTONE: upper 1.5 ft skeletal,
foraminifer WACKESTONE grading downward to skeletal,
foraminifer MUDSTONE; generally uncemented, moderately
well consolidated, with scattered "tea-brown" micrite in
rootlets(?); white to very pale orange; well-sorted,
fine-grained sand to silt, mostly silt; thin, elongate,
vertical tubular cemented burrows(?) or root tracks(?)
scattered throughout with common pale-yellowish-brown
("tea-brown") calcite centers in burrows; abundant,
well-cemented, white burrows or nodules in basal 0.8
ft. Lower contact gradational. SAMPLES: S @ 991.2 -

991.6; X @ 991.2.

977.0 - 997.9 WACKESTONE: skeletal; uncemented to poorly cemented with abundant well-cemented nodules, unconsolidated; altered; white to very pale orange; silt- to medium-grained, generally very fine grained, cemented nodules of same color and fabric common. Lower contact sharp, undulatory with 0.1 ft of relief on surface.

[Disconformity indicated by nature of contact, marked change in cementation and appearance of molds, vugs, and small caverns below.]

997.9 - 1004.0 PACKSTONE TO WACKESTONE: foraminifer, skeletal; very well cemented, pervasively cemented; altered, mollusc molds, some spar-filled, sparse corals micritized, partially dissolved and locally spar-filled; very pale orange to dark-yellowish-brown (mostly spar), hazy varicolored mottled areas with indistinct borders; fine- to coarse-grained, mostly medium- to coarse-grained; poorly sorted; moldic, solution-enlarged moldic, vuggy, and cavernous porosity; poorly developed, spongy crust forms

upper 0.3 ft; possible rhizolith lined with "tea-brown" micrite at 1000.7 ft; scattered mollusc molds. At least four cements evident: (1) "tea-brown" micrite; (2) spar in matrix; (3) "dog-tooth" spar lining common in mollusc molds; and (4) laminated, grayish-yellow, botryoidal cement in caverns. Thin veneer of vadose silt in larger vugs and molds. Contains abundant Lepidocyclina. Lower contact gradational. SAMPLE: S@ 1003.0 - 1004.0; X@ 999.2, 1003.0; M@ 999.2 - 999.5, 1003.0 - 1004.0.

1004.0 - 1009.3 PACKSTONE: foraminifer, skeletal; poorly to moderately cemented, irregularly cemented with spongy texture in upper 0.9 ft; altered, Lepidocyclina replaced by spar, scattered mollusc molds, corals recrystallized and spar-replaced; very pale orange to pale yellowish brown, mottled with moderate yellowish brown; very fine to coarse-grained, mostly medium- to coarse-grained; moderately sorted near top, becoming poorly sorted near base; mud common in basal 2.0 ft; numerous well-cemented nodules with concentrated "tea-brown" micrite. Contains

abundant Lepidocyclina. Lower contact sharp.

PACKSTONE TO FLOATSTONE: upper 2.0 ft coral coralgal

cement concentrated in irregular blotches throughout remainder of unit. Corals and (Acropora sticks)

coralgae concentrated in upper 2.0 ft. Large molluscs scatterd throughout. Foraminifers less abundant and possible burrows present from 1017.2 - 1018.7 ft. Large

[Discontinuity indicated by marked increase in cementation and nature of contact.]

1009.3 - 1018.7

FLOATSTONE with foraminifer, skeletal PACKSTONE matrix, grading downward to foraminifer, skeletal PACKSTONE; well-cemented; altered, Lepidocyclina (foraminifers) replaced by spar, molluscs molds, corals recrystallized and partially replaced by spar, but recognizable as discrete clasts; very pale orange to dark yellowish brown, speckled with pale-yellowish-brown foraminifers; from top to 1011.4 ft; very pale orange to moderate yellowish brown speckled with pale-yellowish-brown Lepidocyclina from 1011.4 - 1017.7 ft; very pale orange mottled with pale yellowish brown to moderate yellowish brown with sparse pale-yellowish-brown Lepidocyclina from 1017.7 ft to base; fine- to coarse-grained, mostly coarse-grained; moderately to poorly sorted; porosity moldic, vuggy, and small cavernous porosity. At least five kinds of cements: (1) "tea-brown"; (2) spar; (3) botryoidal; (4) drusy; and (5) "dog-tooth" spar; "teabrown" cement concentrated in upper 2.0 ft particularly in upper 0.1 ft with faint laminated crust; "tea-brown"

botryoidal-lined small cavern present from 1017.2 - 1017.9 ft. Lower contact gradational. SAMPLES: S@ 1011.0 - 1011.4, 1017.4 - 1017.9; X@ 1011.0, 1017.4; M@ 1017.9 - 1018.4.

1018.7 - 1029.3PACKSTONE: skeletal, foraminifer; pervasively wellcemented; altered, mollusc steinkerns and molds, corals with spar-replaced centers and exterior voids; very pale orange with pale-yellowish-brown, and minor darkyellowish-brown mottled areas; fine- to coarse-grained, mostly fine-grained that appear to be recrystallized (fabric resembles that of algal-coated PACKSTONE); remaining medium- to coarse-grains include foraminifers, large molluscs, and scattered thin finger corals; moldic, vuggy, fissure and small-scale cavernous, porosity, small caverns and vugs commonly filled with vadose silt and spar (drusy and "dog-tooth") and lined or filled with botryoidal cement; common burrows, many vertical, concentrate larger foraminifers, spar, and sparse "tea-brown" cement; unit distinguished by common fractures; vertical fractures (fissures) partly lined or filled with spar and botryoidal cement; intervals with inclined fractures appear in core as rubble, are less

fractures were <u>not</u> reactived by KOA but were partly rebroken by drilling. Lower contact gradational. SAMPLES: S @ 1022.8 - 1023.2; X @ 1022.4, 1022.8.

cemented and possibly leached. Note: unit differs from overlying rock (1909.3 - 1018.7 ft) only in having far fewer <u>Lepidocyclina</u>. Intervals with numerous fractures are from 1021.8 - 1022.3, 1024.8 - 1026.2, 1027.3 - 1027.6, and 1028.0 - 1028.3 ft. Note: rehealed

1029.3 - 1031.9

PACKSTONE: muddy, skeletal; poorly cemented with irregular patches moderately well cemented; altered, mollusc molds and steinkerns; very pale orange; fine- to coarse-grained, mostly fine-grained; moldic porosity; scattered grains in matrix leached; one patch of pale-yellowish-brown spar cement in upper part; scattered molluscs and foraminifers; most grains recrystallized with description similar to that for interval from 1018.7 - 1029.3 ft above. Lower contact probably gradational.

1031.9 - 1038.2

PACKSTONE: skeletal, mollusc; moderately cemented to moderately well cemented; altered, mollusc molds and steinkerns; some steinkerns replaced with pale-yellowish-brown spar; very pale orange; fine- to coarse-grained, mostly fine indistinct grains similar to those in units above; scattered small and large foraminifers; a few coral molds with spar-replaced centers preserved; moldic and vuggy porosity; minor spar infilling of molds, and possible fine hairlike crystalline linings;

one vug with "dog-tooth" spar. From 1031.9 - 1033.7 ft, well-cemented with slight decrease downward; remainder of interval moderately cemented wth decrease downward to punky and rubbly textures. Lower contact sharp, disconformable.

[TOP OF SEDIMENT PACKAGE 8. Disconformity suggested by increase in cementation and change in rock type.]

- 1038.2 1040.9FRAMESTONE: coralgal, coral; well-cemented, pervasively cemented; altered, corals commonly indistinct, recrystallized, spar-replaced, molluscs molds and steinkerns; varicolored, mottled with very pale orange and dark yellowish brown; fine- to very coarse grained; matrix fine- to medium-grained, probable foraminifer PACKSTONE; moldic, vuggy, and small-scale cavernous porosity; cement makes up a visibly large proportion of rock. Several episodes of vadose-silt fill and cementation evident. Cement commonly botryoidal; fine hairlike crystalline linings also present, and at least one secondary pore formed within the cement. botryoidal cement unlaminated except for outermost Contains scattered Lepidocyclina. Lower contact gradational. SAMPLES: S @ 1039.1 - 1039.5, 1040.2 -1040.6; X @ 1039.1, 1040.2.
- 1040.9 1043.2 FRAMESTONE(?): unit similar to above with partially leached and recrystallized foraminifers and corals preserved; heavily leached rock punky, porous, disintegrates readily. From 1041.0 1041.3 ft, core intact and better-preserved; remainder recovered as rubble.
- ______
- 1043.2 1045.3 PACKSTONE: skeletal, mollusc; probably similar to interval from 1031.2 1038.2 ft; moderately to poorly cemented irregularly cemented; highly leached with punky, porous appearance; mollusc molds common, many grains molds; very pale orange; at least one spar-replaced coral.

1045.3 - 1045.9 NO RECOVERY.

*** TOTAL DEPTH OF HOLE 1045.9 FT ***

BOREHOLE KCT-5

Lat/Long (E/W-1960): 11°40′11.7" N, 162°11′58.5" E

Lat/Long (WGS-1972): 11°40′11.6" N, 162°11′58.5" E

Location (IVY-grid, ft): 148,815 N and 071,087 E

Distance/Bearing from KOA GZ: 645 ft, 176.5 deg

Water Depth (H&N): 98.9 ft Hole Depth (bsf): 306.6 ft

Hole Spudded: 04/01/1985 Drilling Ended: 04/04/1985

Sampling: SS, SH Recovery: 44% (135.0 ft)

Logs: MCS, GR/DN/CP, GR/NT, CSV Date Logged: 04/04-05/1985

Casing: 8-5/8-in. @ 35 ft; 7-5/8-in @ 85 ft* Deviation: 0.9 deg @ 292 ft.

Drilling Mud/Additives: BVS (34 sx), POP (124 sxs), SEP (196 sx)

Geologists: B.R. Wardlaw, B.A. Skipp Drillers: G. Mooney, C. Peltier

Paleontologist: R. Margerum, E.E. Compton Logger: M. Beals

* All casing recovered.

Redescribed: 10/20/1985

Depth	Description
0.0 - 7.3	PACKSTONE to GRAINSTONE: PACKSTONE (from 0.0 - 1.0 ft): broken skeletal, skeletal; uncemented; unaltered; very pale orange; generally fine- to medium-grained, with sparse coarse-grains; mostly foraminifers, corals, and Halimeda. PACKSTONE (from 3.0 - 4.3 ft): as above; fine- to coarse-grained; identifiable fossil fragments more common. GRAINSTONE (from 6.7 - 7.3 ft): as above; fine- to very coarse grained; whole Halimeda plates preserved; identifiable fossil grains more abundant than obscure grains; skeletal preservation mixed containing some chalky grains, others fresh; contains moderate-red (5R5/4) Homotrema. Sequence of three samples appears to represent a graded bed.

7.3 - 9.0 NO RECOVERY.

9.0 - 16.0	PACKSTONE: from 9.0 - 10.3 ft, broken(?) skeletal, skeletal; uncemented; mixed skeletal alteration, generally unaltered; very pale orange to white; fine- to very coarse grained, mostly coarse-grained; moderately well-sorted; scattered whole Halimeda grains, but most broken, coral fragments, foraminifers, microgastropods, broken molluscs, and other skeletal elements. From 12.0 - 13.1 ft, PACKSTONE: as above, fine- to coarse-grained, mostly coarse-grained; contains slightly less mud than interval from 9.0 - 10.3 ft. From 15.0 - 16.0 ft, tight PACKSTONE: fine- to very coarse grained. Sequence of three samples appears to represent a graded bed.
16.0 - 18.1	
18.1 - 18.7	PACKSTONE: skeletal; uncemented; mixed skeletal alteration; very pale orange; fine- to coarse-grained, mostly medium- to coarse-grained; skeletal grains similar to units above, including fragments of moderate-red (5R5/4) octocoral and moderate-red (5R5/4) Homotrema.
18.7 - 21.1	NO RECOVERY.
21.1 - 27.8	FLOATSTONE: rubble, coral; matrix sparse skeletal PACKSTONE, unsorted; uncemented; mixed alteration, containing whole unaltered Halimeda plates and red coral, lithoclasts of possible "tea-brown" micrite crust, corals with partially micritized and spar- replaced centers, one coral at 23.5 ft preserved as spar-lined molds; containing very pale orange to white with minor pale-yellowish-brown; containing fine-grained to cobble-sized clasts. Consists of several runs with finer matrix apparently washed out. SAMPLE: I @ 21.5; R @ 21.4.
27.8 - 29.5	NO RECOVERY.
29.5 - 37.2	FLOATSTONE: rubble, coral; matrix skeletal PACKSTONE; poorly sorted; uncemented; mixed alteration, containing unaltered corals at 32.4 - 32.5 ft, micritized coral at 37.1 - 37.2 ft, lithoclast fragments of soil horizon with "tea-brown" cement at 34.1 - 34.2 ft; most skeletal grains broken and splintered, but distinguishable; very

pale orange with minor pale yellowish brown; very fine grained sand- to cobble-sized clasts; containing slightly more mud than interval above. Lower contact probably gradational.

~			
37•2	_	38.9	NO RECOVERY.
38.9	_	43.4	FLOATSTONE: rubble, coral; matrix tight skeletal PACKSTONE; unsorted; uncemented; fragments slightly altered, containing chalky <u>Halimeda</u> grains and gastropod fragments, brachiopod at 39.8 ft, corals partially recrystallized; most skeletal grains broken or splintered, but distinguishable; very pale orange; containing very fine grained— to cobble—sized fragments; abundant broken <u>Halimeda</u> plates and broken corals. Lower contact gradational. SAMPLES: I @ 38.9; R @ 40.4.
43.4		45.2	NO RECOVERY.
45•2	-	49.9	FLOATSTONE: tight skeletal, coral; matrix skeletal PACKSTONE; uncemented; slightly altered, sparse broken chalky <u>Halimeda</u> plates, recrystallized coral fragments; very pale orange; poorly sorted; most skeletal grains broken but distinguishable. SAMPLES: M @ 45.2 - 45.7; I @ 45.7.
49.9		51.4	NO RECOVERY.
51.4	-	52.7	
52.7		54.5	NO RECOVERY.

54.5. - 55.6 CORAL HEAD: shattered Astreopora(?) head; moderately altered, mostly spar-replaced; very pale orange; angular fine-grained to cobble-sized fragments. SAMPLE: I @ 55.0. 55.6 - 56.1 WACKESTONE: rubble, skeletal; uncemented; white to very pale orange; one lithic clast with spar-linings of molds and vugs at 55.6 - 55.7 ft; muddy interval. Lower contact gradational. SAMPLE: R @ 56.0. 56.1 - 57.2 NO RECOVERY. FLOATSTONE: rubble, coral with PACKSTONE matrix; 57.2 - 94.2 uncemented; moderately altered to strongly altered, corals micritized, some partially replaced by spar, chalky Halimeda plates, and spar-replaced, echinoid spines recrystallized but with some color retained, whole pelecypod at 78.4 ft, with small microfractures on underside; Porites sp. at 81.7 ft; Astropora(?) at 84.0 ft; Platygyra(?) fragments scattered from 89.1 - 95.8 ft, white to very pale orange; very fine grained sand to cobble-sized fragments; common coral rubble; micritized, corals partially micritized. Lower contact probably gradational. SAMPLES: I @ 69.3, 82.0; R @ 60.7, 75.1, 90.0. 94.2 - 95.8 NO RECOVERY. PACKSTONE: skeletal, coral; poorly cemented; moderately 95.8 - 96.7 altered, chalky Halimeda plates common, Fungia recrystallized with thin, exterior spar layer, Porites lutea recrystallized with some spar replacement broken into thin wafers; very pale orange; moderately wellsorted; fine- to coarse-grained, mostly medium-grained. SAMPLE: I @ 96.0. 96.7 - 98.6 NO RECOVERY. FLOATSTONE: rubble, coral; matrix PACKSTONE; uncemented; 98.6 - 131.7 moderately altered, large pelecypod very chalky, Halimeda chalky, corals partially recrystallized and partially spar replaced; very pale orange; unsorted; fine-grained sand to cobble-sized clasts, mostly coarseto very coarse-grained; whole pelecypod at 121.1 ft, Porites lutea at 101.6 and 114.4 ft; Acropora cuneata at

117.9 - 118.3 ft. Contains sparse, large, pebble-sized lithoclast of cemented PACKSTONE TO WACKESTONE at 128.0 ft. SAMPLE: I @ 108.0, 121.5; R @ 105.9, 120.8, 128.0.

131.7 - 133.5 NO RECOVERY.

RUDSTONE: coral, <u>Porites lutea</u>; uncemented; slight to moderate alteration, <u>Porites lutea</u> partially spar-replaced, chalky <u>Halimeda</u> grains; very pale orange to white; fine- to coarse-grained, mostly medium- to coarse-grained fragments. SAMPLE: I @ 134.0; R @ 133.5.

134.3 - 136.6 NO RECOVERY.

136.6 - 141.3 FLOATSTONE: rubble, coral; matrix PACKSTONE: skeletal; uncemented; slightly to moderately altered, corals partially recrystallized and spar-replaced, Halimeda chalky; very pale orange to white; fine- to coarse-grained, mostly coarse-grained to granule- and pebble-sized clasts. Contains scattered poorly to moderately cemented lithoclasts of skeletal WACKESTONE OR PACKSTONE. SAMPLE: M @ 140.5 - 141.3.

141.3 - 143.6 NO RECOVERY.

PACKSTONE TO FLOATSTONE: rubble, <u>Halimeda</u>, skeletal, foraminifer; matrix PACKSTONE to sparse rubble

FLOATSTONE; uncemented; slightly to moderately altered, whole chalky <u>Halimeda</u> grains, <u>Halimeda</u> interiors appear unmicritized; very pale orange; fine- to coarse-grained, mostly coarse-grained; unsorted. Lithoclasts consist of granule- to pebble-sized clasts of moderately to poorly cemented, skeletal, mollusc, <u>Halimeda</u> PACKSTONE similar to matrix. Spar-replaced corals sparse; scattered echinoid spines; common foraminifers throughout. Lower contact probably sharp. SAMPLES: I @ 146.0, 159.2.

159.2 - 161.0 NO RECOVERY.

[Disconformity implied by slight increase in cementation and alteration and introduction of drusy and brown spar in unit below.]

161.0 - 167.8 FLOATSTONE: rubble, coral; matrix skeletal, muddy PACKSTONE to WACKESTONE; matrix uncemented; moderately altered, containing whole Halimeda grains completely

micritized, corals recrystallized and partially spar-replaced, Astreopora(?) head at 167.4 ft with pale-yellowish-brown spar-filled center; very pale orange to white, with minor yellowish brown; fine- to coarse-grained, poorly sorted; scattered cemented burrows; mold with drusy spar filling at 161.2 ft. Lithoclasts at top contain "tea-brown" micrite. Contains abundant Acropora sticks; small Porites lutea fragment at 167.7 ft. Unit probably originally poorly cemented coral FLOATSTONE. SAMPLE: I @ 162.0.

167.8 - 169.6 NO RECOVERY.

169.6 - 173.9 FLOATSTONE: coral, with skeletal, mollusc WACKESTONE matrix; uncemented, moderately consolidated; slightly to moderately altered, probably decreasing downward,

Halimeda chalky, corals partially micritized, and one pale-yellowish-brown, spar-replaced coral center; white to very pale orange; silt to coarse-grained, mostly fine-grained; stick corals common; one large-fragment of Platygyra(?) at 172.7 ft. Lower contact marked by sharp color change. SAMPLE: I @ 170.0.

173.9 - 175.4 NO RECOVERY.

[Possible disconformity indicated by appearance of "tea-brown" micrite and sparcement in underlying unit.]

PACKSTONE: mollusc, Halimeda, skeletal; uncemented; 175.4 - 181.1 slightly altered, mollusc shells chalky, fine surface ornamentation preserved on gastropods, Halimeda chalky with partially micritized centers; very pale orange to moderate yellowish brown near base; fine- to very coarse grained, mostly medium- to coarse-grained; abundant broken pelecypod shell fragments, contains one rounded, nearly whole Mytilus shell at 176.3 ft (Mytilus appears to contribute darker-colored pelecypod grains); one horizontal burrow(?) with dark-yellowish-brown sparfilled center at base of unit; contains Polynices(?) shell with abundant "tea-brown" filled borings at 180.5 ft. Small areas associated with pelecypods moderately to poorly cemented; upper part of unit containing fragments of spar-cemented, Halimeda GRAINSTONE. Lower contact gradational.

181.1 - 187.9 GRAINSTONE TO PACKSTONE: skeletal, micromollusc, foraminifer; uncemented; slightly alterated, well-preserved foraminifers, large molluscs chalky, micromolluscs with nacreous luster, one coral with pale-

yellowish-brown, spar-replaced center; very pale orange to very pale orange to white, lighter color in lower part; gradational change from darker to lighter pale-orange from 175.4 - 189.0 ft; very fine to coarse-grained, mostly fine-grained; moderately well sorted; scattered moderately well to well-cemented burrows, resembling matrix, but with concentrations of larger foraminifers; burrows sharply outlined with dark-yellowish-brown centers; one burrow near base has center mold lined with dogtooth spar. Lower contact probably gradational.

187.9 - 189.0 NO RECOVERY.

189.0 - 193.5

FLOATSTONE: coral; matrix PACKSTONE TO GRAINSTONE: skeletal, foraminifer; uncemented; slight alteration, slightly recrystallized corals; very pale orange; consisting of cobble-sized corals in mostly fine- to medium-grained matrix; moderately well sorted near top, poorly sorted in lower part; one drusy spar-filled shelter with cemented matrix below at 189.5 ft. Contains several types of small coral heads and Pocillopora(?) at 190.5 ft. Lower contact gradational. SAMPLE: I @ 189.0.

193.5 - 195.3 NO RECOVERY.

195.3 - 199.4

WACKESTONE: mollusc, coral; uncemented, with scattered patches of cemented matrix, probably burrows; slightly altered, molluscs (Mytilus and gastropods) retain some color and nacreous luster, corals slightly recrystallized; very pale orange to white; very fine to coarse-grained, mostly very fine grained; moderately sorted; burrowed, one burrow with moldic center lined with "dog-tooth" spar, scattered burrows with yellowish-brown spar-filled centers. Corals include small Seriatopora sticks.

199.4 - 201.5 NO RECOVERY.

[Discontinuity indicated by change in alteration.]

201.5 - 203.4 PACKSTONE: skeletal, mollusc; moderately cemented; altered, corals recrystallized, partially spar-replaced and leached, molluscs very chalky, forming molds, a few pelecypods with scattered spar-filled steinkerns; very pale orange to white. Unit probably originally moderately to poorly cemented PACKSTONE, now broken to

fine-grained to pebble-sized material. Contains scattered corals and corals with adhering cemented matrix, and cemented matrix; cemented material similar in composition and texture to uncemented matrix; unit probably heavily burrowed and broken up by Shelby-tube sampling. One pale-yellowish-brown, spar-filled burrow center or coral at top of unit.

203.4 - 204.7 NO RECOVERY.

[Disconformity marked by abundant "tea-brown" micrite, sparse rhizoliths, and increase in cementation in unit below.]

204.7 - 208.0

FLOATSTONE: coral, with skeletal, mollusc PACKSTONE matrix; moderately to well-cemented, now broken; skeletal components; altered, corals micritized and spar-replaced, pelecypods very chalky, larger foraminifers spar-replaced; very pale orange to pale yellowish brown, upper 0.2 ft moderate yellowish brown. Broken pieces at top of unit are cemented skeletal PACKSTONE with abundant "tea-brown" micrite, several probable rhizoliths, and fragments of laminated crust. One Porites lutea fragment, completely replaced with spar, has attached "tea-brown" cemented matrix at base of unit. Alteration and abundance of "tea-brown" micrite decrease downward; uncemented material increases in abundance downward. At 206.2 ft, contains slightly chalky gasropod with faint color banding and small pebble-sized piece of grayish-orange "dog-tooth"-spar void filling is present. From 207.9 - 208.9 ft, contains common large burrows with coarse skeletal PACKSTONE filling and "tea-brown" micrite cement with several mollusc molds in the burrow fillings. Lower contact gradational.

208.0 - 217.8

WACKESTONE: coral, skeletal, mollusc; moderately to well-cemented, probably irregularly cemented, now broken; slightly altered, Halimeda chalky, Mytilus shells brown-colored, corals spar-replaced; very pale orange to white with scattered moderate-yellowish-brown spar; poorly sorted; MUDSTONE-filled burrows common with mollusc molds and scattered spar cement.

[Disconformity indicated by abundant "tea-brown" micrite-filled rhizoliths, and sparse "tea-brown" micrite in upper 0.3 ft of unit below in both cemented and uncemented portions of core.]

217.8 - 231.3

WACKESTONE WITH FLOATSTONE: generally skeletal, mollusc, foraminifer WACKESTONE with scattered intervals approaching coral FLOATSTONE; well-cemented to moderately cemented, probably becoming poorly cemented

downward, now broken; skeletal components highly altered at top, becoming less altered downward, molluscs chalky, commonly with spar-lining interiors, common thin stick corals partially spar-replaced; very pale orange to white, with scattered moderate-yellowish-brown cement and spar. Contains well-cemented burrows in lower part with scattered spar-cemented skeletal MUDSTONE material; possible "tea-brown" micrite-filled rhizoliths at 221.4 ft; at 225.0 ft, contains grayish-orange dogtooth spar-filled void, a probable fracture, and one yellowish-brown drusy calcite-filled coral mold(?). Lower contact gradational.

231.3 - 233.6 NO RECOVERY.

233.6 - 241.2 WACKESTONE: skeletal, foraminifer, coral; uncemented; slightly altered, gastropods chalky, pelecypods with color retention, corals recrystallized, spar-replaced; very pale orange to white; Contains Acropora sticks near top, Mytilus fragments, and a possible burrow near top with yellowish-brown spar-cement. Lower contact gradational.

241.2 - 242.6 NO RECOVERY.

242.6 - 263.5 FLOATSTONE: coral, matrix skeletal WACKESTONE, moderately to well-cemented, irregularly cemented, probably with poorly cemented or uncemented areas; contains scattered well-cemented burrows(?); unit now broken; slightly altered, corals partially micritized and spar-replaced, fragment of Mytilus shell with brown color, chalky pelecypod fragments; minor yellowish-brown spar; white to very pale orange; scattered cemented mud-filled burrows; Lithophagus borings, one filled wih drusy spar

at 253.2 ft; sparse moldic porosity in burrows; scattered grayish-orange, spar-infilled corallites. Lower contact sharp.

263.5 - 266.5 NO RECOVERY.

[Disconformity indicated by change in cementation and "tea-brown" micrite below; upper part of lower unit laced with "tea-brown" micrite-lined rhizoliths.]

266.5 - 283.9 WACKESTONE: skeletal; probably represents moderately to well-cemented(?), broken by sampling; altered, corals mostly spar-replaced, gastropods preserved as molds and steinkerns; very pale orange to pale yellowish brown.

Tridacna shell fragment at 269.7 ft; upper 4.0 ft of

unit with scattered "tea-brown" micrite-filled rhizoliths(?), probable remains of a spongy crust with "tea-brown" micrite near top; basal 0.1 ft contains pebble-sized piece of well-cemented MUDSTONE with sparfilled cracks. Poor recovery.

283.9 - 294.0

POOR RECOVERY: probably coral, skeletal PACKSTONE; common foraminifers near base; material recovered is moderately to well-cemented, now broken but unit may have been partly uncemented or irregularly cemented; moderately altered skeletal components, spar-replaced corals, pelecypods very chalky or preserved as molds; very pale orange with pale-yellowish-brown spar in upper 0.1 ft, becoming very pale orange to pale yellowish brown downward; at 292.6 ft, contains spar-replaced algal(?) structure.

[TOP OF SEDIMENT PACKAGE 3; major disconformity indicated.]

294.0 - 306.6

POOR RECOVERY: material recovered includes: (1) completely spar-replaced coral; (2) scattered "teabrown" cemented skeletal PACKSTONE with chalky larger foraminifers and microgastropods; and (3) coralgalencrusted coral(?) with spar-filled cracks. Unit may have been coral FLOATSTONE with PACKSTONE matrix. [Drill bit dropped 2.5 ft in interval from 295.5 - 298.0 ft, indicating small cavern beneath hard surface.]

-- TOTAL DEPTH OF HOLE 306.6 FT --

BOREHOLE KDT-6

Lat/Long (E/W-1960): 11°40′05.3" N, 162°11′59.0" E

Lat/Long (WGS-1972): 11^o40'05.3" N, 162^o11'58.9" E

Location (IVY-grid, ft); 148,178 N and 071,140 E

Distance/Bearing from KOA GZ: 1,182 ft, 181.0 deg

Water Depth (H&N): 56.2 ft Hole Depth (bsf): 123.8 ft

Hole Spudded: 04/05/1985 Drilling Ended: 04/06/1985

Sampling: SS, SH, LY* Recovery: 45% (55.1 ft)

Logs: GR/DN/CP, GR/NT, GR/LSSN, CSV Date Logged: 04/06-07/1985

Casing: 8-5/8-in. @ 41.3 ft 85 ft* Deviation: 0.9 deg @ 292 ft

Drilling Mud/Additives: BVS (5 sx), POP (51 sx), SEP (1 sx)

Geologists: B.R. Wardlaw, B.A. Skipp Drillers: G. Mooney, R. Weber

Paleontologist: R. Margerum, E.E. Compton Logger: M. Beals

* Cored intervals: 45.8 - 67.6 and 108.3 - 123.8 ft.

Redescribed: 10/22/85

Depth		Description
0.0 -	1.4	GRAINSTONE: skeletal; uncemented; containing scattered moderate-red (5R4/6) grains; very fine to fine-grained, well-sorted; very pale orange to yellowish gray (5Y8/1).
1.4 -	3.2	NO RECOVERY.
3.2 -	10.4	GRAINSTONE: skeletal; uncemented; mixed-alteration of skeletal components; medium-grained to coarse-grained and moderately well sorted from 3.2 - 6.0 ft; fine- to coarse-grained, mostly coarse- to very coarse grained, and moderately sorted from 6.0 - 10.4 ft; pale yellowish brown to very pale orange. Sequence in upper 4.1 ft appears to be graded bed. Unit contains abundant crisp, unaltered Halimeda plates, mostly broken; abundant mollusc fragments with original coloration, moderate-red

(5R4/6) and pale-red (10R6/2) Homotrema, altered mollusc(?) fragments with adhering grayish-orange adhering spar, abundant bright-red octocoral fragments. From 9.0 - 9.1 ft, contains cobble-sized, pale-yellowish-brown coral (abraded, slightly recrystallized) with thin dark sediment veneer. SAMPLES: T @ 9.0; I @ 9.0.

10.4 - 12.1 NO RECOVERY.

12.1 - 16.1 PACKSTONE TO GRAINSTONE: skeletal, Halimeda; uncemented;

generally unaltered; very pale orange; silt to very coarse grained, mostly coarse-grained; moderately sorted; unit appears to become slightly finer grained downward; containing abundant broken and whole <u>Halimeda</u> grains, common molluscs fragments with color retention, moderate-red (5R4/6) and pale-red (10R6/2) <u>Homotrema</u> grains, bright-red octocoral fragments.

16.1 - 18.0 NO RECOVERY.

18.0 - 21.9 GRAINSTONE: foraminifer, mollusc, <u>Halimeda</u>; uncemented;

apparently completely unaltered; very pale orange to grayish orange; fine- to coarse-grained, mostly medium-grained, sparse pebble-sized molluscs and Heliopora fragments; moderately sorted; abundant foraminifers; common broken and whole Halimeda plates and mollusc shells; scattered coral pebbles including medium-bluish-gray Heliopora, common bright-red octocoral fragments, moderate-red (5R4/6) and pale-red (10R6/2) Homotrema grains.

grains.

21.9 - 23.7 NO RECOVERY.

23.7 - 44.6 FLOATSTONE: tight mixed-rubble, coral, with skeletal PACKSTONE matrix: uncemented; mixed alteration, recrystallized and unrecrystallized cobble-sized coral fragments, some encrusted with fresh Homotrema and bleached pale-red (10/R6/2) Homotrema on spar-replaced coral, medium-bluish-gray Heliopora fragments scattered throughout, bright-red octocoral fragments, broken fresh Halimeda plates, unaltered mollusc shells; cobble-sized

Halimeda plates, unaltered mollusc shells; cobble-sized lithoclasts of well-cemented, very pale orange skeletal MUDSTONE with scattered coral and gastropod molds with minor spar-lining. Contains scattered lithoclasts of

moderately to poorly cemented <u>Halimeda</u>-skeletal PACKSTONE. SAMPLE: M@43.9 - 44.6. [Driller noted hard layer at 44.6 ft; destroyed carbide bit drilling hard layer.] SAMPLES: I@24.0, 32.2, 43.9.

44.6 - 53.9

POOR RECOVERY: mostly washed coral-rubble. From 50.7 - 51.3 ft., contains large pieces of coral, coralgal FRAMESTONE, well-cemented, unaltered, with moderate-red (5R4/6) and pale-red (10R6/2) Homotrema; very pale orange; shelter and interparticle porosity, and abundant borings partly filled with uncemented, skeletal PACK-STONE. From 44.6 - 50.7 ft, contains large, largely unaltered, abraded coral rubble; from 51.3 - 53.9 ft, largely Acropora sticks.

53.9 - 59.7

POOR RECOVERY: mostly heavily washed; contains three types of pebble- to cobble-sized clasts: (1) coral material, some with adhering, moderately cemented, skeletal PACKSTONE matrix; (2) lithoclasts of very pale orange, moderately cemented, Halimeda-skeletal PACKSTONE; and (3) bryozoan-coralgal FRAMESTONE. Coral at top of unit extensively recrystallized Porites sp. with mediumbluish-gray to medium-dark-gray stain concentrated near and on exterior and in borings (similar to material from just beneath A/B faunal boundary.) Contains cobblesized clasts of grayish-orange, bryozoan-coralgal FRAMESTONE at 58.5 ft and at base; large striated, septate worm tube at 58.5 ft, Fungia at 58.3 ft, Acropora cuneata colony at 57.3 ft, other corals throughout. Note: moderate-red (5R4/6) Homotrema not observed in unit.

59.7 - 67.6 NO RECOVERY.

67.6 - 87.6

PACKSTONE WITH FLOATSTONE: generally coral, Halimeda, skeletal PACKSTONE with coral FLOATSTONE; poorly cemented to uncemented, poorly cemented in upper 10.0 ft; slightly altered, chalky Halimeda with unaltered centers, corals recrystallized, some partially sparfilled; very pale orange to white; silt - to coarsegrained, mostly coarse-grained, pebble- and cobble-sized coral fragments; very poorly sorted. From 67.6 - 78.6 ft, dominantly Halimeda PACKSTONE with patchy cementation; from 78.6 - 84.7 ft, coral, Halimeda FLOATSTONE; from 84.7 - 87.6 ft, muddy, coral, Halimeda PACKSTONE. Lower contact probably sharp, disrupted by sampling.

[Disconformity marked by increase in cementation and alteration in unit below.]

PACKSTONE: skeletal, coral; well-cemented to moderately cemented; moderately altered, containing chalky, completely micritized Halimeda plates, chalky pelecypod shells, gastropod molds; very pale orange to yellowish gray (5Y5/1); fine- to coarse-grained, mostly fine-grained; scattered moldic, interparticle and shelter porosity; scattered gastropod molds with steinkerns; scattered greenish-gray (5GY6/1) spar filling interpartical and shelter pores and some skeletal

interiors. Lower contact abruptly gradational.

90.0 - 105.9 PACKSTONE: coral, <u>Halimeda</u>; moderately to poorly cemented, probably irregularly cemented; slightly altered, <u>Halimeda</u> grains chalky throughout, corals partially spar-replaced, some corals recrystallized; very pale orange from 90.0 - 95.1 ft, very pale orange to white from 95.1 - 105.4 ft; silt to coarse-grained, mostly coarse-grained; corals occurring scattered throughout as pebble- and cobble-sized particles; corals more broken up than in interval from 67.6 - 87.6 ft; rare moldic and shelter porosity in corals and coralgal overgrowths. Lower contact abruptly gradational. [Changed from Shelby tube, hammer samples to Longyear core samples.]

105.9 - 108.3 NO RECOVERY.

108.3 - 109.3 CORAL HEAD: <u>Porites lutea</u>; partly spar-infilled interseptal spaces slightly altered; very pale orange; coal head appears to be upright; <u>Lithophagus</u> borings. Lower contact sharp.

109.3 - 110.6 FLOATSTONE: coral with skeletal PACKSTONE matrix; poorly to moderately cemented, irregularly cemented; slightly altered with chalky Halimeda plates mostly micritized, corals slightly recrystallized; very pale orange; poorly sorted; silt- to cobble-sized grains, mostly coarse-sand and granule-sized grains; scattered moldic porosity in corals; Platygyra(?) at 109.4 ft, recrystallized Astreopora(?) at 109.9 ft. Lower contact abruptly gradational.

[Minor disconformity indicated by change in cementation and presence of "tea-brown" micrite in top of unit below.]

110.6 - 118.2 BAFFLESTONE: coral; matrix skeletal PACKSTONE; generally moderately cemented; irregularly cemented; moderately altered, <u>Halimeda</u> plates mostly micritized, corals partially recrystallized and some spar-replaced; very pale orange; fine- to coarse-grained, mostly coarse-

grained, unsorted; moldic and interparticle porosity in corals; scattered borings in corals; in upper 0.1 ft., contains spongy crust on coral with "tea-brown" micrite. Contains abundant coral heads in growth position; Astreopora(?) at top and 111.8 ft, large Favia(?) at 116.6 ft, Platygyra(?) at 117.9 ft, digitate bryozoan(?) at 114.5 ft; heads and bryozoan with coralgal overgrowths and crusts. Lower contact abruptly gradational. SAMPLE: M @ 114.5 - 115.3.

118.2 - 123.8

PACKSTONE WITH FLOATSTONE: generally skeletal, coral; skeletal PACKSTONE with intervals of coral FLOATSTONE with skeletal PACKSTONE matrix; generally moderately cemented with small poorly cemented areas, irregularly cemented; moderately altered, <u>Halimeda</u> plates generally micritized, corals slightly recrystallized with sparse spar-replacement; very pale orange; silt to coarse-grained, mostly coarse-grained with cobble-sized corals; poorly sorted to unsorted; corals with scattered moldic porosity and borings; moldic and interparticle porosity common; muddy interval from 118.8 - 119.6 ft.

*** TOTAL DEPTH OF HOLE 123.8 FT ***

KET-7

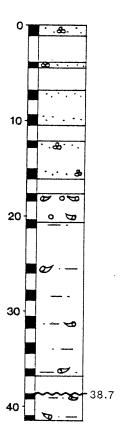


PLATE 5

BOREHOLE KET-7

Lat/Long (E/W-1960): 11^o40'03.9" N, 162^o11'59.9" E

Lat/Long (WGS-1972): 11°40′03.8" N, 162°11′59.9" E

Location (IVY-grid, ft): 148,034 N and 071,147 E

Distance/Bearing from KOA GZ: 1,326 ft, 181.2 deg

Water Depth (H&N): 51.1 ft Hole Depth (bsf): 41.4 ft

Hole Spudded: 04/07/1985 Drilling Ended: 04/07/1985

Sampling: SS, SH Recovery: 32% (41.1 ft)

Logs: None Deviation: No survey run

Drilling Mud/Additives: BVS (6 sx), POP (154 sx)

Geologists: B.R. Wardlaw, B.A. Skipp Drillers: G. Mooney, R. Weber

Paleontologists: R. Margerum, E.E. Compton

Redescribed: 10/21/1985

Depth		Description
0.0 -	1.1	GRAINSTONE: foraminifer, skeletal; uncemented; generally unaltered skeletal components, containing sparse slightly altered grains; very pale orange to yellowish gray (5Y8/1); fine- to medium-grained, well-sorted.
1.1 -	3.9	NO RECOVERY.
3.9 -	4.5	GRAINSTONE: foraminifer, skeletal; uncemented; generally unaltered, containing fresh Halimeda grains, scattered moderate-red (5R4/6) Homotrema grains, and mollusc fragments with color retention and preserved nacreous layer; also containing scattered bleached Homotrema grains, dull mollusc fragments, and slightly chalky Halimeda flakes; very pale orange to grayish orange; fine- to very coarse grained, mostly coarse-grained, moderately sorted.

4.5	-	6.8	NO RECOVERY.
6.8		10.4	GRAINSTONE: skeletal; uncemented; generally unaltered grains (as overlying recovered unit); very pale orange to grayish orange; generally fine- to coarse-grained, mostly medium- to coarse-grained, containing some pebble-sized coral fragments, slightly muddy(?).
10.4	_	12.1	NO RECOVERY.
12.1	_	16.1	GRAINSTONE: foraminifer, Halimeda ; uncemented; unaltered skeletal components; very pale orange; fine- to coarse-grained, containing scattered pebble-sized coral fragments, mostly fine-grained, moderately sorted.
16.1	_	17.6	NO RECOVERY.
17.6	_	20.6	RUDSTONE: coral; matrix muddy PACKSTONE: <u>Halimeda</u> skeletal; uncemented; mixed-alteration, containing lustrous, unaltered pelecypod, coral with spar-replaced center, pale-red <u>Homotrema</u> on coral, many tiny fragments of bright-red octocoral in matrix; yellowish gray (5Y7/2) (including corals); unsorted; silt to cobble-sized fragments. Contains <u>Heliopora</u> at base. Lower contact abruptly gradational.
20.6	-	36.8	PACKSTONE: skeletal, coral, <u>Halimeda</u> ; uncemented; slightly mixed alteration, mostly unaltered with crisp <u>Halimeda</u> , moderate-red (5R4/6) foraminifers and bright-red coral fragments scattered throughout sparse spar replacement in corals; at 33.5 ft, abraded <u>Acropora</u> with bleached <u>Homotrema</u> indicates some mixing; yellowish gray (5Y7/2); fine- to coarse-grained, mostly fine- to medium-grained, with scattered coral pebbles and cobbles throughout; poorly to moderately sorted; unit appears to be coarsergrained near bottom.
36.8		38.7	NO RECOVERY. [Note: Hard layer reported at base of unit by driller.
			* * * * * * * * * * * * * * * * * * * *
			KAGE 2. Disconformity indicated by increases in hardness eletal components below.]
20 7		20.2	DACUCTONE: skolotal corel uncomented slightly altered

PACKSTONE: skeletal, coral, uncemented; slightly altered, 38.7 - 39.2 medium-bluish-gray rind on most coral fragments, corals partially spar-replaced, bleached light-pink Homotrema; yellowish gray (5Y7/2) to light olive gray (5Y5/2); fine-grained to pebble-sized fragments, mostly medium-grained, poorly sorted; pebbles mostly coral fragments; common mollusc fragments; dark flecks common throughout matrix and in cemented matrix adhering to coral fragments; washings from above showed similar corals with dark rinds with sparse greenish-colored spar infillings. Note: upper 0.1 ft of unit may have been moderately cemented.

39.2 - 41.0	NO RECOVERY.
41.0 - 41.4	PACKSTONE: coral, <u>Halimeda</u> ; uncemented; slightly altered, <u>Porites lutea</u> fragment micritized and partly spar- replaced, <u>Halimeda</u> chalky with small unaltered centers; very pale-orange; fine- to coarse-grained, mostly coarse-grained, moderately sorted; contains <u>Porites</u> <u>lutea</u> with <u>Lithophagus</u> borings.

*** TOTAL DEPTH OF HOLE 41.4 FT ***

BOREHOLE KFT-8

Lat/Long (E/W-1960): 11°40′08.4" N, 162°11′58.7" E

Lat/Long (WGS-1972): 11°40′08.4" N, 162°11′58.6" E

Location (IVY-grid, ft): 148,490 N and 071,107 E

Distance/Bearing from KOA GZ: 870 ft, 179.1 deg

Water Depth (H&N): 77.8 ft Hole Depth (bsf): 317.9 ft

Hole Spudded: 04/07/1985 Drilling Ended: 04/09/1985

Recovery: 40% (126.1 ft) Sampling: SS, SH

Logs: GR/DN/CP, GR/NT, GR/LSSNT, CSV Date Logged: 04/10/1985

Casing: 8-5/8-in. @ 52 ft Deviation: 1.3 deg @ 305 ft

Drilling Mud/Additives: BVS (16 sx), MLP (394 sx), LCM (2 sx), PAD (52 gals)

Geologists: B.R. Wardlaw, T.W. Henry Drillers: G. Mooney, R. Weber

Paleontologist: R. Margerum, E.E. Compton Logger: M. Beals

Redescribed: 10/21/1985

Depth	Description
0.0 - 4.8	GRAINSTONE: skeletal; uncemented; unaltered; very pale orange to yellowish gray (5Y8/1); very fine to coarsegrained, mostly fine-grained from 0.0 - 3.2 ft, mostly medium- to coarse-grained from 3.2 - 6.3 ft; well-sorted; contains common foraminifers, coral fragments, microgastropods; scattered fresh Halimeda plates, scattered moderate-red (5R6/4) Homotrema and bright-red octocoral grains; unit is graded bed. Lower contact probably gradational.
4.8 - 6.3	NO RECOVERY.
6.3 - 7.9	PACKSTONE: skeletal, <u>Halimeda</u> ; uncemented; unaltered; very fine grained to coarse-grained, mostly medium- to coarse-grained; appears to coarsen downward from 6.3 -

6.7 ft, becomes finer at 6.7 ft, coarsens downward from

6.7 ft to base; moderately sorted; containing common broken fresh Halimeda plates, moderate-red (5R4/6) and light-red Homotrema, moderate-red (5R4/6) octocoral grains, foraminifers, coral fragments, and color-banded microgastropods and other mollusc debris. Lower contact abruptly gradational. SAMPLE: M @ 7.2 - 7.9.

7.9 - 9.5 NO RECOVERY.

9.5 - 17.2

PACKSTONE: Halimeda, skeletal; uncemented; mixedalteration, fresh and chalky whole and broken Halimeda
plates, light-red Homotrema, unaltered Porites lutea at
15.5 ft, abundant moderate-red octocoral fragments, some
color-banded lustrous molluscs, minor chalky molluscs;
very pale orange; very fine to very coarse grained,
mostly coarse- to very coarse grained, containing sparse
coral pebbles from 16.2 ft to base; moderately sorted.
Contains two small pebble-sized fragments of paleyellowish-brown corals (Dictyaraea and small Porites
sp.) at 17.1 ft, apparently unaltered. Contains sparse
rubble lithoclasts in lower 1.0 ft. Lower contact

gradational. SAMPLE: I @ 17.1.

17.2 - 18.7 NO RECOVERY.

PACKSTONE: coral, sparse rubble, skeletal; uncemented; 18.7 - 26.3 mixed-alteration, containing "dog-tooth" spar at 20.2 ft, bleached pinkish-gray Homotrema at 23.5 ft, fresh moderate-red (5R4/6) Homotrema at 26.2 ft, molluscs both fresh with color and chalky, abundant bright-red octocoral fragments; very pale orange; silt to very coarse grained, mostly coarse- to very coarse grained with abundant coral pebbles. Unit appears to coarsen downward with pebbles of coral and lithoclast rubble more abundant in lower part; lithoclasts consist of moderately cemented, skeletal PACKSTONE with minor moldic porosity. Mixed alteration appears to increase with the increase in coral rubble. Scattered darkbluish-gray fragments at base of unit. Unit contains more mud than overlying one. Lower contact sharp. SAMPLES: M @ 25.1 - 25.7.

26.3 - 28.2 NO RECOVERY.

28.2 - 32.1 PACKSTONE: (tight) skeletal; uncemented; mixed-alteration, containing chalky <u>Halimeda</u>, chalky gastropods, and moderately cemented burrows with light-yellowish-brown, spar-cemented centers; very pale orange; very fine to

coarse-grained, mostly medium- to coarse-grained; pebble- and cobble-sized burrows and sparse coral fragments; burrows moderately well cemented, filled with skeletal, Halimeda PACKSTONE. SAMPLE: I @ 31.4.

32.1 - 34.5	NO RECOVERY.
34.5 - 38.9	FLOATSTONE: rubble, coral; matrix skeletal PACKSTONE; uncemented, unsorted; mixed-alteration, sparse moderate-red Homotrema including small colony encrusting dark-bluish-gray Heliopora in turn encrusting cobble-sized coral head at 35.0 ft, scattered chalky and fresh(?) Halimeda grains, altered and unaltered mollusc shells, recrystallized and fresh corals; very pale orange; silt-to cobble-sized grains, unsorted.
38.9 - 40.6	NO RECOVERY.
40.6 - 53.6	POOR RECOVERY: probably rubble, coral FLOATSTONE with skeletal PACKSTONE matrix; uncemented; mixed-alteration, fresh Heliopora, sparse moderate-red octocoral fragments, chalky Halimeda, partially spar-replaced corals, sparse spar-filled burrows, lithoclast with medium-bluish-gray rind; very pale orange, with darker moderate-bluish-gray and greenish-gray (5GY6/1), mostly granule- to pebble-sized coral fragments; contains scattered "tea-brown" cemented lithoclasts. SAMPLES: M @ 44.3 - 45.0; I @ 41.8.
53.6 - 64.1	FLOATSTONE: rubble, coral, lithoclast; matrix PACKSTONE: skeletal, Halimeda; uncemented; mixed-alteration, chalky Halimeda, some with micritized and some with unmicritized centers, corals all slightly recrystallized, purple echinoid spine; very pale orange; very fine grained to cobble-sized clasts, mostly very coarse grained to granular; poorly sorted. Contains common large- to small-pebble-sized lithoclasts of moderately cemented Halimeda, skeletal PACKSTONE. Contains cobble-sized clasts of Platygyra sinensis at 63.1 ft and Acropora cuneata at 63.8 ft. SAMPLE: I @ 54.0, 60.2.
64.1 - 66.4	NO RECOVERY.
66.4 - 67.1	CORAL HEAD: fractured Platygyra sinensis; relatively fresh; very pale orange.

67.	1 .	69.8	NΩ	RECOVERY.
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69.8 - 74.4 FLOATSTONE: rubble; matrix skeletal, lithoclast PACKSTONE; predominantly altered, slightly altered Halimeda (chalky), recrystallized coral fragments, some with grayish-orange spar; very pale orange to white; silt- to small cobble-sized material, unsorted. Lithoclasts exclusively moderately to poorly cemented, granule, pebble- and small cobble-sized, Halimeda, skeletal, mollusc PACKSTONE. SAMPLE: M @ 70.4 - 71.1.

74.4 - 76.0 NO RECOVERY.

76.0 - 82.8 FLOATSTONE: rubble, coral; matrix Halimeda, skeletal PACKSTONE; uncemented; generally unmixed alteration, moderate-red octocoral grains; bleached common grayish-pink to light-red Homotrema, chalky gastropod shell with minor spar at 79.8 ft, gastropods with nacreous luster and color at 82.2 ft and at 83.8 ft (large Conus), Halimeda plates generally crisp to chalky, corals with some spar replacement; yellowish gray (5Y7/2) to pale olive (10Y6/2); silt to cobble-sized fragments, mostly medium-grained sand to granule-sized; very poorly

sorted. Lower contact sharp, marked by color change.

82.8 - 83.9 NO RECOVERY.

FLOATSTONE: rubble, coral; matrix Halimeda PACKSTONE; uncemented; seemingly more consistent alteration than in intervals above, slightly altered, Halimeda chalky throughout, corals commonly partially spar-replaced and recrystallized; very pale orange to white; very fine grained to cobble-sized fragments, mostly coarse-grained to cobble-sized; unsorted; scattered moderate-brown echinoid spines; Platygyra sinensis at 101.5 ft; one chalky pelecyod fragment. Lithoclasts moderately cemented PACKSTONE, granule- to cobble-sized, appear to represent rock fragments from one sequence of strata.

118.1 - 119.3 NO RECOVERY.

[Probable disconformity based on presence of "tea-brown" micrite at top of unit below.]

119.3 - 120.5 PACKSTONE: skeletal; poorly to moderately cemented, "teabrown" micrite scattered throughout; altered, <u>Halimeda</u> plates chalky; very pale orange; silt to very coarse grained, mostly medium— to coarse-grained; poorly sorted; minor moldic and interparticle porosity; rock broken up by sampling, probably fractured before sampling. SAMPLE: M @ 119.9 - 120.5.

120.5 - 122.2 NO RECOVERY.

122.2 - 136.6

PACKSTONE: skeletal, <u>Halimeda</u>; uncemented to poorly cemented, with scattered poorly to moderately cemented areas on nodules; slightly altered, <u>Halimeda</u> chalky, gastropod with color at 129.2 ft, corals partially recrystallized and spar-replaced; very pale orange to white; very fine grained to cobble-sized fragments, mostly medium- to coarse-grained, with scattered coral pebbles and cobbles; granule- to pebble-sized cemented patches; common <u>Halimeda</u>, foraminifers, and microgastropods.

136.6 - 138.9 NO RECOVERY.

[Disconformity(?) based on presence of moderate-yellowish-brown, spar-replaced coral at top of unit below.]

138.9 - 153.1

PACKSTONE: skeletal, coral, <u>Halimeda</u>; poorly cemented to uncemented; slightly altered in general, but moderately altered at top; very pale orange to white, coral (<u>Acropora cuneate</u>?) at top with some pale-yellowish-brown spar-filling and -replacement. Lower contact sharp.

153.1 - 155.3 NO RECOVERY.

[Disconformity based on increase in alteration and presence of dogtooth spar cement in coral at top of unit below.]

155.3 - 155.9

CORAL HEAD: fractured <u>Astreopora</u>(?) head, extensively sparreplaced and central vug lined with grayish-orange to pale-yellowish-orange, "dog-tooth" spar; very pale orange; at least some fracturing due to sampling.

155.9 - 158.4 NO RECOVERY.

158.4 - 159.6

PACKSTONE: skeletal, coral; uncemented, with at least two poorly cemented thin layers; moderately altered, heavily micritized corals, very chalky Halimeda; very pale orange to white. Contains two thin (0.02 ft-thick) well-

cemented undulatory layers cemented with moderateyellowish-brown, fine-textured spar with sparse laminations. Lower contact sharp.

159.6	_	161.4	NO RECOVERY.
161.4		161.9	CORAL HEAD: <u>Porites</u> <u>lutea</u> ; slightly altered, partially recrystallized; very pale orange; fractured during sampling, at least in part; sparse PACKSTONE matrix with one completely recrystallized pelecypod valve.
161.9		163.9	NO RECOVERY.
163.9	-	175.6	PACKSTONE: skeletal, coral; poorly cemented(?); moderately altered, <u>Halimeda</u> completely chalky, disintegrates when touched, corals micritized; very pale orange to white; very fine grained to pebble-sized fragments, mostly very fine to coarse-grained; some moldic and interparticle porosity; <u>Porites lutea</u> fragment at 166.5 ft; badly recrystallized at 169.7 ft; corals common, <u>Halimeda</u> probably abundant though very altered. Lower contact sharp.
175.6	_	177.3	NO RECOVERY.
177.3	-	177•7	friable very pale orange to white; at least partially broken during drilling.
177.7		179.6	NO RECOVERY.
* * * *	*	* ? * * *	* * * * ? * * * * * * * ? * * * * * * *
[Discon below.]	for	mity based	on presence of abundant spar and moldic porosity in unit
179.6	-	184.7	FLOATSTONE: coral; sparse skeletal PACKSTONE matrix; poorly cemented; highly altered, corals with extensive spar-replacement, micritization, and subsequent leaching of micrite to form voids. Lower contact abruptly gradational.
184.7		188.6	PACKSTONE: skeletal, mollusc; probably moderately to poorly cemented; moderately altered, pelecypod chalky with sparreplaced umbo, gastropod interiors and exteriors spar-

replaced and spar-lined(?); very pale orange; very fine grained to pebble-sized fragments, mostly very fine to coarse-grained, moderately sorted; sparse moldic and interparticle porosity.

188.6 - 190.5 NO RECOVERY.

[Disconformity based on presence of "tea-brown" micrite, rhizoliths(?), and increased cementation in top of unit below.]

190.5 - 203.0 PACKSTONE: skeletal, coral; upper 0.4 ft well- to moderately cemented, remainder moderately to poorly cemented; moderately common "tea-brown" micrite in upper 0.4 ft with possible microrhizoliths; moderately altered, Halimeda grains completely micritized and soft, Platygyra partially recrystallized and replaced with paleyellowish-brown spar at 196.2 ft; very pale orange in

upper 0.4 ft, very pale orange to white in remainder of unit; very fine grained to cobble-sized fragments, mostly fine- to granule-sized; granules appear to be clumps of poorly cemented matrix; some moldic porosity in corals; small Astreopora(?) at 196.6 ft.

203.0 - 204.9 NO RECOVERY.

204.9 - 206.3

PACKSTONE: Halimeda, coral, foraminifer; probably poorly cemented with moderately cemented nodules; moderately altered, Halimeda chalky, partly micritized, very pale orange with minor grayish-orange tones; silt- to pebblesized grains, mostly medium- to fine-grained, poorly sorted. Contains scattered Halimeda and cords, including small Acropora sticks. SAMPLE: M @ 204.9 - 205.6.

206.3 - 208.4 NO RECOVERY.

[Disconformity based on increase in cementation and presence of abundant "teabrown" micrite in unit below.]

208.4 - 209.2

FLOATSTONE: coral, matrix skeletal, mollusc PACKSTONE; moderately cemented, containing abundant "tea-brown" micrite lining edges of corals, dispersed elsewhere; moderately altered, mollusc shells very chalky, some spar-replaced gastropod steinkerns, corals partly recrystallized; very pale oange with moderate-yellowishbrown stringers.

209.2 - 211.7 NO RECOVERY.

211.7	_	212.5	PACKSTONE: skeletal <u>Halimeda</u> , foraminifer; poorly cemented, with scattered, moderately cemented burrows, cementation decreasing downward, scattered "tea-brown" micrite; moderately altered, pelecypods chalky with spar-replaced steinkern, <u>Halimeda</u> at top chalky, but probably not completely micritized; very pale orange; very fine to very coarse grained, mostly medium- to coarse-grained.
212.5		215.1	NO RECOVERY.
215.1	_	222.0	FLOATSTONE WITH WACKESTONE: generally coral FLOATSTONE with skeletal WACKESTONE matrix and interbedded with same; uncemented; slightly altered, Halimeda very chalky, corals commonly well-preserved; white to very pale orange; very fine grained, mostly mud with larger pebble-and cobble-sized corals. Well-cemented burrows from 221.9 - base filled with skeletal, pellet WACKESTONE with moderate-yellowish-brown, cemented centers. Contains small Astreopora (?) heads.
* * * *	* *	* ? * * *	* * * * ? * * * * * * * ? * * * * * * ? *
		mity based rite below	on increase in cementation and alteration and possible "tea-surface.]
222.0	-	222.3	FLOATSTONE: coral, matrix skeletal, <u>Halimeda</u> WACKESTONE; well-cemented; strongly altered skeletal components; minor "tea-brown" micrite; minor moldic porosity; white to very pale orange with pale-yellowish-brown mottling.
222.3		222.9	WACKESTONE: coral, skeletal; poorly cemented to uncemented with sparse moderately cemented burrow(?) or nodules; white to very pale orange.
222.9		224.8	NO RECOVERY.
224.8		226.0	FLOATSTONE: coral, with skeletal PACKSTONE matrix; poorly to moderately cemented; moderately altered, slightly chalky Halimeda ; very pale orange. Samll fragments of slightly recrystallized Astreopora with thin coralgal coating on bottom side. SAMPLE: M @ 225.3 - 226.0.
226.0		228.2	NO RECOVERY.
228.3	_	232.5	PACKSTONE: coral, skeletal; poorly to moderately cemented, with scattered "tea-brown" micrite in upper part of unit, more common in basal 0.4 ft; moderately altered, Halimeda chalky throughout, pelecypods with chalky exteriors,

gastropod in relatively good shape, corals slightly recrystallized and spar-replaced; very pale orange; silt and very fine grained to pebble-sized fragments, mostly very fine grained, with corals and cemented matrix pebbles. Contains common <u>Porites(?)</u> sticks; large pelecypod at 231.3 ft. Lower contact sharp.

232.5 - 235.4

CORAL HEADS: Porites lutea; sparse well-cemented PACKSTONE; matrix slightly altered, slightly recrystallized; very pale orange; Porites lutea fractured; common borings and broken Lithophagus valves; containing minor "tea-brown" micrite.

235.4 - 238.2 NO RECOVERY.

238.2 - 290.5

WACKESTONE AND FLOATSTONE: from top to 242.5 ft coral FLOATSTONE with skeletal, mollusc WACKESTONE matrix, becoming interbedded coral, skeletal, mollusc WACKESTONE and sparse coral FLOATSTONE with same matrix downward; poorly cemented; slightly altered mollusc shells with sparse nacreous luster and minor color retention; Halimeda grains chalky; corals partly recrystallized and spar-replaced; white to very pale orange; very fine grained; contains abundant large, broken fractured corals and pelecypods; contains scattered spar-cemented burrows, one with internal mold lined with "dog-tooth" spar. Contains common small Acropora and other coral sticks, scattered small coral heads throughout, small Porites lutea heads from top to 242.5 ft; large Turbo at 284.5 ft.

290.5 294.2 NO RECOVERY.

[Disconformity indicated by increase in cementation and presence of "tea-brown" micrite below surface.]

294.2 - 295.3

WACKESTONE: skeletal, gastropod; upper 0.1 ft. moderately well cemented, containing common "tea-brown" micrite; becoming less well-cemented, irregularly cemented downward with corresponding decrease in "tea-brown" micrite, lower part of unit poorly cemented; very pale orange with pale-yellowish-brown mottling; unit containing mainly interpartical porosity, but upper 0.1 ft with minor moldic porosity. Contains small whelks and small, thin-shelled pelecypods.

295.3 - 299.9 NO RECOVERY.

[Disconformity indicated by marked increase in both cementation and marked increase of "tea-brown" micrite cement below surface; underlying unit has skeletal components slightly more altered than overlying sequence.]

299.9 - 311.1 WACKESTONE: skeletal, mollusc; upper 1.0 ft moderately well-cemented, fractured, containing abundant "tea-brown" micrite in upper 0.2 ft, becoming moderately cemented (fractured) downward; very pale orange with abundant pale yellowish brown in upper 1.0 ft, becoming less common downward and increasing again from 310.1 - 311.1.

Contains Tridacna shell (fractured) at 310.5 ft with "tea-brown"-cemented shelter; abundant small gastropods, particularly in upper 0.2 ft.

311.1 - 317.6 NO RECOVERY.

[TOP OF SEDIMENT PACKAGE 3. Disconformity indicated by marked increase in cementation and alteration of skeletal components.]

317.6 - 317.9 WACKESTONE: coral-skeletal; pervasively very well cemented; very pale orange with minor pale-yellowish-brown mottling; porosity very low, moldic with sparse spar partially filling same; unit badly fractured. Contains piece of large coral. Driller spun-off on top of unit, very hard.

*** TOTAL DEPTH OF HOLE 317.9 FT. ***

OAK Crater Borehole Descriptions

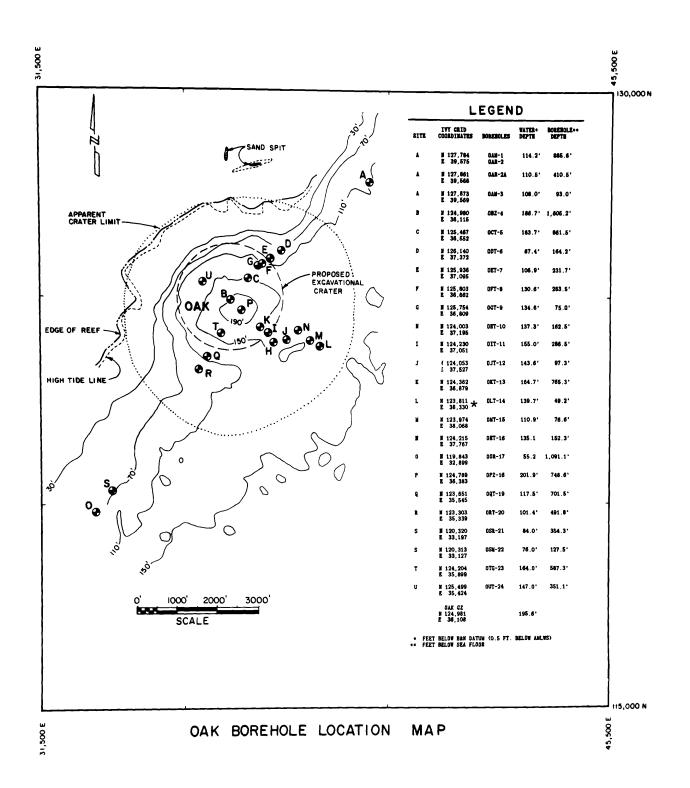


FIGURE 29. -- Map of OAK crater showing borehole sites (depicted by letters) and general bathymetric contours (contour interval equals 5 m). (Map courtesy of B.L. Ristvet and E.L. Tremba.) * See page 390 for correction.

SUMMARY OF PHASE II BOREHOLES DAK CRATER - PEACE PROGRAM

							Colonia de la co				THE RESIDENCE AND PARTY OF THE PERSON NAMED IN COLUMN 2 IS NOT THE	Section of the control of the contro
0	WATER	HOLE	RECO	RECOVERY	FROM GROUND ZERO	UND ZERO	IVY-GRID	RID	CALIDIC	J	DATE	HOLE
BOKEHOLE	(H&N)	Utrim (ft bsf)	FOOTAGE	PERCENT	DISTANCE	BEARING	FT НОЯТИ	F1 EAS1	TYPE	TYPES	STARTED/ENDED	CURITLE LIUN
0AM-1* 0AR-2*	114.2	401.6 885.6	197.4 366.3	491. 761	4,458	051	127,784	039,575	۲	GR/DH/CP GR/NU TAC	4-10 4-24	4-24
0AR-2A	110.5	410.5	188.1	46\$	4,500	050	127,861	039,566	SS, SH 1 Y	MCS GR/DN/CP GR/HU	4-24	4-27
0AM-3	108.0	93.0	54.9	26 5	4,510	090	127,873	695,660	SS, SH	GR/UN/CP GR/NU	4-28 4-29	4-29
6-280	198.7	1,605.2	8.796	\$ 09	,	082	124,980	036,115	SS, SH LY, CH	MCS GR/DN/CP GR/HII	4-29 5-18	5-20
9-100	163.7	851.5	260.6	31.6	658	042	125,467	036,552	SS, SII	MCS GR/NU GR/DH/CP	5-21 5-28	5-29
9-100	90.1	164.2	86.8	53.	1,715	048	126,140	037,372	SS, SII	None	5-29 5-30	5-30
<i>L</i> -130	106.9	231.7	113.4	49%	1,375	046	125,938	037,095	88, SH	MCS GR/DH/CP GR/HU	5-30 5-31	5-31
0FT-8	130.8	283.5	104.0	37\$	1,129	043	125,803	036,882	SS, SH	MCS GR/NU	6-01 6-02	6-02
6-190	134.8	75.0	28.3	381	1,044	042	125,754	036,809	SS, SII	GR/#U	6-03 6-03	6-03
0HT-10	137.3	162.5	64.5	40%	1,462	132	124,003	037,195	SS, SH	GR/HU	6-03 6-04	6-04
011-11	155.0	286.5	111.5	368	1,206	129	124,230	037,051	SS, SH	MSC GR/NU GR/DH/CP	90-9 90-9	90-9
0JT-12	143.8	97.3	53.4	57.2	1,696	123	124,053	037,527	SS, SH	GR/NU	6-06 6-07	6-07

TABLE 13 (continued on next page)

SIMPLARY OF PHASE II BORKHOLES OAK CRATER - PEACE PROGRAM (Continued)

	WATER	HOLE	RECO	RECOVERY	FROM CROUND ZERO	UND ZERO	IVY-CRID	RID			DATE	HOLE
ВОКЕНОЦЕ	(116N)	0EPTII (ft bøf)	FOOTAGE	PERCENT	DISTANCE	BEARING	FT NORTH	FT EAST	SAMPLE	LOG	DRILLING STARTED/ENDED	CDMPLETION DATE
OKT-13	164.7	765.8	248.5	32%	686	129	124,362	036,879	SS, SH	MCS GR/DN/CP GR/NU	6-07	6-13
0LT-14	139.7	49.2	27.1	35%	2,754	121	123,569	038,473	SS, SII	None	6-14 6-14	4 1-9
OHT-15	110.9	76.6	36.7	481	2,204	111	123,974	038,068	SS, SII	GR/NU	6-15 6-15	§-1\$
ONT-16	135.1	152.3	13.1	184	1.827	1115	124,215	037,767	SS, SH	GR/NU	6-15 6-16	91-9
00R-17	55.2	1.160,1	563.5	32 X	6.058	212	119,843	032,899	SS, SH	MCS GR/DN/CP GR/NU SRS	6-16 6-25	6-29
0P2-18	201.9	748.6	188.1	26%	335	125	124,789	036,383	SS, SH	GR/DN/CP GR/NU SRS BHG	6-29 7-03	7-06
001-19	117.5	701.5	126.0	18%	1.444	203	123,651	035,545	SS. SH	MCS GR/DN/GP GR/NU SRS	7-07	7-12
ORT-20	101.4	491.8	74.3	151	1.846	205	123,303	035,339	SS, SH	GR/DN/CP SRS BHG	7-12	7-15
0SR-21	84.0	354.3	63.9	181	5,495	212	120,320	033,197	SS. SH	GR/DN/CP GR/NU SRS BUG	7-16	61-1
OSM-22	76.0	127.5	30.6	241	5,539	213	120,313	033,127	SS	None	7-19	7-20
016-23	164.0	587.3	7:1	Ħ	804	195	124,204	035,899	RB SS, SH	GR/CP SRS BIIG	7-20	7-23
OUT-24	147.0	351.2	56.8	191	858	307	125,499	035,424	SS, SH	GR/NU	7-23	7-25

* Upper 401.6 ft of borehole dedicated to material property sampling; lower 484.0 ft was dedicated to geologic sampling.

TABLE 13. -- Summary of borehole data for OAK crater. Dates given in Enewetsk time; sample-type abbreviations explained in Table 5; abbreviations for downhole logs given in Table 6.

time; sample-type abbreviations explained in Table 5; abbreviations for downhole logs given in Table 6. [*IVY-grid location estimated for borehole OLT-14.] TABLE 13 (continued). -- Summary of borehole data for OAK crater. Dates given in Enewetak

209 page 211 follows

BOREHOLE OAR-2A

Lat/Long (E/W-1960): 11°36′43.8" N, 162°06′41.4" E

Lat/Long (WGS-1972): 11^o36'43.6" N, 162^o06'43.6" E

Location (IVY-grid, ft): 127,784 N and 039,569 E

Distance/Bearing from OAK GZ: 4,500 ft, 050.2 deg

Distance/Bearing from OAR-2: 77.5 ft, 353 deg

Water Depth (H&N): 110.5 ft Hole Depth (bsf): 410.5 ft

Hole Spudded: 04/25/1985 Drilling Ended: 04/27/1985

Sampling: SS, SH, LY* Recovery: 46% (188.1 ft)

Logs: MCS, GR/DN/CP, GR/NT Date Logged: 04/27-28/1985

Deviation: 0.9 deg @ 347 ft Casing: 8-5/8 in. @ 41.3 ft**

Drilling Mud/Additives: SEP (117 sx), BVS (44 sx), PAD (39 gals), LCM (2 sx)

Geologists: T.W. Henry and J.I. Tracy Drillers: G. Mooney, D. Webber

Loggers: C.S. Novinskie, A. Reynolds Paleontologist: E. Brouwers

Redescribed: 09/12/1985

* Cored from 41.7 - 410.5 ft.

** All casing pulled.

Depth Description

[TOP OF SEDIMENT PACKAGE 1.]

O.O - 4.2 GRAINSTONE WITH PACKSTONE: skeletal-Halimeda; upper 1.0 ft very fine grained, skeletal PACKSTONE, grading abruptly downward to coarse- to very coarse grained, Halimeda GRAINSTONE; uncemented; unaltered Halimeda and other skeletal grains, scattered moderate-red (5R4/6) Homotrema throughout; very pale orange. Containing 80 percent Halimeda from 2.9 - 4.1 ft; scattered small coral fragments throughout, including Astreopora(?) at 1.1 ft; abundant small mollusc fragments and small, whole strombid at 0.3 ft. SAMPLES: T @ 0.0, 0.5, 3.7; X @ 0.2.

NO RECOVERY

5.8 - 25.7

4.2 - 5.8

PACKSTONE AND WACKESTONE: upper 5.0 ft, mollusc, skeletal PACKSTONE, grading downward to mollusc, skeletal WACKESTONE, grading back to PACKSTONE from 19.8 ft to base; uncemented; unaltered, unabraded skeletal components, including moderate-red (5R4/6) Homotrema grains as low as 23.6 ft; color grading as follows: bulk of unit to 21.0 ft grayish orange; 21.0 to 21.4 ft, yellowish gray (5Y7/2) to grayish yellow green; 21.4 to 23.4 ft, yellowish gray (5Y7/2); 23.4 to 24.2 ft, yellowish gray (5Y7/2) to dusky yellowish green (5G5/2); and 24.2 to base, dusky yellowish green (5GY5/2), with dark-greenish-gray, very fine grained shell material ("salt-and-pepper" sand) and larger pelecypod shells. Unit contains common molluscs in upper part, including Cerithius, abundant strombids; corals scattered throughout, including small Acropora sticks and small Porites sp. heads. Fungia at 20.4 ft: scattered unaltered Halimeda grains throughout. Lower contact sharp, marked by abrupt color change. [Note: Paleontologic samples from base of unit contain moderately common, medium-darkgray ostracode and microgastropod steinkerns, fecal pellets(?), and partially replaced foraminifer tests and other microfossil shells; this material occurs with the normal microfuna and is evidence of reworking at this level. Portion from 25.4 ft to base contains abundant reworked components.] SAMPLES: T @ 6.4, 9.1, 15.3, 20.2, 23.6, 25.4; X @ 9.7, 20.1, 24.1, 25.4.

[TOP OF SEDIMENT PACKAGE 2. Disconformity at this point is clearly indicated by change from unaltered skeletal components to slightly altered ones and a slight increase in cementation including sparse "tea-brown" micrite below surface.]

25.7 - 34.0

skeletal, Halimeda, coral; generally poorly PACKSTONE: cemented to uncemented but containing very sparse "teabrown" micrite at 28.9 ft, minor skeletal alteration, including slightly chalky Halimeda grains, pinkish-gray (bleached) Homotrema near top; very pale orange with minor grayish-orange to pale-yellowish-brown stain associated with small rhizoliths. Contains scattered small coral heads, badly altered, small, scattered Acropora sticks. SAMPLES: T @ 28.4, 28.9 [two thin sections, one with microrhizoliths(?)]; X @ 28.4, 28.9.

34.0 - 41.6

GRAINSTONE: skeletal, mollusc; generally uncemented but with minor areas poorly cemented scattered throughout, some minor sparry calcite cement; sparse slightly chalky Halimeda grains; very pale orange to grayish orange; fine- to coarse-grained, becoming slightly finer grained from 38.6 ft to base, poorly sorted, abraded grains. Lower contact not recovered. SAMPLES: T @ 34.0, 38.4; X @ 34.0, 34.6, 40.1; 41.7.

[Disconformity indicated by marked increase in cementation and abrupt change in rock type. Placement of this surface indicated by notes from driller.]

- 41.6 43.8

 WACKESTONE: pelecypod, skeletal, well-cemented in top

 1.2 ft, becoming moderately to poorly cemented,

 irregularly cemented downward, containing very minor

 "tea-brown" micrite near top; larger shell material

 relatively unaltered, pelecypod at 42.1 ft with color

 retention, smaller shells in lower part of unit moldic;

 very pale orange to pale yellowish brown; slightly

 burrowed. Contains large pelecypod shells particularly

 common in upper part of unit; all in wave/current

 unstable configuration; Conus at 43.8 ft. SAMPLES:

 S @ 41.8 42.0.
- ________
 - 43.8 62.1 POOR RECOVERY: unit probably very soft and generally uncemented; driller reports upper 5 ft drilled very rapidly. Small coral fragment slightly infilled with calcite cement at 46.7 46.9 ft. Remainder of recovery consists of small pieces of moderately to well-cemented, pelleted, very pale orange WACKESTONE and washings of altered shell material.

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[Presence of possible disconformity in overlying interval of poor recovery indicated by change in cementation of underlying units, including appearance of moderately common "tea-brown" micrite, and by increase in coral alteration.]

- 62.1 62.6 CORAL HEAD: Porites lutea colony in growth position; bored slightly with Lithophagus; head relatively unaltered, unrecrystallized; outer edge of coral stained with abundant "tea-brown" micrite cementing skeletal WACKESTONE matrix in upper 0.05 ft of unit to coral top; very pale orange. SAMPLES: S@62.1 62.3; X 62.1.
- FLOATSTONE AND WACKESTONE: coral FLOATSTONE, with matrix of mollusc, Halimeda, skeletal WACKESTONE and interbedded with same; generally moderately cemented, with well-cemented burrows; minor scattered "tea-brown" calcite associated with small cylindrical tubes throughout; Halimeda grains very chalky, slightly moldic; very pale orange with small areas of pale-yellowish-brown; minor moldic porosity; small coral head at 64.4 ft partly spar-filled very chalky (almost moldic); interval from 66.3 66.4 ft soft (caught in bit at end of run). Contains overturned Astreopora(?) head at 66.4 67.1 ft with small Porites lutea head just beneath, bored with Lithophagus. SAMPLE: X @ 63.4.

67.1	-	71.2	NO RECOVERY.
71.2	-	81.6	WACKESTONE: skeletal, gastropod; moderately cemented irregularly cemented from 71.2 to 81.0 ft, somewhat mottled with small areas poorly cemented to 81.6 ft, lower part of unit uncemented; skeletal material altered, chalky Halimeda grains, gastropods commonly preserved as spar-filled steinkerns, pelecypods as molds; very pale orange in upper part, very pale orange to white in basal 0.6 ft. Contains small scattered corals; large pelecypod replaced with spar at 75.2 ft. SAMPLES: S@ 75.8 - 76.1; X@ 75.7, 75.8.
81.6	_	90.4	NO RECOVERY: soft, hammer-sample attempted.
90.4	_	90•7	POOR RECOVERY: recovery consists of WACKESTONE: skeletal; uncemented, chalky; very pale orange; very fine grained material.
* * * *	*	* * * * *	* * * * * * * * * * * * * * * * * * * *
[Disconformity clearly indicated by change in cementation and by increase in			
alterat	íon	of corals	below this horizon. However, the position of this this interval is not closely determinable.
90.7	-	91.0	POOR RECOVERY: lower 0.3 ft of recovery consists of (1) skeletal, pelleted, foraminifer WACKESTONE-filled Callianassa burrow; cemented with abundant "tea-brown" micrite cement; and (2) calcite-infilled coral fragments. SAMPLES: T @ 90.7; X @ 90.7.
91.0	_	95•2	NO RECOVERY.
95.2		115.9	FLOATSTONE: coral; matrix skeletal WACKESTONE; areas of good recovery moderately cemented, irregularly cemented; areas of poor or no recovery probably consisting of uncemented material, coral pieces, and cemented burrows; molluscs preserved as molds, some corals partly recrystallized, Halimeda very chalky in area of moderate to poor cementation. Contains abundant corals, including small Favia(?) head at 115.4 ft, Fungia and Acropora sticks at 114.9 ft, abundant small heads of Porites spriddled with Lithophagus from 100.0 - 105.1 ft; small Astreopora(?) from 110.6 - 110.2 ft. [Note: several intervals with uncemented coarse-grained sand; fines may

115.9 - 126.6 NO RECOVERY: coral pieces in run from 115.9 - 119.5 ft probably fallen-in from uphole.

[Disconformity indicated by marked increase in cementation, presence of abundant "tea-brown" micrite in upper part of underlying unit, increase in alteration of skeletal components, and by presence of possible laminated crust at top of unit.]

126.6 - 141.2 FLOATSTONE (tight): coral; matrix skeletal, mollusc WACKESTONE. Top 0.05 ft may be laminated crust, very hard, pale yellowish brown, with abundant "tea-brown" micrite. Unit irregularly cemented throughout, moderately to well-cemented from top to 132.5 ft, poorly cemented to uncemented to base, "tea-brown" micrite abundant in upper part of unit to 127.6 ft, then sparse, concentrated along edge of corals to about 133.6 ft; corals partly recrystallized, partly replaced by chalk, minor spar infilling, gastropods in upper part have sparreplaced shells. Color as follows: top to 127.6 ft, pale yellowish brown to very pale orange, with very pale orange to white corals; 127.6 to 135.2 ft, pale yellowish brown to very pale orange mottled with very pale orange; 135.2 ft to base, generally very pale orange. Contains highly varied fauna, abundant gastropods, predominantly small coral heads, including small Porites sp., Astreopora(?) at 133.4 - 134.1 ft. SAMPLES: S @ 126.6 -127.1; X @ 126.6, 130.0.

141.2 - 147.9 NO RECOVERY

147.9 - 149.5 PACKSTONE TO WACKESTONE: mollusc, coral, skeletal; poorly cemented, very minor "tea-brown" micrite, crumbly; well-preserved shells; very pale orange with minor very pale orange to pale yellowish brown. Contains diverse mollusc assemblage, including thin-walled forms; gastropods include Turbo, cerithid, Cyprea, and numerous other

forms; large fragment of Tridacna. SAMPLE: X @ 148.9.

149.5 - 155.2 NO RECOVERY.

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WACKESTONE TO FLOATSTONE: skeletal, coral WACKESTONE interbedded with coral FLOATSTONE with WACKESTONE matrix; poorly cemented, crumbly, minor "tea-brown" micrite; fossils slightly altered to unaltered, minor Halimeda grains only slightly chalky, scattered pelecypods with color retention. Corals consist of several types, including small Lithophagus-bored Porites head not in growth position; thin-walled pelecypods. SAMPLE: X @ 157.3.

157•9	-	162.3	NO RECOVERY.
162.3	_	163.0	POOR RECOVERY: Interval limited to cemented, nodules(?) of pelleted, skeletal WACKESTONE TO PACKSTONE; very pale orange with minor pale yellowish brown.
163.0	-	171.2	NO RECOVERY.
171.2	-	171.6	irregularly shaped, cemented nodules. SAMPLE: T@ 171.4.
171.6		175•9	NO RECOVERY.
			* * * * * * * * * * * * * * * * * * * *
			sted by increase in skeletal alteration, increase in sence of minor "tea-brown" micrite and drusy calcite lining
175•9	-	177.0	CORAL HEADS: large <u>Lithophagus</u> -bored <u>Porites</u> <u>lutea</u> in growth position with another type of small coral head at top; matrix consists of "tea-brown"-cemented, skeletal WACKESTONE; well-cemented, containing minor small mollus molds, minor, very chalky <u>Halimeda</u> , corals not recrystallized; containing minor calcite druse lining small molds of gastropods; coral very pale orange, matrix very pale orange to pale yellowish brown. Large <u>Tridacna</u> shell in middle of unit. SAMPLES: S@ 176.7 - 177.0; X@ 176.0, 176.7; R@ 176.4.
177.0	-	181.7	BAFFLESTONE/FRAMESTONE TO FLOATSTONE: alternating intervals of BAFFLESTONE TO FRAMESTONE with intervening tight coral FLOATSTONE; some specimens and small heads clearly in growth position, others toppled. Matrix skeletal PACKSTONE; moderately to well-cemented, patchy, very minor "tea-brown" micrite; minor sparry druse lining minor molds. Unit contains wide array of corals; large Favia(?) head at 177.8 to 178.0 ft, small branching Acropora at 177.3 ft (toppled) and 178.0 - 178.4 ft (in growth position); small heads of Acropora cuneata, in growth position, encrusted with minor coralline algae from 181.0 - 181.7 ft; contains scattered pelecypods, gastropods throughout. SAMPLE: X @ 181.0.
181.7		 182 . 9	CORAL HEAD: Porites lutea in growth position; upper surface

181.7 - 182.9 CORAL HEAD: <u>Porites lutea</u> in growth position; upper surface bored with <u>Lithophagus</u>, borings infilled with well-cemented, pale-yellowish-brown ("tea-brown") skeletal

PACKSTONE TO WACKESTONE matrix; coral partly recrystallized, very pale orange with minor spar-infilled paleyellowish-brown to moderate-yellowish-brown areas.

	سے سے سے جبر سے جب سے سے جبر سے سے سے سے سے جبر سے	
182.9 - 186.6	FLOATSTONE, coral; some heads in	

mollusc PACKSTONE matrix in upper 1.6 ft, becoming slightly less muddy in matrix downward; porosity high, abundant intergranular and shelter porosity. Subunits as follows: 182.9 - 184.5 ft, FLOATSTONE, poorly to moderately cemented, minor to moderate "tea-brown" micrite; very pale orange with minor pale yellowish brown; contains slate-pencil echinoid spine, Turbo operculum, Fungia, small Porites sp. head in growth position. 184.5 - 185.3 ft, tight FLOATSTONE TO FRAMESTONE, Acropora cuneata heads, poorly cemented matrix, color like overlying subunit; contains slate-pencil echinoid spine. 185.3 - 186.6 ft, tight FLOATSTONE, moderately cemented, some areas well-cemented, common "tea-brown" micrite in lower part. SAMPLES: S @ 185.3 - 185.6; X @ 183.5, 185.3.

186.6 - 187.6 CORAL HEAD: <u>Porites lutea</u> in growth position, bored with <u>Lithophagus</u>, well-preserved; matrix of skeletal PACKSTONE, poorly to moderately cemented; very pale orange. Contains large Turbo shell.

187.6 - 188.6 PACKSTONE: foraminifer, skeletal; uncemented; shell material well-preserved; very pale orange; fine- to medium-grained, well-sorted; containing small well-cemented, skeletal PACKSTONE nodules. Contains minor small coral pieces, moderately recrystallized. [Note: no "tea-brown" calcite.] SAMPLES: T @ 188.2; X @ 188.1.

188.6 - 189.9 POOR RECOVERY: consists of pebble-sized nodules like overlying unit but moderately to well-cemented, slightly altered Halimeda grains; very pale orange. [Note: no "tea-brown" micrite.]

189.9 - 190.7 CORAL HEAD: <u>Porites lutea</u>, well-preserved, with veneer of well-cemented skeletal PACKSTONE at top; very pale orange.

190.7 - 194.3 NO RECOVERY.

* * * * ? * * * ? * * * * * ? * * * *

[Possible disconformity indicated by increase in cementation and appearance of "tea-brown" micrite below surface; exact placement uncertain.]

FLOATSTONE: coral, mollusc, with foraminifer, skeletal 194.3 - 199.5 PACKSTONE matrix; moderately to well-cemented, "teabrown" micrite moderately common; coral in lower part of unit partially spar-replaced. Unit contains slate-pencil echinoid spines, abraded shell fragments, large Tridacna shell at 195.2 ft, small Porites sp., scattered Acropora sticks, and large foraminifers. Lower 0.3 ft is Porites lutea head, very pale orange, with large area recrystallized to pale-yellowish-brown sparry calcite; this head is apparently resting on hardground formed by upper surface of lower unit. Lower contact sharp, gently undulatory with 0.05 ft of relief. [Note: unit is more like overlying sequence depositionally but differs in mode of preservation of skeletal components, particularly corals.] SAMPLES: S @ 199.2 - 199.5; T @ 195.1, 195.3; X @ 195.1, 195.3, 199.2.

[Disconformity indicated by sharp, gently undulatory, microkarstic surface, by an increase in cementation below boundary, and by partial infilling of coral mold at top of underlying unit with skeletal material from overlying unit.]

199.5 -204.5 WACKESTONE AND PACKSTONE TO FLOATSTONE: coral, skeletal foraminifer WACKESTONE to sparse coral FLOATSTONE in upper part of unit, grading downward to coral, skeletal PACKSTONE from 203.9 - 204.5 ft; pervasively very well cemented from top to 202.5 ft, becoming moderately to poorly cemented, irregularly cemented downward with lower 0.5 ft of unit containing small well-cemented nodules surrounded by moderately to poorly cemented material; containing moderate "tea-brown" micrite in upper part of unit; corals in upper part chalky, with "tea-brown" micrite lining exteriors; gastropods preserved as molds in upper part of unit, becoming chalky downward; yellowish gray to pale yellowish brown in upper part, mottled with very pale orange. Corals in upper part include Acropora sticks, small Porites sp. at 200.8 ft; large spiny gastopods (Drupa?) at base (with lower part of overlying unit). Lower contact imperceptably gradational. SAMPLES: S @ 199.5 - 200.3; X @ 199.5.

PACKSTONE: mollusc, skeletal, with intervals containing sparse corals; poorly cemented; skeletal material well-preserved; very pale orange. Contains thin-shelled pelecypods of several types, large heavily bored <u>Tridacna</u> shell with abundant spar replacement at 205.4 ft, several types of gastropods, small branching coral. SAMPLES: S @ 206.6 - 206.9; X @ 204.9, 206.6.

208.4 - 208.8 CORAL HEAD: <u>Porites lutea</u>, in growth position, bored with Lithophagus retaining original shell coloration; coral

well-preserved, unrecrystallized; very pale orange.

208.8 - 223.4

FLOATSTONE: coral, with skeletal, mollusc PACKSTONE matrix to about 214.5 ft, grading downward to poorly sorted GRAINSTONE matrix; generally moderately cemented; moderately cemented to 211.6 ft with slight "tea-brown" micrite stain along edge of corals; poorly cemented from 211.6 - 212.5 ft; moderately cemented from 212.5 - 214.5 ft; poorly cemented from 214.5 - 216.0 ft; moderately to poorly cemented from 216.0 - 216.3 ft but with large area of "tea-brown" micrite; generally uncemented from 216.3 ft to base; upper part slightly moldic porosity, but shells preserved downward, including sparse color retention in gastropods below 114.8 ft; very pale orange. Upper 0.2 ft contains continuation of overlying Porites lutea head in part of core; unit contains Astreopora head at 211.6 ft, large stick-like coral from 211.6 - 213.2 ft; abundant, diverse molluscan assemblage, including thin-shelled pelecypods, fragile gastropods, Cardium at base. [Note: lagoonal fauna.] Lower contact sharp. SAMPLES: S @ 212.8 - 213.3; T @ 218.5; X @ 214.5, 212.8.

[Disconformity indicated by sharp contact, abundant "tea-brown" micrite below surface, crust-like hardground with borings in top, and marked increase in cementation.]

223.4 - 234.0

PACKSTONE AND GRAINSTONE: upper part mollusc, foraminifer, skeletal PACKSTONE, becoming coral FLOATSTONE with PACKSTONE matrix from 228.8 - 229.8 ft with abundant small Acropora sticks; from 229.8 - 232.2 ft, poorly sorted, mollusc, foraminifer, skeletal GRAINSTONE; moderately sorted GRAINSTONE from 232.2 ft to base. Upper 0.3 ft contains laminated crust with small sponge and gastropod borings penetrating upper 1 cm, very well cemented; pale yellowish brown, mottled with very pale orange, abundant "tea-brown" micrite cement; unit poorly cemented from 223.7 - 233.3 ft; uncemented from 233.3 -234.0 ft; skeletal preservation excellent throughout unit; very pale orange with moderate-brown (5R4/4) matrix. Unit contains generally very thin shelled molluscs, including articulated pelecypods. Lower contact gradational. SAMPLES: S @ 223.4 - 223.7; T @ 232.7; X @ 223.4, 227.3.

234.0 - 245.1

GRAINSTONE WITH PACKSTONE: subdivided into following lithic subunits: from 234.0 - 234.6 ft, mollusc, foraminifer, skeletal PACKSTONE TO GRAINSTONE, moderately cemented, irregularly cemented; generally very pale orange with very pale orange to pale-yellowish-brown mottling (in better-cemented areas). From 235.5 - 239.0 ft, GRAINSTONE, skeletal, foraminifer, mollusc, uncemented, generally medium-grained with larger mollusc fragments, moderately well sorted; Conus at 238.1 with color

retention. From 239.0 - 242.1 ft, GRAINSTONE: Calcarina (foraminifer), uncemented, medium-grained, well-sorted, containing few other large skeletal grains, very pale orange to grayish orange. From 242.1 - 245.1 ft, PACKSTONE, skeletal, foraminifer, uncemented but containing minor scattered areas with some sparry-calcite cement, cemented burrows(?). SAMPLES: T @ 232.7, 240.0, 245.0 (cemented burrow ?); X @ 236.1, 245.0.

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[A disconformity at this level may be indicated by abrupt increase in cemented diagenetic nodules at this horizon.]

PACKSTONE: skeletal, foraminifer; generally very fine to fine-grained, moderately well-sorted, slightly muddy; generally uncemented but some well-cemented, patchy areas and diagenetic nodules with spar cement; skeletal material slightly more altered than above; mottled pale yellowish brown (cemented areas) to very pale orange (uncemented); cementation varying as follows: 245.1 - 246.5 ft, 50% cemented; 246.5 - 249.0 ft, 10% cemented; 249.0 - 249.9 ft, about 60% cemented; 249.9 - 250.7 ft, 10% cemented; 250.7 - 251.0 ft, large cemented burrow(?) (containing chalky pelecypod shell). Contains sparse macrofauna, mainly molluscs. SAMPLES: T@ 249.5, 249.7, 250.7; X@ 246.7, 249.5, 250.7.

251.9 - 255.2 NO RECOVERY.

255.2 - 255.5

PACKSTONE: similar to unit from 245.1 - 251.9 ft with single burrow(?) described as follows: GRAINSTONE TO PACKSTONE; foraminifer, skeletal; coarse-grained, poorly sorted, moderately to poorly cemented, spar-cemented; very pale orange to pale yellowish brown.

255.5 - 263.0 NO RECOVERY.

263.0 - 288.1

PACKSTONE AND FLOATSTONE: coral FLOATSTONE alternating with skeletal PACKSTONE and minor skeletal WACKESTONE matrix; alternating uncemented and poorly cemented areas; very pale orange in uncemented zones, very pale orange to pale yellowish brown in partly cemented intervals; shells and corals slightly altered to unaltered, minor spar infilling of gastropod shells in upper 4.0 ft of unit. Subunits as follows: 263.0 - 263.4 ft, PACKSTONE with large pelecypod; 263.4 - 264.1 ft, FLOATSTONE, with abundant unabraded Acropora sticks; 264.1 - 270.3 ft, PACKSTONE with scattered corals, containing small, well-cemented, WACKESTONE-filled burrows(?), grading downward; 270.3 - 273.4 ft, WACKESTONE; 273.4 - 273.8 ft,

PACKSTONE; 273.8 - 274.2 ft, coral FLOATSTONE with PACKSTONE matrix; 274.2 - 279.1 ft, PACKSTONE, with abundant, diverse, generally thin-shelled pelecypods, unaltered shells, containing scattered, very small, cemented, WACKESTONE-filled burrows(?); 279.1 - 279.4 ft, coral FLOATSTONE with skeletal PACKSTONE matrix; 279.4 -280.6 ft, fine-grained, foraminifer, skeletal PACKSTONE with scattered, small cemented burrows(?), containing sparse large shells, grading downward; 280.6 - 282.9 ft. foraminifer(?), skeletal PACKSTONE, uncemented at top, becoming moderately cemented at base; very fine grained, very well sorted; containing single, well-cemented PACKSTONE-filled diagenetic nodule(?) (texture same as matrix); 282.9 - 285.3 ft, PACKSTONE like overlying subunit but less well-sorted, containing several molluscrich layers, smaller burrows(?) and scattered very small corals, moderately to poorly cemented in upper part and in burrows(?), becoming poorly cemented at base. excellent skeletal preservation, grading downward; 285.3 - 285.9 ft, skeletal WACKESTONE TO FLOATSTONE, partly uncemented, partly moderately cemented; 285.9 - 288.1 ft, PACKSTONE TO FLOATSTONE, moderately cemented, irregularly cemented, with sparse well-cemented areas, sparse wellcemented small burrows containing very minor molds. diagenetic nodules containing moderately common, smallto medium-sized molluscs and scattered very small corals (Seriatopora), gastropods with color retention. Lower contact disrupted by drilling. SAMPLES: S @ 286.5 -286.9: T @ 265.4 (burrow?), 278.0, 281.6, 281.8 (burrow?); X @ 263.3, 273.4, 278.4, 281.6, 282.9, 286.5.

[The general increase in cementation from 288.1 - 288.9 ft with spar infilling and presence of "tea-brown" micrite below this horizon suggests a discontinuity.]

288.1 - 290.3

FLOATSTONE AND WACKESTONE: upper part coral FLOATSTONE becoming skeletal, coral WACKESTONE downward; subunits as follows: from 288.1 - 288.9 ft, Acropora FLOATSTONE, unabraded sticks, containing mollusc, skeletal WACKESTONE matrix; well-cemented, coral sticks very chalky, large pelecypod shells partially replaced by sparry calcrite, partially moldic; burrowed, very pale orange to pale yellowish brown. From 288.9 - 290.3 ft, mollusc, coral WACKESTONE, moderately to well-cemented, patchy, abundant large pelecypods partially spar-replaced, with "teabrown" micrite lining outside of shells, dark-yellowishbrown sparry calcite infilling upper parts of shell interiors (geopetal structures) and as gastropod steinkerns, mottled very pale orange with minor paleyellowish-brown to dark-yellowish-brown areas; contains large pelecypods in upper part of subunit.

290.3 - 291.5 WACKESTONE: skeletal, coral; moderately to poorly cemented with minor well-cemented diagenetic nodules, containing minor sparry calcite infilling of shells; very pale orange; contains common Seriatopora sticks. Containing small branching Seriatopora sticks stained with abundant "tea-brown" micrite.

291.5 - 295.0 NO RECOVERY: probably like overlying unit; matrix on top of coral in underlying unit same.

295.0 - 297.4 CORAL HEAD: Porites lutea in growth position, very pale orange, unrecrystallized, minor "tea-brown"-micrite stain on side of coral; matrix consists of poorly cemented to uncemented, skeletal PACKSTONE in middle of unit.

297.4 - 300.1 PACKSTONE: skeletal, coral; uncemented; very pale orange;

containing small well-cemented, irregularly shaped, diagenetic nodules(?), comprising less than 5 percent of unit. Corals consist of small fragments of Seriatopora and single small piece of Porites sp. SAMPLE: T@ 298.0.

[TOP OF SEDIMENT PACKAGE 3. Slight increase in cementation and change in preservation of skeletal components, particularly corals, are evidence for disconformity at this position.]

FLOATSTONE: coral; skeletal WACKESTONE matrix; wellcemented; corals preserved only as molds and chalk; very
pale orange, becoming mottled pale yellowish brown from
304.0 - 307.5 ft. Corals consisting of small branching
forms, including Acropora sticks. Seriatopora, and
digitate Porites; minor mollusc molds. Recovery poor.
consisting of knobby, irregularly shaped, cemented
material typical of vuggy limestone. Upper part of unit
contains no spar lining of coral molds, very sparse spar
lining from 309.7 ft downward, where recovered material
consists of sparse skeletal WACKESTONE. SAMPLES: S@
300.1 - 300.3, 307.2 -307.4; T@310.3; X@300.1, 307.2,
307.5, 310.2.

[Unit below this point is similar lithically to overlying unit but differs in having abundant spar infilling of gastropod shells and less moldic porosity.]

319.4 - 328.9 WACKESTONE WITH FLOATSTONE: generally skeletal, mollusc WACKESTONE, grading to coral FLOATSTONE from 319.4 - 324.2 ft; unit pervasively well-cemented; fossils generally preserved only as molds, larger pelecypod shells partially spar-replaced, partly shell material; abundant moderate-yellowish-brown spar infilling of enlarged molds and small vugs, lining others, persisting

to 324.3 ft, very scattered from 324.3 - 327.6 ft, common again from 327.6 - 328.9 ft; unit very pale orange, mottled slightly with very pale orange to pale yellowish brown. Recovery from 319.4 - 320.7 ft consists of pebble-sized pieces of broken rock; from 323.8 - 326.5 ft, good recovery; 326.5 - 328.9 ft, rubbly with large pieces of spar, contains diagenetic nodules, minor spar. SAMPLES: S @ 320.4 - 320.7; T @ 323.8 328.6; X @ 319.4, 320.4, 323.8, 328.6.

328.9 - 331.3 NO RECOVERY.

331.3 - 336.0

FLOATSTONE: coral; sparse skeletal WACKESTONE matrix; well-cemented, moldic to slightly enlarged moldic porosity (mostly coral sticks), minor spar infilling; very pale orange mottled with pale-yellowish-brown and minor dark yellowish brown to pale yellowish brown; pelecypod shells partly replaced by spar, partly moldic. Contains abundant large Acropora sticks, unabraded, probably toppled, pelecypods. SAMPLES: S @ 331.3 - 331.9; X @ 331.3.

[Note: Although the overlying section of rock from 319.4 to 336.0 ft contains large molds and small vugs and is characterized by abundant sparry calcite lining and infilling these, the general rock type and matrix is determinable macroscopically. From 336.0 to 393.8 ft, the rock is generally highly vuggy, may contain small caverns, and has extremely high permeability. In this lower section, the rock is so pervasively altered diagenetically that it is difficult to macroscopically identify the macrofunal components and the finer-grained matrix material. The abrupt appearance of "tea-brown" micrite cement just below this point, along with the marked increase in recrystallization of the entire rock, indicates a disconformity at or about this point in the sequence.]

336.0 - 341.8

FLOATSTONE: coral, matrix probably skeletal PACKSTONE; from 334.6 to 338.3 ft, coral FLOATSTONE, abundant large molluscs, mainly pelecypods, grading downward to tight coral FLOATSTONE to base. Unit well- to very well cemented, containing dispersed "tea-brown" micrite in upper part, becoming more common downward to about 338.3 ft; corals, molluscs in upper part perserved generally as molds with moderate sparry-calcite lining; preservation downward exclusively moldic to enlarged molds to minor vugs, not as spar-filled or -lined as overlying subunit; very pale orange with pale-yellowish-brown to moderateyellowish-brown areas. Corals include small digitate forms, mainly Acropora(?), large unidentifiable sticks, and small heads; molluscs consist of large pelecypods, particularly in upper part of unit, and gastropods. SAMPLES: S @ 336.7 - 337.3; X @ 336.7, 337.9.

341.8 - 342.5	CORAL HEAD: Astreopora(?) in growth position; coral walls completely replaced by moderate-yellowish-brown sparry calcite with interiors filled with very pale orange micritic material; moldic, in part slightly vuggy, high perameability.
342.5 - 351.9	FLOATSTONE(?): coral, mollusc; matrix generally indeterminant macroscopically but some indication of WACKESTONE matrix at about 350.5 ft; may have been coral FLOATSTONE from 350.5 - 351.9 ft with PACKSTONE matrix. Corals consist of several types of Acropora(?) sticks and small Astreopora(?) heads extensively recrystallized and replaced by moderate-yellowish-brown sparry calcite throughout; unit extremely vuggy, breaks up badly in coring. [Note: caliper log shows badly washed-out zone here.] SAMPLES: S@350.2 - 350.6; X@347.1, 350.2.
351.9 - 355.2	NO RECOVERY. [This interval in OAR-2 looks like a sea- water-filled cave; it is interpreted as an unconsolidated sand in this hole. Driller noted that it cored very rapidly.]
355.2 - 360.2	POOR RECOVERY: knobby pieces of skeletal PACKSTONE(?) or WACKESTONE with some coral molds; minor sparry calcite in recovery, only thin drusy lining of molds; well-cemented pieces; very pale orange to pale yellowish brown. Probably represents continuation of overlying unit. SAMPLE: X @ 360.1.
360.2 - 367.5	FLOATSTONE(?): coral, locally tight; matrix highly recrystallized skeletal WACKESTONE in upper part, may be PACKSTONE OR WACKESTONE matrix in lower part; unit well-cemented, pervasively recrystallized; tends to break up because of extensive large coral molds enlarged slightly to small vugs; vugs generally infilled partly with sparry calcite in upper part; below 365.7 ft, coral molds not infilled; pale yellowish brown to very pale orange, with moderate-yellowish-brown spar. Corals generally consist of large sticks of Acropora. SAMPLES: S@361.7 - 362.0, 366.9 - 367.5; X@360.2, 361.7, 366.9.
367.5 - 371.1	POOR RECOVERY: consisting of small rounded pieces similar to overlying unit. SAMPLE: X @ 370.0.
371.1 - 372.7	PACKSTONE: pervasively recrystallized and altered; very highly porous, moderately coherent, friable; appears to

have even texture throughout, no discernable macrofossils, although may contain some coral molds infilled with matrix; very pale orange. SAMPLES: S@372.0 - 372.5; X@372.0.

372.7	-	377.2	NO RECOVERY.
377.2	-	379.7	PACKSTONE: pervasively recrystallized, moderately coherent, very porous, appears to have uniform texture, friable. Most macrofauna cannot be identified, contains sparse, very small Seriatopora(?) fragments. SAMPLE: X @ 379.6.
379.7	_	390.9	NO RECOVERY: [Note: material from core run rounded, spar- replaced coral and well-preserved piece of Porites lutea, both clearly fallen down from uphole.]
390.9	-	393.8	PACKSTONE(?) OR WACKESTONE(?): pervasively recrystallized; moderately cemented, friable; minor gastropod steinkerns. spar-replaced shell material; very pale orange. SAMPLE: X @ 391.6.
393.8	-	402.5	FLOATSTONE TO PACKSTONE/WACKESTONE: coral FLOATSTONE with matrix of skeletal PACKSTONE TO WACKESTONE in upper part, interbedded with same and locally with skeletal WACKESTONE downward from 400.0 - 402.5 ft; upper part of unit moderately to extensively recrystallized, containing abundant small molds, becoming progressively less common downward; lower part of unit containing chalky molluscs and moderately chalky corals; upper part moderately cemented with scattered well-cemented nodules; unit becoming progressively less-cemented below, poorly cemented at base; very pale orange. Contains small Acropora sticks, Seriatopora, and digitate Porites(?); from 400.0 ft downward, contains large pelecypods and small scattered gastropods. SAMPLE: X @ 399.7.
402.5	-	403.7	CORAL HEADS: small Porites lutea heads with skeletal WACKESTONE matrix; poorly cemented, coral not recrystallized except for outer rind which contains some "tea-brown" micrite stain; pale yellowish brown.
403.7	-	405.1	FLOATSTONE: coral, in skeletal PACKSTONE TO WACKESTONE matrix; poorly cemented, irregularly cemented; corals unrecrystallized, molluscs slightly chalky; pale yellowish brown. Contains fragile Seriatopora and small digitate Porites; small, thin-walled molluscs, small gastropod.

405.1 - 410.5

POOR RECOVERY: recovery may be fall-in, consisting of small Porites sp. head and well-cemented, skeletal, pelleted, WACKESTONE-TO-PACKSTONE-filled burrows(?); burrows(?) elongate, very pale orange to pale yellowish brown, partly spar-cemented(?). Driller reports soft interval. SAMPLES: T @ 406.5; X @ 406.5, 406.6, 430.9.

*** TOTAL DEPTH OF HOLE 410.5 FT ***

BOREHOLE OAR-2

Continuation of OAM-1 below 401.6 ft bsf)

Lat/Long (E/W-1960): 11^o36'43.0" N, 162^o06'41.5" E

Lat/Long (WGS-1972): 11°36′42.8" N, 162°06′41.4" E

Location (IVY-grid, ft): 127,784 N and 039,575 E

Distance/Bearing from OAK GZ: 4,458 ft, 051.0 deg

Water Depth (H&N): 114.2 ft Hole Depth (bsf): 885.6 ft

Hole Spudded: 04/10/1985 Drilling Ended: 04/24/1985

Sampling: LY (exclusively) Recovery: 76% (366.3 ft)

Logs: MCS, GR/DN/CP, GR/NU, CSV Date Logged: 04/23-24/1985

Casing: 8-5/8 in. @ 26.2 ft (in OAM-1) Deviation: 0.3 deg @ 500 ft.

0.5 deg @ 725 ft, 0.8 deg @ 830 ft

Drilling Mud/Additives: MPC (27 sx), BVS (216 sx), SEP (117 sx) LCM (4 sx),

PAD (197 gals) [includes materials expended in OAM-1]

Geologists: T.W. Henry and J.I. Tracy Drillers: G. Mooney, D. Webber

Paleontologist: E. Brouwers Logger: M. Beales

* All casing recovered.

Redescribed: 09/13/1985

Depth Description

[Note: This borehole is an extension of dedicated materials properties hole OAM-1 from 401.6 ft to total depth. This borehole starts about 100 ft below the top of SEDIMENT PACKAGE 3.]

401.6 - 403.6 WACKESTONE: skeletal, mollusc; moderately to wellcemented, irregularly cemented; very pale orange with
very pale orange to pale-yellowish-brown mottling;
moldic porosity common throughout unit. Contains thinshelled pelecypods and gastropods. Lower contact
gradational. SAMPLES: T @ 401.9; X @ 401.6.

403.6 - 409.8

WACKESTONE: skeletal, mollusc; poorly cemented, irregularly cemented with well-cemented nodules in upper part, becoming poorly to moderately cemented from 409.0 - 409.8 ft; very pale orange. Lower contact gradational. SAMPLES: X @ 406.5, 409.1.

409.8 - 432.5

WACKESTONE WITH PACKSTONE: mollusc, skeletal; moderately to well-cemented throughout; fossils preserved exclusively as molds throughout unit; very pale orange with very pale orange to pale-yellowish-brown mottling, pelleted bioturbated(?) areas. Contains thin-shelled pelecypods, gastropods, Seriatopora (particularly from 415.0 - 416.1 ft), and other small coral sticks scattered throughout. SAMPLES: S @ 416.1 - 416.5, 432.2 - 432.5; X @ 416.1, 419.9, 420.9, 432.2.

432.5 - 442.5 NO RECOVERY.

[TOP OF SEDIMENT PACKAGE 4. Disconformity indicated by differences in rock types, mode of preservation of corals and other fossils, change from moldic to vuggy porosity, and color of rock. Geophysical logs suggest disconformity located between 437.0 - 440.0 ft.]

442.5 - 456.9

BAFFLESTONE AND FRAMESTONE: coral; alternating lithic types with skeletal PACKSTONE TO WACKESTONE matrix; moderately to well-cemented; most corals chalky, partly replaced by calcite spar, minor molds; lower 1.3 ft becoming progressively less-cemented to moderately to poorly cemented; partly chalky; matrix generally very pale orange with minor very pale orange to paleyellowish-brown mottling; corals very pale orange with pale-yellowish-brown spar-infilling. From 442.5 - 449.0 ft, BAFFLESTONE, consisting of conical or fan-shaped turbinarid coral with skeletal WACKESTONE TO PACKSTONE matrix; from 449.0 - 456.9 ft, consisting mainly of several kinds of corals, some small heads, some encrusting types and other types of Porites, and branching Acropora and Seriatopora making up alternating intervals of FRAMESTONE WITH BAFFLESTONE; unit contains mainly interparticle porosity, minor to moderate moldic porosity, and shelter porosity; matrix contains several types of foraminifers, small gastropods and pelecypods, and echinoid spines. Lower contact abruptly gradational. SAMPLES: S @ 443.8 - 444.3, 454.0 -454.4, 456.0 - 456.3; X @ 443.5, 443.8, 453.5, 454.0, 456.0; M @ 444.3 - 444.8.

456.9 - 458.2 PACKSTONE: skeletal, coral; generally well-cemented from top to 457.2 ft, poorly cemented from 457.2 - 457.5 ft, well-cemented from 457.5 ft to base; skeletal material

generally moderately altered, some molds; very pale orange; fine- to very coarse grained material. Lower contact apparently gradational. SAMPLES: S @ 456.9 - 457.2; T @ 456.9.

458.2 - 464.4

FRAMESTONE WITH BAFFLESTONE: coral; several types of encrusting corals, small coral heads, and branching corals forming alternating FRAMESTONE WITH BAFFLESTONE with skeletal PACKSTONE TO WACKESTONE matrix; subunits as follows: 458.2 - 460.7 ft, alternating BAFFLESTONE with FRAMESTONE; 460.7 - 464.4 ft, FRAMESTONE; unit generally well-cemented, becoming progressively lesscemented in lower 1.3 ft; corals generally chalky, commonly partly infilled with sparry calcite; very pale orange with moderate-yellowish-brown sparry calcite; lower part of unit with some moldic porosity, remainder of unit generally with interparticle and shelter porosity. Most common coral is Porites (sparsely bored with Lithophagus; other corals include Acropora; minor encrusting coralline algae. Lower contact apparently abruptly gradational. SAMPLES: S @ 463.9 - 464.1; X @ 460.4, 463.9.

464.4 - 490.7

PACKSTONE WITH WACKESTONE: generally skeletal, coral, mollusc PACKSTONE but grading to WACKESTONE locally; generally well-cemented to 468.3 ft, becoming moderately cemented downward, poorly cemented in basal 0.5 ft; containing minor small, moderately cemented, paleyellowish-brown to very pale orange nodules at scattered intervals from 480.3 to 487.4 ft; skeletal preservation varying from slightly chalky mollusc shells to minor spar-filled internal molds (steinkerns) in upper part of unit, becoming unaltered downward with nacreous layer preserved in some specimens in lower part of unit; corals correspondingly generally recrystallized, chalky in upper part of unit, becoming well-preserved downward; very pale orange to white. Corals common in upper part of unit, much less prominent from 480.3 to 489.0 ft, becoming progressively more common from 489.0 to 490.7 ft: corals consist of several types of very small heads scattered throughout plus unabraded Seriatopora sticks, small Porites (finger-corals), and small Acropora sticks; abundant thin-shelled pelecypods, and several types of gastropods, foraminifers. Lower contact imperceptably gradational. SAMPLES: S @ 488.6 - 488.8; T @ 471.9, 483.4; X @ 470.7, 480.0, 488.6, 490.0; M @ 472.2 - 472.9, 483.4 - 484.4.

490.7 - 525.3

FLOATSTONE: unit generally coral FLOATSTONE with skeletal, mollusc PACKSTONE TO WACKESTONE matrix; grades to tight FLOATSTONE from 491.3 - 492.0 ft and from 495.8 - 496.5

ft; fossils well-preserved, corals unabraded, unrecrysallized, gastropods and pelecypods with nacreous layer unaltered on some specimens; very poorly cemented to uncemented, well-consolidated; very pale orange; unit contains very sparse, small, moderately cemented burrows from 499.4 - 499.5 ft, large lined worm-tube(?) at 505.0 ft. Contains abundant large and small gastropods (several types) and pelecypods; corals include small Acropora sticks and small Porites fingers, common scablike coral at 505.0 and 515.4 ft, slender Porites sp. at 511.0 - 512.0 ft; small Porites sp. head at base of unit. Lower contact imperceptably gradational. SAMPLES: T @ 496.0, 505.8; X @ 500.4, 512.2, 525.0; M @ 521.0 - 521.8.

- PACKSTONE TO WACKESTONE: mollusc, coral, skeletal PACKSTONE with scattered intervals grading to WACKESTONE,
 approaching coral FLOATSTONE in lower part of unit;
 uncemented, well-consolidated; skeletal components
 unaltered, molluscs with nacreous layer preserved,
 corals unrecrystallized, unabraded; very pale orange;
 generally very fine grained. Contains small digitate
 Acropora sticks and other small finger corals.
- 529.7 531.6 CORAL HEAD: large <u>Porites</u> sp. head in growth position; well-preserved; very pale orange; minor borings; minor matrix of skeletal PACKSTONE.
- 531.6 533.7 PACKSTONE AND FLOATSTONE: coral, FLOATSTONE from top 532.3 ft, with skeletal, mollusc PACKSTONE matrix; grading downward to skeletal, mollusc PACKSTONE to base; uncemented, well-consolidated; skeletal components well-preserved, unaltered nacreous layers on molluscs, corals unabraded, unrecrystallized; generally very pale orange, but some very pale orange to pale-yellowish-brown corals. Contains small Porites and Acropora sticks. Lower contact gradational. SAMPLE: X @ 531.7.
- 533.7 539.9 FLOATSTONE (tight): coral, with skletal, mollusc PACKSTONE matrix from top to 536.5 ft and WACKESTONE matrix from 536.5 539.9 ft; uncemented, well-consolidated; skeletal components unaltered, unabraded; very pale orange. Contains digitate Porites sp. and small, Acropora sticks, several types of gastropods and pelecypods. Lower contact gradational.
- 539.9 540.8 WACKESTONE: skeletal, mollusc; uncemented, well-consolidated; unaltered skeletal components; very pale orange. Lower contact gradational.

540.8 - 543.1 FLOATSTONE: coral, with skeletal, mollusc WACKESTONE matrix; uncemented, well-consolidated; unaltered, unabraded skeletal components; very pale orange. Contains diverse mollusc fauna, including numerous large gastropods, corals include moderately common digitate Porites. SAMPLE: X @ 542.7. 543.1 - 550.2 NO RECOVERY. Driller reports very soft material (probably WACKESTONE). 550.2 - 557.0 FLOATSTONE: coral; with alternating mollusc, skeletal PACKSTONE TO WACKESTONE matrix; becomes tight FLOATSTONE from 550.2 - 551.6 ft; uncemented, well-consolidated; unaltered, unabraded skeletal components; very pale orange to grayish orange. Contains abundant; diverse mollusc fauna, including large gastropods, large pelecypods at 551.8 and 556.1 ft; corals include several types, including abundant Acropora. Lower contact apparently gradational. SAMPLE: X @ 553.1. WACKESTONE WITH PACKSTONE: upper part of unit mollusc, 557.0 - 581.0 skeletal WACKESTONE with alternating muddy PACKSTONE, becoming sparse coral FLOATSTONE from 568.2 - 568.6 ft, grading back to WACKESTONE downward and to mollusc, skeletal WACKESTONE TO PACKSTONE in lower roughly onehalf of unit, uncemented, well-consolidated; skeletal components unaltered, unabraded, molluscs with nacreous layer preserved; very pale orange; contains scattered, moderately cemented diagenetic nodules at 563.8, 564.1, 565.6, and from 579.1 - 580.0 ft. Contains diverse mollusc fauna, including large pelecypod at 579.7 ft; Cyprea at 578.9 ft, and common Strombus at 572.0, 577.5 ft, and scattered elsewhere; corals more common below 564.5 ft, include Acropora sticks, Porites sticks, sparse Seriatopora at 565.6 - 570.0 ft. Lower contact

581.0 - 586.5 FLOATSTONE: generally coral FLOATSTONE with mollusc-skeletal WACKESTONE matrix; subunits as follows: 581.0 - 585.0 ft, FLOATSTONE; 585.0 - 584.4 ft, tight coral FLOATSTONE; 586.1 - 586.5 ft, skeletal PACKSTONE; unit uncemented except for well-cemented diagenetic nodules scattered throughout, constituting up to 30 percent of unit locally; containing unaltered, unabraded shells and corals; very pale orange with minor pale-yellowish-brown

gradational. SAMPLES: T @ 563.8, 565.6 (nodule), 569.1 (nodule), 578.9; X @ 564.6, 573.5; M @ 562.8 - 563.8.

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to grayish-orange tones. Corals include common small Porites, digitate Acropora, and sparse Seriatopora. Lower contact abruptly gradational. SAMPLE: X @ 584.1.

586.5 - 599.0

PACKSTONE AND FLOATSTONE: coral FLOATSTONE with molluscskeletal PACKSTONE matrix alternating with skeletal, mollusc WACKESTONE; intervals of FLOATSTONE from 586.9 -587.7, 588.6 - 589.6, and 592.3 - 593.7 ft; unit containing alternating uncemented areas and moderately cemented areas, patchy, particularly in finer-grained areas, moderately cemented areas comprising up to 80 percent of rock from 586.8 - 587.7 anA &jj4" g &jv4/ GL; skeletal components unabraded, unaltered, even in areas of moderate cementation; burrows partly pelleted; very pale orange to pale yellowish brown mottled with pale yellowish brown in upper part, becoming more paleyellowish brown to very pale orange in lower part. Contains Porites finger corals, sparse Seriatopora, Acropora sticks, and other corals, molluscs, including gastropods and pelecypods, moderately common, large gastropods particularly concentrated from 592.1 - 592.9 [Note: Units from 465.8 to 599.0 ft generally contain abundant very fine grained skeletal sand and silt; most of the skeletal components within this interval are not abraded and generally are unbroken.] Lower contact abruptly gradational. SAMPLES: S @ 586.9 - 587.8; X @ 586.9, 595.8; M @ 594.2 - 595.2.

599.0 - 605.6

PACKSTONE: skeletal, coral, mollusc; poorly to moderately cemented; skeletal grains (particularly corals) rounded, abraded, bored; unbroken mollusc shells and other skeletal components sparse; grains unrecrystallized, diagenetically unaltered; generally uncemented except for zone moderately to poorly cemented from 605.3 to 605.5 ft; fine- to medium-coarse-grained, poorly sorted; very pale orange to yellowish gray (5Y7/2) at top becoming pale yellowish brown to pale orange downward, pale yellowish brown in cemented zone from 605.3 - 605.5 ft. Unit contains up to 10 percent granule- and small pebble-sized grains, mainly, brownish-gray, abraded coral fragments. Lower contact abruptly gradational. SAMPLES: S @ 605.2 - 605.4; T @ 602.8, 605.5; X @ 605.2, 605.4.

605.6 - 606.9

PACKSTONE AND FLOATSTONE: from top to 606.4 ft, skeletal PACKSTONE containing broken shell fragments but no dark clasts like from 599.0 to 605.6 ft; from 606.4 ft to base, coral FLOATSTONE with matrix of very fine grained skeletal, mollusc PACKSTONE; coral and skeletal components unabraded, unaltered, like unit from 586.5 to 699.0 ft; uncemented, well-consolidated; pale yellowish brown to very pale orange.

PACKSTONE: skeletal, coral; uncemented, well-consolidated; skeletal components diagenetically unaltered; pale yellowish brown to yellowish gray; medium-grained, rounded granule-sized clasts of coral, rounded, abraded, bored, stained brownish-gray; containing bent but generally vertical brownish-gray streak. Lower contact sharp undulatory. SAMPLES: S @ 606.9 - 607.3; X @

[This contact may mark a depositional hiatus but not represent a major disconformity.]

606.9.

606.9 - 607.3

607.3 - 628.9FLOATSTONE AND PACKSTONE: coral FLOATSTONE with skeletal,

mollusc PACKSTONE matrix and interbedded with same; uncemented, well-consolidated; unaltered, unabraded skeletal components, molluscs with nacreous layer commonly preserved; pale yellowish brown to very pale orange; heavily bioturbated. Lithic subunits as follows: 607.3 - 615.8 ft, FLOATSTONE (matrix muddy PACKSTONE from 608.1 - 608.6 ft); 615.8 - 620.2 ft, PACKSTONE; 620.2 - 628.9, FLOATSTONE. Contains Acropora sticks, Porites sp., sparse Seriatopora sticks, abundant large pelecypods from 614.0 - 614.5 ft, numerous types of small gastropods. Lower contact gradational. SAMPLES: T @ 617.5; X @ 614.4, 623.8; M @ 615.8 -616.8.

628.9 - 633.9 FLOATSTONE: tight coral, with skeletal, mollusc PACKSTONE matrix; uncemented; unaltered skeletal components, molluscs with nacreous layer preserved; pale yellowish brown to dark yellowish brown. Contains Acropora, Porites, and scattered Seriatopora sticks, scattered gastropods. Lower contact gradational. SAMPLE: x @ 633.9.

633.9 - 637.9 PACKSTONE TO FLOATSTONE (sparse): coral, mollusc, skeletal; uncemented, well-consolidated; containing unaltered skeletal components; pale yellowish brown to dark yellowish brown. Contains scattered small Acropora sticks, small gastropod fragments. Lower contact gradational. SAMPLE: M @ 636.9 - 637.9.

637.9 - 640.6 FLOATSTONE (tight): coral, with mollusc, skeletal PACKSTONE matrix; uncemented, well-consolidated; containing unaltered skeletal components; dark yellowish brown to moderate yellowish brown. Contains abundant sticks of Acropora, Porites, and Seriatopora, several types of pelecypods, including myalinid at 638.7 ft and

gastropods; contains lignitic wood fragments at 640.2 ft (one piece about 15 mm across). Lower contact gradational. SAMPLES: S @ 639.7 - 640.2; X @ 639.7.

640.6 - 659.0 FLOATSTONE AND PACKSTONE: coral FLOATSTONE with skeletal, mollusc PACKSTONE matrix, interbedded with coral PACKSTONE; uncemented, well-consolidated; containing unaltered skeletal components; bioturbated; moderate yellowish brown to light yellowish brown. Lithic subunits as follows: 640.6 - 642.6 ft, PACKSTONE; 642.6 - 646.5 ft, tight FLOATSTONE; 646.5 - 647.9 ft, PACKSTONE; 647.9 - 651.7, tight FLOATSTONE with small Porites head in middle; 651.7 - 653.0 ft, sparse FLOATSTONE; 653.0 - 654.5 ft, PACKSTONE; 654.5 - 659.0 ft, FLOATSTONE. Contains abundant Acropora sticks, Porites sticks, small Porites heads including P. andrewsi-type, scattered Seriatopora, abundant large pelecypods (particularly from 640.6 to 643.5 ft) numerous types of gastropods. Lower contact gradational. SAMPLES: X @ 646.2, 654.3.

[Note: Gamma-ray log has higher activity below this point.]

659.0 - 664.1 PACKSTONE: skeletal; uncemented, well-consolidated; containing unaltered skeletal components; pale yellowish brown to dark yellowish brown. Contains very sparse

Seriatopora sticks, few molluscs. Lower contact gradational. SAMPLE: X @ 663.9.

664.1 - 666.1 FLOATSTONE: tight coral; with skeletal, mollusc PACKSTONE matrix; uncemented, well-consolidated; unaltered skeletal components; pale yellowish brown to dark yellowish brown. Contains Porites sticks, scattered gastropods. Lower contact gradational. SAMPLES: S@ 664.4 - 665.0; X@ 664.4.

PACKSTONE: skeletal, mollusc; uncemented, wellconsolidated; unaltered skeletal components; pale
yellowish brown to dark yellowish brown. Contains
scattered gastropods; sparse lignitic fragments and
streaks; small shark tooth at 665.2 ft. Lower contact
gradational. SAMPLE: M @ 667.1 - 667.9.

667.9 - 678.2 FLOATSTONE: coral; mollusc, skeletal PACKSTONE matrix;

uncemented; well-consolidated; pale yellowish brown to dark yellowish brown from top to 673.3 ft, becoming pale yellowish brown downward. Contains Acropora sticks, small Porites andrewsi-type heads, small Porites sticks, Seriatopora; several types of gastropods; scattered

lignitic fragments from 666.8 - 669.6 ft; micropaleontologic sample from 677.9 - 678.2 ft contains abundant monaxon-sponge spicules. SAMPLES: S @ 669.1 - 669.6; X @ 669.1, 673.1.

678.2 - 679.1 NO RECOVERY.

FLOATSTONE AND PACKSTONE: coral-mollusc, skeletal, muddy PACKSTONE from 679.1 - 683.4 ft; interbedded coral FLOATSTONE with mollusc, skeletal PACKSTONE matrix and interbedded with same from 683.4 to 698.7 ft; uncemented, well-consolidated; skeletal components unaltered, unabraded, many molluscs with aragonitic layer preserved; very pale orange to pinkish gray; unit burrowed throughout; small cemented burrow at 687.9 ft. Unit contains abundant small Porites, including scattered Porites andrewsi-type, scattered Acropora throughout, platy coral at 693.5 - 694.0 ft; abundant molluscs, including large pelecypods, large pecten at 694.2 ft; numerous types of gastropods, including Strombus at 694.1 and 694.5 ft; large, lined worm tube

[TOP OF SEDIMENT PACKAGE 5.]

698.7 - 699.8

CORAL HEADS: moderately large <u>Porites</u> sp. heads in growth position, with mollusc-skeletal PACKSTONE matrix; matrix uncemented; well-consolidated; unaltered components; both coral heads and matrix very pale orange, with minor dusky-blue stained coral in lower 0.3 ft.

at 686.4 - 687.2 ft. [Note: except for lighter color and absence of scattered wood fragments, this unit does not differ from overlying unit.] SAMPLES: S @ 689.0 -

689.4; T @ 687.9, 690.0; X @ 682.0, 689.0, 691.0.

699.8 - 701.8

FLOATSTONE: coral (tight), with mollusc, skeletal PACKSTONE matrix; uncemented, well-consolidated; unaltered, generally unabraded but broken mollusc fragments and unabraded small coral-rich intervals alternating with mollusc-rich layers; very pale orange. Corals generally small Porites, Acropora, and Seriatopora, scattered Cycloseris; abundant pelecypod and gastropods. SAMPLES: T @ 700.4 (small burrow); X @ 701.3; M @ 701.8 - 703.1.

701.8 - 705.4 PACKSTONE WITH sparse FLOATSTONE: con

PACKSTONE WITH sparse FLOATSTONE: coral, mollusc, skeletal; uncemented, well-consolidated; unaltered, unabraded skeletal components; color varies as follows: from 701.8 - 702.9 ft, pale yellowish brown to very pale orange, grading downward to pale yellowish

brown; from 702.9 - 705.4 ft, dark yellowish brown. Contains digitate Porites from 703.8 - 704.6 ft with common Seriatopora and Acropora; highly diverse gastropod and pelecypod faunas, some broken but mostly whole shells. Lower contact gradational. SAMPLE: M @ 701.8 - 703.1.

- 705.4 709.2 FLOATSTONE: coral; skeletal, mollusc PACKSTONE matrix; uncemented; containing unaltered skeletal components; pale yellowish brown. Contains Seriatopora and Acropora sticks, diverse gastropods and pelecypods. Lower contact gradational.
- 709.2 711.4 FLOATSTONE: tight coral FLOATSTONE with mollusc, skeletal PACKSTONE matrix; uncemented, well-consolidated; unaltered, unabraded skeletal components; pale-yellowish-brown from 709.2 710.2 ft, changing abruptly to pale-yellowish-brown to very pale orange at 710.2 ft, remaining same to base of unit. Contains numerous molluscs, including Cyprea at 709.9 ft; sparse Seratopora, common digitate Porites and numerous other digitate corals. Lower contact gradational.
- 711.4 712.1 BAFFLESTONE: corals; skeletal, mollusc PACKSTONE matrix; uncemented; unaltered; very pale orange to pale yellowish brown. Contains single granule of dark-yellowish-brown phosphate (vertebrate fragment), branching form of <u>Porites</u> sp. heavily bored with Lithophagus. Lower contact gradational.
- 712.1 752.2FLOATSTONE WITH PACKSTONE AND BAFFLESTONE: generally coral FLOATSTONE with skeletal, mollusc PACKSTONE matrix and interbedded with same. Lithic subunits as follows: 712.1 - 713.3 ft, FLOATSTONE; 713.3 - 714.3 ft, PACKSTONE; 714.3 - 714.6 ft, small Porites sp. head on side; 714.6 - 721.6 ft, PACKSTONE TO (sparse) FLOATSTONE; 721.6 - 725.5 ft, Porites (branching form) BAFFLESTONE; 725.5 - 739.4 ft, FLOATSTONE WITH PACKSTONE; 739.4 - 744.1 ft, muddy, gastropod PACKSTONE TO WACKESTONE WITH FLOATSTONE; 744.1 - 745.0 ft, muddy PACKSTONE; 745.0 - 752.0 ft, mollusc PACKSTONE. uncemented; containing unaltered, unabraded skeletal components; color varies: very pale orange to pinkish gray in upper part, gradually grading downward to pale yellowish brown by 725.5 ft and downward to pale yellowish brown to very pale orange by 748.6 ft and continuing to base. Unit contains sparse, small, cemented diagenetic nodules at 720.7 ft, from 730.1 -730.4 ft, at 740.2 ft and from 741.7 - 742.5 ft. Diverse mollusc fauna includes well-preserved, large

Strombus sp. at 718.7, 742.7, 744.2, 745.3, and 746.3 ft; large pelecypod at 718.7 ft; diverse small finger corals, including digitate Porites, and Cycloseria (small sclerectinian) at 747.6 ft. Base abruptly gradational. SAMPLES: S @ 738.8 - 739.4; T @ 740.2 (cemented burrow), 742.1 (cemented burrow); X @ 714.0, 725.3, 733.5, 738.8, 744.8; M @ 732.1 - 732.8, 751.1 - 752.0.

752.2 - 757.6

FLOATSTONE: tight coral, with skeletal, mollusc PACKSTONE TO WACKESTONE matrix; uncemented; unaltered, unabraded skeletal components; predominantly pale yellowish brown with tones very pale orange. Unit includes high diversity of corals, including several small heads of Porites, Asteropora(?) in growth position, numerous branching corals, including Acropora and others, toppled but tightly packed; many of corals bored; contains scattered branching bryozoans, also toppled. Coral at 755.5 ft with minor staining and recrystallization(?) on edge of branch. Lower contact gradational. SAMPLE: X @ 753.9.

757.6 - 759.7

FLOATSTONE: coral, with muddy, skeletal, mollusc PACKSTONE matrix; uncemented, unaltered, unabraded skeletal components; predominantly pale yellowish brown with tones very pale orange. Contains several types of generally small toppled corals, including branching Acropora sp.; small branching bryozoans fairly common, particularly from 758.5 to 759.7 ft. Lower contact gradational.

759.7 - 767.0

WACKESTONE TO PACKSTONE WITH FLOATSTONE: middle part of unit coral FLOATSTONE; remainder skeletal, mollusc WACKESTONE TO PACKSTONE; generally uncemented, but containing numerous small, well-cemented nodules scattered throughout and moderately well-cemented interior-fillings of pelecypods; skeletal components unabraded, unaltered; predominantly pale yellowish brown with tones pale-yellowish-orange. SAMPLES: S@ 760.9 - 761.4; X@ 760.9, 766.5.

767.0 - 767.4

CORAL HEAD: small head of <u>Astreopora(?)</u> in growth position, slightly bored, unaltered; pale yellowish brown to very pale orange.

767.4 - 779.9

PACKSTONE WITH FLOATSTONE: coral, mollusc, skeletal PACKSTONE grading to thin zones of coral FLOATSTONE throughout; generally uncemented, but large moderately to poorly cemented nodule from 771.1 - 771.3 ft and in

darker zone from 771.9 - 772.3 ft; unaltered skeletal components, unabraded, strongly bioturbated; generally, predominantly pale yellowish brown with very pale orange tones throughout except for zone from 771.9 - 772.3 ft (pale-yellowish-brown with dark-yellowish-brown tones). Lower contact gradational. SAMPLES: S @ 771.9 - 772.4; X @ 771.9, 776.1, 776.5; M @ 778.7 - 779.9.

779.9 - 787.5

FLOATSTONE WITH BAFFLESTONE: coral FLOATSTONE with skeletal, mollusc PACKSTONE matrix from 779.9 - 781.4 ft, grading downward to tight coral FLOATSTONE from 781.4 ft to base; uncemented except for scattered well-cemented, small nodules; unaltered, unabraded skeletal components; pale-yellowish-brown to very pale orange. Contains small coral sticks and digitate forms throughout, apparently toppled. Lower contact gradational. SAMPLE: X @ 784.5.

787.5 - 796.8

BAFFLESTONE: coral with skeletal PACKSTONE matrix; uncemented in upper portion with sparse well-cemented nodules, with increase in cementation downward with coral fillings and sheltered areas beneath coral, becoming moderately to well-cemented from 790.4 - 793.2 ft, about 30% of rock is irregularly cemented, becoming less-cemented downward; unaltered, unabraded skeletal components; pale yellowish brown to very pale orange, becoming pale yellowish brown in basal 0.1 ft; matrix fine- to very fine grained (much finer grained than adjacent units). Baffle consists of long, slender finger corals (Porites sp.) clearly in place. Lower contact gradational. SAMPLES: T @ 796.0; X @ 793.4.

796.8 - 799.7

PACKSTONE WITH FLOATSTONE: coral, mollusc, skeletal; uncemented, unaltered, unabraded components; much coarser grained than overlying unit; pale yellowish brown. Contains small finger corals, in growth position in upper part of unit; corals in lower part of unit darker in color; contains pelecypods, and gastropods. Lower contact gradational.

799.7 - 804.0

PACKSTONE TO WACKESTONE: mollusc, skeletal, coral PACKSTONE with small areas of skeletal WACKESTONE; uncemented; containing mollusc fragments with nacreous layer preserved; bioturbated; contains small area of stacked pelecypod shells at 803.9 ft to base; burrowed; pale yellowish brown. Highly diverse mollusc assemblage, consisting of numerous types of pelecypods, including large Strombus at 801.4 and 801.9 ft. Lower contact abruptly gradational. SAMPLES: X @ 803.4.

[TOP OF SEDIMENT PACKAGE 6.]

PACKSTONE: mollusc, skeletal, coral; uncemented; skeletal components generally unaltered, corals slightly chalky from 808.0 ft to base; pale yellowish brown to dark yellowish brown from top to 807.0 ft, becoming dark yellowish brown from 807.0 - 807.2 ft, pale yellowish brown to dark yellowish brown from 807.2 ft to base.

Contains diverse mollusc fauna, large Strombus at 805.9 ft. SAMPLE: M @ 807.2 - 808.0.

809.8 - 813.0 FLOATSTONE: coral, densely packed, in skeletal WACKESTONE
TO PACKSTONE matrix; generally uncemented but with
moderately to well-cemented skeletal, pelleted,
WACKESTONE-filled burrows at 810.9 ft; skeletal material
unabraded, unaltered; generally pale yellowish brown
throughout, but becoming slightly lighter at base.
SAMPLES: S @ 812.3 - 813.7; X @ 812.3.

[Note: The organic-rich units from 607.3 to 813.0 ft, particularly the ones with dark-yellowish-brown tones, have a strong aroma similar to that of wet wood ashes when left exposed to air for even a short period of time.]

[Hiatus at 813.0 ft suggested by subtle change from carbonate WACKESTONE matrix above to carbonate MUDSTONE matrix below surface, by pervasive cementation below this point, by first appearance of calcite-spar infilling of small crack just below this point and infilling of voids beginning about 3 ft below this point. No color change of sharp break occurs in the core hue. There may be a slight increase in alteration of coral material below surface, with some specimens containing minor chalk infilling of interseptal spaces in lower units.]

813.0 - 813.7 BAFFLESTONE OR FLOATSTONE: coral (Pocillopora?) possibly in place, with sparsely skeletal, pelleted MUDSTONE matrix; pervasively well-cemented; very small crack infilled with sparry calcite just below top of unit; lower 0.3 ft highly burrowed; pale yellowish brown to very pale orange with small patches of pale yellowish brown. Lower contact gradational. SAMPLE: S @ 812.7 - 813.7 (overlaps upper unit).

FLOATSTONE AND BAFFLESTONE: small heads of <u>Porites</u> and <u>Astreopora(?)</u> generally in place set in matrix of muddy skeletal PACKSTONE; about one-fourth of total unit well-cemented, patchy, imparting nodular appearance to rock; remainder uncemented but well-consolidated; containing moderate-brown calcite-spar infilling small voids in nodules, locally in areas of former shelter porosity, and in mollusc interiors from top of unit (moderately common) to as low as 823.8 ft (very sparse); corals generally well-preserved but slightly recrystallized, containing small minor septal infilling of chalky

material and of light-colored micrite; unit very pale orange to pale yellowish brown in upper part, grading downward to very pale orange at base. Contains several types of small corals in addition to major heads; molluscs scattered, large Strombus at 815.3 ft. Lower contact gradational. SAMPLE: S @ 816.8 - 817.1; T @ 817.1, 823.6; X @ 813.7, 816.8, 823.3.

824.3 - 826.5 CORAL HEADS: Porites sp., several small heads; matrix moderately well cemented skeletal PACKSTONE; pale yellowish brown to very pale orange.

826.5 - 827.7 FLOATSTONE: coral, tight with skeletal, mollusc PACKSTONE
TO WACKESTONE matrix; uncemented, well-consolidated,
unaltered, unabraded skeletal components; paleyellowish-brown to very pale orange. [Description
mainly from material property sample.] Contains several
types of corals, including small branching Porites.
SAMPLES: T @ 827.6; M @ 826.6 - 827.5.

827.7 - 830.2 CORAL HEADS: <u>Porites</u> sp.; pale yellowish brown to very pale orange; several heads.

830.2 - 830.4 POOR RECOVERY: several pieces of coral, like overlying unit, rounded and disrupted by drilling. [Run also contained several rounded pieces of underlying unit, also disrupted by drilling; error in placement of disconformity below is from 830.2 to 833.2 ft.)

[Major dissolution disconformity indicated by marked increase in cementation, presence of "tea-brown" micrite cement, and change in mode of preservation of fossils below this surface. This surface is an excellent reflector at this point on the atoll and is moderately continuous in this area.]

830.4 - 834.9 PACKSTONE(?): rock highly diagenetically altered, foraminifer-skeletal PACKSTONE; well-cemented, minor "tea-brown" micrite cement; skeletal components highly altered, preserved only as molds, containing sparse spar-lined internal molds and scattered, small lined cracks; very pale orange with sparse moderate yellowish brown; moldic porosity low, mainly pelecypod shells. Foraminifers include large forms. Core recovery poor, broken pieces only. SAMPLES: T @ 833.5; X @ 833.5.

834.9 - 835.5 FLOATSTONE OR BAFFLESTONE: coral; well-cemented, highly altered diagenetically, with corals and molluscs preserved only as molds, partially filled with material;

matrix appears to be sparsely skeletal WACKESTONE; pale yellowish brown to very pale orange. Includes several types of finger corals preserved only as ghosts; scattered small gastropods. Unit badly broken up in drilling. SAMPLE: T @ 834.9.

835.5 - 845.8

GRAINSTONE(?) OR PACKSTONE(?): foraminifer-skeletal; generally very well cemented, slightly less-cemented from 836.3 - 836.6 ft and containing minor "tea-brown" micrite; unit strongly altered; pale yellowish brown to very pale orange in upper part, becoming very pale orange with minor pale-yellowish-brown mottling from 836.6 ft to base; sparse moldic porosity generally confined to molluscs; minor areas from 836.6 - 845.8 ft with enlargement of fossil molds; slight spar-infilling of pelecypod molds from 836.6 - 845.8 ft; medium- to coarse-grained. Subunit from 844.9 - 845.7 ft burrowed(?). Unit contains scattered small coral fragments throughout; foraminifers, including large forms, very common; scattered large pelecypods. Unit contains common high-angle, unhealed fractures, particularly from 835.5 - 836.3 and from 836.6 - 845.8 ft. Lower contact apparently sharp. SAMPLES: S@ 835.5 - 835.8; 837.5 - 838.0; 845.3 - 845.7; X @ 835.5, 837.5, 844.4, 845.3; M @ 835.7 - 836.6.

[Discontinuity indicated by marked change in rock type and by apparent sharp contact beween adjacent units. There also may be a minor crust just below a small vug at the unit contact.]

845.8 - 854.5

WACKESTONE(?): coral, sparsely skeletal; may be sparse FLOATSTONE(?); apparent subunit from 852.6 - 852.8 ft apparently burrowed, foraminifer, skeletal WACKESTONE TO PACKSTONE. Upper 0.1 ft of unit may be laminated crust, predominantly pale yellowish brown with lighter line at base, some "tea-brown" micrite, remainder of unit very pale orange mottled with pale yellowish brown; wellcemented, with minor "tea-brown" micrite scattered throughout; corals scattered throughout unit poorly preserved, mainly as partly infilled molds and ghosts; unit highly altered, finely sucrosic texture; low porosity, generally moldic with scattered enlarged molds; slightly vuggy from 852.7 - 852.8 ft. Small slightly infilled Porites(?) head from 853.4 - 853.7 SAMPLES: S @ 845.9 - 846.3 (contains contact with overlying unit in upper 0.05 ft of slab), 851.1 - 851.4; T @ 852.7; X @ 845.9, 851.1, 851.9, 854.4.

[The radical change in lithic type and environment at this horizon may not represent major hiatus. This interval is difficult to interpret because of core breakage and poor recovery.]

854.5 - 857.1 GRAINSTONE (?) OR PACKSTONE(?): skeletal, foraminifer, highly altered, well-cemented, sparse moldic porosity; pale yellowish brown to very pale orange, mottled.

Contains large infilled coral in upper 0.2 ft. SAMPLE: T @ 855.1.

857.1 - 871.7 NO RECOVERY. Major problems developed with metal filings plugging bit; tripped back in hole with 6-3/4 in. bit, hit tight spot at 760.0 ft, rereamed hole to 860.0 ft, rockbitted to 871.7 ft with hole still trying to close. Driller said that most of this interval drilled as though it were hard except for a 1- to 2-ft thick "soft" layer, the top of which is about 866.0 ft.

FLOATSTONE (?) OR BAFFLESTONE(?): coral, with apparent 871.7 - 880.2 matrix of foraminifer-skeletal WACKESTONE, locally apparently PACKSTONE matrix; may be grading downward to GRAINSTONE matrix at base of unit; very well cemented, but coral-rich zones highly, finely fractured (high angle); unit extensively diagenetically altered, with corals preserved only as finely druse-lined molds generally slightly enlarged to small vugs; very pale orange with locally mottled areas very pale orange to pale yellowish brown; probably burrowed. Contains small, unabraded branching corals, some of which may be in place; Lepidoclina (large) foraminifers scattered throughout unit. [Note: Fractures occur throughout unit but in part seem to be old, partially healed fractures reactivated by drilling; these old surfaces do not appear to exhibit any displacement.] Base apparently gradational. [Note: Small Porites head at top of unit and at top of run does not appear to have come from this unit; also, large pieces of Tridacna shells from 878.0 - 878.4 ft also occur at the top of a run and probably fell from uphole; one of these Tridacna pieces has been in contact with drill bit at least three times.] SAMPLES: S @ 872.0 - 872.3, 876.0 - 876.3, 876.9 - 877.2, 878.8 - 879.0, 879.8 - 880.2; X @ 872.0, 873.5, 876.0, 876.9, 878.0, 878.8, 879.8.

880.2 - 885.6 GRAINSTONE: large foraminifer, skeletal; well-cemented from top to 882.3 ft, moderately cemented from 882.3 - 884.0 ft, moderately to poorly cemented to base, recrystallized skeletal components; very pale orange; medium- to coarse-grained, moderately well-sorted; minor moldic porosity (mollusc shells) in upper part, becoming predominantly interparticle porosity downward.

Lepidocyclina (large) foraminifers conspicuous in unit. [Note: High-angle fractures present in unit from

880.2 to 882.8 ft; rock not as badly shattered, more competent than overlying unit.] SAMPLES: S @ 882.1 - 882.5; X @ 882.1, 883.0; M @ 883.3 - 884.0.

[Note: Unable to advance hole beyond 885.6 ft due to caving. Could not advance hole; abandoned at this point.]

*** TOTAL DEPTH OF HOLE 885.6 ft. ***

BOREHOLE OBZ-4

Lat/Long (E/W-1960): 11°36′15.2" N, 162°06′06.7" E

Lat/Long (WGS-1972): 11°36′15.0" N, 162°06′06.7" E

Location (IVY-grid, ft): 124,980 N and 036,115 E

Distance/Bearing from OAK GZ: 7.1 ft, 081.9 deg

Water Depth (H&N): 198.7 ft Hole Depth (bsf): 1,605.2 ft

Hole Spudded: 04/29/1985 Drilling Ended: 05/18/1985

Sampling: SS, SH, LY*, CH* Recovery: 60% (967.8 ft)

Logs: MCS, GR/DN/CP, GR/NT, CSV Dates Logged: 05/2,4,7,10/1985

Deviation: 0.7 deg (N 30 deg E) @ 372 ft; 3.2 deg @ 950 ft; 4 deg (N 20 deg W)
@ 1,044 ft; 4 deg @ 1,125 ft; 4.2 deg @ 1,150 ft; 4.2 deg @ 1,200 ft; 4.3
deg @ 1,252 ft; 4.2 deg @ 1,325 ft; 4.5 deg @ 1,373 ft; 4.7 deg (N 80 deg W)
@ 1,599 ft; 4.7 deg @ 1,605 ft.

Casing: 12-in. riser casing @ 63.9 ft, 8-5/8-in. @ 183.6 ft, 7-5/8 in. @ 446.4 ft (all casing pulled).

Drilling Mud/Additives: BVS (337 sx), PAD (172 gals), LCM (16 sx),

DF (34.5 gals)

Geologists: T.W. Henry and J. I. Tracey Drillers: G. Mooney, C. Peltier

B.R. Wardlaw and B.A. Skipp Loggers: C. Novinskie, A. Reynolds

Paleontologists: E. Brouwers, T.A. Gibson, R. G. Stamm

Redescribed: 10/16-20/1985

* Cored Interval: Longyear (407.3 - 457.6, 486.0 - 537.3, 538.1 - 553.4, 555.4 - 1,085.2, and 1,143.1 - 1,605.2 ft). Christensen: (1,085.2 - 1,143.1 ft).

Depth	Description
0.0 - 2.6	MUDSTONE: skeletal; uncemented; unaltered grains, including moderate-red (5R4/6) Homotrema grains; very soft; yellowish gray (5Y7/2); contains fine-grained sand-sized microfossils. Note: unit slightly grainier than underlying unit. Recovered on base of split-spoon, reported by driller as NO RECOVERY.
2.6 - 30.5	MUDSTONE: uncemented, plastic, very soft; containing no conspicuous grains until about 24.8 ft; yellowish gray (5Y8/1). Becoming skeletal MUDSTONE at about 24.8 ft, containing minor moderate-red (5Y4/6), very fine sand-sized grains; from 26.8 - 27.4 ft, slightly darker than rest of unit, changing back to yellowish gray (5Y8/1) below. Note: at 15.3 ft, contains small quantity of moderate-dark-brown, medium-grained sand. Lower contact imperceptably gradational. SAMPLES: T@ 2.6, 8.7, 17.8, 24.8, 26.8, 29.8.
30.5 - 41.0	WACKESTONE AND PACKSTONE: upper part skeletal WACKESTONE, grading downward to skeletal PACKSTONE; uncemented, slightly plastic in upper part, containing in upper part very fine to fine-grained sand-sized shells and tests, some as large as medium-grained sand; lower part very fine to medium-grained, muddy, skeletal PACKSTONE; moderately well sorted material in that coarser fraction is almost completely missing throughout unit; yellowish gray (5Y8/4) in upper part, becoming yellowish gray (5Y8/4) to very pale orange in lower; contains scattered moderate-red (5R4/6) grains throughout unit. Lower contact imperceptably gradational. SAMPLES: T @ 31.5, 39.3, 44.5; R @ 34.5.
41.0 - 61.8	GRAINSTONE: skeletal; uncemented, soft; upper part slightly silty, very fine grained sand, grading generally progressively downward to medium-grained sand by 49.4 ft, muddy fine- to very fine grained sand from 49.4 ft, becoming fine-grained sand by 50.1 ft, progressively coarsening downward to coarse-grained sand at base; well-sorted in sense of absence of coarser fraction; very pale orange; containing scattered moderate-red (5R4/6) grains. [Note: odor of hydrogen sulfide discernable throughout, particularly strong at 61.8 ft. SAMPLES: T @ 51.3, 57.2, 61.8; R @ 60.1.

61.8 - 63.1 NO RECOVERY.

63.1 - 73.0

PACKSTONE TO GRAINSTONE: skeletal; slightly muddy, very coarse grained, granular sand; completely uncemented, unconsolidated; very pale orange. Contains exclusively broken shell fragments and small scattered granule— to small pebble—sized clasts of coral; some skeletal material unaltered, including scattered, fresh Halimeda grains and very sparse mollusc fragments with original shell color; at 69.6 ft, contains first recognized, granule—sized, piece of pale—yellowish—brown, slender, digitate Porites sp. Note: unit becomes very muddy (PACKSTONE?) at 67 to 69 ft; yields strong odor of hydrogen sulfide. Lower contact gradational. SAMPLES: T @ 63.4, 69.6; R @ 72.0.

73.0 - 83.7

PACKSTONE, skeletal; very muddy at top, becoming very coarse grained, muddy sand at base with granule- to small gravel-sized coral and skeletal clasts, all broken, very poorly sorted; uncemented, unconsolidated; very pale orange to yellowish gray (5Y8/4). Clasts consist of mixture of diagenetically unaltered and altered skeletal and coral fragments up to small pebble-size; scattered gastropod/pelecypod fragments with minor original shell color and broken, badly abraded fragments without original shell color; other clasts consist of uncrystallized small coral fragments; at 75.1, 78.7, and 79.1 ft. [Note: unit contains moderate odor of hydrogen sulfide throughout.] SAMPLES: T @ 57.9, 79.1; R @ 74.9.

83.7 - 104.1

PACKSTONE: sparse rubble, coral; very coarse grained, granular, muddy sand with gravel, completely unsorted; uncemented, unconsolidated; very pale orange. Unit contains mixture of diagentically altered and unaltered skeletal components all broken and other clasts; most pebble-sized pieces are small broken heads of Porites sp. (generally unaltered) and granule- to small-pebble-sized pieces of moderate-yellowish-brown (diagenetically altered) Porites sticks, contains scattered unaltered gastropod fragments with minor fragments with color retention (small Conus at 91.2), small lithoclasts of very pale orange, moldic, cemented rock at 91.3 and 98.2 ft; completely replaced small coral fragment or mollusc shell at 85.4 ft. SAMPLES: T@ 85.4, 91.3, 98.2 (small lithoclast); R@ 84.4, 93.1, 104.1.

104.1 - 110.4

FLOATSTONE: mixed-rubble, coral; PACKSTONE matrix; siltto granule- and small pebble-sized clasts up to 2-1/4 in. in diameter; uncemented, moderately compacted; very pale orange. Clasts consist mainly of broken pebblesized fragments of very pale orange to grayish-orange Porites lutea (largest clasts and most common ones), broken, pale-yellowish-brown Acropora and digitate Porites sticks; some of coral is not recrystallized, some is highly recrystallized and brown-strained throughout; sparse clasts of chalky, very pale orange, moderately cemented, micromoldic PACKSTONE(?) up to granule-size. Fossils, other than coral fragments, include small Turbro (high-spired grastropod, slightly altered). Note: abundance of Porites lutea pieces is striking feature of unit. SAMPLES: T @ 107.5, 110.4.

110.4 - 112.0 NO RECOVERY.

112.0 - 161.2

FLOATSTONE: tight mixed-rubble, coral FLOATSTONE in PACKSTONE matrix; unsorted; uncemented, moderately consolidated; very pale orange. Clasts consist mainly of broken pieces of coral in varying stages of alteration, including fragments of Acropora and Porites sticks, and less-altered, pebble-sized pieces of Porites sp. throughout; spar-filled/replaced small corals at 115.8 and 130.5 ft, cobble-sized clast of very heavily Lithophagus-bored Porites lutea at 142.7 ft, badly fractured, with pelecypod material unaltered; cobblesized clast of moderate-yellowish-brown Porites lutea at 162.5 ft. Almost every screened sample contains granule- to pebble-sized lithoclasts, varying in lithic type and degree of alteration; these include: (1) piece of moderately cemented skeletal PACKSTONE cemented with "tea-brown" micrite, micromoldic porosity with molds partly spar-infilled at 115.8 ft and 121.6 ft; (2) lithoclast at 136.0 ft may be part of laminated crust(?); (3) moderately cemented, well-sorted, skeletal GRAINSTONE at 144.4 ft; (4) pebble-sized piece of moderate-yellowish-brown to dark-yellowish-orange spa from vug infilling at 147.3 ft; (5) well-cemented, sparcemented, very poorly sorted, Halimeda, skeletal GRAINSTONE at 152.1 ft; and (6) coarse-granule-sized clast of coralgal(?) material encrusted partly by moderate-red (5R4/6) (unbleached) Homotrema rubrum, in turn partly encrusted by another type of foraminifer at 152.2 ft. Macrofossils are likewise mixed, generally broken, consisting of unaltered gastropod fragments, partially replaced shells, and internal molds (or steinkerns); lowest unaltered gastropod is at 118.9 ft adjacent to large gastropod steinkern and small Turbo operculum. Note: the last uncontestable macro-material that is of probable Holocene or Recent age is solitary piece of unbleached, moderate-red (5R4/6) Homotrema rubrum at 152.1 ft. SAMPLES: T @ 112.6, 115.8, 117.5, 121.6, 136.0, 141.8, 142.7, 144.4, 147.3, and 152.1; R @ 112.0, 119.5, 120.8, 129.6, 138.5, 147.3, 156.9.

161.2 - 163.3 NO RECOVERY.

163.3 - 176.2 FLOATSTONE: rubble, with skeletal, mollusc, foraminifer PACKSTONE matrix; uncemented, well-consolidated; containing slightly altered skeletal components, including scattered pectens with color and nacreous layer preserved, and slightly chalky Halimeda grains;

very pale orange; medium- to coarse-grained, moderately well-sorted. Contains scattered, pebble-sized pieces of well-cemented, spar-cemented, rounded, foraminifer, skeletal PACKSTONE (burrows?) at 163.3 ft, at 164.2 ft, and in zones from 166.5 - 168.0 to 169.8 - 170.2 ft; piece of poorly to moderately cemented Halimeda, skeletal, foraminifer PACKSTONE with "tea-brown" lined tube through it; contains large granule of grayishorange spar at 174.7 ft. Contains scattered wellpreserved Acropora sticks at 166.5 -168.0 ft, spine of slate-pencil echinoid at 172.9 ft, and broken pieces of large, thick-shelled pectens at 164.6, 169.8, and 170.1 Upper part of unit looks disturbed but no apparent mixing of components; unit does not contain macrocomponents from organic-rich zone. SAMPLES: T @ 163.3, 170.1, 170.4; R @ 166.5.

176.2 - 179.1 FLOA

FLOATSTONE(?): coral, rubble(?) with foraminifer(?), skeletal, Halimeda(?) PACKSTONE matrix and interbedded with same in upper part of unit; uncemented, well-consolidated; shell material moderately altered to unaltered; pale yellowish brown. Upper part contains small bored, unrecrystallized Acropora(?) fragment with attached pelecypod (oyster?); several small pieces of Astreopora(?) in middle, and 0.2 ft-thick piece of badly broken Porites lutea at base, bored with Lithophagus with original shell material still preserved.

179.1 - 181.3 NO RECOVERY.

181.3 - 183.7

GRAINSTONE TO PACKSTONE: skeletal, foraminifer GRAINSTONE TO PACKSTONE, very fine to fine-grained, well-sorted, containing scattered larger shells; including very chalky gastropods; very pale orange. Lower contacts gradational. SAMPLE: T @ 183.3.

183.7 - 194.0

FLOATSTONE: rubble, coral; matrix skeletal PACKSTONE; uncemented; moderately altered skeletal components; very pale orange; moderately cemented areas (burrows?) and well-cemented, spar-cemented lithoclasts scattered

throughout unit, some of which contain moderate amount of "tea-brown" stain; very pale orange. Unit contains scattered, chalky gastropod shells in upper part (broken), scattered corals slightly to moderately altered coral sticks and small <u>Porites</u> heads throughout. Note: contains fragment of dark-yellowish-brown, branching coral at 186.8 ft; pebble-size fragment of medium-light-gray-stained, badly worn, coral at 190.4 ft; spar-cemented lithoclast at 190.8 ft; grayish-orange spar filling from vug at 191.0 ft. SAMPLES: T @ 183.8, 186.6, 190.4, 194.0 - 196.0 (washings).

194.0 - 196.0

NO RECOVERY: cuttings from top of next sample included strongly "tea-brown"-stained pieces of GRAINSTONE OR PACKSTONE and fragments of spar-replaced coral. SAMPLES: T @ 190.4, 196.0 (note above).

196.0 - 196.2

CORAL HEAD: Favia head completely replaced with paleyellowish-brown sparry calcite; crust of very fine grained, skeletal, foraminifer sand imbedded on top (similar to underlying unit).

196.2 - 214.2

GRAINSTONE TO PACKSTONE: upper part very fine grained, well-sorted, foraminifer GRAINSTONE becoming progressively coarser-grained, more poorly sorted downward; becoming fine- to medium-grained, foraminifer sand by 201.9 ft, and fine- to coarse-grained skeletal PACKSTONE (chalky) by 210.5 ft and persisting to base; unit uncemented, containing slightly altered skeletal components, including slightly recrystallized corals, gastropods with color retention; very pale orange in upper part, becoming very pale orange to white in lower part. Contains small, whole strombids at 201.9 and 202.5 ft, large, slightly broken gastropod at 202.8 ft with delicate color retention and nacreus luster, scattered corals at 205.5 - 205.7 ft, small fragment of Tridacna at 208.1 ft. SAMPLES: T @ 202.4; R @ 199.9.

214.2 - 216.4 NO RECOVERY.

216.4 - 226.3

FLOATSTONE: mixed-rubble; PACKSTONE matrix; uncemented, well-consolidated; completely unsorted; very pale orange. Clasts consist of granule- to small cobble-sized, generally angular pieces of moderately to well-cemented rock; more notable types as follows: at 216.9 ft, large highly replaced, broken, thick-shelled pelecypod with cemented, very fine to medium-grained, skeletal GRAINSTONE (burrow?) adhering to same; at 217.0 ft, 3-in., broken, cemented, skeletal PACKSTONE TO

GRAINSTONE with "tea-brown" cement, micromoldic porosity; at 219.3 ft, pebble-sized piece of grayish-orange spar partly infilling and replacing small piece of coral; at 223.0 ft, spar-cemented, foraminifer-skeletal GRAINSTONE; at 225.2 ft, well-cemented, spar-cemented, skeletal PACKSTONE, micromoldic porosity. Matrix consists of smaller pieces of recrystallized fossils(?). SAMPLES: T @ 223.0, 225.2; R @ 219.8.

226.3 - 228.2 NO RECOVERY.

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[Although in disrupted sequence, the large piece of rock just below this point reveals evidence of a disconformity from somewhere in the sequence by the presence of major "tea-brown" material cementing and lining and filling a large rhizolith.

228.2 - 228.3

GRAINSTONE: foraminifer, <u>Halimeda</u>, <u>Marginopora</u>; wellcemented, containing abundant "tea-brown" micrite; fineto coarse-grained, poorly sorted; pale yellowish brown
to very pale orange, with dark-yellowish-brown,
concentric lining/filling of rhizolith; minor micromoldic porosity in lower part. Contains abundant large
foraminifers and scattered microgastropods. [Note:
might be piece of breccia.] SAMPLE: T @ 228.2.

228.3 - 244.8

FLOATSTONE: rubble; pebble- and granule-sized clasts set in muddy, fine- to very coarse grained PACKSTONE matrix consisting of smaller rock debris, abundant recrystallized and diagenetically altered skeletal components, minor unrecrystallized fossils (microgastropods and Halimeda), and sparse sand-sized particles of grayish-yellow (5Y8/4) sparry calcite; unit completely unsorted; uncemented, well-consolidated; very pale orange. Granule- and pebble-sized angular clasts consist of following types of rock (in desceasing abundance): (1) Generally angular, commonly fractured pieces of sparse coral WACKESTONE TO MUDSTONE; corals either represented only as casts on edge of clasts or as extensively spar-replaced pieces of coral, including Seriatopora, Porites sticks, and Acropora; generally well-cemented, particularly common in upper part of unit (e.g., 228.3 - 229.3, 237.5 - 238.3. (2) Fragments of skeletal, foraminifer GRAINSTONE, well-cemented, containing minor "tea-brown" micrite; more common in upper part of unit but scattered to base. (3) Rounded, pebble-sized pieces, probably burrows, that were cemented with spar; generally very fine grained; skeletal GRAINSTONE TO PACKSTONE, occurring only below 240.7 ft. (4) Pieces of relatively unaltered coral;

partly replaced <u>Porites</u> sp. at 235.3 ft; unaltered <u>Lithophagus</u>-bored <u>Porites lutea</u> at 244.6 ft (with mollusc retaining chanly shell). SAMPLES: T from selected clasts throughout unit.

244.8 - 247.6 NO RECOVERY.

247.6 - 265.7 FLOATSTONE TO PACKSTONE: rubble FLOATSTONE like overlying unit but apparently containing less closely packed clasts, becoming rubble PACKSTONE below 259.4 ft; unsorted; uncemented, well-consolidated; very pale orange, becoming very pale orange to white in lower part. [Note: PACKSTONE matrix contains sand-sized, grayish-orange spar fragments and sparse unaltered shell fragments, like overlying unit.] Angular granule- and pebble-sized clasts consist mainly of (1) cemented foraminifer, skeletal GRAINSTONE with molds, (2) wellcemented, skeletal GRAINSTONE with "tea-brown" cement, highly recrystallized, containing abundant microfractures (at 253.4 ft); (3) badly brecciated piece of pervasively recrystallized moldic coral (at 259.4 ft and scattered elsewhere). [Note: from 255.7 ft to base, less obvious mixing of types of sand-sized grains, although still retain sparse, broken shells with color retention.] SAMPLES: T (clasts) @ 249.8, 250.1, 252.7, 253.4, 256.4, 259.4; T (matrix) @ 250.1, 256.4, 265.1;

265.7 - 266.4 CORAL HEAD: Astreopora(?), in growth position; very pale orange with minor grayish-orange tones, recrystallized but not infilled with sparry calcite, friable, came out of sampler intact but shattered when sawed.

R @ 249.8.

266.4 - 268.3 PACKSTONE: consists of altered, broken, skeletal fragments, including pieces of small corals; uncemented, well-consolidated, containing very well cemented, very fine grained, well-sorted, GRAINSTONE-filled burrow at base. SAMPLE: T @ 266.6, 268.2 - 268.3.

FLOATSTONE TO PACKSTONE: coral, rubble; uncemented, wellconsolidated; very poorly sorted to unsorted; very pale
orange; matrix consists of recrystallized skeletal
components, including large foraminifers, abundant
unidentified fragments, scattered small echinoid
spines. Corals include Acropora and Porites sticks
(apparently abraded, badly recrystallized but not sparinfilled), large Acropora stick at 274.0 ft (worn,
bored), large fragment of coral stock at 287.1 ft
(abraded), small delicate pieces of Seriatopora

scattered throughout, large <u>Fungia</u> at 279.6 ft, and <u>Astreopora(?)</u> at 276.8 ft; abraded <u>Turbo</u> opercula at 276.9 and 285.5 ft. Clasts generally moderately common to abundant, generally moderately to well-cemented, angular, granule- to pebble-sized pieces of foraminifer, skeletal GRAINSTONE; fragment at 268.4 ft, extensively recrystallized, mollusc, skeletal GRAINSTONE(?), very poorly sorted, moldic porosity, spar-cemented, very pale orange to moderate yellowish brown; similar piece at 270.4 ft contains <u>Acropora(?)</u> and <u>Seriatopora</u> molds; clast at 279.8 ft contains some "tea-brown" micrite along apparent tube or burrow. SAMPLES: T @ 268.4, 279.9.

288.4 - 288.8

MUDSTONE(?): very fine textured rock, porcellaneous luster; grayish orange; highly fractured forming micronspaced, concentric patterns, shattering readily into silt to very fine sand-sized shards. [When orginally sampled, came out of Shelby tube as relatively entact unit, but began breaking up into shards almost immediately; probably, slightly recrystallized, shattered Tridacna shell.

288.8 - 291.0 NO RECOVERY.

291.0 - 294.3

FLOATSTONE: rubble; matrix of PACKSTONE consisting of small pieces of moderately cemented foraminifer GRAINSTONE, poorly sorted to unsorted, and sand-sized debris consisting of altered skeletal components, mostly unidentifiable, scattered sand-sized particles of grayish-orange spar and mollusc fragments with color retention; unit uncemented, well-consolidated; very pale orange. Clasts consist of angular, granule- and small-pebble-sized, moderately cemented, foraminifer GRAINSTONE; rounded fragments probably well-cemented small burrows, some of which appear filled with skeletal MUDSTONE(?) and others with skeletal GRAINSTONE. SAMPLES: T @ 288.6, 291.5 ft.

[Disconformity clearly indicated by large piece of laminated crust.]

294.3 - 294.7 LAMINATED CRUST: rock originally skeletal, foraminifer GRAINSTONE; strongly cemented with "tea-brown" micrite in upper part of unit, probably becoming more poorly cemented downward; moderate yellowish brown with dark-yellowish-brown areas; contains microrhizoliths; upper part contains minor fractures, rehealed with sparry-

calcite cement; contains single small-pebble-sized-piece

of badly abraded, bored <u>Porites(?)</u> stick stained medium dark gray. Harder, more homogeneous, finer-grained pieces broken into very sharp, conchoidally fractured pieces, which contain microfractures.

294.7 - 296.8 NO RECOVERY.

296.8 - 327.4

PACKSTONE: rubble; matrix mainly PACKSTONE, consisting of unsorted, predominantly silt- to very coarse grained sand-sized broken fragments of rock and altered skeletal components, many of which cannot be identified; uncemented, well-consolidated; very pale orange. matrix at 302.8 ft consists of this type of material with Seriatopora sticks, small echinoid spines, large foraminifers (all recrystallized), and broken mollusc fragments and whole, high-spired microgastropods with original shell material and coloration; washed matrix above and below did not contain these unaltered shell materials; matrix at 315.5 ft mainly of sand- to granule-sized pieces of unidentifiable rock and skeletal material. Contains sparse angular pebble-sized clasts of moderately cemented altered rock material like that making up matrix and moderate to heavily recrystallized corals scattered throughout, including small fragment of Fungia at 318.0 ft and small spar-infilled, highly bored Porites(?) sp. at 317.6 ft. SAMPLES: T @ 300.6, 312.0.

327.4 - 340.8

FLOATSTONE: rubble; mostly angular granule- to small pebble-sized pieces of partly cemented, heavily altered, coral-bearing rock; PACKSTONE matrix generally pieces of same type of material but with some unaltered, broken shells sparsely infiltrating into sand matrix; unsorted, uncemented, well-consolidated, pale yellowish brown to very pale orange from 327.4 - 328.0 ft, very pale orange with minor pale yellowish brown and moderate yellowish brown from 328.0 - 330.5 ft, becoming pale yellowish brown downward. [Note: downhole geophysical logs show zone of extreme wash-out from 334 - 344 ft. Lithoclasts as follows: at 333.3 - 333.8 ft, pebble-sized angular fragments of prevasively recrystallized rock, very pale orange to white, well-cemented and pebble-sized pieces of skeletal PACKSTONE OR GRAINSTONE(?) with "tea-brown" micrite cement associated with microrhizolith(?) with some spar-infilling; at 339.6 ft, rounded, very fine grained PACKSTONE-filled burrow(?). Coral pieces are heavily recrystallized, mostly spar-replaced, associated partly with lithoclasts. SAMPLES: T @ 331.0, 333.3.

340.8 - 343.1 NO RECOVERY.

PACKSTONE: skeletal, coral, mollusc, uncemented, wellconsolidated, containing small scallop and gastropod
with original coloration and nacreous layer preserved at
347.0 ft, spar-filled steinkern of gastropod at 346.5
ft; very pale orange to white; many smaller skeletal
components throughout unit broken but unaltered
diagenetically, but also contains apparently infiltered
recrystallized skeletal fragments throughout. Contains
scattered, moderately cemented PACKSTONE-TO-GRAINSTONEfilled burrows. Contains large, broken pieces of partly
altered Tridacna shell at top.

347.2 - 363.2 FLOATSTONE: coral, coralgal, rubble, matrix of PACKSTONE consisting of unsorted silt- to coarse-sand-sized pieces of recrystallized skeletal material and rock fragments, diagenetically unaltered broken skeletal material, and scattered fragments of grayish-orange calcite spar; uncemented, well-consolidated; very pale orange. Granule- to small pebble-sized clasts generally angular, consisting of moderately to poorly cemented rock; becomes FLOATSTONE with PACKSTONE matrix from 353.0 ft to base with pieces of well-cemented, skeletal PACKSTONE(?) or WACKESTONE(?) containing badly recrystallized corals and coral molds, including Acropora sticks; vertical burrow at 350.0 ft has abundant "tea-brown" micrite cement and unaltered micromolluscs cemented to exterior. Contains crushed, articulated pelecypod at 356.0 ft. From 362.8 - 363.0 ft, contains piece of recrystallized encrusting coralline algae and small knobby colonies of same encrusting completely recrystallized, slightly moldic coral fragment; sparse small cracks at top of coralgal(?) material infilled with clear sparry-calcite cement; well-cemented; very pale orange, mottled with very pale orange to pale yellowish brown. [Note: caliper logs show extremely washed-out zone from 353 to

362 ft.] SAMPLES: T @ 350.0, 362.8.

363.2 - 365.5 NO RECOVERY.

GRAINSTONE: skeletal, foraminifer; uncemented, wellconsolidated; fine- to coarse-grained, moderately to
poorly sorted, containing small shell fragments with
originial coloration; very pale orange to grayishorange. Contains very pale orange PACKSTONE subunit
from 380.6 - 380.8 ft consisting of very fine grained
sand and silt, uncemented, containing very sparse, small
lignite flakes. Contains abundant Amphistogina.
SAMPLE: T @ 375.5.

381.2 - 383.0 NO RECOVERY.

383.0 - 388.8

RUDSTONE TO FLOATSTONE: rubble, clasts like interval from 353.0 - 362.8 ft; very coarse grained to granule-sized clasts of dark-yellowish-brown spar. Contains both from in-place and in wash-in from next run granule-sized fragments of grayish-black, lignite. Fragments collected from small piece of limestone from center of sample from Shelby tube were definitely in place and making impression against limestone; contained very thin rind (< 1 mm thick) of moderate-reddish-brown hematite(?) on outside of cylindrical piece of charcoal, which in turn was about 10 mm in diameter; as fragile fragments were examined under microscope, they disintegrated rapidly. SAMPLE: T @ 383.0 - 383.6.

388.8 - 392.1

GRAINSTONE: foraminifer skeletal; uncemented, wellconsolidated; containing some fragments of micromolluscs with original color; fine- to coarse-grained, moderately sorted; very pale orange with grayish-orange tones.

392.1 - 394.3 NO RECOVERY.

[TOP OF SEDIMENT PACKAGE 3. Disconformity indicated by change in rock type and increase in cementation and alteration.]

394.3 - 408.8

FLOATSTONE TO RUDSTONE: coral, rubble; mostly wellcemented lithoclasts in skeletal, lithoclast WACKESTONE TO PACKSTONE matrix, matrix containing both altered and unaltered skeletal fragments; uncemented, wellconsolidated; very pale orange. Pebble- to cobblesized, angular clasts of well-cemented WACKESTONE or MUDSTONE(?) with coral molds (originally a coral FLOATSTONE?); pebble-sized fragment of dark-grayishorange "dog-tooth" spar-replaced Porties lutea(?) at 397.6 ft; spar-replaced large pebble of Porites lutea(?) at 400.1 ft; cobble-sized clast from 408.1 - 408.2 ft (bent thick-walled Shelby tube) of small head-like colonies of coralgal(?) material encrusting highly recrystallized coral(?); well-cemented; very pale orange, mottled with pale yellowish brown to very pale orange. Poor recovery from 408.2 - 408.8 ft. SAMPLE: T @ 408.1 - 408.2.

408.8 - 412.3 NO RECOVERY.

412.3 - 414.6 FRAMESTONE AND FLOATSTONE: coral-coralgal(?); upper 1.0 ft consists of coring-rounded pebble- to small cobble-sized pieces of rock like underlying subunit, plus "tea-brown" infiltered piece of same, and large pieces of grayishorange, sparry calcite almost completely replacing large Astreopora(?) head and what appears to be one small piece of Porites head; vuggy porosity and spar-lined molds of stick corals evident in pieces recovered. From 412.3 ft to base, core entact; small acroporoid sticks mostly preserved as spar-lined molds; larger coral heads mostly replaced by grayish-orange sparry calcite; these appear bound together by encrusting coralline algae and foraminifers (Carpenteria-type); matrix well-cemented WACKESTONE(?), spar-cemented, pervasively recrystallized, appears to contain scattered larger foraminifers; basal piece of run is completely sparreplaced Porites lutea, broken up by drilling. Some of fine-grained material (coralline algae?) appears to

412.3 - 412.5; S @ 412.8 - 414.2.

occur as clasts, partly fractured and healed with sparry-calcite cement. Unit with reduced vuggy

porosity(?). Micritic material is very pale orange and very pale orange to pale yellowish brown. SAMPLES: T @

414.6 - 425.0 NO RECOVERY. Hole problems.

425.0 - 426.1 FLOATSTONE(?) AND FRAMESTONE(?): coral-coralgal(?). Made three attempts to retrieve core in hole from interval; first attempt contains of pieces of completely spar-replaced coral (Porites lutea?) encrusted with coralline algae; next attempt contains pieces of spar-replaced other coral types and coralgal(?)-encrusted branching acroperoid molds; last retrieval consists of pervasively recrystallized rock consisting of abundant Acropora(?) molds apparently encrusted with coralgal(?) material.

426.1 - 437.1 NO RECOVERY.

437.1 - 437.3 FRAMESTONE(?): coralgal-coral; piece of branching acroporoid coral encrusted by digitate coralline algae; well-cemented; moldic porosity (coral) slightly reduced by grayish-orange, "dog-tooth"-spar lining; very pale

orange mottled with very pale orange to pale yellowish brown. [Note: may have fallen downhole from overlying units.] SAMPLES: S @ 437.1 - 437.3; X @ 437.1.

437.3 - 455.5 NO RECOVERY.

[Note: Continued to have hole problems; pulled out drill string at 452.0 ft, ran log, and ran casing to 448 ft; could not drive casing to bottom because of broken rock in bottom of hole (driller brought up approximately 300 - 400 lbs in circulating mud). Interval from 455.5 - 477.2 ft was drive sampled with thick-walled Shelby tube.]

455.5 -	455.7	PACKSTONE: skeletal, <u>Halimeda(?)</u> , foraminifer(?); poorly
		cemented; heavily altered, chalky; very fine to very
		coarse grained; very pale orange. Unit appears to be
		broken in place by sampling.

4331) 40010 NO MILOUVILLE GLITTEG OGC	455.7	-	460.6	NO	RECOVERY:	drilled	out.
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460.6 - 461.2 PACKSTONE: foraminifer, skeletal PACKSTONE TO
GRAINSTONE(?); moderately cemented, some spar-cement;
skeletal components recrystallized; very pale orange;
moldic, micromoldic porosity; very pale orange.
Formerly better-cemented areas broken up into small
pebble-sized angular fragments that do not seem to be
fractured further.

461.2 - 466.0 NO RECOVERY: drilled out.

466.0 - 466.5 PACKSTONE: like unit from 460.6 - 461.2 ft; contains small fragments of coral preserved as molds; does not seem badly fractured.

466.5 - 471.2 NO RECOVERY: drilled out.

471.2 - 471.6 PACKSTONE(?): probably like unit from 460.6 - 461.2 ft;
large angular fragment containing medium-grained
skeletal PACKSTONE(?) along with fragments of
extensively recrystallized finer-grained rock containing
coral molds. Some fragments with minor spar cement.

471.6 - 476.9 NO RECOVERY: drilled out.

476.9 - 477.2 POOR RECOVERY: Recovery consists generally of fractured fragments of medium- to coarse-grained, skeletal foraminifer PACKSTONE(?) TO GRAINSTONE(?), moderately to well-cemented, some spar cement; skeletal components highly recrystallized; moldic, micromoldic porosity; very pale orange. Also contains single small pebble-sized, angular clast of LAMINATED CRUST, well-cemented, abundant "tea-brown" micrite; fragment internally brecciated (microscopic scale) with fractures cemented

with "tea-brown" micrite; fragment originally consisted of very fine grained, coated-grain(?) PACKSTONE(?); pale yellowish brown to very pale orange with abundant moderate-yellowish-brown stain. SAMPLES: T @ 476.9(?) (fragment of laminated crust).

477.2 - 481.0 NO RECOVERY: switched back to Longyear at 481.0 ft.

481.0 - 481.6 PACKSTONE(?): poor recovery, consists of angular fragments of moderately well cemented, prevasively recrystallized PACKSTONE(?); micromoldic, moldic porosity.

481.6 - 493.7 NO RECOVERY.

493.7 - 494.7

POOR RECOVERY: consists of pebble- to small cobble-sized, drilling-rounded pieces of very pale orange, highly recrystallized, skeletal WACKESTONE and foraminifer, mollusc PACKSTONE; acroporoid coral molds on side of WACKESTONE-fragment; one piece contains spar-lined vertical(?) worm tube; pieces contain Marginopora. Note: striking feature of this material is that it appears to be unbrecciated and does not contain microfractures.

494.7 - 502.5 NO RECOVERY

[TOP OF SEDIMENT PACKAGE 4.]

502.5 - 503.5

WACKESTONE TO PACKSTONE: skeletal, foraminifer; well-cemented, containing moderately common "tea-brown" micrite; skeletal components heavily recrystallized; pale yellowish brown to very pale orange with pale-yellowish-brown areas. Contains old fractures apparently at least partly spar-healed and new, unhealed fractures. Recovery consists of gravel- to small cobble-sized pieces.

503.5 - 506.7

FRAMESTONE: coral-coralgal; unit contains several types of corals, including large Astreopora(?) head in growth position, almost completely replaced by grayish-yellow (5Y8/4), coarse-textured sparry calcite; other corals include small heads and acroporoid sticks (mostly preserved only as spar-lined molds) bound together by coralline algae (in turn making small heads, locally), minor encrusting foraminifers (Carpenteria-type). Matrix in part consists of well-cemented, skeletal, foraminifer WACKESTONE with small areas containing

coarse-sand- to granule-sized pieces of coralline algae. Unit generally held together in coring, well-cemented; vuggy in part, moldic in part, some former vugs slightly to completely infilled with sparry calcite; areas of former shelter porosity partially infilled with sparry cement. Rock shows several stages of cementation; large Astreopora(?) head has one fracture running from spar infilling coral, through coralgal cap, and into surrounding matrix; this fracture is partially healed with a slightly lighter colored sparry cement and lined with same in areas where healing is not complete. In addition, the rock has been subsequently fractured and not healed. SAMPLES: S @ 503.5 - 503.8, 505.0 - 505.4; X @ 503.5, 505.0.

	x e 503.5, 505.0.
506.7 - 513.2	NO RECOVERY.
513.2 - 514.3	FRAMESTONE(?): head of Porites (?) completely infilled with sparry calcite, recrystallized, bored; run also contains small, broken pieces of coralgal crusts and fragments of completely recrystallized mollusc(?), skeletal PACKSTONE(?) OR WACKESTONE(?); well-cemented; very pale orange with minor pale-yellowish-brown tones.
514.3 - 518.9	NO RECOVERY.
518.9 - 523.5	WACKESTONE(?) OR PACKSTONE(?) OR FLOATSTONE(?): skeletal, coral, mollusc(?); highly fractured, highly recrystallized; most fossils preserved only as sparlined molds; unit probably originally had vuggy porosity.
523.5 - 543.1	NO RECOVERY: used Longyear except for split-spoon at 537.9 - 539.9 ft.
543.1 - 543.6	PACKSTONE(?) OR WACKESTONE(?): skeletal, coral, mollusc; well-cemented, some sparry-calcite cement, heavily recrystallized, most fossils preserved as spar-lined molds; very pale orange. Recovery in lower 0.2 ft consists of unfractured, unbroken rock; upper part is like overlying recovered unit, consisting of pebble-sized pieces, not as fractured; mottled very pale orange and very pale orange to pale yellowish brown. SAMPLE: T @ 543.4.

543.6 - 548.4 NO RECOVERY.

548.4 - 548.6

POOR RECOVERY: coral FLOATSTONE(?), with matrix of skeletal, mollusc(?), WACKESTONE(?) TO PACKSTONE; fractured; well-cemented, pervasively recrystallized; most fossils preserved as partly spar-lined molds; very pale orange.

548.6 - 552.8 NO RECOVERY: probably granule-sized sand, like below.

552.8 - 553.4

POOR RECOVERY: very coarse grained to granular sand; uncemented; very pale orange; fragments consist of altered skeletal grains and rock-fragments like overlying units and fragments of grayish-orange spar.

[Note: may represent wash-in of coarser-grained material from uphole.]

[Note: Tried split-spoon from 553.4 to 554.4 ft; returned to Longyear system after that attempt.]

553.4 - 560.1 NO RECOVERY.

[Note: Enter thick zone of good core-recovery at this point.

560.1 - 595.6

PACKSTONE WITH WACKESTONE: mollusc, skeletal, coral PACK-STONE with minor intervals grading to skeletal, mollusc, coral WACKESTONE from 560.4 - 567.4 and 594.9 - 595.5 ft; and locally becoming sparse coral FLOATSTONE; predominant matrix is very fine grained sand and silt. Unit poorly cemented in upper part, becoming uncemented rapidly downsection, generally well-consolidated; skeletal material in upper part generally preserved as molds, gastropods as spar-filled steinkerns, becoming progressively less altered downward; nacreous layer and coloration of molluscs preserved by about 580 ft. Unit contains scattered, small, very fine grained, wellcemented, skeletal, pelleted(?) PACKSTONE-filled burrows and nodules in zones throughout: 560.1 - 567.4 ft, 30% nodules; 567.4 - 568.9 ft, very sparse; 568.9 - 572.9 ft, about 40%; 572.9 - 594.9 ft, 10 - 15% burrows(?); 594.9 - 595.3 ft, 30% burrows/nodules; 595.3 - 595.6 ft, 10 - 15% burrows(?). Color varies as follows: very pale orange from 560.1 - 569.4 ft; grading downward to very pale orange with slight tones of grayish orange from 569.4 - 572.5 ft (highly burrowed); becoming very pale orange to pale yellowish brown from 572.5 to 577.1 ft; grading rapidly to generally pale yellowish brown and pale yellowish brown to dark yellowish brown from 577.1 - 577.4 ft; grading back to very pale orange from 577.4 ft to base. Strong odor of hydrogen sulfide from 578.3 - 578.6 ft (in light-colored section), 587.8 -

588.1 ft (with coral head, also light-colored, and 593.4 - 595.4 ft (slight odor). Unit contains scattered small Porites sp. sticks, Seriatopora sticks, and sparse Acropora(?) sticks throughout; small shattered Porites lutea(?) head at 577.8 - 578.1 ft, small spar-replaced fragment of Astreopora(?) at 594.5 ft; gastropods include several types, including probable fragment of strombid with nacreous layer and color retention at 578.0 ft; small turretellids sparse throughout; other types of small gastropods scattered; pelecypods not as abundant; abundant foraminifers at 585.0 ft. [Note: coral sticks generally very pale orange except in darker zone.] Lower contact gradational. SAMPLES: M @ 561.1 - 561.8.

595.6 - 611.8

WACKESTONE WITH PACKSTONE: skeletal, coral, mollusc; predominantly very fine grained sand and silt, but with larger skeletal fragments; uncemented, well-consolidated except for muddy WACKESTONE intervals; generally slightly altered skeletal components (corals uncolored, slightly recrystallized); not as heavily burrowed as overlying unit; very pale orange throughout. as follows: From 595.6 - 599.8 ft WACKESTONE TO PACKSTONE, abundant mollusc fragments. From 599.8 to 600.8 ft, PACKSTONE to tight WACKESTONE; about 5% cemented small burrows, containing sticks of Porites, Seriatopora, Acropora(?). From 600.8 - 602.5 ft, muddy WACKESTONE, coral, mollusc; very soft ("soupy"); containing large, broken pelecypod shell with nacreous layer and color preserved at 601.7 ft. From 602.5 -603.8 ft, PACKSTONE to tight WACKESTONE containing minor cemented burrows, abundant Seriatopora, minor mollusc fragments, badly fractured Porites head in basal 0.3 ft. From 603.8 - 610.3 ft, muddy WACKESTONE; very soft ("soupy"); containing small strombids with original shell material, scattered small sticks of Porites and Seriatopora. From 610.3 - 611.8 ft, muddy PACKSTONE, scattered corals, small Porites fingers, Seriatopora, and other small corals; small turretelids and other gastropods.

611.8 - 619.7 NO RECOVERY.

619.7 - 619.9

PACKSTONE(?): skeletal, mollusc; matrix predominantly very fine grained sand and silt; uncemented; very pale orange to pale yellowish brown. Large, thick-shelled <u>Tridacna</u>, heavily bored, with nacreous layer preserved, blocked off bit.

619.9 - 630.3 NO RECOVERY.

630.3	-	631.0	PACKSTONE AND FLOATSTONE: coral, mollusc, skeletal; matrix predominantly very fine grained sand and silt; upper part PACKSTONE, lower probably FLOATSTONE; uncemented; pale yellowish brown; upper part well-compacted; lower part consists of washed Porites sp. and other small coral sticks, three types of gastropods, unaltered, but bored; small piece of lignitic material found in washings.
631.0	_	636.2	NO RECOVERY.
636.2	_	638.2	sand- and silt-sized particles dominate matrix; uncemented, well-consolidated; dark yellowish brown to pale yellowish brown; contains dusky-brown lignitic streak at 636.6 ft and small granules of charcoal throughout unit. [Beginning of higher gamma activity on downhole log at about 636.0 ft.]
638.2	-	646.9	NO RECOVERY.
646.9		647.6	fine grained sand and silt; uncemented, well- consolidated; pale yellowish brown to dark yellowish brown. Contains small moderately cemented pelleted, skeletal, PACKSTONE-filled burrows, one with grayish- black-vertebrate fragment cemented to edge.
647.6		649•0	NO RECOVERY.
TOP OF	SE	DIMENT	PACKAGE 5. Strong point on gamma-ray log at about 649.0 ft.]
649.0			
653.1	***	658•1	LIGNITIC PACKSTONE AND PACKSTONE: skeletal, mollusc, coral; matrix dominated by very fine grained sand and silt; uncemented, well-consolidated; generally dark yellowish brown. Subunits as follows: From 653.1 - 653.5 ft, PACKSTONE with grayish-black, lignitic streak less than 1 mm wide in middle. From 653.5 - 654.9 ft, about 30 - 40%, grayish-black, lignitic streaks in dark-yellowish-brown to olive-black PACKSTONE. From 654.9 - 658.1 ft, grades downward to pale yellowish brown- to moderate-yellowish brown, coral, skeletal FLOATSTONE with thin lignitic streaks at 657.4 and 657.6 ft. Unit contains scattered small gastropods throughout, large,

shattered pelecypod with nacreous layer preserved at 653.7 ft, small <u>Porites</u> sticks, small coral heads, and small fragment of <u>Porites</u> <u>lutea</u> near base. SAMPLES: M @ 653.1 - 653.7.

658.1	-	662.0	NO RECOVERY.
662.0	-	663.9	FLOATSTONE TO RUDSTONE: (probably washed-out much of matrix) apparently coral skeletal, mollusc PACKSTONE; uncemented; moderate yellowish brown to pale yellowish brown. Corals include several types of small, heavily bored heads, including Porites lutea(?), scattered sticks; generally in growth position or toppled; contains several types of large, heavy-shelled gastropods, including a neretid with original color, and Polynices nacreous layer preserved, some bored.
663.9	_	671.7	NO RECOVERY.
671.7	-	672.0	FLOATSTONE(?): apparently skeletal PACKSTONE matrix; dark yellowish brown to pale yellowish brown. Pieces of small heads of <u>Porites</u> sp. and other corals, including branching forms. Disturbed by drilling. SAMPLE: T @ 671.7.
672.0	_	681.0	NO RECOVERY.
681.0		681.6	FLOATSTONE(?): like overlying recovered unit; consists of several types of small corals including heads of Porites sp. Disturbed by drilling.
681.6	-	691.5	NO RECOVERY.
691.5	_	701.9	FLOATSTONE WITH PACKSTONE; coral FLOATSTONE with skeletal, mollusc PACKSTONE TO WACKESTONE matrix from top to 698.1 ft, grading downward to skeletal, mollusc PACKSTONE; abundant very fine grained sand and silt in matrix; uncemented, well-consolidated; pale yellowish brown with dark-yellowish-brown tones from 691.5 - 698.0 ft, grading rapidly downward to dark yellowish brown to pale yellowish brown below 698.0 ft, and gradually to pale yellowish brown to grayish orange in lower 1 ft; unit has strong wood-ash odor throughout, expands rapidly upon exposure to air. Contains highly diverse macrofauna, including numerous gastropods, (small

turretelids, large <u>Strombus</u> at 699.5 ft with color retention, small <u>Cypraea</u> at 698.2 ft), numerous types of pelecypods (generally broken), diverse corals including sparse Porites andrewsi-type.

		sparse <u>Porites</u> <u>andrewsi</u> -type.
701.9 -	703.0	CORAL HEAD: <u>Porites lutea</u> head partly bored by <u>Lithophagus</u> containing axis of large <u>Strombus</u> , heavily bored with sponges or algae.
703.0 -	704.1	NO RECOVERY.
704.1 -	708.9	PACKSTONE AND WACKESTONE: from top to 707.1 ft, highly skeletal, mollusc PACKSTONE, grading downward to WACKESTONE from 707.1 ft to base; uncemented, well-consolidated; moderate yellowish brown to pale yellowish brown. Contains diverse mollusc fauna of thin-shelled peleycpods, small gastropods, including Conus at 704.6 ft; lower part containing small Porites sticks; black phosphate fragment (fish plate?) at 704.9 ft. [Note: unit expands after exposure; strong wood-ash odor.]
708.9 -	711.8	NO RECOVERY.
711.8 -	712.4	CORAL HEADS: small heads of <u>Porites lutea(?)</u> and coral sticks in matrix of skeletal, mollusc PACKSTONE; uncemented, well-consolidated; pale yellowish brown to moderate yellowish brown.
712.4 -	722.1	PACKSTONE TO WACKESTONE: skeletal, mollusc, coral; uncemented, well-consolidated; pale yellowish brown to moderate yellowish brown; generally silt and very fine grained sand matrix.
722.1 -	722.8	CORAL HEAD: <u>Porites lutea(?)</u> , pale yellowish brown to moderate yellowish brown; small borings.
722.8 -	738.6	WACKESTONE AND PACKSTONE: skeletal, mollusc, coral; uncemented, well-consolidated; moderate yellowish brown. Subunits as follows: From 722.8 ft to 724.7 ft, coral PACKSTONE, small, well-cemented burrow at base. From 724.7 - 729.9, NO RECOVERY. From 729.9 - 732.2 ft, coral, skeletal, mollusc WACKESTONE, moderate yellowish brown, but small patches of dark yellowish brown set at angle to bedding (roots?). From 732.2 - 732.9 ft, skeletal WACKESTONE, compact. From 732.9 - 737.9 ft, skeletal WACKESTONE TO SPARSE PACKSTONE with small,

well-cemented, pelleted, skeletal burrows scattered throughout; containing large neritid gastropods with nacreous layer preserved and color retention. From 737.9 to 738.6 ft, skeletal, mollusc WACKESTONE, moderate yellowish brown to pale yellowish brown, containing small, well-cemented burrows. Lower contact gradational.

- 738.6 757.6 FLOATSTONE: coral, set in skeletal, mollusc WACKESTONE matrix; uncemented, well-consolidated to very well consolidated; moderate yellowish brown to pale yellowish brown. Unit contains strong odor of wood-ashes throughout. Diverse macrofauna, mainly corals, including Porites andrewsi-type, Porites sp., Seriatopora, scattered Stylophora, and Pocillopora; several types of pelecypods and gastropods; almost every washed piece contains numerous larger foraminifers, including Anphistogina, Marginopora, and Sorites. Subunits as follows: From 738.6 - 740.5 ft, FLOATSTONE, big Porites sp. heads, bored. From 740.5 - 751.4 ft, FLOATSTONE, small Porites andrewsi-type of coral from 745.8 - 748.0 ft with moderate-brown outer layers and dusky-blue interior stain. From 751.4 - 757.6 ft, sparse FLOATSTONE, containing abundant smaller stick corals, mainly Seriatopora. SAMPLE: M @ 756.4 - 757.4.
- 757.6 766.5 PACKSTONE: coral, mollusc; matrix locally muddy, predominantly very fine grained sand and silt with coarser skeletal fragments, mostly gastropods; uncemented, small well-cemented nodule at 762.3 ft, very well consolidated; moderate yellowish brown. Contains abundant, diverse gastropod fauna, small corals. Strong odor of wood-ashes. Lower contact gradational.
- 766.5 781.9 FLOATSTONE: coral; with mollusc, skeletal PACKSTONE matrix; generally very fine grained sand and silt; generally uncemented, moderately common well-cemented nodules throughout, more common from 777.0 780.4 ft, very well consolidated; dark yellowish brown to pale yellowish brown throughout. Contains highly abundant mollusc fauna, including small Cypraea at 781.2 ft, abundant, diverse corals, including small Porites sp. heads, Porites andrewsi-type, Seriatopora, Stylophora(?), and Pocillopora(?). Lower contact gradational.
- 781.9 782.9 PACKSTONE: mollusc, skeletal; finely broken pelecypod and gastropod shells set in very fine grained, silty sand; uncemented, very well consolidated; dark yellowish brown to pale yellowish brown. Lower contact gradational.

782.9 - 793.6 FLOATSTONE WITH PACKSTONE: interbedded coral FLOATSTONE with skeletal, mollusc PACKSTONE matrix and interbedded with same; uncemented, well-consolidated; unaltered mollusc fragments and shells; upper part dark yellowish brown, grading downward to pale yellowish brown to dark yellowish brown in lower part. Subunits as follows: from 782.9 - 785.2 ft, mollusc PACKSTONE, very coarse grained with abundant well-cemented nodules; from 785.2 - 786.5 ft, coral, pelecypod FLOATSTONE, containing abundant, generally coarse-grained pelecypod fragments, including large, bored Strombus(?) at 785.6 ft, containing small, well-cemented nodules, skeletal PACKSTONE-filled burrows; from 786.5 - 787.4 ft, mollusc PACKSTONE, sparse corals; very fine-grained shells predominate, including small turretellids; from 787.4 -793.6 ft, sparse coral FLOATSTONE. Lower contact gradational. SAMPLE: M @ 783.3 - 785.2.

[TOP OF SEDIMENT PACKAGE 6.]

793.6 - 810.3 FLOATSTONE WITH PACKSTONE: generally coral FLOATSTONE with skeletal mollusc PACKSTONE matrix; uncemented, wellconsolidated, unaltered skeletal material; pale yellowish brown to dark yellowish brown in upper part, becoming lighter to pale yellowish brown at base. Subunits as follows: from 793.6 - 794.1 ft, coral, mollusc PACKSTONE; from 794.1 - 794.7 ft, coral FLOATSTONE, Porites andrewsi-type sitting at angle to bedding; from 794.7 - 797.3 ft, sparse coral FLOATSTONE; from 797.3 - 800.3 ft, coral FLOATSTONE, including P. andrewsi-type and Porites sp. with very pale orange interiors, moderate-yellowish-brown exteriors; from 800.3 - 802.3 ft, mollusc-coral FLOATSTONE, corals like overlying subunit, abundant, large broken pelecypod fragments; contains abundant small, well-cemented nodules; from 802.3 - 810.3 ft, tight coral FLOATSTONE; dominated by P. andrewsi-type of coral, Seriatopora, and other corals; containing small, well-cemented burrows up to pebble-size commonly from 802.3 - 804.7 ft, sparsely to 808.8 ft. Lower contact gradational.

810.3 - 815.1 FLOATSTONE AND PACKSTONE: sparse coral FLOATSTONE with skeletal, mollusc WACKESTONE TO PACKSTONE matrix and interbedded with same; generally uncemented, but with common well-cemented nodules from 810.8 - 811.3 ft; slightly altered corals, crumbly; pale yellowish brown to dark yellowish brown. From 814.0 - 815.1 ft, contains Porites sp. heads, broken. Contains possible angular, poorly cemented clasts of very fine grained material same color as matrix in lower 0.2 ft. Lower contact sharp, marked by slight color change, set at about 15 degrees to bedding.

[Possible disconformity, probably not a major hiatus, indicated by nature of contact, subtle but distinct color change, and by increase in alteration of all skeletal components in underlying units.]

- 815.1 818.4 PACKSTONE TO WACKESTONE: coral, mollusc, skeletal; silty, very fine to medium-grained, poorly sorted; poorly to well-cemented, cementation in patches, irregular; unit burrowed, apparently containing PACKSTONE-filled burrows; fossils preserved mainly as molds, particularly molluscs and foraminifers, gastropods as steinkerns (no spar); pale yellowish brown. SAMPLE: T @ 817.8.
- - 818.4 818.8 MUDSTONE: partly LAMINITE (probably depositional), thinly laminated in upper 0.1 ft, becoming nonlaminated below 818.5 ft; uncemented, plastic in lower part. SAMPLE: T @ 817.8.
- - 818.8 819.5 MUDSTONE TO WACKESTONE: foraminifer, skeletal MUDSTONE to sparse WACKESTONE; very well cemented, fossils preserved generally as molds; moderate yellowish brown. Contains large branching coral almost completely preserved as mold infilled with uncemented mud like adjacent units; large burrow, completely cemented, filled with pelleted, skeletal WACKESTONE. SAMPLE: S @ 818.8 819.5.
- MUDSTONE: partly LAMINITE; skeletal; uncemented, plastic; coarsely laminated; thicker pale-yellowish-brown laminae about 1.5 to 2 cm thick with thinner (0.3-cm-thick), very pale orange to pale-yellowish-brown laminae.

 [Note: lower laminae set at angle of about 15 degrees to bedding (see deviation record); well-cemented pieces of upper unit pushed down into this unit, bending upper set of thin laminae.] Lower contact apparently gradational. SAMPLES: S @ 819.5 820.0.
- WACKESTONE TO PACKSTONE(?): skeletal, pelleted(?), very fine grained WACKESTONE in upper 0.8 ft, becoming skeletal PACKSTONE(?) downward; uncemented to poorly cemented; micromoldic porosity; pale yellowish brown.

 Lower contact gradational. SAMPLES: T @ 820.1, 821.0.
- PACKSTONE WITH GRAINSTONE(?): foraminifer, skeletal
 GRAINSTONE in upper part, fine- to coarse-grained,
 becoming medium- to coarse-grained, skeletal,
 foraminifer, mollusc PACKSTONE(?) downward; wellcemented in upper part, moderately to poorly cemented
 elsewhere (layered), minor sparry-calcite cement in
 foraminifer-rich beds; selective moldic porosity

(generally mollusc material); pale yellowish brown to moderate yellowish brown. Contains scattered, badly recrystallized coral fragments (several types). [Note: Cemented bed at 824.1 ft sitting about 15 degrees to horizontal; see core deviation record.] SAMPLES: S @ 822.3 - 822.6, 824.1 - 824.4.

824.6 - 853.8

PACKSTONE WITH GRAINSTONE: foraminifer, skeletal GRAINSTONE AND PACKSTONE from top to 831.0 ft, GRAINSTONE in well-cemented areas, generally finegrained, but with coarser skeletal fragments; skeletal, foraminifer PACKSTONE in poorly cemented areas in upper part of unit. Unit becomes generally very fine grained PACKSTONE below about 831.0 ft, muddy PACKSTONE below 845.0 ft. Unit contains micromoldic porosity, (particularly mollusc fragments) in well-cemented areas; generally moderately to poorly cemented, irregularly cemented, well- to moderately cemented from 825.0 - 825.4 ft and from 825.7 - 826.9 ft; upper part pale yellowish brown with minor very pale orange tones, becoming very pale orange to pale yellowish brown by 841.0 ft and very pale orange by base. Unit contains well-cemented nodules, generally well-cemented, moderate yellowish brown to very pale orange, containing sparse "tea-brown"-micrite cement; generally burrows becoming smaller, more closely spaced downward from top to 832.4 ft, very sparse; from 832.4 - 834.3 ft, scattered; from 834.3 - 838.4 ft, about 50% of unit; from 838.4 - 847.4 ft, very sparse; 847.4 - 850.4 ft, about 50% of unit; 850.4 - 851.1 ft, sparse; 851.1 - 853.0 ft, about 60% of unit. Contains mainly microfossils; molluscs sparse in upper part of unit, becoming almost absent in lower part; corals conspicuously absent from entire unit; small worm tube at 851.8 ft. SAMPLES: T @ 825.2, 831.7, 835.2, 840.1.

[Disconformity indicated by increase in cementation, including appearance of "tea-brown" micrite below surface.]

853.8 - 855.3

FLOATSTONE: coral; matrix skeletal, foraminifer PACKSTONE; poorly cemented, fossils heavily altered, corals preserved as internal and external molds exclusively; very pale orange to pale yellowish brown. From top to 853.8 ft, sparse coral FLOATSTONE, small, cemented burrows; becoming tight FLOATSTONE(?) in lower part. Coral fragment in upper part encrusted with Carpenteriatype foraminifer; lower part contains small heads, including Alveopora(?). Lower contact disrupted by drilling.

PACKSTONE TO FLOATSTONE: coral, mollusc, skeletal
PACKSTONE locally approaching coral FLOATSTONE;
predominantly very fine grained matrix with coarser
grained skeletal components in upper part, becoming
fine- to medium-grained, silty downward; moderately to
well-cemented in upper part, becoming poorly cemented,
irregularly cemented downward, containing very sparse
"tea-brown" micrite in lower 0.2 ft; mollusc fragments
generally moldic; corals preserved as internal and
external molds exclusively; pale yellowish brown to very
pale orange; containing very sparse, well-cemented
burrows. Contains moderately common gastropods,
generally small; corals include several types, including
Stylophora.

WACKESTONE AND PACKSTONE: upper 0.4 ft skeletal WACKSTONE grading downward to skeletal PACKSTONE TO WACKESTONE; very fine grained material dominates; upper part poorly cemented, with "tea-brown" area at top of unit; moderately common "tea-brown" micrite in middle and lower part of unit, apparently associated with burrows(?) or rhizoliths(?) and narrow, closely spaced branching rhizoliths(?) set at about 45 degrees to core in finer-grained material; unit very pale orange at top, grading downward to very pale orange to pale yellowish brown with pale yellowish brown to moderate-yellowish-brown micrite.

860.4 - 860.7 CORAL HEAD: <u>Favia</u>-type coral, internal mold, mud-filled;

moderately cemented; pale yellowish brown to moderate vallowish brown

yellowish brown.

PACKSTONE: skeletal, foraminifer; very fine grained sand and silt mainly with some larger skeletal material, largely small mollusc fragments; upper 0.3 ft very well cemented, otherwise generally poorly cemented but with coarser-grained areas moderately to well-cemented; skeletal material poorly preserved, with foraminifers recrystallized, molluscs preserved as molds; very pale orange to very pale orange and pale yellowish brown; containing very sparse, skeletal, pelleted WACKESTONE-filled burrows. Lower contact apparently sharp.

[TOP OF SEDIMENTARY PACKAGE 7. Disconformity indicated by marked increase in cementation and change in facies.]

866.4 - 872.7 GRAINSTONE WITH PACKSTONE(?): foraminifer (<u>Lepidocyclina</u>), skeletal; medium- to coarse-grained; upper part contains predominantly mollusc and foraminifer grains, moderately poorly sorted; becoming predominantly well-sorted,

medium— to coarse—grained foraminifer sand downward (estimated 60 to 80% foraminifers); from 866.4 to 867.7 ft, very well cemented with sparry calcite cement, becoming moderately cemented downward with areas well-cemented, others poorly cemented; foraminifers badly recrystallized, with some moldic porosity in same in upper 0.2 ft of unit; other skeletal components generally preserved as molds; upper part pale yellowish brown to moderate yellowish brown, speckled with moderate yellowish brown, becoming slightly lighter downward. Foraminifers include large forms such as Lepidocyclina. SAMPLES: S @ 866.6 - 867.0. Lower contact gradational.

872.7 - 895.7

WACKESTONE TO MUDSTONE: skeletal, foraminifer, subunits as follows: top to 872.9 ft, PACKSTONE TO WACKESTONE, bimodal grain size; from 872.9 - 877.5 ft, MUDSTONE; 877.5 - 893.3 ft, WACKESTONE; from 893.3 ft - base, MUDSTONE TO WACKESTONE, approaching PACKSTONE at base. Unit generally poorly cemented with well-cemented nodules; skeletal components recrystallized, slightly moldic; generally very pale orange; containing wellcemented, pale-yellowish-brown to moderate-yellowishbrown, skeletal, pelleted WACKESTONE-filled burrows and nodules with scattered, minor "tea-brown" micrite throughout. Nodule occurrences/dominance as follows: from 872.7 - 882.1 ft, very sparse (large one at 881.9 ft); from 882.1 to 887.7 ft, about 20%; from 887.7 -890.3 ft, about 60%; from 887.8 - 893.3 ft, progressively more common to about 80% of rock; from 893.3 to 894.9 ft, smaller, about 30%; cementation extends beyond the burrows throughout most of unit. Note: unit is characterized by dearth of corals. Contains sparse Lepidocyclina throughout. Lower contact abruptly gradational. SAMPLE: S @ 882.1 - 882.3.

895.7 - 897.6

PACKSTONE TO GRAINSTONE: foraminifer (Lepidocyclina), skeletal; fine- to medium-grained predominantly but with scattered larger grains in upper part, grading downward to skeletal, foraminifer PACKSTONE; poorly cemented except for moderately well-cemented layer from 896.1 - 896.3 ft; upper 0.6 ft with about 40% "tea-brown"- stained small burrows; burrows below becoming only about 10% of rock; unit very pale orange to light yellowish brown in upper part, becoming very pale orange to grayish orange below. Lower contact apparently gradational.

897.6 - 898.5 NO RECOVERY.

898.5 - 915.9

MUDSTONE AND WACKESTONE WITH PACKSTONE: skeletal, foraminifer; poorly cemented except for well-cemented, pelleted, skeletal PACKSTONE TO WACKESTONE-filled burrows; micromoldic porosity; generally very fine grained, silty material predominates; very pale orange in finer-grained subunits, very pale orange to pale yellowish brown elsewhere, with pale-yellowish-brown to moderate-yellowish-brown stain on burrows. Subunits as follows: from top to 901.3 ft, PACKSTONE; 901.3 - 905.4 ft, WACKESTONE; 905.4 ft - base, MUDSTONE. Burrows and nodules as follows: from 898.5 - 899.2 ft, about 50%; from 899.2 - 906.4 ft, < 5% (one large burrow at 900.8 ft); from 906.4 - 906.9 ft, about 30%, including large one at base; from 906.9 - 909.6 ft, < 5% (tend to be elongate, set at angle to bedding); from 909.6 - 910.8 ft, 70%, mottled, anastomosing; 910.8 - 912.2 ft, 30 -40% (anastomosing); 912.2 - 915.9 ft, 20%. Lower contact disturbed by drilling, apparently sharp.

[TOP OF SEDIMENTARY PACKAGE 8. Disconformity clearly indicated by change in rock type, apparent crust at or on surface of underlying unit, change in mode of alteration of skeletal components, and presence of small sparry-filled vugs in underlying unit. Drilling became difficult when underlying unit was penetrated, chattering and vibrating strongly.]

915.9 - 917.8

FLOATSTONE: coral, with extensively recrystallized skeletal, pellet WACKESTONE OR PACKSTONE TO FLOATSTONE; upper 0.2 ft with cemented, angular mud-chips(?); lower part pervasively recrystallized through harder pieces; several fragments may have been part of laminated crust(?); microdrusy carbonate lining small and large vugs; well-cemented mainly but broken by drilling, small areas uncemented, filled with MUDSTONE (silt-sized particles); moderate yellowish brown mottled with pale yellowish brown and very pale orange in cemented part, mold filling very pale orange to white. Breaks into small, sharp, angular pieces; drilled very roughly, extreme rig vibration; did not lose circulation. Corals, several types, preserved exclusively as molds. SAMPLES: S @ 916.1 - 916.3, 916.9 - 917.3, 917.3 -917.5, 917.7; T @ 916.7 (soft material); X @ 916.1.

917.8 - 920.4 NO RECOVERY.

920.4 - 931.4

WACKESTONE WITH PACKSTONE: foraminifer, skeletal; generally poorly cemented but moderately cemented (burrow?) from 925.1 - 925.3 and 927.6 ft filled with skeletal, foraminifer, pellet WACKESTONE; skeletal material extremely recrystallized; seemingly very fine

grained particles dominate; very pale orange. Most of unit WACKESTONE; PACKSTONE subunits as follows: from 924.6 - 925.3 ft, 928.5 - 929.5 ft, and 930.8 - 931.4 ft.

931.4 - 936.2 PACKSTONE WITH WACKESTONE: foraminifer (Lepidoclina); generally skeletal, PACKSTONE WITH WACKESTONE; moderately cemented at top with sparse "tea-brown" micrite, becoming poorly cemented downward; extensively recrystallized skeletal components (sucrosic texture); containing at top of unit abundant, well-cemented pellet, skeletal, foraminifer WACKESTONE-filled burrows(?); very pale orange and very pale orange to moderate yellowish brown; very fine to caorse-grained, very poorly sorted. SAMPLE: T @ 931.8.

936.2 - 939.7 NO RECOVERY.

939.7 - 943.6 WACKESTONE TO PACKSTONE: skeletal, foraminifer (Lepidocyclina); poorly cemented; extensively recrystallized skeletal grains; very pale orange to white; very fine grained (except for Lepidocyclina), silty. SAMPLE: M @ 939.7 - 940.7. Lower contact gradational.

943.6 - 949.3 PACKSTONE TO WACKESTONE: skeletal, mollusc; moderately cemented, irregularly cemented in upper part, becoming progressively better-cemented downward; lower part moderately cemented; extensively recrystallized

(sucrosic texture); moldic porosity throughout; very pale orange; medium- to coarse-grained, silty. Lower contact gradational.

949.3 - 964.7 WACKESTONE TO PACKSTONE: mollusc, skeletal, pellet; generally well-cemented throughout, soft zones from 955.9 - 957.3 and 965.7 - 968.7 ft; moldic porosity (large) common throughout; enlarged to small vugs at 950.9 - 952.9 ft (lost circulation here); fossils preserved exclusively as molds; molds with minor drusy lining from 952.9 - 954.0 ft; very pale orange to pale yellowish brown. Characterized by high diversity of large pelecypods and gastropods, including Pinna at 955.5 ft, and other large pelecypods; corals mainly Seriatopora; large, lined, vertical worm(?) tubes from 952.5 - 954.4 ft, filled with pellet, skeletal WACKESTONE. SAMPLES: S @ 952.9 - 953.3, 957.7 - 958.2.

[Discontinuity marked by reappearance of "tea-brown" micrite in underlying unit.]

964.7 - 968.7 PACKSTONE: mollusc, skeletal; moderately cemented, moderate "tea-brown" micrite; moldic porosity; very pale orange to pale yellowish brown, mottled with moderate yellowish brown; fine to very coarse grained, muddy. Contains molds of several types molluscs, including large pelecypods. Lower contact gradational.

- 968.7 982.2 FLOATSTONE: sparse coral, with skeletal, mollusc WACKESTONE matrix in upper part, grading downward to sparsely skeletal WACKESTONE matrix in lower part; moderately to well-cemented to about 971.3 ft, very well cemented, pervasively cemented below, containing "teabrown" micrite dispersed throughout unit from 968.7 -970.0 ft, layer of "tea-brown" micrite at 969.9 ft, very scattered downward; moldic (large) porosity with scattered thin drusy lining below 978.0 ft; very pale orange mottled with pale yellowish brown. Corals encrusted by coralline algae(?) at several places (e.g., 979.1 ft). Contains large pelecypods and gastropods throughout (very large pelecypod at 964.9 ft); internal and external molds of Stylophora at 679.7 - 680.0 ft (see lower unit). Base abruptly gradational. SAMPLES: S @ 968.9 - 969.3, 976.7 - 977.1.
- ______
- 982.2 982.7 PACKSTONE: pellet, pelecypod, with abundant mud in matrix; moderate-sized pelecypods closely packed; some not in wave-and-current-stable position; very well cemented; pale yellowish brown to moderate yellowish brown with pale-yellowish-orange matrix; containing abundant geopetal features, partly moldic porosity, sparsely microdruse lining. Base apparently abruptly gradational. SAMPLES: S @ 981.5 982.7; X @ 983.1.
- 982.7 990.9 FLOATSTONE: sparse, coral, pelecypod; matrix skeletal pellet WACKESTONE (tight); very well cemented throughout; macromoldic porosity mainly of coral heads and sticks and pelecypods, partly infilled with microdruse, boytroidal lining from 984.0 to base; healed spar-filled shrinkage(?) cracks at 990.0 990.8 ft; very pale orange mottled with pale yellowish brown. Contains small, completely replaced upright Porites lutea(?) head at 983.6 983.9 ft; fragments of external mold of large Favia(?) head encrusted with coralline algae at 985.0 985.8 and 986.3 986.5 ft; Pocillopora at 990.2 ft; molluscs mainly large pelecypods, scattered

throughout; scattered <u>Lepidocyclina</u>. Bases gradational. SAMPLES: S @ 983.1 - 983.6, 990.0 - 990.6; X @ 990.0, 990.7; M @ 982.0 - 988.0.

990.9 - 992.1 WACKESTONE: mollusc, skeletal pellet; very well cemented, pervasively cemented; moldic porosity, commonly with fine druse; very pale orange; generally very fine grained to coarse-grained. Contains large pelecypods, small coralgal(?) heads. SAMPLES: S@991.7 - 992.4 [includes contact with lower unit]. Lower contact sharp, with up to 0.5 ft relief, set at about 30 degrees to core (see core-deviation record). SAMPLE: S@991.7

- 992.4.

[Disconformity clearly indicated by radical change in rock types and by knife-edge nature of undulatory contact.]

992.1 - 995.8 GRAINSTONE TO PACKSTONE: upper part medium- to coarse grained, foraminifer (Lepidocyclina) GRAINSTONE (80% foraminifers), grading downward to very fine to coarsegrained, silty, skeletal foraminifer PACKSTONE downward and becoming skeletal PACKSTONE by 992.8 ft and to base; upper part very well cemented, becoming progressively less-cemented downward, moderately cemented at base; nonmoldic at top, becoming micromoldic downward; contains very sparse vugs in upper part (coral(?), lined with botryoidal cement; very pale orange to pale yellowish brown at top, becoming very pale orange downward. Interval from 992.4 - 992.7 contains foraminifer, skeletal WACKESTONE, apparently associated with vugs (infilling from overlying unit?). Lower contact gradational. SAMPLES: [see overlying unit]; S @ 992.4 - 992.8; X @ 992.4, 992.9.

995.8 - 998.0 WACKESTONE TO PACKSTONE: WACKESTONE TO PACKSTONE in upper part, grading to WACKESTONE downward; pellet, skeletal; moderately cemented to poorly cemented; irregularly cemented, with small common moderately cemented nodules throughout. Contains scattered foraminifers. Lower contact grades. Note: pellets in nodules moldic, slightly enlarged.

998.0 - 1006.8 MUDSTONE: sparse skeletal, pellet, scattered pelecypod molds, irregularly cemented, generally poorly to moderately cemented, but with poorly cemented patches; small moderately cemented nodules throughout; very pale orange to white. Pellets moldic, enlarged slightly.

Macrofauna consists exclusively of scattered, large, articulated pelecypods. Lower contact gradational.

SAMPLES: S @ 1000.5 - 1000.7.

1006.8 - 1018.3

PACKSTONE AND GRAINSTONE: upper part medium— to coarse-grained, skeletal PACKSTONE, grading downward to very coarse grained, granular, skeletal, coralgal(?) foraminifer (Lepidocyclina) GRAINSTONE by 1013.9 ft; characterized by high variety of rounded, abraded, skeletal components, including Lepidocyclina; poorly to moderately cemented in upper part, becoming moderately to poorly cemented downward; minor moldic porosity, particularly mollusc grains. Contains coralgal—coated recrystallized, small coral head at 1016.6 ft with minor druse. Lower contact gradational. SAMPLES: T@ 1016.6; M@ 1008.8 - 1009.8.

1018.3 - 1019.7

GRAINSTONE: very coarse grained, granular, coralgal, mollusc, skeletal; very well cemented, drusy spar-filled pores; minor moldic porosity (coral sticks); grains abraded, rounded; pale yellowish brown to very pale orange; poorly sorted. Contains Lepidocyclina. Lower contact sharp, undulatory. SAMPLES: S @ 1019.0 - 1019.6.

[Disconformity indicated by change in rock type and nature of contact.]

1019.7 - 1020.9

MUDSTONE: skeletal, mollusc, pellet, locally approaching FLOATSTONE; very well cemented except for soft, mudfilled interval from 1019.8 - 1019.9 ft; macromoldic porosity with corals, large articulated pelecypods. Contains Stylophora and other stick-coral fragments. Lower contact abruptly gradational. S @ 1019.9 - 1020.7.

1020.9 - 1032.2

MUDSTONE TO WACKESTONE: very sparsely skeletal in upper part, pellet in upper part, grading to sparse skeletal WACKESTONE downward; very well cemented, homogeneous; sparse moldic porosity, sparse vugs lined with drusy calite and botryoidal cement; very pale orange with sparse pale-yellowish-brown mottled areas (burrows?) in upper part; large, irregularly shaped mass moderate yellowish brown with slight tones dark yellowish moderately cemented in upper part, becoming moderately to poorly cemented downward; minor moldic porosity, particularly molluscs. Contains sparse WACKESTONEfilled burrows in upper part. Effervesces slowly in dilute HCl. Contains scattered "razor clams" throughout; scattered gastropods. Lower contact gradational. SAMPLES: S @ 1024.2 - 1024.7, 1029.9 -1030.3; T @ 1023.0; X @ 1029.9, 1030.4; M @ 1008.8 -1009.8.

1032.2 - 1036.8

WACKESTONE: gastropod, pelecypod; well-cemented to very well cemented; minor molds, small, scattered vugs lined with drusy calcite and botryoidal cement like overlying unit; pervasively recrystallized; minor healed brecciation evident at 1032.4 and 1034.3 ft; very pale orange mottled with light yellowish brown. Lower contact apparently sharp. SAMPLES: S @ 1032.6 - 1033.0, 1035.1 -1035.3.

1036.8 - 1038.3

PACKSTONE TO WACKESTONE: upper part gastropod, skeletal PACKSTONE with abundant small gastropods (all one type, all steinkerns) and scattered pelecypods, grading downward to skeletal WACKESTONE in lower part, back to PACKSTONE at base; moderately cemented, minor "teabrown" micrite(?) in upper part of unit; moldic porosity; very pale orange to moderate yellowish brown. Contains large pelecypod at 1038.1 - 1038.3 ft, scattered corals. Lower contact abruptly gradational.

1038.3 - 1040.8

PACKSTONE TO GRAINSTONE: skeletal mollusc, foraminifer PACKSTONE in upper part of unit, grading downward to very coarse grained, skeletal, mollusc, foraminifer GRAINSTONE in middle of unit to base; skeletal composition highly varied, consisting of small moldic gastropods, small pelecypod fragments, foraminifers, small coralgal clasts, etc.; moderately to poorly cemented, crumbly, containing scattered "tea-brown" micrite; moldic porosity; very pale orange with areas pale yellowish brown to moderate yellowish brown. Lower contact sharp, undulatory.

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[Disconformity suggested by sharp contact and change in rock type.]

1040.8 - 1045.0

FLOATSTONE: coral with pellet, skeletal WACKESTONE matrix; very well cemented at top, becoming moderate to well-cemented downward; very dense, moldic porosity; mottled pale yellowish brown, moderate yellowish brown, and very pale orange. Contains sparse larger foraminifers (contains contact with upper unit). Lower part of unit broken up in drilling. SAMPLE: S @ 1040.8 - 1041.2.

1045.0 - 1078.7

PACKSTONE, WACKESTONE, AND MUDSTONE: upper part foraminifer, mollusc, skeletal PACKSTONE, medium— to coarse—grained, grading downward to skeletal, foraminifer WACKESTONE by 1048.0 ft and to sparsely skeletal WACKESTONE TO MUDSTONE from 1053.4 — 1078.7 ft; varies from moderately to poorly cemented, moderate amount of "tea-brown"(?) micrite associated with rootlets(?) in upper part of unit; skeletal components very badly recrystallized, including foraminifers; very

pale orange to pale yellowish brown in upper part, grading downward to very pale orange in middle, and to very pale orange to white in lower part. Cementation as follows: from 1045.0 - 1048.0 ft, moderately cemented; from 1048.0 - 1048.7 ft, very well cemented (containing small vugs partly filled with botryoidal); from 1051.8 - 1053.4 ft, moderately to poorly cemented; from 1053.4 - 1078.7 ft, irregularly cemented, moderately to poorly cemented. Well-cemented small nodules common from 1053.4 ft to base. Lower part of unit has sucrosic texture. Lower contact sharp.

[Disconformity clearly indicated by physical nature of contact and by marked change in degree of cementation, including presence of "tea-brown" cement and rhizoliths in upper part of underlying unit.]

1078.7 - 1100.1

FLOATSTONE AND MUDSTONE: sparse coral FLOATSTONE with sparse foraminifer, skeletal MUDSTONE(?) matrix and interbedded with same; very well cemented, from top to 1085.9 ft, with several stages of cementation evident; density high; sparse macromoldic porosity associated with larger pelecypods and corals, partly infilled, single microchannel fissure at 1080.3 - 1080.6 ft; lower part well-cemented with irregular poorly cemented areas (e.g., 1085.7 - 1086.1 ft.); very pale orange mottled with pale yellowish brown. Corals include Stylophora at 1081.0 ft and scattered elsewhere, large Porites lutea head at 1081.7 - 1082.0 ft [coral was apparently largely or completely replaced by sparry calcite, largely dissolved, and infilled with carbonate mud, and the remaining void at the top was subsequently partially filled with spar and botryoidal material]; coral may be encrusted with coralline algae; large foraminifers sparse, badly recrystallized. [Note: upper part of unit contains thin, elongate, moderate-yellowish-brown areas that may have been "tea-brown"-filled rootlets.] At 1096.1 ft, low-angle fractures, at least one partially rehealed. Lower contact sharp. SAMPLES: S@ 1079.1 - 1079.6, 1080.3 - 1080.6, 1080.7 - 1081.6, 1081.7 - 1082.6; X @ 1080.7.

1100.1 - 1101.8 NO RECOVERY.

[Disconformity evidenced by change in color, facies, and alteration, and presence of thin laminated crust and paleosol features.]

1101.8 - 1101.9

LAMINATED CRUST: well-cemented; probable "tea-brown" calcite; pale yellowish brown to very pale orange; fine-to medium-grained; varicolored laminae; clotted texture, glaebules, and possible rhizoliths. Lower contact grades abruptly. SAMPLE: T @ 1101.8.

1101.9 - 1103.8	WACKESTONE: sparse mollusc; patchy cementation, moderately cemented (50%) to poorly cemented; mollusc steinkerns and molds; very pale orange; fine-grained, mostly silt; moldic porosity; scattered "tea-brown" calcite-filled rhizoliths in upper part and "tea-brown" micrite at 1102.5 ft forms dendritic borings pattern on pelecypod steinkern; "tea-brown" micrite scattered through unit. Contains scattered large pelecypods.
1103.8 - 1112.2	NO RECOVERY.
1112.2 - 1113.0	MUDSTONE: skeletal; poorly to moderately cemented, irregularly cemented; very pale orange with moderate-yellowish-brown ("tea-brown") micrite; very fine grained. Lower contact abruptly gradational.
1113.0 - 1114.1	FLOATSTONE: coral, with skeletal, pellet MUDSTONE matrix; well-cemented; molluscs form molds and steinkerns, corals form partial molds, scattered ones spar-replaced; very pale orange with minor pale-yellowish-brown spar; fine-grained; moldic porosity; pellets form common micromolds; rock broken by drilling. Contains mainly Stylophora .
1114.1 - 1125.1	NO RECOVERY.
1125.1 - 1125.8	MUDSTONE: skeletal; generally uncemented with moderately cemented burrows altered; white; very fine grained silt.
1125.8 - 1126.3	NO RECOVERY.
1126.3 - 1128.8	WACKESTONE: coral, mollusc; moderately to poorly cemented, irregularly cemented; corals partial molds, some spar-replaced, mollusc molds and steinkerns; very pale orange to white with sparse "tea-brown" micrite and pale-yellowish-brown spar; matrix very fine to fine-grained; moldic porosity. Contains sparse Stylophora and Porites sp. Lower contact gradational.
1128.8 - 1129.6	WACKESTONE: skeletal; largely uncemented with scattered moderately cemented patches; highly altered; very pale orange; gray and white material fused during drilling present in sample; fine- to medium-grained sand matrix; minor spar fillings. Lower contact sharp.

1129.6 - 1135.2	FLOATSTONE: coral, (Seriatopora) with mollusc WACKESTONE matrix; well-cemented in upper part, becoming moderately to poorly cemented below 1134.2 ft; corals and molluscs preserved as molds and steinkerns, abundant sparreplacement and -cementation; mottled very pale orange and pale yellowish brown (spar); matrix mostly very fine-grained; abundant (20%) moldic porosity. Contains predominantly small Seriatopora stocks, sparse Stylophora and other corals. Lower contact gradational. SAMPLES: S @ 1130.4 - 1130.8; X @ 1130.4.
1135.2 - 1135.9	FLOATSTONE: tight oncoid, with skeletal PACKSTONE matrix; well-cemented; corals and molluscs preserved as molds and steinkerns, nucleii of oncoids also molds; very pale orange mottled with pale yellowish brown; spar cement; matrix fine- to medium-grained with pellet molds; oncoids pebble-sized; spar fills shelter and interparticle pores, molluscs and corals not infilled, forming secondary moldic porosity. SAMPLE: S @ 1135.2 - 1135.5.
1135.9 - 1138.9	NO RECOVERY.
1138.9 - 1139.4	PACKSTONE: mollusc, skeletal; moderately cemented; molluscs preserved as molds and steinkerns, some spar replacement; very pale orange, minor pale yellowish brown; mostly medium-grained; moldic porosity. Lower contact abruptly gradational.
1139.4 - 1139.9	WACKESTONE: sparse, skeletal; poorly cemented; very pale orange, with minor pale-yellowish-brown, spar-cemented matrix; mostly fine- to medium-grained; possible small burrows.
1139.9 - 1143.1	NO RECOVERY.
1143.1 - 1145.8	PACKSTONE: foraminifer, skeletal; poorly cemented, scattered moderately cemented nodules, poorly consolidated; scattered coral molds; very pale orange to white; very fine to coarse-grained; moderately sorted. Contains abundant Lepidocyclina.
1145.8 - 1148.7	NO RECOVERY.

1148.7 - 1150.7

WACKESTONE: foraminifer, skeletal; uncemented; moderately cemented burrows have spar-cemented centers; poorly consolidated; very pale orange to white; very fine to very coarse grained; less-sorted than unit above; scattered sparse small cemented burrows. Contains abundant Lepidocyclina. Lower contact gradational.

1150.7 - 1151.9

MUDSTONE: foraminifer, skeletal; uncemented, unconsolidated; some burrows with spar-cemented centers and fossil molds; white to very pale orange; very fine to coarse-grained; few scattered small, cemented burrows. Contains common Lepidocyclina.

1151.9 - 1159.4

NO RECOVERY.

1159.4 - 1165.7

WACKESTONE: foraminifer, skeletal; generally poorly cemented with abundant well-cemented nodules approaching 50% from 1163.4 - 1165.7 ft; cementation increases toward bottom of unit; molluscs and corals molds; very pale orange to white, very fine to coarse-grained; moldic porosity; abundant cemented burrows infilled with dolowackestone that is less muddy than matrix and has abundant pellet molds. SAMPLE: Lower contact abruptly gradational. S @ 1165.3; M @ 1162.4 and 1163.4.

1165.7 - 1174.0

FLOATSTONE: coral, with sparse mollusc, pellet WACKESTONE matrix; well-cemented, minor moderately cemented intervals; corals and molluscs preserved molds, some spar-replaced, sparse steinkerns, foraminifers appear to be spar-replaced; very pale orange to white with faint mottling, possibly burrows; mostly very fine to medium-grained with small coral sticks and molluscs; common pellets, many altered to molds. Contains common foraminifers including sparse Lepidocyclina scattered throughout; abundant Seriatopora sticks (unabraded). Lower contact sharp, gently undulatory. SAMPLE: P@ 1172.45 - 1172.7.

[Disconformity indicated by changes in color, facies, and alteration, presence of possible laminated crust, and paleosol features.].

1174.0 - 1175.0

LAMINATED CRUST: well-cemented; possible "tea-brown" micrite in shelters beneath corals and partly replacing corals; corals largely recrystallized; pale yellowish brown with faint, white, irregular laminae; clotted texture, fenestrae(?); fine- to medium-grained.

SAMPLE: S @ 1174.3 - 1174.7.

1177.5 - 1187.0

FLOATSTONE: coral, with mollusc, skeletal MUDSTONE matrix; well-cemented; molluscs preserved as molds and steinkerns, corals partly dissolved and partly sparreplaced near top, more completely dissolved near base; large-scale moldic porosity; very pale orange to white with common yellowish-brown-spar giving mottled appearance; mostly silt with pellets (pellets commonly molds); most skeletal elements pebble- to cobble-sized corals, scattered small and large molluscs; moldic porosity; common fractures from 30 to 90 degrees to bedding; smaller fractures spar-filled; spar infilling shelters. Contains several types of corals, including common digatate Stylophora, acroporid sticks, small Favia(?) heads at 1179.8 and 1182.0 ft. Lower contact abruptly gradational. SAMPLES: S @ 1180.1 - 1180.5; X @ 1180.1, 1180.4; M @ 1178.6 - 1179.6.

1187.0 - 1189.0

PACKSTONE: mollusc, foraminifer; moderately to poorly cemented, containing "tea-brown" micrite and spar; moldic porosity; pale yellowish brown to very pale orange with moderate-yellowish-brown, sparry areas; generally fine-to coarse-grained, silty, moderately sorted. Lower contact gradational.

1189.0 - 1211.3

WACKESTONE: skeletal, mollusc; generally poorly cemented with abundant moderately cemented burrows and nodules; molluscs preserved as molds and steinkerns, pellets(?) white; very fine to medium-grained, with more mud in interval from 1194.2 - 1195.7 ft; containing scattered skeletal, pellet PACKSTONE-filled burrows; unit very pale orange (uncemented), with very pale orange to pale yellowish brown burrows; fine- to coarse-grained; abundant moldic porosity; nodules. Contains sparse spar-replaced corals. From 1207.4 ft - base, nodules less abundant. Lower contact imperceptably gradational. SAMPLES: X @ 1198.5; M @ 1192.5 - 1193.5.

1211.3 - 1214.2

PACKSTONE TO GRAINSTONE: skeletal, foraminifer PACKSTONE from top to 1212.3 ft, grading to GRAINSTONE downward, back to PACKSTONE in basal 0.2 ft; uncemented, poorly consolidated; skeletal components recrystallized; very pale orange; fine- to very coarse grained, mostly fine-grained, becoming muddy near base. Contains mainly small foraminifers, scattered Lepidocyclina near base. Lower contact imperceptably gradually.

1214.2 - 1218.2

WACKESTONE TO MUDSTONE: skeletal, foraminifer; uncemented, poorly consolidated; very pale orange to white; very fine to medium-grained, mostly very fine grained;

skeletal elements less abundant near base (MUDSTONE); at 1217.2 ft, modeately cemented, pebble-sized piece with "tea-brown" micrite. Lower contact apparently gradational.

[Contact marked by increase in "tea-brown" cement in nodules and slight increase in consolidation.]

- 1218.2 1223.1
- MUDSTONE: coral, skeletal; generally poorly cemented, with small moderately cemented nodules or burrows, moderately to poorly consolidated; "tea-brown" micrite common as replacement rinds on corals and within filled shelters; corals extensively recrystallized, partly dissolved, some spar-replaced; generally very pale orange to white with very pale orange to dark-yellowish-brown ("tea-brown" micrite and spar), coral-bearing areas; very fine grained, silty; some moldic porosity; corals with attached cement decreasing in abundance from top to bottom of unit. Small corals associated with possible burrows. Lower contact gradational. SAMPLES: T @ 1222.8.

1223.1 - 1228.7

WACKESTONE: sparse, skeletal, generally poorly cemented, with moderately to well-cemented burrows(?) and nodules, moderately consolidated; molluscs preserved as molds and steinkerns, scattered "tea-brown" micrite; white to very pale orange with scattered dark-yellowish-brown spar; silty to medium-grained, generally very fine grained; altered pelecypod shell at 1227.8 ft. Small burrows, skeletal, pellet WACKESTONE-filled; well cemented containing "tea-brown" micrite and minor moldic porosity in burrows. Unit becomes muddier toward base. Base imperceptably gradually.

1228.7 - 1231.2

MUDSTONE: skeletal; uncemented, moderately consolidated; molds in burrows; white to very pale orange; mostly very fine grained; scattered small WACKESTONE-filled burrows; some spar replacement. At 1230.4 ft, small recrystallized Porites lutea. Lower contact gradational.

1231.2 - 1232.9

WACKESTONE: sparse skeletal, pellet; moderately cemented; molluscs preserved as molds and steinkerns, corals mostly dissolved; very pale orange; very fine grained, with larger skeletal elements; sparse moldic porosity. Contains small scattered <u>Seriatopora</u> sticks.

1232.9 - 1235.1 NO RECOVERY.

1235.1 - 1248.6

WACKESTONE: foraminifer, skeletal; generally uncemented with abundant, well-cemented burrows, poorly consolidated; corals spar-replaced, large molluscs calcite-replaced but retaining shell structure; burrows with minor molds; very pale orange, with very pale orange to pale-yellowish-brown mottling; generally silty to fine-grained; common small burrows; pale orange near top, darker colored toward base with some "tea-brown" micrite present. Contains reworked lithoclasts from unit below in lower 0.4 ft of unit. Lower contact sharp, undulatory. SAMPLES: M @ 1247.1 - 1248.1.

[Disconformity indicated by increase in cementation and porosity, change in color, appearance of spar-lined fillings, and increase in "tea-brown" micrite below surface and presence of lithoclasts reworked into base of overlying unit.]

1248.6 - 1264.9

skeletal, mollusc; moderately to well-cemented, PACKSTONE: containing sparse "tea-brown" micrite, very sparse spar cement and infillings in upper part; mollusc shell layers moderately well-preserved in places, but molluscs generally preserved molds in cemented intervals, sparse "dog-tooth"-spar infillings, corals recrystallized or preserved as molds; unit pale yellowish brown near top, generally becoming mottled very pale orange (matrix) and pale yellowish brown (burrows) downward; mostly mediumto coarse-grained; small molds abundant. From 1248.6 -1249.1 ft, large worm tube; at 1249.2 ft, large mollusc with shell material preserved though probably recrystallized. In burrows, pellets and foraminifers better preserved than in matrix. Unit variably cemented as follows: well-cemented from 1248.6 - 1252.5 ft; moderately cemented from 1252.5 - 1254.7 ft; wellcemented from 1254.7 - 1255.8 ft; moderately cemented from 1255.8 - 1258.3; well-cemented from 1258.3 - 1259.3 ft; moderately cemented from 1259.3 - 1261.3 ft; moderately to well-cemented from 1261.3 - 1264.9 ft. Lower contact gradational. SAMPLES: S @ 1252.2 -1252.6, 1267.3 - 1267.7; X @ 1252.2.

1264.9 - 1288.7

WACKESTONE: generally skeletal, mollusc, becoming tight skeletal-foraminifer from top to 1269.1 ft and from 1284.5 ft to base; generally well- to moderately cemented; molluscs preserved as molds and steinkerns, sparse corals partly dissolved with spar-replaced centers and rinds; very pale orange with minor very pale orange to pale-yellowish-brown (spar) mottling; mostly fine- to medium-grained; moldic porosity. From top to 1274.0 ft, tight WACKESTONE approaching PACKSTONE. Cementation as follows: from top to 1274.0 ft, well-cemented with moderate spar; from 1274.0 - 1278.0 ft, well- to moderately cemented; from 1278.0 - 1281.5 ft, no recovery; from 1281.5 - 1284.5 ft well-cemented at

top to uncemented at base with some steinkerns spar-replaced and "dog-tooth"-spar infillings; from 1284.5 - 1288.7 ft, generally poorly cemented with moderately cemented burrows(?) with moderately unconsolidated; common "tea-brown" micrite. SAMPLE: T @ 1267.3; X @ 1267.7; M @ 1275.4 - 1276.4.

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[Disconformity suggested by change in facies, increase in cementation and presence of abundant "tea-brown" micrite.]

1288.7 - 1300.4

GRAINSTONE TO PACKSTONE: foraminifer (Lepidocyclina)
GRAINSTONE from top to 1292.0 ft, grading downward to
PACKSTONE; well-cemented from 1288.7 - 1290.0 ft, poorly
cemented to uncemented through remainder of unit; with
common well- to moderately cemented nodules; molluscs
preserved as molds and steinkerns, corals sparse but
small, partly dissolved coral head with coralgal rind
preserved with exterior spar-replaced at top of unit;
pale yellowish brown to moderately yellowish brown in
upper part, becoming pale yellowish brown to very pale
orange downward; fine- to very coarse grained, mostly
coarse-grained. Lower contact gradational. SAMPLES:
S @ 1298.3 - 1298.6; X @ 1289.7, 1298.3.

1300.4 - 1304.7

WACKESTONE: skeletal, foraminifer; generally poorly cemented to uncemented; molds in burrows; very pale orange with pale-yellowish-brown burrows imparting mottled appearance; mostly fine- to medium-grained. Burrows contain Lepidocyclina and micromolluscs, sparse moldic porosity. At 1303.2 ft, small worm tube. SAMPLE: M @ 1300.4 - 1301.4.

1304.7 - 1308.7

FLOATSTONE: coral with tight foraminifer, skeletal WACKESTONE matrix; well-cemented from top to 1307.8 ft, becoming moderately cemented downward; corals altered, partly dissolved and spar-filled, molluscs preserved as molds and steinkerns, foraminifers as partial molds; very pale orange with pale-yellowish-brown spar near top; mostly medium-grained, varies from silt to very coarse grained; moldic porosity. Contains large Lepidocyclina; corals mainly Seriatopora sticks. Lower contact gradational. SAMPLE: S @ 1304.7 - 1305.0.

1308.7 - 1320.2

FLOATSTONE(?) OR WACKESTONE(?): coral FLOATSTONE with skeletal WACKESTONE; matrix or WACKESTONE; extensively recrystallized; poorly cemented to uncemented, poorly consolidated; molluscs preserved as molds and steinkerns; very pale orange to white with scattered pale-yellowish-brown spar in burrows(?); silt to coarsegrained, mostly fine-grained; moldic porosity in corals;

scattered well-cemented burrows(?) containing PACKSTONE: skeletal, foraminifer, pellet PACKSTONE; small Porites(?) heads consistently replaced by dark-colored spar; other small corals recognized only by faint relict structure. Lower contact gradational.

1320.2 - 1323.8

BAFFLESTONE: coral; sparse skeletal WACKESTONE(?) matrix; moderately cemented; extensively recrystallized; altered corals resemble matrix, molluscs preserved as molds and steinkerns; very pale orange to pale yellowish brown; generally very fine to coarse-grained; moldic porosity. Generally digitate coral with growth form like Acropora cuneata, in growth position, and small coral sticks. Lower contact gradational.

1323.8 - 1327.8

FLOATSTONE AND WACKESTONE(?): coral FLOATSTONE with skeletal, pellet; WACKESTONE(?) matrix and interbedded with same, unit well- to poorly cemented, irregularly cemented; corals preserved as molds, molluscs as molds and steinkerns, extensive recrystallization of skeletal elements especially in better-cemented portions; very pale orange; very fine to very coarse grained, mostly fine-grained; common moldic porosity. Lower contact sharp.

1327.8 - 1337.5

BAFFLESTONE OR FLOATSTONE AND PACKSTONE: alternating foraminifer-skeletal PACKSTONE and coral-coralgal BAFFLESTONE AND/OR FLOATSTONE WITH PACKSTONE matrix; moderately to poorly cemented, irregularly cemented; extensively recrystallized with corals preserved as generally "ghosts", some spar-replaced; coralgal rinds on digitate coral apparently in growth position, others may be toppled; very pale orange with some grayish-orange spar. Contains small spar-replaced Astreopora(?) head at 1332.4 ft. PACKSTONE intervals from top to 1330.6 ft and 1331.8 - 1332.4. SAMPLE: M @ 1328.7 - 1329.7.

1337.5 - 1340.0

FRAMESTONE: coral; alternating <u>Porites lutea</u> and <u>Astreopora(?)</u> heads; very poorly preserved, extensively recrystallized and partly spar-replaced, disaggregated, crumbly; very pale orange to grayish orange. Lower contact gradational.

1340.0 - 1347.6

PACKSTONE: coral, skeletal, possibly grading to coral FLOATSTONE, locally; moderately cemented in upper 0.5 ft, becoming poorly to moderately cemented to base with scattered well-cemented nodules; extensively altered and recrystallized skeletal components, corals replaced by

fine spar; moldic porosity; very pale orange to grayish orange. Contains mold of large Astreopora(?) head at top, scattered small Porites lutea(?) heads scattered throughout; contains large crescent shaped Miogypsina(?) and Lepidocyclina sparsely throughout. Lower contact gradational.

1347.6 - 1390.5

WACKESTONE TO PACKSTONE: unit generally foraminifer, skeletal WACKESTONE with scattered corals, grading downward to muddy PACKSTONE below 1386.0 ft; generally uncemented to very poorly cemented, with well- to moderately cemented burrows and nodules common (40-50%) in unit from top to about 1371.5 ft, becoming progressively less common (10-20%) from 1371.5 ft -1386.4 ft, and progessively more common from 1386.4 ft base; most macrofossils poorly preserved as molds, but chalky pelecypod fragments at 1386.2 ft, corals extensively recrystallized; generally very pale orange throughout, becoming very pale orange to grayish orange from 1386.0 ft to base. Contains moderately common Miogypsina(?) and Lepidocyclina from top to about 1360.0 ft. Lower contact apparently sharp, undulatory. SAMPLES: S @ 1352.4 - 1353.6; M @ 1365.8 - 1366.6.

[Disconformity indicated by presence of "tea-brown" cement in crust with possible laminations and in subsequent strata and slight increase in cementation.]

1390.5 - 1395.3

FRAMESTONE(?): skeletal; possible, poorly preserved irregularly laminated crust in upper 0.3 ft; moderately to poorly cemented, irregularly cemented, containing abundant "tea-brown" micrite in upper 0.3 ft, abundant "tea-brown" micrite associated with large vertical tube, rhizolith, or burrow from 1392.9 - 1393.4 ft, and dispersed throughout unit; skeletal components extensively altered making identification of rock tenuous, recrystallized small coral at 1392.6 ft. SAMPLE: S @ 1390.5 - 1390.7; X @ 1390.8. Lower contact gradational.

1395.3 - 1413.4

WACKESTONE(?): skeletal; uncemented to poorly cemented; highly altered skeletal components, identifiable forms preserved as molds, and molluscs as steinkerns; very pale orange to white; very fine to coarse-grained, mostly fine-grained matrix. Small recrystallized coral at 1399.2 ft. Note: NO RECOVERY from 1402.4 - 1411.0 ft. SAMPLE: M @ 1395.9 - 1396.9; T @ 1411.9; X @ 1412.0.

1413.4 - 1414.2 NO RECOVERY.

[Disconformity indicated by change in facies, increase in cementation, and by presence of "tea-brown" micrite and spongy crust.]

1414.2 - 1422.5

GRAINSTONE, PACKSTONE, AND FLOATSTONE: extensively altered; upper part coral, foraminifer, skeletal GRAINSTONE grading to coral FLOATSTONE with GRAINSTONE matrix, becoming coral FLOATSTONE with PACKSTONE interbedded with skeletal, foraminifer PACKSTONE in lower part; generally poorly cemented, crumbly; very pale orange to pale yellowish brown; medium- to very coarse grained; moldic porosity in corals; "tea-brown" micrite in upper 0.6 ft concentrated in three irregular horizontal bands or "crusts", and scattered throughout interval, generally decreasing toward base. Contains abundant <u>Lepidocyclina</u>, <u>Miogypsina(?)</u>, and other foraminifers: apparently several types of small corals, including extensively recrystallized Porites lutea(?). Lower contact gradational. SAMPLES: S @ 1417.5 - 1417.8; X @ 1417.4; M @ 1417.8 - 1418.8.

1422.5 - 1428.8

PACKSTONE: foraminifer, skeletal; uncemented, moderately consolidated; foraminifers probably micritized; very pale orange; medium- to coarse-grained. Contains abundant larger and smaller formaminifers including Lepidocyclina and Miogypsina(?), sparse small corals. Lower contact gradational. SAMPLES: X @ 1427.4; M @ 1427.8 - 1428.8.

1428.8 - 1430.1

WACKESTONE: foraminifer; uncemented, moderately consolidated; foraminifers probably recrystallized, containing two small corals with "tea-brown" micrite alteration; white; very fine- to coarse-grained, mostly medium- to coarse-grained; moldic porosity in corals; both small and large foraminifers abundant. Contact abruptly gradational.

1430.1 - 1434.6

PACKSTONE: foraminifer; poorly cemented, moderately consolidated; larger foraminifers recrystallized; very pale orange to white; fine- to very coarse grained, with abundant mud in lower 1.1 ft; moldic porosity in corals in upper 1.0 ft. Lower contact gradational.

1435.6 - 1436.7

WACKESTONE: skeletal; generally poorly cemented with 50% small, well-cemented nodules, extensively altered skeletal material; white to very pale orange. Lower contact sharp.

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[Disconformity indicated by increase in cementation, presence of weak "teabrown" micrite and coral mold.]

1436.7 - 1445.7

PACKSTONE: foraminifer; poorly to moderately, irregularly cemented; upper 0.2 ft well cemented with weak "tea-brown" micrite; "tea-brown" micrite scattered throughout unit to 1439.5 ft, concentrated at top and at 1438.3 ft; moderately consolidated; foraminifers recrystallized; unit very pale orange to pale yellowish brown; mediumto coarse-grained with mud. Foraminifers include large Lepidocyclina and other large forms; scattered corals

SAMPLES: T @ 1436.7; X @ 1436.8.

1445.7 - 1452.1

WACKESTONE TO PACKSTONE: foraminifer, skeletal; upper 2.0 ft PACKSTONE TO WACKESTONE; grading downward to WACKE-STONE; generally uncemented, moderately consolidated, containing 5-10% very small, well-cemented nodules; foraminifers slightly altered, sparse corals altered; very pale orange to white; very fine to very coarse grained, generally very fine grained; minor moldic (small molds) porosity in corals. Contains scattered echinoid spines. Lower contact sharp, undulatory.

preserved as molds. Lower contact gradational.

[Disconformity indicated by presence of crust with clotted texture, abundant rhizoliths and glaebules, "tea-brown" cement, and increase in cementation.]

1452.1 - 1452.7

WACKESTONE: skeletal; well cemented; "tea-brown" micrite in crust at top and scattered throughout small "tea-brown-lined" rhizoliths; scattered "tea-brown micrite throughout; larger foraminifers micritized near top, small gastropod steinkerns; pale yellowish brown. Contains clotted texture and glaebules. Contains small moldic coral. SAMPLE: X @ 1452.2.

1452.7 - 1465.8

WACKESTONE TO PACKSTONE: foraminifer; generally uncemented, moderately consolidated; corals moldic, some minor weak "tea-brown" micrite and spar cement at 1457.1 ft; foraminifers partly recrystallized; white to very pale orange; very fine to very coarse grained; sparse moldic porosity in corals. Subunits as follows: from 1452.7 - 1455.8 ft, WACKESTONE; from 1455.8 - 1456.2 ft, sparse WACKESTONE; from 1456.2 - 1458.3 ft, WACKESTONE with sparse corals; from 1458.3 - 1460.4 ft, WACKESTONE (tight); from 1460.4 - 1461.4 ft, PACKSTONE; from 1461.4 - 1465.4 ft plus 0.4 ft of underlying sample, WACKESTONE with corals and foraminifers and scattered diagenetic nodules. SAMPLES: M @ 1453.0 - 1453.8.

[Disconformity indicated by change in cementation, presence of weak "tea-brown" micrite, and small cavern.]

1465.8 - 1473.6

WACKESTONE TO PACKSTONE: foraminifer; well-cemented from top to 1469.5 ft, becoming moderately to poorly cemented, irregularly cemented downward; skeletal components extensively recrystallized; white to very pale orange; silt to very coarse grained; moldic, vuggy, and cavernous porosity, 2.0 ft-thick cavern noted by driller probably from 1466.0 - 1468.0 ft; well-cemented MUDSTONE fillings with conchoidal fracture (cemented cave lining?) below 1468.0 ft. SAMPLES: S @ 1469.4 - 1469.9; T @ 1465.8; X @ 1465.8, 1469.4 1470.1 (mud), 1471.05 - 1471.3.

1473.6 - 1479.5 NO RECOVERY.

1479.5 - 1485.1

PACKSTONE TO WACKESTONE: foraminifer; PACKSTONE in upper part, grading downward to WACKESTONE below 1482.5 ft; poorly cemented, small, well-cemented nodules near base; moderately consolidated; highly altered, disaggregated corals; very pale orange; muddy intervals white to very pale orange; very fine to very coarse grained; generally fine-grained; one micritized boring tube at 1480.3 ft. Lower contact abruptly gradational.

1485.1 - 1485.9

CORAL HEAD: small in-place <u>Porites</u> <u>lutea</u> replaced by spar, completely disaggregated to fine silt-sized particles at top, preserved as whole recognizeable coral at base.

1485.9 - 1496.1

PACKSTONE: foraminifer, skeletal; foraminifer PACKSTONE TO WACKESTONE in upper 1.0 ft, grading downward to PACKSTONE; from 1490.8 - 1495.7 ft, becomes more of a mollusc, skeletal, foraminifer PACKSTONE with scattered echinoid spines; poorly to moderately cemented, irregularly cemented at top, becoming poorly cemented downward with scattered, moderately spar-cemented nodules; molluscs preserved exclusively as molds and steinkerns, some shell material preserved in lower part; molluscs preserved as molds and steinkerns; very pale orange to white in upper part, grading downward to grayish orange to white; very fine to very coarse grained; moldic porosity. Lower contact sharp. SAMPLES: T @ 1494.8; X @ 1494.8.

[Disconformity indicated by change in facies, increase in incementation and by "tea-brown" crust, and by cave deposits shortly below surface.

1496.1 - 1496.3

SPONGY CRUST: originally coral skeletal GRAINSTONE; well-cemented with "tea-brown" micrite and spar; yellowish brown; mollusc preserved as molds and steinkerns, corals as molds. Contains Seriatopora(?). SAMPLES T @ 1496.1; X @ 1496.1.

1496.3 - 1497.7

MUDSTONE: skeletal, poorly cemented, with moderately cemented odules, moderately consolidated, very scattered "tea-brown" micrite in nodules; molluscs preserved as molds and steinkerns; white to very pale orange with minor pale-yellowish-brown micrite; silt to mediumgrained, mostly silt to very fine grained; minor moldic porosity. Contains sparse coral molds. Lower contact abruptly gradational.

1497.7 - 1500.5

FLOATSTONE(?) AND LAMINATED MUDSTONE: rock originally FLOATSTONE; coral with sparse skeletal WACKESTONE TO MUDSTONE matrix; from 1497.7 - 1498.2 ft; from 1498.2 -1499.1 ft, thickly laminated, well-cemented, silt (MUDSTONE) infilling large cavity; from 1499.1 - 1500.5 ft, cemented collapse breccia(?) of coral FLOATSTONE(?) with vadose silt infilling and partly healed fractures. Unit generally well-cemented, except for moderately cemented in top 0.6 ft and basal 0.5 ft; very pale orange (FLOATSTONE) and pinkish gray to very pale orange (MUDSTONE). Unit in part probably a cave deposit with complex dissolution history with molds, partly filled molds and filled molds. Contains abundant coral fragments and gastropods. Lower abruptly gradational. SAMPLES: S @ 1498.0 - 1498.3, 1499.5 - 1500.0; T @ 1498.5; X @ 1498.5, 1499.5, 1500.2.

1500.5 - 1502.5

WACKESTONE: skeletal; poorely cemented, moderately consolidated; white to very pale orange, silt to coarse-grained, mostly very fine grained; minor vuggy porosity with vadose-silt fillings in vugs in upper 0.8 ft; sparse echinoid spines. Lower abruptly gradational.

1502.5 - 1516.2

FLOATSTONE AND WACKESTONE: probably coral FLOATSTONE with foraminifer (Lepidocyclina) WACKESTONE interbedded with skeletal, foraminifer WACKESTONE; coral, foraminifer; mostly poorly cemented, with some moderately cemented, intervals moderately consolidated; corals preserved as molds; molluscs as molds and steinkerns; some foraminifers molds; white to very pale orange; very fine grained to very coarse grained; moldic porosity and vuggy porosity present, especially in lower 0.1 ft. Contains several types of corals, mainly small digitate form; scattered articulated pelecypods in lower part. Lower contact apparently sharp. SAMPLES: T @ 1511.2, X @ 1511.2; M @ 1509.2 - 1510.2.

[Disconformity indicated by change in cementation and presence of "tea-brown" micrite layers below.]

1516.2 - 1517.9

FLOATSTONE: coral; matrix MUDSTONE TO GRAINSTONE, oncoid, foraminifer; well-cemented; corals badly altered, recrystallized, partly replaced and partly dissolved, molluscs preserved as molds and steinkerns; very pale orange and minor pale yellowish brown; coarse—to very coarse grained, containing pebble—sized clasts; moldic porosity; one vertical fracture; two "tea-brown" micrite layers, subhorizontal at top and irregular at base, possible vadose silt. Lower contact abruptly gradational. SAMPLES: S@1516.6 - 1517.1, 1517.6 - 1517.9; X@1516.6, 1517.6.

1517.9 - 1519.7 NO RECOVERY.

[Contact marked by abundant "tea-brown" micrite below.]

1519.7 - 1529.9

FLOATSTONE TO BAFFLESTONE: coral; matrix PACKSTONE TO WACKESTONE, foraminifer, coralgal, skeletal; wellcemented; corals recrystallized and partly to wholly dissolved, oncoids(?) recrystallized, molluscs preserved as molds and steinkerns; very pale orange with scattered moderate-yellowish-brown micrite and white, geopetal (vadose) silt; silt to very coarse grained; abundant moldic and vuggy porosity, with many molds and vugs partly filled with vadose mud and silt; geopetal structures abundant from 1522.8 - 1524.3 ft; coralline algae common particularly in upper part; "tea-brown" micrite concentrated in spaces around corals in upper 0.5 ft, and scattered throughout unit; unit less wellcemented in lower 2 ft; foraminifer/oncoid matrix in centers of corals; partly healed, subvertical fractures in middle part of interval. Possible cemented breccia from 1524.8 - 1525.3 ft. SAMPLES: S @ 1519.8 - 1520.2, 1523.5 - 1524.2, 1524.8 - 1525.3; X @ 1519.8, 1523.5; M @ 1520.2 - 1521.2.

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[Discontinuity marked by marked increase in "tea-brown" micrite, and introduction of lined and filled vugs.]

1529.9 - 1539.5

PACKSTONE TO WACKESTONE: foraminifer, coral, skeletal; some large foraminifers with thin algal coats (cortoids); corals variably altered, some corals reduced to thick nearly structureless micritic outer envelopes with dissolved, filled and recemented centers; some foraminifers replaced by "tea-brown" micrite near top, less altered downward; varicolored, mostly pale yellowish brown, but mottled with white (vadose silt) and dark yellowish brown ("tea-brown" micrite); dark-yellowish-orange stain from 1535.9 - 1536.4 ft; mostly silt to very coarse grained; matrix silt to very fine grained sand; sparse to common moldic, minor vuggy porosity; molds and vugs in upper part lined with

apparent botryoidal cement and partly filled with vadose silt and matrix; voids within corals show complex diagenetic history and and locally have abundant "tea-brown" micrite; vertical to subvertical fractures common, some healed. Cortoids commonly coated foraminifers. Lower contact gradational. SAMPLES: S@ 1531.5 - 1531.7, 1532.2 - 1532.7, 1535.2 - 1535.6; T@ 1531.5; X@ 1535.2, 1535.6; M@ 1538.5 - 1539.5.

1539.5 - 1550.4

WACKESTONE TO MUDSTONE: large foraminifer; generally poorly uncemented, poorly to moderately consolidated becoming moderately cemented from 1547.0 ft to base; foraminifers slightly altered; very pale orange to white, becoming very pale orange in lower part, foraminifers very pale orange, giving spotted appearance; silt to very coarse grained sand (foraminifers), bimodal; lithologies vary with relative abundances of foraminifers. MUDSTONE intervals from 1542.4 - 1542.7, 1543.4 - 1544.3, and 1546.3 - 1546.6 ft; WACKESTONE TO MUDSTONE from 1547.7 - 1550.4 ft. Lower contact imperceptably gradational. SAMPLE: M @ 1538.5 - 1539.5.

1550.4 - 1555.4

PACKSTONE TO WACKESTONE: foraminifer; upper part PACKSTONE to tight WACKESTONE grading downward to PACKSTONE; moderately cemented; smaller foraminifers spar-replaced; very pale orange; very fine to very coarse grained, mostly medium- to coarse-grained; moldic porosity; abundant diverse benthic foraminifers, including Miogypsina and Lepidocyclina. Lower contact sharp.

[Disconformity indicated by change in cementation and presence of sparse "teabrown" micrite below surface and sparse rhizoliths(?) within "tea-brown" layer, and presence of vadose silt in molds and cracks in underlying unit.]

1555.4 - 1557.6

WACKESTONE: foraminifer, skeletal; well-cemented; molluscs preserved as molds and steinkerns; very pale orange to pale yellowish brown with moderate-yellowish-brown areas ("tea-brown" micrite); very fine grained to coarse-grained; moldic and vuggy porosity, sparse fracture porosity; vadose silt fills some vugs and scattered subvertical fractures. Zone of "tea-brown" micrite, layer 0.1 ft thick oriented about 60 degrees to bedding, extends across core from 1556.4 - 1557.2 ft., and contains sparse rhizoliths(?); "tea-brown" dispersed in subunit above layer, abundant below layer. Lower contact abruptly gradational. SAMPLE: S @ 1556.7 - 1557.2.

1557.6 - 1565.9

PACKSTONE: skeletal, algal-coated-grain(?), foraminifer; mostly well-cemented but moderately cemented from 1561.9 - 1563.9 ft; matrix sparse; micromolluscs preserved as molds and steinkerns; very pale orange, with minor very pale orange to white near base; minor moldic porosity; common healed (moderate-brown cement) fractures oriented from 45 to 70 degrees to bedding; silt to fine-grained, generally very fine grained, moderately sorted. Contains scattered cone-shaped burrows(?). SAMPLES: S @ 1562.4 -1562.7, 1565.5 - 1565.9; X @ 1562.4, 1565.5.

[Disconformity indicated by marked increase in "tea-brown" micrite, change in cementation, increase in porosity, presence of common vadose-silt fillings, and a possible spongy crust at top of underlying unit.]

1565.9 - 1584.6

EXTENSIVELY RECRYSTALLIZED LIMESTONE: coral BAFFLESTONE(?) with skeletal, foraminifer, coralgal, tight WACKESTONE TO PACKSTONE(?) matrix and possibly interbedded with same; some intervals may be coral FLOATSTONE: coral, coralgal; well-cemented, pervasively cemented; extensively recrystallized, corals dissolved, molluscs preserved as molds; sparsely mottled very pale orange and pale yellowish brown from top to 1580.2 ft becoming very pale orange to pale yellowish brown downward; from 1580.2 - 1584.5 ft, very pale orange, from 1584.5 -1591.9 ft, very pale orange and pale yellowish brown; silt(?) to very coarse grained, matrix mostly medium- to very coarse-grained; "tea-brown" micrite abundant in upper 1.1 ft, scattered or abundant in intervals throughout unit, faded and harder to distinguish from spar in lighter-colored intervals noted above; common molds and vugs; vadose-silt filling molds and vugs throughout unit; botryoidal-cement linings common in vugs and fractures, notably at 1570.8 ft (vug) and at 1577.6 ft (fracture); drusy calcite linings common from 1567.7 - 1571.4 ft as thin layers on botryoidal cement; "dog-tooth" spar abundant from 1583.0 - 1584.5 ft; fractures scattered through unit, most near-vertical, few subhorizontal. Contains several types of large foraminifers throughout; corals generally branching forms, some in growth position, scattered small colonies. Lower contact probably abruptly SAMPLES: S @ 1565.9 - 1566.4, 1570.9 gradational. 1571.4, 1574.6 - 1575.2, 1578.7 - 1579.1, 1579.2 -1579.6, 1584.0 - 1584.6, 1585.9 - 1586.4, 1597.1 -1597.4; T @ 1567.7, 1575.9, 1577.6; X @ 1565.9, 1566.5, 1570.9, 1575.2, 1578.7, 1579.2, 1579.6, 1584.0 1584.6; M @ 1568.1 - 1569.0, 1573.2 - 1574.2, 1583.0 - 1584.0.

1584.6 - 1593.0

FRAMESTONE AND BAFFLESTONE: coral-coralgal FRAMESTONE interbedded(?) with coral BAFFLESTONE TO FLOATSTONE(?) with skeletal, foraminifer PACKSTONE matrix; generally

well-cemented but broken into cobble-sized, well-cemented pieces in lowr one-half of unit; extensively pervasively recrystallized (like overlying unit);

Astreopora(?) head at top disaggregating to sand-sized particles, others preserved as infilled molds; cements and colors like overlying unit. Lower contact gradational. SAMPLES: S@ 1585.9 - 1586.4; X@ 1585.9 1586.4.

1593.0 - 1597.2

GRAINSTONE TO PACKSTONE: algal-coated grain, foraminifer; upper part PACKSTONE, grading downward to GRAINSTONE; moderately to well-cemented; algae are micritized some molds, molluscs preserved as molds; very pale orange, minor pale-yellowish-brown ("tea-brown") micrite in upper part of unit; generally coarse—to very coarse grained; sparse moldic and fracture porosity; large subvertical fracture lined with botryoidal cement from 1596.5 - 1597.2 ft; grains mostly broken, finely digitate growth forms of red coralline algae and foraminifers. Lower contact gradational. SAMPLES: S@ 1597.1 - 1597.4; X @ 1597.1.

1597.2 - 1599.5

PACKSTONE WITH BINDSTONE: generally coralgal foraminifer PACKSTONE; well-cemented; corals partly dissolved and micritized; algae micritized; very pale orange to white with minor pale-yellowish-brown spar; mostly medium- to very coarse grained; moldic porosity, some vuggy and fracture porosity, minor interparticle porosity; binding coralline algae (BINDSTONE) at top and at 1598.9 ft; pelecypod shell and mud infilling (spar cement?) at 1599.1 ft; open vertical fractures partly lined with botryoidal cement. Contains sparse corals. SAMPLE: S (see overlying unit).

1599.5 - 1601.1

WACKESTONE WITH BINDSTONE: skeletal, foraminifer; coral WACKESTONE with coralgal BINDSTONE in upper 0.5 ft; mostly well-cemented; extensively recrystallized corals altered, indistinct, some with coralgal rinds, partly dissolved and micritized; mottled white with very pale orange to moderate yellowish brown; coarse—to very coarse grained; moldic and vuggy porosity. Lower contact apparently gradational.

1601.1 - 1603.9

FLOATSTONE(?): coral, with skeletal foraminifer WACKESTONE TO PACKSTONE matrix; generally well-cemented, pervasively cemented; small vugs and molds filled to partially filled with several types of cement that form complex layering (blocky botryoidal, drusy, "dog-tooth," and abundant "tea-brown" micrite); "tea-brown" micrite

abundant from 1601.9 - 1603.9 ft. Unit in part may be recemented breccia. SAMPLES: S @ 1601.3 - 1602.1, 1602.8 - 1603.2, 1603.2 - 1603.7; T @ 1602.1 - 1602.3; X @ 1601.3, 1602.1.

1603.9 - 1605.2 NO RECOVERY.

TOTAL DEPTH OF HOLE 1605.2 FT.

BOREHOLE OCT-5

Lat/Long (E/W-1960): 11^o36'20.1" N, 162^o06'11.1" E

Lat/Long (WGS-1972): 11^o36'19.8" N, 162^o06'11.0" E

Location (IVY-grid, ft): 125,467 N and 036,552 E

Distance/Bearing from OAK GZ: 658 ft, 042.4 deg

Water Depth (H&N): 163.7 ft Hole Depth (bsf): 851.1 ft

Hole Spudded: 05/21/1985 Drilling Ended: 05/28/1985

Sampling: SH, SS Recovery: 31% (260.6 ft)

Logs: MCS, BR/NU, GR/DN/CP, CSV Date Logged: 05/28-29/1985

Deviation: 3.5 deg @ 210 ft, 2.9 deg @ 330 ft, 1.9 deg @ 430 ft, 2.0 deg

@ 590 ft, 2.5 deg @ 845 ft

Casing: 8-5/8-in. @ 26.2 ft (all casing recovered)

Drilling Mud/Additives: SEP (957 sx), BVS (35 sx), LCM (0.5 sx)

Geologists: B.R. Wardlaw, B.A. Skipp Drillers: G. Mooney, R. Weber,

Loggers: C.S. Novinskie, A. Reynolds P. Sacro

Paleontologist: T.G. Gibson Redescribed: 09/18-19/1985

Depth	Description	
0.0 - 0.9	GRAINSTONE: skeletal; uncemented, unconsolidated; mixed(?) alteration; very pale orange; coarse silt- to fine-sand size grains. Contains grayish-black, sand-size grains. Lower contact probably gradational.	
0.9 - 2.7	NO RECOVERY.	
2.7 - 10.2	GRAINSTONE TO PACKSTONE: skeletal, <u>Halimeda</u> ; uncemented, unconsolidated; mixed-alteration, fresh <u>Halimeda</u> , scattered light-brown (5Y6/4) grains, fragments of pelecypods and corals, gastropod with color retention; very pale orange; from 2.7 - 5.9 ft, very fine to	

medium-grained with few coarse-grains; from 5.9 - 7.3 ft, very fine to very coarse grained, mostly medium- to coarse-grained; from 8.6 - 10.4 ft, very fine grained to very coarse grained with granules, mostly very coarse grained; scattered moderate-yellowish-brown pelecypods and corals. Contains small granule of charcoal at 5.9 ft. Large graded bed. Lower contact probably gradational.

10.2 - 11.2 NO RECOVERY.

11.2 - 28.2 FLOATSTONE: coral; PACKSTONE; skeletal, <u>Halimeda</u> matrix; uncemented, unconsolidated; mixed-alteration, fresh <u>Halimeda</u>, spar-replaced coral, molluscs with color retention; very pale orange with some pale-vellowish-

Halimeda, spar-replaced coral, molluscs with color retention; very pale orange with some pale-yellowish-brown coral sticks and grains; grain size crudely increasing downward, very fine to very coarse grained, at top, becoming mostly coarse-grained with scattered pebble-sized material (mostly corals) at base; corals broken, possibly abraded; mixture of moderate-brown (5YR4/4) Porites and very pale orange Porites in same sample, moderate-brown (5YR4/4) coral material unaltered, well-preserved, common, and including Porites, Acropora, Dictyarea, and Seriatopora; also containing gastropods and pelecypods; gastropods at 16.9 - 17.0 ft. SAMPLES: R @ 20.1, 28.1.

28.2 - 32.2 NO RECOVERY.

32.2 - 80.4 FLOATSTONE: mixed-rubble; matrix generally skeletal PACKSTONE; except for WACKESTONE from 63.4 - 70.6 uncemented, unconsolidated; mixed-alteration; ver

PACKSTONE; except for WACKESTONE from 63.4 - 70.6 ft; uncemented, unconsolidated; mixed-alteration; very pale orange to white; very fine to coarse-grained, many pebbles, sparse cobbles. Rubble includes: from 35.0 -35.3 ft, slightly recrystallized Porites lutea fragments; at 45.0 ft, grayish-red-purple echinoid spine; at 39.9 ft and 45.6 ft, pelecypod shells with cemented infillings; at 43.2 ft, unaltered Platygyra sinensis; at 50.7 ft, spar-cemented lithoclast with chalky Halimeda; at 50.9 ft, colorful Mytilus shell fragment; at 54.2, 76.8, 77.3, ft, grayish-pink Homotrema grains; Calcarina spangleri at 73.7 ft; "teabrown" cemented lithoclasts and abundant corals in various alteration states, unaltered to completely recrystallized; common Porites lutea; at 77.4 ft, "teabrown" cemented lithoclast and spar-replaced corals. SAMPLES: R @ 35.1, 42.6, 51.5, 63.5, 70.6.

80.4 - 82.3 NO RECOVERY.

82.3	-	83.3	PACKSTONE: foraminifer, mollusc, skeletal; generally uncemented, with moderately cemented nodules; appears not mixed; molluscs chalky, spar filling in gastropod; very pale orange to white; fine- to very coarse grained; pebble-sized, broken, moderately cemented nodules with abundant chalky mollusc fragments, cemented burrows(?); material in pebbles has same composition as matrix; unit is more homogeneous than units above. SAMPLE: R @ 82.3.
83.3			NO RECOVERY.
85.4	-	101.6	GRAINSTONE TO PACKSTONE: skeletal, mollusc, foraminifer; uncemented, unconsolidated; molluscs mostly chalky, some color retention in microgastropods and Mytilus at 86.6 ft, fresh and recrystallized microfossils; very pale orange to grayish orange; fine- to very coarse grained with some pebble-sized, moderately cemented clasts (burrows?), mostly medium- to very coarse grained, resembling matrix and containing concentrations of broken molluscs, burrows; scattered throughout unit; small pebble-sized, rounded PACKSTONE-filled, cemented burrows unlike matrix from 98.7 to 99.0 ft, GRAINSTONE interval from 94.7 - 98.7 ft. SAMPLES: R @ 91.6, 101.6.
101.6	-	104.0	NO RECOVERY.
104.0		104•7	PACKSTONE: mollusc; similar in composition to unit above; very pale orange; common large pelecypods with cemented infillings and geopetal "dog-tooth" spar; molluscs chalky, layering retained in thick valves.
104.7	_	106.6	NO RECOVERY.
106.6	-	115.8	FLOATSTONE: coral, coralgal rubble; skeletal PACKSTONE: matrix; appears to be mostly coral debris except for top 1.0 ft which is sparse coral PACKSTONE similar to unit from 104.0 - 106.6 ft; uncemented, unconsolidated; partly recrystallized and micritized corals with minor spar replacement; pinkish-gray (bleached) Homotrema grains at 113.3 ft, pelecypod shell with nacreous luster; white to very pale orange; very fine to very coarse grained to pebble-sized fragments; unsorted;

mostly coral and coralgal debris. Pebbles mostly "obscure" coral and coralgae. Lower contact sharp. SAMPLE: R @ 112.3.

115.8	-	133.1	GRAINSTONE TO PACKSTONE: foraminifer, Halimeda, skeletal, mollusc; uncemented, unconsolidated; mixed-alteration, mostly unaltered to slightly altered, nacreous molluscs with color retention, chalky Halimeda, moderate-red (5R5/4) Homotrema, grayish-orange Calcarina, grayish-red-purple echinoid spines; very pale orange to grayish orange; very fine to very coarse grained, mostly medium-to very coarse grained. Contains moderate-red (5R5/4) Homotrema scattered throughout unit. SAMPLES: R @ 116.5, 130.4.
133.1	-	134.8	NO RECOVERY.
134.8	_	147.0	PACKSTONE: skeletal, Halimeda, coral; contains abundant foraminifers from top to 135.6 ft; uncemented; mostly mixed-alteration, moderate-red (5R5/4) Homotrema, chalky Halimeda, corals with micritized rinds and/or spar-replaced, some partly dissolved; yellowish gray (5Y7/2); very fine grained to pebble-sized fragments; poorly sorted; pebbles mostly coral fragments, some Homotrema-encrusted; at 141.3 - 141.6 ft, Porites lutea. Contains large Conus shell with color retention at 135.4 ft, altered, spar-replaced Porites sp. at 135.1. Lower contact gradational.
147.0	-	149.0	NO RECOVERY.
149.0	-	180.1	FLOATSTONE: coral, rubble; matrix PACKSTONE: skeletal, Halimeda; uncemented, unconsolidated; moderately altered, corals partly recrystallized, spar-replaced and -infilled, Halimeda chalky throughout; unit very pale orange with white Halimeda grains; very fine grained to sparse cobble-sized fragments, mostly corals and coral debris; predominately Porites lutea with small Porites sp. head with small boring at 158.2 - 158.5 ft, and 169.4 - 169.6 ft; contains small pebble-sized angular clasts of moderately cemented, moldic, skeletal PACKSTONE scattered throughout. SAMPLE: R @ 160.3.
180.1		182.5	NO RECOVERY.

182.5 - 183.1 PACKSTONE: rubble, skeletal, mollusc, uncemented; moderately altered, pelecypods chalky with spar infillings; very pale orange; very fine to pebble-sized grains; pebbles angular, moderately cemented concentrations of skeletal-mollusc PACKSTONE, probably burrows. 183.1 - 185.6 NO RECOVERY. GRAINSTONE to PACKSTONE: mollusc, foraminifer; generally 185.6 - 196.8 uncemented; slightly altered, most pelecypods chalky, some microgastropods retain color, foraminifers slightly altered; very pale orange to grayish orange; finegrained to pebble-sized fragments, mostly coarse- to very coarse grained; cemented skeletal GRAINSTONE-filled burrows(?); more muddy PACKSTONE at base. Lower contact conformable. 196.8 - 198.5 NO RECOVERY. 198.5 - 203.1 PACKSTONE: mollusc; mostly uncemented, unconsolidated; slightly altered, pelecypods slightly chalky and sparreplaced, oyster shell retains moderate-brown to moderate-reddish-brown color; unit very pale orange with white to moderate-brown (5YR4/4) pelecypod valves; very fine-grained to pebble-sized material; mostly large pelecypods with cemented infillings, some cemented matrix (burrows?). Contains common large pelecypods, including common Cardium, are mostly nearly whole, single valves. 203.1 - 204.7 NO RECOVERY. [Disconformity indicated by "tea-brown" micrite-replaced coral, scattered "teabrown" cement, and change in facies, increase in skeletal alteration.] 204.7 - 209.4 WACKESTONE: coral, Halimeda; generally uncemented, but moderately consolidated; moderately altered, coral with "tea-brown" micrite, some corals spar-replaced, one chalky gastropod with color retention; very pale orange; fine- to coarse-grained with scattered pebble-sized corals, common Halimeda grains; Porites sp. sparreplaced near top; few possible cemented burrows. 209.4 - 211.0 NO RECOVERY.

247.7	-	250.8	NO RECOVERY.
250.8	-	251.5	WACKESTONE: foraminifer, skeletal; generally uncemented, with cemented, rounded burrows; corals partly recrystallized and spar-replaced; mostly white to very pale orange, minor pale-yellowish-brown spar; very fine to very coarse grained, mostly fine- to medium-grained, pebble-sized material corals and burrows; burrows PACKSTONE-filled, skeletal, foraminifer; well-cemented; very pale orange; spar cement; medium- to very coarse grained, mostly medium- to coarse-grained. Contains scattered corals.
			NO RECOVERY.
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[Discon	for	mity indi	cated by increase in alteration.]
254.2	-	254.6	CORAL HEAD: Astreopora(?) head; heavily altered, spar- replaced, recrystallized; very pale orange; mostly broken pieces.
254.6		257.4	NO RECOVERY
257•4	_	257.6	WASH-IN: includes cemented rock probably representative of material below coral; probably cemented WACKESTONE with dogtooth spar-lined vugs.
257.6	-	267.2	FLOATSTONE: rubble, coral; matrix WACKESTONE: skeletal, foraminifer; uncemented with common moderately well-cemented rubble; moderate alteration, corals partly dissolved, partly chalky, partly recrystallized; foraminifers and molluscs chalky; very pale orange with minor pale yellowish brown; very fine to very coarse-grained, mostly fine- to medium-grained; rubble consists of angular fragments of well-cemented, skeletal WACKESTONE; at 264.0 ft, clast of well-cemented, skeletal, foraminifer, pellet WACKESTONE TO PACKSTONE with bored, phosphatic(?) surface and "dog-tooth" sparfilled; sparse "tea-brown" cemented corals with matrix.
267.2		269.0	NO RECOVERY.

[TOP OF SEDIMENT PACKAGE 3. Disconformity indicated by marked increase in cementation and increase in alteration of skeletal components.]

269.0 - 300.6 FLOATSTONE: tight rubble; matrix WACKESTONE: uncemented; rubble consists of fragments of well-cemented coral FLOATSTONE with recrystallized skeletal, corals partly dissolved, WACKESTONE matrix; corals preserved generally as molds, some partially spar-replaced, molluscs exclusively as molds and steinkerns, except for large recrystallized Tridacna fragment at 291.8 ft; very pale orange. Corals include sparse, small Acropora sticks, Seriatopora sticks common from 288.7 - 289.5 ft.

[Discontinuity indicated by marked increase in spar in rubble.].

300.6 - 324.8

FLOATSTONE: (tight) rubble, matrix WACKESTONE; uncemented.
Rubble consists of coral FLOATSTONE(?) with skeletal
foraminifer, WACKESTONE and PACKSTONE matrix; wellcemented; highly recrystallized, corals partly dissolved
and spar-replaced, molluscs mostly molds and steinkerns,
some spar-replaced, foraminifers recrystallized; very
pale orange; spar-rich areas grayish orange; rock
probably originally with moldic and probably highly
vuggy porosity; partially spar-infilled; complex
relationship among blocky, drusy, and "dog-tooth" spar;
from 322.0 - 322.6 ft, completely spar-replaced coral
head(?).

324.8 - 377.0 FLOATSTONE: tight rubble(?); uncemented; rubble is generally coral FLOATSTONE(?) with PACKSTONE TO WACKESTONE matrix and possibly interbedded with same; foraminifer, mollusc; well-cemented; foraminifers recrystallized, corals generally moldic, sparsely, partly dissolved and spar-replaced, molluscs preserved as molds; generally very pale orange but with very pale orange to pale-yellowish-brown mottling scattered throughout. Contains several types of corals dominated by small sticks of Seriatopora, particularly from 364.7

from 364.7 - 365.7 ft probably fall-in.

- 367.6 ft; no obvious coral heads. Note: material

377.0 - 377.7 CORAL HEAD: spar-replaced, partly dissagregated Astreopora(?) head; grayish-orange.

377.7 - 379.4 NO RECOVERY.

379.4 - 380.3 FLOATSTONE: coral; skeletal, foraminifer WACKESTONE TO PACKSTONE matrix; well-cemented; all macrofossils preserved as molds; very pale orange; common moldic porosity.

380.3 - 382.6 NO RECOVERY.

382.6 - 396.0

WACKESTONE: coral, mollusc, pellet(?); mostly well-cemented, but broken rubble; corals and molluscs preserved as molds and steinkerns, some molluscs molds and partial spar-infillings; very pale orange; common moldic porosity. Contains large articulated pelecypod at 385.8 ft, scattered small Seriatopora sticks throughout. Lower contact grades. SAMPLES: T @ 383.7; X @ 383.7.

396.0 - 398.1 NO RECOVERY.

398.1 - 406.0

CORAL HEADS: Porites lutea; sparse matrix coral, mollusc WACKESTONE TO PACKSTONE; probably well-cemented; altered, coral head recrystallized, partly spar-replaced, partly infilled, sparse molluscs preserved as molds and steinkerns; spar infillings in some borings; very pale orange; moldic porosity; Lithophagus at 401.6 ft. Contains scattered Seriatopora sticks in matrix.

406.0 - 408.5 NO RECOVERY.

[TOP OF SEDIMENT PACKAGE 4. Disconformity indicated by marked increase in spar, persisting for more than 25 ft.]

408.5 - 438.7

FLOATSTONE: coral; matrix skeletal, WACKESTONE mollusc, well-cemented; highly altered, abundant spar replacement of corals, dissolution of corals, coarse "dogtooth-spar" linings in vugs, molluscs preserved as molds, steinkerns, and spar fillings; very pale orange mottled with very pale orange to light yellowish brown; grayish-orange spar; abundant moldic and vuggy porosity. This unit was very vuggy and is now broken bits of spar-replaced small coral heads with attached matrix and spar linings.

438.7 - 458.8

WACKESTONE TO FLOATSTONE: generally coral, mollusc, WACKESTONE with sparse FLOATSTONE scattered in unit; generally well- to moderately cemented; large skeletal components generally molds, corals partly dissolved and spar-replaced from 452.7 - 453.2 ft; molluscs preserved as molds and steinkerns, sparse molds filled with spar; pale yellowish brown to very pale orange with moderate-yellowish-brown mottling; common moldic porosity and vuggy porosity in spar-replaced corals. Unit

distinguished from unit above by decrease in spar. Probable bladed-palisade cement at 450.3 ft. Contains several types of small coral sticks, including Seriatopora. SAMPLE: T @ 450.3.

458.8 - 460.9 NO RECOVERY.

460.9 - 526.1

PACKSTONE to WACKESTONE: coral, mollusc, skeletal; probably moderately cemented at top, irregularly cemented, becoming progressively less-cemented downward, probably generally poorly cemented at base; badly broken by hammer-sampling; skeletal components; altered, corals partly dissolved or recrystallized and partly sparreplaced, molluscs preserved as molds and steinkerns, some steinkerns partly spar-replaced; very pale orange to very pale orange to white; very fine to very coarse grained, mostly very fine to coarse-grained, poorly sorted matrix; common moldic porosity; corals several types, apparently very abundant (unit approaching FLOATSTONE locally); articulated Mytilus at 461.3 and 519.0 ft; small coral heads at 481.1, 487.5, 503.0, 503.5 505.9, 512.7, 522.3, 525.4, and 526.1 ft; scattered Seriatopora sticks.

526.1 - 528.4 NO RECOVERY.

528.4 - 546.8

PACKSTONE: coral; mollusc, foraminifer, skeletal; poorly cemented, irregularly cemented in upper part, becoming uncemented at base, with small, well-cemented nodules; altered, corals micritized with common spar-replaced centers, sparse mollusc molds and steinkerns; generally very pale orange, becoming very pale orange to pale yellowish brown in upper 0.1 ft; moldic porosity in corals; some corals disintegrating. Unit becomes less altered in lower part; near base matrix is mostly very fine grained; fewer corals are spar-replaced than in overlying units.

546.8 - 549.0 NO RECOVERY.

549.0 - 549.7

FLOATSTONE: coral; matrix foraminifer, skeletal PACKSTONE; uncemented, well-consolidated; slightly altered, corals slightly recrystallized; very pale orange; very fine grained matrix. Contains small Porites sticks, microgastropods.

549.7 - 551.9 NO RECOVERY.

551.9 - 573.0

FLOATSTONE: coral; matrix skeletal, mollusc WACKESTONE; skeletal; uncemented, well-consolidated; skeletal material slightly altered, molluscs slightly chalky; very pale orange in upper part, becoming very pale orange to pale yellowish brown downward; matrix mostly silt and very fine grained sand. Contains small heads of Porites sp. at 557.8 ft, Favia(?) head from 563.4 -563.9 ft (recrystallized), and scattered small Porites and Seriatopora sticks throughout; interval of poor recovery from 566.5 - 566.7 ft contains fragment of large Strombus and a small gastropod. Lower contact gradational.

573.0 - 594.1

PACKSTONE: mollusc, skeletal; uncemented, wellconsolidated; slightly altered, corals very slightly altered, molluscs slightly chalky, some with nacreous layer preserved; very pale orange to pale yellowish brown; matrix generally very fine to medium-grained sand. Contains several types of small gastropods and scattered pelecypods; coral sticks sparse, including small Seriatopora and Porites sticks.

594.1 - 596.3 NO RECOVERY.

596.3 - 623.0

FLOATSTONE AND PACKSTONE: interbedded coral FLOATSTONE with skeletal, mollusc PACKSTONE matrix and interbedded with same; uncemented, unaltered skeletal components, many molluscs with some nacreous layer preserved; very pale orange to pale yellowish brown, grading downward to pale yellowish brown by 610.6 ft, lower 0.5 ft pale yellowish brown with dark-yellowish-brown tones; matrix generally silty, very fine grained sand. Subunits as follows: FLOATSTONE at 596.3 - 599.3, 602.0 - 602.5, and 617.0 - 619.7 ft; rest of unit PACKSTONE. Contains cohesive yellowish-brown mudchip at 620.2 ft. Contains several types of medium to small gastropods; small Porites lutea head at top, Favia(?) at 600.0 ft, scattered small Porites sp. heads at 599.1 - 600.1 ft, small Alveopora head at 603.0 ft, other small heads, scattered small Porites sticks, and very sparse Seriatopora; cemented small burrow at 622.6 ft with Acropora encrusted by bryozoan(?) or Heliopora(?) preserved in small burrow.

623.0 - 624.9 NO RECOVERY.

313

624.9 - 631.1 PACKSTONE: coral, skeletal; uncemented; unaltered; from 624.9 - 627.8 ft, pale yellowish brown, silty, very fine grained, muddy PACKSTONE; from 627.8 - 630.4 ft, tight PACKSTONE, dark yellowish brown, fine- to medium-grained; from 630.4 - 636.2 ft, yellowish brown, very fine- to very coarse grained.

631.1 - 636.2 NO RECOVERY.

636.2 - 636.6 WACKESTONE: skeletal; uncemented; unaltered grains; pale yellowish brown.

[TOP OF SEDIMENT PACKAGE 5.]

636.6 - 639.2 NO RECOVERY. Driller reorts very soft gamma spike at 638.0 ft; might be lignite.

639.2 - 642.4 WACKESTONE: richly lignitic, skeletal; uncemented; unaltered; dark yellowish brown to dusky yellowish brown; matrix generally silt to very fine grained sand. Lower contact gradational.

642.4 - 645.7

PACKSTONE: lignitic, skeletal, mollusc; uncemented; unaltered, nacreous layer in pelecypods; mostly dark yellowish brown with streaks of dusky yellowish brown to black to 643.3 ft, becoming dark yellowish brown with dark-yellowish-brown tones from 643.3 ft to base; mainly fine- to medium-grained, poorly sorted; most molluscs broken; large gastropods and common microgastropods; foraminifers common; contains small Seriatopora sticks; lignitic streaks scattered in upper part of unit. Lower contact imperceptabley gradational.

645.7 - 667.3

PACKSTONE: skeletal, mollusc, coral; uncemented, wellconsolidated; unaltered skeletal components; very fine
to very coarse grained, mostly very fine to mediumgrained. Color varies as follows: from 645.7 - 648.5
ft, dark yellowish brown to pale yellowish brown grading
downward to pale yellowish brown with moderate yellowish
brown at base; 648.5 - 652.9 ft, pale yellowish brown to
moderate yellowish brown; 652.9 - 660.6 ft, pale
yellowish brown to moderate yellowish brown, grading
downward to pale yellowish brown to dark yellowish
brown; 660.6 - 667.3 ft, pale yellowish brown to dark
yellowish brown. Contains several types of molluscs,
including Anomia(?) at 648.8 ft, abundant single valves
of pelecypods from 648.5 - 652.9 ft and scattered
elsewhere; small coral sticks sparsely scattered

throughout, including <u>Seriatopora</u> and <u>Dictyaraea</u>; scattered small <u>Porites lutea(?)</u> heads in basal 0.6 ft; small sharks tooth at 648.5 ft. Lower contact gradational.

			gradational.
667.3	_		CORAL HEAD: <u>Porites</u> <u>lutea</u> in growth position; moderate yellowish brown.
667.8	-	669.9	NO RECOVERY.
669.9	-	692.8	FLOATSTONE TO PACKSTONE: coral FLOATSTONE interbedded with skeletal, mollusc PACKSTONE and with matrix of same; uncemented, unaltered skeletal components; moderate yellowish brown; matrix dominately very fine to mediumgrained sand. FLOATSTONE intervals as follows: 673.6 - 674.1 (mainly small Porites), 685.6 - 686.9, 689.1 ft - base (largely Seriatopora). Piece of lignite at 683.3 ft. Small PACKSTONE-filled, cemented burrows from 688.8 - 694.9 ft. Contains scattered gastropods, including a Drupa(?) at 673.3 ft. SAMPLE: M @ 679.6 - 680.3.
692.8	_	694•9	NO RECOVERY.
		696.2	CORAL HEADS WITH PACKSTONE: <u>Porites lutea;</u> moderate yellowish brown; matrix mollusc, skeletal PACKSTONE like overlying unit.
696.2	-	697.8	NO RECOVERY.
		698.5	FLOATSTONE: coral; like unit from 667.8 - 694.9 ft.
698.5	-		PACKSTONE: mollusc, skeletal; uncemented; unaltered skeletal components; very fine to very coarse grained; pale yellowish brown to moderate yellowish brown; macrofauna completely composed of broken mollusc grains. Lower contact gradational.
699.2	-	701.1	PACKSTONE TO FLOATSTONE: mollusc, coral; uncemented; unaltered, aragonitic layer preserved in molluscs, corals slightly micritized; pale yellowish brown; very fine- to very coarse-grained, mostly fine- to medium-grained matrix with mollusc. Lower contact sharp.

701.1 - 701.5 WACKESTONE: lignitic, skeletal; uncemented, poorly consolidated; slightly altered; dark yellowish brown with dusky-yellowish-brown zones; very fine to very coarse grained, but mostly very fine to fine-grained; poorly sorted; sparse molluscs; common microgastropods. Lower contact abruptly gradational. 701.5 - 706.9 PACKSTONE TO FLOATSTONE: mollusc, coral; uncemented, poorly consolidated; unaltered; pale yellowish brown; very fine to very coarse grained, poorly sorted. Contains a few whole gastropod and pelecypod shells, mostly broken. 706.9 - 707.2 CORAL HEAD: small inverted head of Porites sp. stained medium light gray; Lithophagus boring. Lower contact sharp. 707.2 - 720.9 FLOATSTONE: coral; matrix, mollusc, skeletal PACKSTONE: uncemented, unconsolidated; unaltered, aragonitic layer in gastropods slightly micritized; pale yellowish brown; very fine to very coarse-grained, mostly very fine to medium-grained. Contains corals and molluscs fragments, whole gastropods (paricularly from 709.5 - 709.9 ft) pebble-sized; a few medium-gray-stained coral fragments near top of unit. Contains scattered small diagenetic nodules from 717.5 - 718.4 ft, minor moldic porosity. 720.9 - 721.6 CORAL HEAD: small head of Porites sp., very pale orange to pale yellowish brown; broken during sampling. Lower contact probably sharp. 721.6 - 727.1 FLOATSTONE: coral; matrix skeletal PACKSTONE; uncemented, unconsolidated; slightly altered coral pieces, gastropods with nacreous layer preserved; moderate yellowish brown; mostly fine- to medium-grained matrix; scattered coral pebbles. Lower contact probably gradational. 727.1 - 729.3 NO RECOVERY. 729.3 - 730.0 PACKSTONE: mollusc, coral; uncemented, poorly consolidated; slightly altered; moderate yellowish brown to dark yellowish brown; very fine to very coarse grained, mostly fine-grained, poorly sorted; abundant very coarse grained shell fragments; a few whole gastropods, one large Strombus at 729.4 ft; scattered coral sticks.

730.0		732.2	NO RECOVERY.
732.2		744.8	WACKESTONE: mollusc, coral, skeletal; uncemented, poorly consolidated; slightly altered, at 742.1 ft, one large pelecypod valve micritized and bored; moderate yellowish brown to dark yellowish brown; mostly silt- and fine-grained sand sized matrix. Contains large Strombus(?) fragment at 738.5 ft and bored, abraded Strombus(?) at 742.2 ft. Subunit from 744.6 - 744.8 ft with lignitic streaks, dark yellowish brown. Lower contact gradational.
744.8	-	754.7	FLOATSTONE: coral, matrix mollusc, skeletal WACKESTONE; alternating sparse and tight FLOATSTONE; uncemented; resembles unit from 732.2 - 744.6 ft; broken Porites sp fragments dominant from 745.0 - 745.4 ft, becoming mollusc-rich downward from 745.4 ft; very large broken pelecypod at 751.5 ft with encrusting skeletal material and micritized internal layer. Corals include small sticks of Porites and Seriatopora. Lower contact gradational.
754.7	_	756.7	NO RECOVERY.
756.7		772.5	PACKSTONE: mollusc, skeletal; uncemented, unconsolidated; very slightly altered, some gastropods retain dull nacreous luster; pale yellowish brown from top to 768.0 ft, becoming slightly darker downward; very fine to medium-grained matrix predominates; scattered broken and unbroken large gastropods; abundant microgastropods throughout; one inverted coral head [Astreopora(?)] at 760.9 - 761.2 ft; scattered small cemented, tight PACKSTONE burrows from top to 768.0 ft.
772.5	_	781.2	FLOATSTONE: coral; matrix mollusc, skeletal PACKSTONE; uncemented, poorly consolidated; slightly altered, slight increase in alteration of corals, more recrystallized, less well-preserved than in units above

781.2 - 785.9 NO RECOVERY.

generally dark yellowish brown with minor dusky

gradational. SAMPLE: M @ 780.3 - 781.0.

yellowish brown from 774.7 - 775.7 ft; very fine to very coarse grained, mostly fine-grained matrix. Contains small, pebble-sized heads of <u>Porites</u> sp. and <u>Porites</u> lutea; several types of gastropods. Lower contact

[TOP OF SEDIMENT PACKAGE 6.]

785.9 - 798.0

WACKESTONE: mollusc, skeletal, coral; uncemented, poorly consolidated; slightly altered as in unit above; dark yellowish brown to pale yellowish brown in upper part, grading downward to pale yellowish brown at base; very fine to very coarse grained, mostly silt to mediumgrained sand matrix, poorly sorted. Contains scattered cemented burrows filled with fine-grained PACKSTONE; from 785.9 - 794.4 ft. Subunit from 794.4 - 797.3 ft approaches PACKSTONE. Contains abundant microgastropods, scattered larger gastropods, other mollusc fragments, scattered coral sticks. Lower contact probably gradational.

798.0 - 800.2 NO RECOVERY.

800.2 - 813.0

FLOATSTONE: coral (alternating sparse and tight); matrix skeletal WACKESTONE to PACKSTONE; uncemented, unconsolidated; slightly altered; pale yellowish brown; very fine to very coarse grained, mostly silt and fine-grained sand matrix in upper part; unit coarsens downward to mostly fine- to medium-grained sand near base. Contains whole bored gastropod near top; corals mainly small Acropora and Porites sticks, sparse Seriatopora, small heads of Porites sp. heads and Porites lutea(?); common foraminifers near base.

Note: This unit contains lowest gastropods with nacreous layer preserved at 812.7 ft (absent below).

813.0 - 815.4 NO RECOVERY.

815.4 - 822.3

WACKESTONE: coral, skeletal; uncemented; slightly altered; pale yellowish brown, slightly lighter near base; very fine grained, mostly silt with fine-grained skeletal debris; sparse medium-sized grains (foraminifers); pebble-sized corals. Contains bored Porites sp. at 816.0 ft; pebble-sized fragments of relatively unaltered Porites. May contain reworked granule-sized fragments in lower 0.3 ft.

822.3 - 824.7 NO RECOVERY.

[Disconformity indicated by change in color, increase in alteration, and possibly reworked granules in unit above.]

824.7 - 831.6 PACKSTONE: coral, skeletal; generally poorly cemented to uncemented, irregularly cemented, with moderately cemented diagenetic nodules common from top to 825.2 ft; moderately altered, corals recrystallized, almost unrecognizeable, partly dissolved, molluscs preserved as molds and steinkerns; very pale orange; very fine to very coarse grained, poorly sorted, dominantly silt and medium- to coarse-grained sand. Lower contact gradational. 831.6 - 834.1 NO RECOVERY. PACKSTONE: skeletal, foraminifer; uncemented; moderately 834.1 - 837.3 altered; moderate yellowish brown; fine- to coarsegrained, moderately sorted, mostly silt, medium- and coarse-grained sand; foraminifers common. Lower contact probably gradational. 837.3 - 838.1 PACKSTONE: skeletal; generally uncemented; moderately altered, containing mollusc molds and steinkerns; very pale orange to pale yellowish brown; very fine to coarse-grained, generally fine- to medium-grained, poorly sorted; common moldic porosity; large pelecypod steinkern at 837.4 ft; unit badly broken by sampling methods. Lower contact probably gradational. 838.1 - 840.6 NO RECOVERY. PACKSTONE: skeletal, foraminifer; generally poorly to 840.6 - 847.4 moderately cemented, irregularly cemented; moderately altered, molluscs preserved as molds and steinkerns, some spar-filled; very pale orange; very fine to mediumgrained; abundant, well-cemented, large diagenetic nodules; medium- to coarse-grained with some spar cement and scattered "tea-brown" micrite particularly in nodule at 847.3 ft; common fine moldic porosity. Lower contact gradational. 847.4 - 849.9 NO RECOVERY. 849.9 - 851.1 PACKSTONE: skeletal, foraminifer; uncemented; moderately altered; very pale orange; silt, and very fine to medium-grained sand, moderately well-sorted; mostly broken skeletal debris and foraminifers with few coarse grains (foraminifers); sparse small well-cemented

burrows; burrows PACKSTONE: tight, foraminifer, skeletal; fine moldic porosity; burrows common near top. Like overlying unit but without diagenetic nodules.

*** TOTAL DEPTH OF HOLE 851.1 FT. ***

BOREHOLE ODT-6

Lat/Long (E/W)-1960): 11°36′26.7" N, 162°06′19.3" E

Lat/Long (WGS-1972): 11°36′26.5" N, 162°06′19.3" E

Location (IVY-grid, ft): 126,140 N and 037,372 E

Distance/Bearing from OAK GZ: 1,715 ft, 047.5 deg

Water Depth (H&N) 90.1 ft Hole Depth (bsf): 164.2 ft

Hole Spudded: 05/29/1985 Drilling Ended: 05/30/1985

Sampling: SS, SH Recovery: 53% (86.8 ft)

Logs: None Deviation: No survey run

Drilling Mud/Additives: SEP (217 sx) Casing: None Set

Geologists: B.R. Wardlaw, B.A. Skipp Drillers: R. Weber, P. Sacro

Paleontologist: T.G. Gibson Redescribed: 09/20/1985

Depth	Description
0.0 - 1.8	GRAINSTONE/PACKSTONE: foraminifer, skeletal; uncemented; unaltered; very pale orange to moderate yellowish brown; poorly sorted, silt to granule size, generally very coarse grained; scattered whole and broken grains of fresh Halimeda , moderate-red (5R4/6) Homotrema .
1.8 - 4.4	FLOATSTONE: mixed-rubble; matrix skeletal PACKSTONE; uncemented; mixed-alteration, moderate-red (5R4/6) and pale-red (5R6/2) Homotrema, fresh whole gastropod, micritized coral with moldic porosity, cemented burrows(?) with spar-replaced corals; unsorted, mossy granule- to pebble-sized grains. Lower contact probably sharp.
4.4 - 20.2	GRAINSTONE: foraminifer, skeletal; unaltered, fresh Halimeda, moderate-red Homotrema; very pale orange; very fine to very coarse grained, silt present but moderately well-sorted Halimeda whole and broken skeletal

components; abundant <u>Halimeda</u> from 17.4 - 20.2 ft; from 13.6 - 15.3 ft, slightly better-sorted than remainder, mostly fine- to coarse-grained. Lower contact sharp.

20.2 - 21	FLOATSTONE: mixed-rubble; matrix skeletal PACKSTONE: uncemented; mixed-alteration, completely spar-replaced corals, moderate-red (5R5/4) Homotrema, recrystallized corals, common fresh Goniolithon encrusted with moderate-red (5R5/4) Homotrema; very pale orange; poorly sorted, mostly pebble- and granule-sized grains. Lower contact sharp.
21.6 - 25	8 GRAINSTONE: foraminifer, skeletal; same as unit from 4.4 - 20.2 ft. [Sample from 25.2 - 25.7 ft is wash-in.]
25.8 - 26	RUDSTONE: sparse; rubble sparse matrix skeletal PACKSTONE; uncemented; mixed-alteration, chalky pelecypods, fresh gastropods, recrystallized, spar-replaced coral and less-altered coral, mostly altered material, no unbleached Homotrema ; very pale orange; poorly sorted, mostly pebble-sized fragments; one cobble-sized lithoclast of laminated crust with "tea-brown" micrite cement and abundant glaebules. Lower contact sharp. SAMPLES: T @ 25.8; X @ 25.8.
26.2 - 34	9 GRAINSTONE: description same as for unit 4.4 - 20.2 ft. Lower contact sharp. Wash-in from 27.2 - 27.5 ft.
34.9 - 35	FLOATSTONE: mixed-rubble; matrix sparse, skeletal PACKSTONE; poorly sorted; uncemented; mixed-alteration, moderate-red Homotrema, encrusting Goniolithon, completely spar-replaced corals, "tea-brown" cemented lithoclasts; very pale orange; mostly granule- to pebble-sized clasts. Lower contact sharp.
35.1 - 53.	2 GRAINSTONE: description similar to that for unit 4.4 - 20.2 ft; from 49.3 - 53.2 ft, mostly medium-grained, moderately well-sorted.
53.2 - 62.	GRAINSTONE WITH PACKSTONE: upper part foraminifer, skeletal GRAINSTONE, grading downward to skeletal, foraminifer, Halimeda GRAINSTONE TO PACKSTONE from 59.8 ft to base; uncemented; containing moderate-red (5R5/4) and pinkish-gray Homotrema, fresh Halimeda, molluscs with color, (e.g., small Olivia at 57.9 ft) foraminifers apparently unaltered; very pale orange; very fine to very coarse grained, mostly fine-grained, poorly sorted;

becoming muddy from 59.8 ft to base. Unit contains bored, cobble-sized coral fragments from 53.2 - 55.4 ft (lower piece with coralgal coating); large bored <u>Turbo</u> at 53.7 ft with some moderate-red (5R4/6) and pale-red (5R6/2) encrusting <u>Homotrema</u>. Lower contact probably gradational.

- WACKESTONE: Halimeda, skeletal; uncemented; slightly altered, Halimeda fresh, pale-red (5R6/2) and moderate-red (5R4/6) Hometrema; unit generally yellowish gray (5Y7/2), becoming yellowish gray (5Y7/2) to very pale orange in basal 0.2 ft; silt to very coarse grained, mostly silt to very fine grained; becoming less muddy in basal 0.2 ft; containing Halimeda, corals, and foraminifers coarse-grained sand to pebble-sized grains; scattered mollusc fragments; from 65.1 68.2 ft, pebble-sized corals and calcareous algae common.
- 68.2 71.1 CORAL HEADS: coral; most fragments inverted, with slightly corroded, bored surfaces; very pale orange; mostly pebble- to cobble-sized fragments, no discernible matrix.
- 71.1 73.8 PACKSTONE: <u>Halimeda</u>, coral, skeletal; uncemented; generally unaltered, <u>Halimeda</u> fresh, corals unaltered but with bored corals and corroded exteriors, very pale orange; silt to very coarse grained, mostly very fine to fine-grained; <u>Halimeda</u>, coral fragments, foraminifers and scattered molluscs very coarse grained, granules and pebbles. Contains scattered dark-gray, coarse-sand grains ("salt-and-pepper") sand.
- 73.8 74.1 CORAL HEAD: <u>Porites lutea</u> and another coral; encrusted by pale-red (5R6/2) Homotrema.

ITOP OF SEDIMENT PACKAGE 2. Disconformity indicated by change in color

[TOP OF SEDIMENT PACKAGE 2. Disconformity indicated by change in color, increase in cementation, change in lithofacies, and reworked-phosphatic(?) grains in overlying unit.]

74.1 - 74.8 PACKSTONE: skeletal, foraminifer, mollusc; moderately well-cemented to poorly cemented, better cemented in upper 0.15 ft; slightly altered, Halimeda completely micritized, molluscs with nacreous luster near top, some with color, foraminifers apparently unaltered; alteration apparently decreases downward; light olive gray (5Y6/1) to medium bluish gray, speckled with dark-

gray, possibly phosphatic grains; silt to very coarse-grained, poorly sorted, mostly broken skeletal elements; minor moldic porosity in upper 0.15 ft. SAMPLES: S@74.1 - 74.3; X@74.8.

74.8 - 76.7 NO RECOVERY.

76.7 - 77.1

PACKSTONE: skeletal, foraminifer; uncemented; slightly altered, large broken pelecypod valve with bored, recrystallized interior; grayish orange with moderate-yellowish-brown tones, containing abundant, small dark-yellowish-orange grains; silt to very coarse grained, mostly fine- to medium-grained; foraminifers constitute most of coarse-grained fraction; fragment of large pelecypod valve at 76.7 ft; bean-shaped, rounded very coarse grains possibly abraded skeletal grains. Lower contact sharp.

77.1 - 90.8

FLOATSTONE: sparse coral; matrix skeletal, Halimeda
PACKSTONE; poorly cemented, irregularly cemented, matrix adhering to some coral fragments, containing small diagenetic nodules with sparse "tea-brown" micrite from 79.8 - 80.2 ft, sparse uncemented matrix; moderately altered, corals generally slightly altered, some partly spar-replaced; Halimeda completely chalky, partly dissolved; very pale orange to white; unit probably broken during hammer sampling; poorly sorted; corals include several fragments of recrystallized Porites
Lutea; one grayish-purple-red echinoid spine; scattered moldic and interparticle porosity. Lower contact probably gradational.

90.8 - 103.2

PACKSTONE: mollusc; poorly to uncemented, irregularly cemented, with shelters beneath large pelecypod shells generally cemented; moderately altered, molluscs chalky, some spar-infillings, corals partly recrystallized and spar-replaced; very pale orange; very fine to very coarse grained, poorly sorted, whole molluscs and coral fragments as coarser material; containing scattered diagenetic nodules, small burrow(?) at 93.8 ft. Some color retention in mollusc fragments. Contains several types of large pelecypod shells, some small articulated shells; Polynices ("moon snail") at 92.0 and 97.4 ft, other small gastropods, scattered Cardium, scattered foraminifers. Lower contact sharp.

[Disconformity indicated by increase in cementation and sparse "tea-brown" micrite associated with rhizoliths.]

PACKSTONE TO WACKESTONE: mollusc, Halimeda(?), skeletal; moderately cemented, irregularly cemented at top, becoming poorly cemented downward; upper part with some "tea-brown" micrite associated with small rhizoliths(?); skeletal components chalky to moldic in upper part, chalky downward; very pale orange. Contains several types of molluscs; small, open-framework coral at 112.0 ft.

[Disconformity indicated by slight increase in cementation, common "tea-brown" micrite, and abundant "tea-brown" micrite-lined rhizoliths.]

113.9 - 116.9 FLOATSTONE TO FRAMESTONE: coral; matrix skeletal PACKSTONE; moderately cemented, irregularly cemented; skeletal components altered, recrystallized corals and coralgae; very pale orange with pale-yellowish-brown rhizoliths; abundant rhizoliths filled or lined with "tea-brown" micrite. Lower contact probably gradational.

116.9 - 129.0 FLOATSTONE: coral; matrix mollusc, skeletal PACKSTONE; generally uncemented; moderately altered, molluscs and corals micritized; very pale orange; poorly sorted; very fine to very coarse grained; corals and broken molluscs pebbles and cobble-sized; sparse moldic porosity. Lower contact probably gradational.

129.0 - 135.1 PACKSTONE: coral, skeletal; generally uncemented; moderately altered, corals recrystallized, pelecypods preserved as molds and steinkerns; very pale orange to white; silt to very coarse grained, mostly fine-grained; sparse moldic porosity; sparse foraminifers; scattered small cemented burrows, some with "tea-brown" micrite centers. Contains scattered small coral heads and scattered Acropora sticks. Lower contact probably gradational.

PACKSTONE TO FLOATSTONE: sparse coral FLOATSTONE with skeletal PACKSTONE matrix and interbedded with same; generally poorly cemented, irregularly cemented, some matrix moderately cemented around corals; moderately altered, one coral completely recrystallized, molluscs chalky; white to very pale orange; silt to very coarse grained, mostly silt to fine-grained sand; sparse moldic porosity. Contains whole Cyprea ("money cowry") at 142.7 ft; scattered sparse foraminifers; several types of small coral heads and Acropora sticks. Lower contact sharp.

[Disconformity indicated by increase in cementation, reappearance of "tea-brown" micrite, and change in lithofacies.]

PACKSTONE: skeletal, foraminifer; moderately cemented, irregularly cemented at top, becoming less cemented downward, cemented moderate "tea-brown" micrite, possible rhizoliths(?); moderately altered, Halimeda chalky, corals recrystallized; very pale orange to white with minor pale-yellowish-brown stain; silt to very coarse-grained, mostly silt and fine-grained sand; abundant, large moderately cemented burrows filled with PACKSTONE; tight, Halimeda, foraminifer, skeletal PACKSTONE, mostly medium- to coarse-grained. Lower contact gradational.

- 148.0 156.6 PACKSTONE: skeletal, foraminifer; generally uncemented; moderately altered, molluscs chalky, white to very pale orange; silt to very coarse grained, mostly silt to fine-grained. Contains scattered, large cemented burrows; burrows skeletal, foraminifer PACKSTONE, cemented, some with sparse "tea-brown" micrite; mostly medium- to very coarse grained; sparse moldic porosity in burrows. Lower contact gradational.
- 156.6 164.2 WACKESTONE TO PACKSTONE: skeletal; mostly uncemented;

moderately altered, molluscs chalky and molds; very pale orange to white; silt to medium-grained, moderately well-sorted. Contains scattered large, cemented PACKSTONE-filled burrows, skeletal, mollusc; fine- to medium-grained; burrows near top with sparse "tea-brown" cement; moldic porosity in burrows.

*** TOTAL DEPTH OF HOLE 164.2 FT ***

BOREHOLE OET-7

Lat/Long (E/W-1960): 11°36′24.7" N, 162°06′16.5" E

Lat/Long (WGS-1972): 11^o36'24.5" N, 162^o06'16.5" E

Location (IVY-grid, ft): 125,938 N and 037,095 E

Distance/Bearing from OAK GZ: 1,374 ft, 045.9 deg

Water Depth (H&N): 106.9 ft Hole Depth (bsf): 231.7 ft

Hole Spudded: 05/30/1985 Drilling Ended: 05/31/1985

Sampling: SS, SH Recovery: 49% (113.4 ft)

Logs: MCS, GR/DN/CP, GR/NT Date Logged: 05/31/1985

Deviation: No survey run Casing: None set

Drilling Mud/Additives: SEP (315 sx)

Geologists: B.R. Wardlaw, B.A. Skipp Drillers: R. Weber, P. Sacro

Loggers: C.S. Novinskie, A. LeBreton Paleontologist: T.G. Gibson

Redescribed: 01/29/1986

Depth	Description
0.0 - 9.6	GRAINSTONE: foraminifer, skeletal, Halimeda; uncemented; slightly mixed-alteration, mostly unaltered, crimson and pale-red (5R6/2) Homotrema, fresh molluscs with color, one cemented burrow with chalky molluscs at 8.4 ft, unaltered Halimeda; very pale orange; very fine to very coarse grained; probably one large graded bed. From 0.0 - 2.1 ft, mostly fine- to medium-grained; from 2.1 - 6.4 ft, mostly medium- to coarse-grained with common Halimeda in lower part; from 6.4 - 9.6 ft, mostly coarse-grained to pebble-sized grains; molluscs with color retention from 8.1 - 8.3 ft; common Halimeda from 8.5 - 9.6 ft; at 8.4 ft, cemented pebble-sized lithoclast(?) and abraded cemented burrow with moldic porosity. Lower contact gradational.

9.6 - 12.6 GRAINSTONE: skeletal, foraminifer, <u>Halimeda</u>; uncemented; slightly mixed-alteration, mostly unaltered, partly slightly altered coral, crimson and pale-red (5R6/2)

Homotrema, fresh and chalky Halimeda, grayish-red-purple echinoid spines, fragments of colorful molluscs; very pale orange; very fine grained sand to pebble-sized clasts; apparently large graded bed; from 9.6 - 9.9 ft, mostly fine- to medium-grained; from 9.9 - 11.7 ft, mostly medium- to very coarse grained; from 9.9 - 10.2 ft, mostly medium- to very coarse grained with common pebble-sized coral sticks and one whole pelecypod; from 10.2 - 11.7 ft, mostly medium- to very coarse grained, without pebbles; from 11.7 - 12.6 ft, mostly coarse-grained sand to pebble-sized grains with common calcareous algae, Halimeda, and coral sticks; some coral sticks speckled and appear abraded and bleached.

crimson Homotrema on bleached coral fragment; sparse

12.6 - 17.3 NO RECOVERY.

17.3 - 21.2 GRAINSTONE: foraminifer, skeletal, <u>Halimeda</u>; uncemented; slightly mixed-alteration, mostly unaltered, crimson and pale-red (5R6/2) <u>Homotrema</u>, one micritized <u>Porites</u> sp., with moderate-red (5Y4/2) <u>Homotrema</u>, fresh foraminifers; very pale orange; very fine grained sand to pebble-sized clasts; probably one graded bed; from 17.3 - 17.7 ft, mostly fine- to medium-grained; from 17.7 - 21.2 ft, mostly coarse-grained sand to pebble-sized fragments; at 17.7 - 17.8 ft, micritized Porites pebble; at 18.7 ft,

coral sticks. Lower contact gradational.

21.2 - 25.4 GRAINSTONE: foraminifer, skeletal, Halimeda; uncemented; slightly mixed-alteration, mostly unaltered, colorful microgastropods, fresh foraminifers, crimson and pale-red (5R6/2) Homotrema, fresh Halimeda; very pale orange; very fine grained sand to pebble-sized clasts; probably one graded bed; from 21.2 - 21.6 ft, mostly medium- to coarse-grained with common pebbles (coral sticks); from 21.6 - 22.6 ft, mostly medium- to very coarse grained, with common coralline algae and Halimeda; from 22.6 - 25.4 ft, medium- to very coarse grained with coral sticks, molluscs, and coralgal pebbles.

GRAINSTONE: foraminifer, skeletal, Halimeda; uncemented; slightly mixed(?)-alteration, mostly unaltered, crimson and pale-red (5R6/2) Homotrema, fresh foraminifers, grayish-purple echinoid spines, fresh and slightly altered Halimeda; very pale orange; very fine grained sand to pebble-sized clasts, graded bed; from 25.4 - 25.7 ft, mostly medium- to coarse-grained; from 25.7 - 27.3 ft, mostly coarse sand to pebble-sized clasts, common coralgal pebbles.

27.3 - 49.4GRAINSTONE: foraminifer, skeletal; uncemented; mixedalteration, unaltered, crimson and pale-red (5R6/2) Homotrema, unaltered Halimeda, fresh molluscs, crimson octocoral; very pale orange becoming very pale orange to yellowish gray (5Y7/2) in lower 1.0 ft; fine- to very coarse grained, poorly sorted, mostly coarse-grained; scattered sparse coral and coralgal pebbles, becoming slightly coarser downward with increase in Halimeda plates; whole unaltered gastropods at 42.4 ft and 44.8 ft. 49.4 - 56.8 PACKSTONE: Halimeda, coral, skeletal; uncemented; unaltered, common pale-red (5R6/2) Homotrema, fresh gastropods and pelecypods, some with color retention, crimson octocoral fragments, Halimeda crisp throughout; very pale orange to yellowish-gray (5Y7/2) in upper part, becoming yellowish gray (5Y7/2) downward; silt, very fine grained sand to pebble-sized clasts, mostly medium- to very coarse grained, scattered coral pebbles and cobbles. Contains few whole molluscs from 50.5 -52.3 ft; Bikiniastea(?) at 49.9 ft, Porites sp. at 50.6 ft; Heliopora at 50.8 ft. Lower contact probably gradational. WACKESTONE: coral, Halimeda, skeletal; uncemented; 56.8 - 63.7 unaltered, pale-red (5R6/2) Homotrema, unaltered Halimeda, corals and coralgae partly micritized; yellowish-gray (5Y7/2) very pale orange; silt to pebblesized clasts, very poorly sorted, mostly fine- to medium-grained; common pebble-sized corals. Contains Turbo with nacreous luster and color retention at 61.6 ft. Lower contact probably gradational. 63.7 - 64.6PACKSTONE: coral, Halimeda, skeletal; uncemented; slightly altered, Halimeda freah, pale-red (5R6/2) Homotrema, some mollusc fragments with color retention; very pale orange to yellowish gray (5Y7/2); silt to pebble-sized fragments, mostly fine- to medium-grained; scattered dark-gray grains ("salt-and-pepper" sand); moldic porosity in corals; reworked material from probable disconformable surface below. 64.6 - 66.5CORAL HEAD: Astreopora head; very pale orange; bored with

Lithophagus; pale-red (10R6/2) Homotrema. Lower contact

[TOP OF SEDIMENT PACKAGE 2. Disconformity indicated by cemented spongy crust, marked increase in the alteration of corals in underlying unit, change in color, and reworked grains in overlying unit.]

66.5 - 67.9 LAMINATED CRUST AND PACKSTONE: skeletal PACKSTONE, with spongy, cemented LAMINATED CRUST at top; moderately to poorly cemented, irregularly cemented; slightly to moderately altered, mollusc, scattered molds, one spar-filled; very pale orange to pale yellowish brown; silt(?) to very coarse grained, poorly sorted; common moldic porosity; scattered dark-gray grains. Contains recrystallized Porites lutea(?) from 67.1 - 67.3 ft.

FLOATSTONE: coral; matrix PACKSTONE TO WACKESTONE:

Halimeda, skeletal; poorly to moderately cemented,
patchy cementation, where cemented PACKSTONE, where
uncemented WACKESTONE; moderately altered, Halimeda very
chalky, and some spar-replaced, corals recrystallized,
micritized, and largely spar-replaced; mostly white to
very pale orange; poorly sorted; moldic porosity common
in corals; scattered "tea-brown" cement in cemented,
grayish-orange PACKSTONE; at 70.4 ft, pale-yellowishbrown, thin, seam of skeletal WACKESTONE; mostly
uncemented; less than 0.1 ft thick; at 76.3 ft, grayishgreen (10G4/2) Heliopora fragment. Lower contact sharp.

[Disconformity indicated by presence of vadose silt and "dog-tooth" spar in corals in underlying unit.]

78.8 - 81.9 FLOATSTONE: coral, coralgal; matrix PACKSTONE: skeletal; poorly cemented, irreglarly cemented; moderately to highly altered, spar-replaced corals with "dog-tooth" spar lining vugs; white to very pale orange with grayish-orange spar; poorly sorted; moldic and minor vuggy porosity; common vadose silt-filled vugs forming geopetal structures with dogtooth spar-infillings.

Lower contact gradational. T @ 78.8; X @ 78.8.

PACKSTONE: mollusc, skeletal; poorly cemented, irregularly cemented; moderately altered, common chalky molluscs, scattered "dog-tooth" spar; very pale orange; silt to pebble-sized grains, mostly poorly sorted; common well-cemented burrows filled with mollusc, skeletal PACKSTONE; moldic porosity; common cemented infillings of matrix in pelecypods; at 93.8 ft, oyster shell with color (moderate-brown); at 84.7 ft, patch of grayish-yellow "dog-tooth" spar. Lower contact sharp.

[Disconformity indicated by increase in cementation and change in lithofacies.]

95.3 - 97.9 WACKESTONE: mollusc, coral, pellet, skeletal; moderately to well-cemented; moderately altered, molluscs micritized, some probably spar-replaced, corals partly micritized, dissolved, and spar-replaced; very pale orange; silt to very coarse grained; mostly very fine to fine-grained; geopetal structure with matrix infilling and "dog-tooth" spar at 95.4 ft. Contains Acropora cuneata at base. Lower contact gradational.

97.9 - 104.9 FLOATSTONE: coral; matrix skeletal PACKSTONE; poorly cemented to uncemented; moderately altered, corals partly micritized and spar-replaced; very pale orange; poorly sorted. Contains Porites lutea from 102.2 - 103.0 ft.

PACKSTONE: Halimeda, foraminifer skeletal, mollusc; poorly cemented to uncemented, irregularly cemented; slightly to moderately altered, Halimeda chalky and partly dissolved, molluscs with color retention; very pale orange, becoming very pale orange to grayish orange in lower part; silt, fine- to very coarse grained, mostly medium- to coarse-grained; molluscs pebble-sized fragments; scattered cemented matrix in mollusc infillings.

111.6 - 113.7 NO RECOVERY.

[Disconformity indicated by change in lithofacies and presence of "tea-brown" cement and rhizoliths.]

113.7 - 120.9 FLOATSTONE: coral; matrix skeletal PACKSTONE; poorly cemented to moderately cemented (at top), irregularly cemented; slightly to moderately altered, corals partly micritized and slightly dissolved; very pale orange to white; poorly sorted; spongy-textured Porites lutea in upper 0.2 ft with common "tea-brown-filled" rhizoliths and "tea-brown" cement in matrix in an apparent shelter; rhizoliths sparse in remaining 0.6 ft of upper part of unit; scattered moldic porosity.

120.9 - 122.6 NO RECOVERY.

[Disconformity indicated by presence of "tea-brown" micrite, rhizoliths, and glaebules forming crust on surface of coral.]

122.6 - 123.1 CORAL HEAD: Porites lutea; moderately altered, Porites

lutea recrystallized; foraminifers partly dissolved;
very pale orange with dark-yellowish-brown ("tea-brown")
micrite in upper part; common moldic porosity; "teabrown" cement-lined rhizoliths. Lower contact sharp.

123.1 - 131.0FLOATSTONE: sparse coral, with skeletal PACKSTONE matrix; poorly cemented irregularly cemented; moderately altered, corals partly heavily micritized and sparreplaced, Halimeda chalky; very pale orange to white; silt to pebble-sized grains, poorly sorted; scattered cemented burrows filled with Halimeda, mollusc PACKSTONE. Contains Acropora sticks and other corals. Lower contact gradational. 131.0 - 134.7 FLOATSTONE: sparse coral, with Halimeda, skeletal WACKESTONE matrix; uncemented; slightly to moderately altered, Halimeda chalky throughout but still intact, corals micritized; white to very pale orange; silt to pebble-sized grains, mostly silt to fine-grained with very coarse Halimeda grains and pebble-sized Acropora sticks; borings and sparse moldic porosity in corals. Lower contact gradational. 134.7 - 135.5 FLOATSTONE: sparse coral, with Halimeda PACKSTONE matrix; resembles unit above but with less mud; white to very pale orange. 135.5 - 136.8 NO RECOVERY. [Possible disconformity indicated by thin cemented interval with spar and "teabrown" cement, and by a change in lithofacies.] 136.8 - 137.2 PACKSTONE: foraminifer, skeletal; well-cemented with locally abundant spar and "tea-brown" cement; slightly to moderately altered, molluscs slightly chalky; pale yellowish brown to very pale orange; silt to very coarse grained, mostly medium- to coarse-grained. Contains common molluscs. Lower contact gradational. 137.2 - 142.7 PACKSTONE TO GRAINSTONE: skeletal, foraminifer; uncemented; slightly to moderately altered, Halimeda chalky and broken, pelecypods chalky; very pale orange to very pale orange to white; silt to very coarse grained, mostly fine- to medium-grained becoming slightly coarser grained downward; mostly broken

142.7 - 151.5 WACKESTONE: foraminifer, skeletal; poorly cemented to uncemented, irregularly cemented; slightly to moderately altered, molluscs chalky, foraminifers unaltered, some color retention in micromolluscs; white to very pale

and Halimeda.

skeletal debris; scattered foraminifers, micromolluscs,

orange; silt to very coarse grained sand, mostly silt and fine-grained sand; burrows containing well-cemented foraminifer-skeletal-mollusc PACKSTONE with spar cement. Lower contact gradational.

151.5 - 157.2 FLOATSTONE: coral; matrix tight skeletal, foraminifer
WACKESTONE; uncemented; slightly to moderately altered,
corals micritized and partly spar-replaced; very pale
orange to white; silt to very coarse grained, poorly
sorted; contains abundant pebble-sized corals; minor

moldic porosity. Lower contact gradational.

- 157.2 173.7 FLOATSTONE: coral; matrix skeletal MUDSTONE; uncemented to poorly cemented, irregularly cemented; slightly to moderately altered, corals micritized and partly spar-replaced; white; with very pale orange corals; silt and coral pebbles; scattered burrows mostly filled with skeletal, pellet MUDSTONE; well cemented; a few WACKESTONE-filled burrows. Contains several types of corals; small oyster at 158.6 ft. Lower contact apparently gradational.
- 173.7 184.8 FLOATSTONE: coral; matrix skeletal PACKSTONE; moderately to poorly cemented, irregularly cemented; slightly to moderately altered, corals micritized and partly sparreplaced; very pale orange to white; poorly sorted; corals granule- to pebble-sized; minor moldic porosity in corals. Lower contact apparently gradational.
- 184.8 186.1 FLOATSTONE: sparse coral, with skeletal, mollusc PACKSTONE matrix; mostly uncemented; slightly to moderately altered, corals micritized and partly spar-replaced, molluscs chalky or preserved as molds; very pale orange to white; silt, very fine to very coarse grained sand, poorly sorted; corals pebbles; common cemented burrows filled with mollusc, foraminifer PACKSTONE.

186.1 - 187.8 NO RECOVERY.

[Disconformity indicated by spar and "tea-brown" micrite cement, and by "tea-brown" micrite-lined rhizoliths in cemented burrows.]

187.8 - 197.3 MUDSTONE WITH WACKESTONE: generally skeletal MUDSTONE, becoming WACKESTONE near base; poorly cemented to uncemented; slightly altered, chalky pelecypods and Halimeda; white; silt to very coarse grained sand, predominantly silt to fine-grained sand. Contains abundant large cemented burrows filled with Halimeda,

	mostly fine-grained; moldic porosity in burrows. Lower contact gradational.
197.3 - 201.6	WACKESTONE: similar to unit above; at 197.3 ft; contains large fragment of <u>Tridacna</u> valve with spar-filled and -lined borings. Lower contact gradational.
201.6 - 205.3	CORAL HEADS: <u>Porites lutea</u> and <u>Porites</u> sp.; matrix PACKSTONE similar to PACKSTONE in unit below.
205.3 - 205.8	FLOATSTONE: coral, with skeletal PACKSTONE matrix; uncemented; slightly to moderately altered, corals micritized and partly spar-replaced; very pale orange to white; silt to very coarse grained, mostly fine- to medium-grained; skeletal debris and corals pebble-sized; moldic porosity in corals.
205.8 - 207.7	
* * * * * * ? * * *	* * * * ? * * * * * * * ? * * * * * * ? * * * * * * * *
[Disconformity indic micrite.]	cated by increase in cementation and presence of "tea-brown"
207.7 - 210.7	PACKSTONE: <u>Halimeda</u> , skeletal; moderately cemented, mostly broken in drilling; moderately altered, <u>Halimeda</u> completely micritized and partly dissolved, pelecypods chalky and with "tea-brown" cemented shelter(?), sparse corals micritized and some filled with "tea-brown" cement; very pale orange; silt to very coarse grained, mostly medium-grained; corals pebble-sized; scattered moldic porosity concentrated in corals.
210.7 - 211.8	CORAL HEAD: <u>Platygyra sinensis;</u> very pale orange; partly disintegrating.
211.8 - 212.0	PACKSTONE: skeletal; uncemented; moderately altered; very pale orange; silt to very coarse grained, mostly fine-to medium-grained.

mollusc PACKSTONE; spar and sparse "tea-brown" micrite cement near top; very fine- to very coarse-grained,

[Disconformity indicated by increase in cementation and abundant "tea-brown" micrite in layers.]

NO RECOVERY.

212.0 213.6

213.6 - 216.8 MUDSTONE: coral, skeletal, pellet; generally wellcemented, becoming moderately cemented in lower part;
heavily to moderately altered, Porites lutea
recrystallized, molluscs molds and steinkerns; very pale
orange; mostly silt and very fine grained sand; common
micromolluscs; "tea-brown" micrite concentrated on
recrystallized, partly dissolved coral; some molds
filled with spar; horizontal layers of "tea-brown"
micrite with molds. Lower contact gradational.

216.8 - 222.7 PACKSTONE: coral, skeletal; moderately to poorly cemented, patchy cementation; moderately altered, pelecypods chalky and molds, corals micritized and partly dissolved; very pale orange; poorly sorted; silt to very coarse grained, mostly fine- to medium-grained; common moldic porosity. Lower contact sharp.

[Disconformity indicated by increase in cementation and porosity, and abundant spar-infillings.]

222.7 - 231.7 PACKSTONE: coral, skeletal; well-cemented; highly altered, corals micritized and recrystallized, molluscs molds and steinkerns and spar-infillings; very pale orange; silt to very coarse grained, mostly medium- to coarsegrained, corals and some molluscs granules and pebbles; common moldic and vuggy porosity; some vugs and molds with grayish-orange "dog-tooth" spar.

*** TOTAL DEPTH OF HOLE 231.7 FT ***

BOREHOLE OFT-8

Lat/Long (E/W-1960): 11°36′24.0" N, 162°06′14.4" E

Lat/Long (WGS-1972): 11°36′23.2" N, 162°06′14.4" E

Location (IVY-grid, ft): 125,803 N and 036,882 E

Distance/Bearing from OAK GZ: 1,129 ft, 043.3 deg

Water Depth (H&N): 130.8 ft Hole Depth (bsf): 283.5 ft

Hole Spudded: 06/01/1985 Drilling Ended: 06/02/1985

Sampling: SS, SH Recovery: 37% (104.0 ft)

Logs: None run Deviation: No survey run

Drilling Mud/Additives: SEP (577 sx) Casing: No casing set

Geologists: B.R. Wardlaw, B.A. Skipp Drillers: R. Weber, P. Saccro

Paleontologists: T.G. Gibson, R.G. Stamm Redescribed: 01/28-29/1986

Depth	Description
0.0 - 0.3	GRAINSTONE: skeletal; uncemented; mostly unaltered, colorful micromollusc fragments, moderate-red (5R4/6) and pale-red (5R6/2) Homotrema, crisp Halimeda; very pale orange to pale yellowish brown; very fine to very coarse grained, mostly medium- to coarse-grained; scattered broken micromolluscs and foraminifers; most grains broken skeletal debris. Lower contact gradational.
0.3 - 2.6	PACKSTONE TO RUDSTONE: skeletal, mixed-rubble; uncemented; mixed-alteration, crimson and pale-red (5R6/2) Homotrema, lithoclast(?) with "dog-tooth" spar infilling, grayish-green- (5G5/2) stained coral clasts; very pale orange; silt to pebble-sized grains, poorly sorted in upper part, grading downward to FLOATSTONE by 0.8 ft and RUDSTONE by 2.2 ft; becomes better-sorted pebble RUDSTONE in lower part of unit; single graded bed. Lower contact sharp.

2.6 - 7.1WACKESTONE TO RUDSTONE: skeletal, rubble; uncemented; mixed-alteration, mostly altered, pelecypod with cemented infilling, crimson and pale-red (5R6/2) Homotrema, unaltered and micritized Halimeda, grayishgreen- (10G4/2) stained coral fragments, burrow with "tea-brown" micrite; very pale orange; silt to pebblesized fragments, very poorly sorted; from 2.6 - 4.2 ft, dominantly fine-grained WACKESTONE with pebbles; grading downward from 4.2 - 6.3 ft to FLOATSTONE, mostly coarseto very coarse grained with scattered pebbles; grading downward; from 6.3 - 8.6 ft, to RUDSTONE dominantly pebbles; probably one graded bed. 7.1 - 8.6NO RECOVERY. 8.6 - 17.2 FLOATSTONE TO RUDSTONE: coral, rubble; matrix skeletal WACKESTONE; uncemented; mixed-alteration, mainly altered, scattered crimson Homotrema, pelecypod with "tea-brown"-cemented infilling, recrystallized coral fragments; very pale orange; unsorted, silt to pebblesized debris, pebbles increase in size and abundance downward (coarsely graded). 17.2 - 18.3 NO RECOVERY. PACKSTONE: rubble, skeletal; uncemented; mixed-alteration, 18.3 - 18.7 crimson Homotrema, one cemented lithoclast with "teabrown" micrite cemented center, pelecypod with cemented infilling, very pale orange. Lower contact gradational. GRAINSTONE: foraminifer, skeletal; uncemented; mostly 18.7 - 19.3 unaltered, crimson and moderate-red (5R6/2) Homotrema, coralgal pebbles. Contains abundant Calcarina spangleri. 19.3 - 20.2 NO RECOVERY. 20.2 - 20.4 WACKESTONE: probably ovoid-shaped, cemented burrow; skeletal PACKSTONE rind around skeletal-pellet WACKESTONE interior; rind about 0.045 ft thick; very fine grained. 20.4 - 20.5 RUDSTONE(?): mixed-rubble, matrix WACKESTONE, skeletal; uncemented; mixed-alteration, unaltered mollusc fragments, cemented WACKESTONE fragment; very pale orange to white; unsorted.

^^ =	00 1	NA DECAMENT
20.5	- 22.1	NO RECOVERY.

22.1 - 39.0 GRAINSTONE: foraminifer, skeletal, Halimeda; uncemented; generally unaltered, crimson and moderate-red (5Y6/2)

Homotrema, unaltered foraminifers, unaltered molluscs with color retention; fresh and micritized Halimeda; very pale orange; silt to pebble-sized fragments, mostly medium- to very coarse grained; scattered pebble-sized coralgal fragments and molluscs, sparse silt. Contains whole, articulated pelecypod at 31.3 ft, abundant Calcarina. Lower contact probably gradational.

39.0 - 44.6 GRAINSTONE TO PACKSTONE: GRAINSTONE in upper part of unit similar to unit above, grading downward to foraminifer, skeletal, rubble PACKSTONE; mixed-alteration, corals thinly encrusted with coralgae and abundant crimson and pale-red (5Y4/6) Homotrema, colorful, high-spined gastropod at 39.8 ft, unaltered and chalky Halimeda; very pale orange; silt to pebble-sized grains, poorly

sorted with abundant coarse <u>Halimeda</u> grains. Lower contact gradational.

44.6 - 71.8

FLOATSTONE: coral, sparse rubble; matrix skeletal
PACKSTONE; uncemented; mixed-alteration; very pale
orange; very poorly sorted, silt to cobble-sized rubble,
mostly pebble-sized coral fragments; spar-replaced
Porites lutea at 48.3, 52.2, 60.6, and 64.6 ft; lightolive-gray (5Y6/1) to olive-gray (5Y4/1), phosphatecemented(?) lithoclast at 64.5 ft, and olive-gray
(5Y4/1) stained corals at 50.0, and 67.6 ft; grayishgreen Heliopora fragment at 64.5 ft; large fractured

Cardium with cemented shelter at 52.4 ft; discolored colorful coral at 48.9 ft; recrystallized coral (Acropora cuneata?) at 48.9 ft; cemented Halimeda PACKSTONE at 56.7 ft; spar-replaced Astreopora(?) clast at 65.0 ft; pale-red Homotrema dominates lower part of unit, but crimson Homotrema occurring at 71.6 ft.

71.8 - 73.3 NO RECOVERY.

73.3 - 81.4 FLOATSTONE: matrix skeletal PACKSTONE; Halimeda;
moderately to poorly cemented, irregularly cemented;
altered, no evidence for mixing; Halimeda completely
micritized and partly dissolved, corals partly
micritized and spar-replaced; very pale orange to white;
poorly sorted; sparse moldic porosity. Broken by hammer
sampling.

81.4 - 83.2 NO RECOVERY. [Disconformity indicated by sparse spar-infilling, moldic porosity, and a change in lithofacies.] 83.2 - 90.2 PACKSTONE: coral, skeletal; moderately to poorly cemented, generally poorly cemented; moderately altered, corals micritized, molluscs preserved as molds and steinkerns, some spar replacement in corals; very pale orange; poorly sorted, silt to pebble-sized grains; abundant moldic porosity; scattered "dog-tooth" spar lining molds; Porites sp. with abundant coralgae at top of unit. 90.2 - 92.5 NO RECOVERY. [Disconformity(?) indicated by increase in alteration and spar replacement and infillings.] 92.5 - 96.0 FRAMESTONE: coral; no matrix; Porites lutea and P. cuneata; moderate alteration; corals heavily micritized and some spar-replaced; "dog-tooth" spar appearently infills Acropora molds; very pale orange; moldic and vuggy porosity; rock broken in sampling. Includes interval of no recovery from 93.4 - 95.8 ft. Lower contact gradational. 96.0 - 96.9 FLOATSTONE: coral; matrix PACKSTONE; skeletal; moderately to cemented, irregularly cemented; moderate alteration, pelecypods very chalky, one Mytilus with color, corals micritized with some spar-replacement; very pale orange; poorly sorted, fragments of Porites lutea; corals bored; common moldic porosity; some molds with "dog-tooth"-spar infillings. 96.9 - 98.9 NO RECOVERY. 98.9 - 103.5 PACKSTONE: mollusc, foraminifer; uncemented to very poorly cemented, irregularly cemented; slightly altered, pelecypods slightly chalky but well-preserved, foraminifers chalky; very pale orange; silt to very coarse-grained, mostly fine- to medium-grained with common very coarse grains; very coarse grains made up of abundant small pelecypods; scattered very large Cardium valves only slightly broken; common foraminifers; matrix on underside of one pelecypod valve slightly cemented.

103.	5	1	05.	7	NΩ	RECOVERY.
117.3 •		-	(1)	. /	NO	Kruuvrki.

PACKSTONE: foraminifer, coral, skeletal; poorly to moderately cemented, irregularly cemented; moderately altered, corals micritized and partly spar-replaced, pelecypods chalky; very pale orange; silt to pebble-sized grains, mostly fine- to medium-grained; coral; common moldic porosity in better cemented areas; high-spired, large gastropod with abundant "dog-tooth"-spar infilling. This unit is similar to one above but is finer-grained, and has more foraminifers and fewer small molluscs.

109.7 - 111.4 NO RECOVERY.

111.4 - 115.8 PACKSTONE: skeletal, foraminifer, mollusc; poorly to moderately cemented, irregularly cemented; slightly to moderately altered, pelecypods micritized; very pale orange; silt to very coarse grained, mostly medium- to coarse-grained; minor moldic porosity.

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115.8 - 117.3 NO RECOVERY.

117.3 - 121.1 WACKESTONE: skeletal, foraminifer, mollusc; similar to unit above but with more silt, smaller PACKSTONE-filled burrows, and molluscs with cemented infillings.

Contains Porites lutea(?) at base. Lower contact sharp.

[Disconformity indicated by increase in cementation and alteration, abundant "tea-brown" micrite, rhizoliths, and glaebules that form a partly recovered crust, 0.15 ft thick. Corals are micritized and dissolved, rhizoliths are filled with "tea-brown" micrite, and "tea-brown" micrite is concentrated in layers.]

121.1 - 138.9 PACKSTONE TO FLOATSTONE: generally Halimeda, coral, skeletal PACKSTONE, grading locally to sparse coral FLOATSTONE; generally poorly cemented, irregularly cemented, except moderately cemented in upper 0.15 ft; moderately altered, Halimeda completely micritized, molluscs very chalky, and some dissolved to form partial molds and steinkerns, corals micritized and partly sparreplaced; very pale orange to white; silt to very coarse grained, mostly fine-grained with pebble- and cobble-sized corals scattered throughout; scattered well-cemented burrows with "tea-brown" micrite near top; burrows generally small, but one large burrow at 131.8 ft is spar-cemented, Halimeda-skeletal PACKSTONE.

Contains very common molluscs from 129.3 - 130.0 ft; Astreopora(?) at 126.0 - 126.4 ft, Acropora cuneata at 138.2 ft, scattered sticks and small heads of Porites sp. throughout.

138.9 - 140.3 NO RECOVERY.

140.3 - 141.2 PACKSTONE: mollusc, skeletal; poorly cemented; slightly altered, some molluscs chalky, some unaltered and colorful; very pale orange; silt to very coarse grained, mostly medium- to very coarse grained; common well-cemented burrows like matrix. This unit may be out of place because of its unaltered nature, grayish-green (5G5/2) Heliopora, color retention and luster in gastropods. Lower contact apparently sharp.

[Disconformity(?) indicated by a slight change in cementation, a change in lithofacies, and presence of sparse "tea-brown" micrite.].

141.2 - 144.3 PACKSTONE: skeletal, coral; generally moderately cemented in upper 0.4 ft, becoming poorly cemented downward; moderately altered, corals micritized and partly spar-replaced and dissolved, pelecypods micritized with cemented infillings; very pale orange; silt to pebble-sized grains, poorly sorted, rubblized(?); scattered weak "tea-brown" cement and well-cemented burrows or corals(?).

144.3 - 146.1 NO RECOVERY.

146.1 - 149.6 FLOATSTONE: mollusc, coral, with skeletal PACKSTONE matrix; uncemented; slightly altered, corals corroded, slightly micritized, molluscs only slightly altered; generally pale yellowish brown with some dark-yellowish-brown coral sticks; silt to coarse-grained matrix with granule-sized coral sticks, poorly sorted; mostly broken skeletal (mollusc) debris. This appears to be a sand dike of matrial from sediment package 5 Corals include Dictyaraea and Seriatopora sticks and Porites sp. Lower contact sharp, slightly by mixed faulted(?).

149.6 - 161.1 FLOATSTONE: coral; matrix mollusc, skeletal PACKSTONE; generally poorly cemented to uncemented; moderately altered to slightly altered, molluscs heavily micritized, some dissolved, some with cemented infillings (steinkerns), others with nacreous luster below 157.8 ft; corals micritized, partly dissolved and spar-replaced; becoming less altered downward; generally

very pale orange in upper part, becoming very pale orange to pale yellowish brown from 160.3 ft to base; very poorly sorted; granule—through pebble—sized grains all appear to be recrystallized coral and coralgal fragments; some moldic and vuggy porosity. Note: from 160.3 ft to base, may be slightly mixed; contains gastropod fragments with nacreous luster and is darker in color. Contains scattered Acropora cuneata and other small corals. Lower contact gradational.

161.1 - 166.3

WACKESTONE TO PACKSTONE: foraminifer, skeletal; moderately, irregularly cemented in upper part becoming uncemented downward; slightly to moderately altered, pelecypods chalky, Halimeda completely micritized and partly dissolved; white to very pale orange; silt to very coarse grained, mostly silt to fine-grained; scattered small, cemented burrows resemble matrix but have less silt; minor "tea-brown" micrite and spar from top to 163.0 ft.

166.3 - 168.7 NO RECOVERY.

168.7 - 171.6

PACKSTONE: foraminifer, mollusc, skeletal; poorlycemented; slightly to moderately altered, molluscs with
shells, some chalky, some with dull luster, <u>Halimeda</u>
micritized and partly dissolved, corals micritized and
partly dissolved, foraminifers partly spar-replaced;
very pale orange; silt to very coarse grained with
sparse granule- to pebble-sized molluscs and corals;
poorly sorted. Contains common small cemented burrows
filled with mollusc PACKSTONE, foraminifer; medium- to
very coarse grained; spar cement.

171.6 - 188.8

MUDSTONE WITH FLOATSTONE: generally coral, pellet MUDSTONE with intervals of sparse coral FLOATSTONE with pellet MUDSTONE matrix; coral; mostly uncemented with 40% cemented burrows; slightly to moderately altered, moderate alteration in burrows, slight in matrix; corals slightly recrystallized and partly dissolved, molluscs chalky; white with very pale orange to white burrows and corals; matrix silt with very few sand grains. Contains common, relatively large burrows; burrows MUDSTONE, pellet, well-cemented, containing common corals and molluscs in centers surrounded by spar-replaced coralgae; scattered spar-filled dessication(?) cracks in burrows. Contains Astropora(?) and Porites. Lower contact probably gradational. SAMPLE: T @ 183.8.

188.8 - 191.8 MUDSTONE: skeletal, pellet; similar to unit above, but with about 80% cemented burrows. Lower contact probably gradational.

- 191.8 198.9 WACKESTONE: coral, skeletal; moderately to poorly cemented, irregularly cemented; slightly to moderately altered, corals micritized and some partly dissolved spar-replaced, some molluscs molds, most chalky; very pale orange to very pale orange to white; silt to very coarse grained, poorly sorted. Contains cemented burrows similar to MUDSTONE of unit from 171.6 188.8 ft with spar-filled dessication(?) cracks; moldic porosity in corals and burrows.
- 198.9 202.0 FLOATSTONE: coral with skeletal, PACKSTONE matrix; uncemented; slightly altered, chalky molluscs, micritized corals, grayish-green (5G5/2) Heliopora; very pale orange; silt to very coarse grained, mostly silt to fine-grained fragments, pebble-sized corals, moderately well-sorted. Contains reworked(?) spar-replaced Favia(?) and "tea-brown" cemented lithoclast(?) near base. Contains Porites sp. and Astreopora. Lower contact sharp.

[Disconformity indicated by increase in cementation and alteration and presence of "tea-brown" cement.]

- 202.0 204.4 PACKSTONE: skeletal, mollusc; moderately cemented; irregularly cemented; slightly to moderately altered, chalky molluscs, grayish-green (5G5/2) Heliopora, corals micritized and spar-replaced; very pale orange; silt to very coarse grained with pebble-sized corals, mostly medium- to coarse-grained; patchy "tea-brown" micrite; molluscs with spar-infillings; some moldic porosity.
- 204.4 210.7 FLOATSTONE: coral; skeletal WACKESTONE matrix; uncemented; slightly to moderately altered, corals slightly micritized and partly spar-replaced; very pale orange towhite; silt to coarse-grained, mostly silt to fine-grained; corals granules and pebbles. Contains scattered Porites throughout, Favia at 208.4 ft.
- 210.7 213.8 WACKESTONE: mollusc; uncemented; slightly to moderately altered, pelecypods slightly chalky, some with dull luster, corals micritized and partly spar-replaced; white; silt to very coarse grained, mostly silt to fine-grained; pebble-sized molluscs and corals; "tea-brown" micrite in one shelter beneath pelecypod valve.

[Possible discontinuity indicated by slight increase "tea-brown" cement and spar-replacement of corals.]

213.8 - 220.1 FLOATSTONE: coral; matrix skeletal PACKSTONE; generally uncemented with very scattered "tea-brown" micrite; moderately altered, corals micritized and spar-replaced, pelecypods chalky; very pale orange; silt to coarse-grained, mostly silt to medium-grained, pebble-sized corals; "tea-brown" micrite scattered throughout, commonly attached to or coating corals. Contains

Acropora cuneata at top, scattered Porites sp. and Porites lutea.

220.1 - 223.4 WACKESTONE: coral, skeletal; moderately cemented; possibly burrowed; moderately altered skeletal components; very pale orange. Contains small coral sticks.

223.4 - 227.6

PACKSTONE: foraminifer, skeletal; like units above, but with fewer corals, more pelecypods and cemented burrows; burrows filled with tight skeletal PACKSTONE that resembles matrix in FLOATSTONE from 213.8 - 220.1 ft. Unit poorly to moderately cemented, irregularly cemented, with sparse "tea-brown" micrite. Lower contact gradational.

227.6 - 228.2 PACKSTONE TO GRAINSTONE: foraminifer, skeletal; resembles units above with predominantly fine-grained matrix, moderately well-sorted; composed of broken skeletal debris, common foraminifers, no corals, and few pelecypods; very pale orange.

228.2 - 230.4 NO RECOVERY.

[TOP OF SEDIMENT PACKAGE 3. Major disconformity indicated by increase in cementation, increase in porosity, scattered spar-filled vugs, and marked increase in amount of "tea-brown" micrite.]

230.4 - 233.5

PACKSTONE: skeletal; moderately cemented, irregularly cemented; moderately altered, Heterostigina micritized and partly dissolved with spar-filled centers, molluscs chalky and molds, corals micritized and partly dissolved; very pale orange to pale yellowish brown; silt to very coarse grained (abundant) skeletal debris (bimodal); common moldic porosity; upper part spongy, micromoldic porosity; rock slightly broken and less-cemented near base than top; both "tea-brown" and spar cement commonly scattered throughout unit. Contains broken, recrystallized Tridacna shell at top.

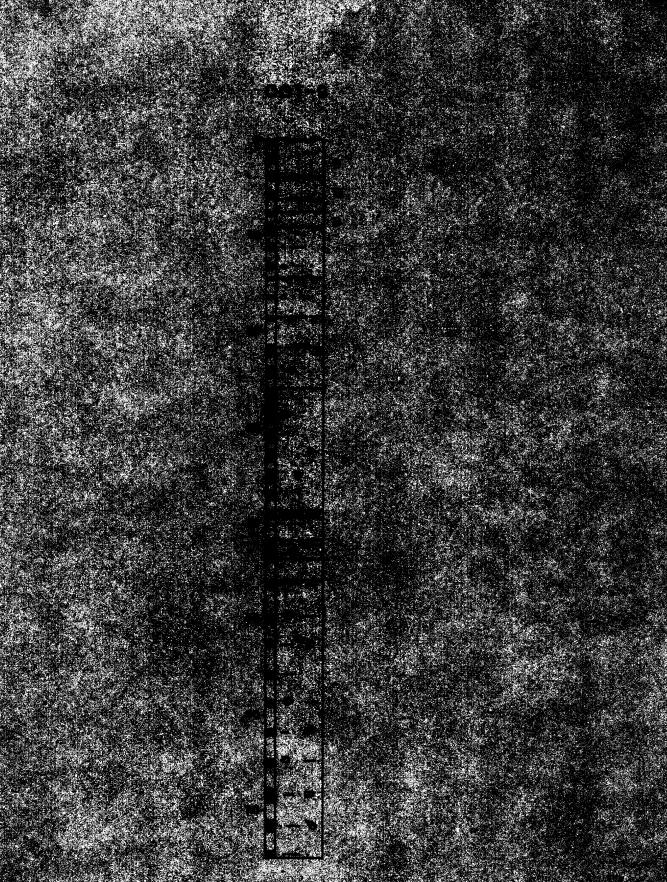
233.5 - 256.5 FLOATSTONE: coral, with skeletal, foraminifer PACKSTONE matrix; moderately to well-cemented; moderately to heavily altered, corals micritized, partly spar-replaced and dissolved, molluscs molds, steinkerns, and sparfilled molds; very pale orange, some patchy mottling of pale orange and light yellowish brown; silt to very coarse grained matrix, commonly medium- to coarsegrained; moldic and vuggy porosity common; pores commonly lined with "dog-tooth" spar; spar and "teabrown" cement present throughout unit, but are slightly less abundant in lower part. NO RECOVERY.

256.5 - 258.5

258.5 - 283.5

FLOATSTONE(?): coral, with skeletal WACKESTONE matrix; well-cemented, becoming moderately cemented downward; pervasively recrystallized, corals spar-replaced or preserved as vugs. Contains common "dog-tooth" spar lining molds and small vugs; unit badly broken by sampling, but probably with extensive moldic and vuggy porosity; very pale orange to white. Contains small recrystallized Porites lutea head at top.

*** TOTAL DEPTH OF HOLE 283.5 FT ***



BOREHOLE OGT-9

Lat/Long (E/W-1960): 11°36′22.9" N, 162°06′13.7" E

Lat/Long (WGS-1972): 11°36′22.7" N, 162°06′13.6" E

Location (IVY-grid, ft): 125,754 N and 036,809 E

Distance/Bearing from OAK GZ: 1044 ft, 42.2 deg

Water Depth (H&N): 134.8 ft Hole Depth (bsf): 75.0 ft

Hole Spudded: 06/03/1985 Drilling Ended: 06/03/1985

Sampling: SS, SH Recovery: 38% (28.3 ft)

Logs: None run Deviation: No survey run

Drilling Mud/Additives: SEP (75 sx) Casing: No casing set

Geologists: B.R. Wardlaw, B.A. Skipp Drillers: R. Weber, P. Sacro

Paleontologists: T.G. Gibson, R.G. Stamm Redescribed: 01/29/1986

Depth	Description
0.0 - 3.9	GRAINSTONE: skeletal, Halimeda; uncemented; mixed- alteration, crimson Homotrema, moderate-yellowish-brown micritized coral fragments, grayish-pink foraminifers and altered and abraded foraminifers, micritized and colorful molluscs, unaltered and chalky, Halimeda; very pale orange to pale yellowish brown; very fine to very coarse grained; from 0.0 - 2.1 ft, mostly medium- to coarse-grained; from 2.1 - 3.9 ft, mostly fine- to medium-grained; mostly broken skeletal elements; scattered moderate-yellowish-brown coral sticks at base; a reverse-graded bed; mixed with sands from sediment package 5. Lower contract abruptly gradational.
3.9 - 6.2	GRAINSTONE: foraminifer, skeletal; uncemented; mixed- alteration, crimson and pale-red (5R6/2) Homotrema, fresh and chalky Halimeda, grayish-green (5G5/2)

Heliopora, few fragments of moderate-yellowish-brown coral, grayish-orange spar, grayish-pink and altered and

abraded foraminifers, unaltered and chalky mollusc fragments; very pale orange with interval of very pale orange to light yellowish brown from 5.4 - 5.6 ft; very

fine to very coarse grained, mostly medium— to coarse-grained; scattered pebble—sized mollusc fragments and Halimeda grains; large graded bed.

6.2 -	- 7.4	NO RECOVERY.
7.4 -	- 9.1	GRAINSTONE: skeletal, coral; uncemented; mixed- alteration, unaltered coral with crimson Homotrema, pale-red (5R6/2) Homotrema, pale-yellowish-brown, micritized coral, unaltered Halimeda, whole fresh small pelecypod valves; very pale orange to pale yellowish brown; silt to pebble-sized grains, poorly sorted, mostly coarse-grained; common pebble-sized corals; large graded bed. Lower contact gradational.
9.1 -	- 14.3	PACKSTONE: skeletal, rubble; uncemented; mixed-alteration, crimson and pale-red (5R6/2) Homotrema, colorful molluscs, spar-replaced coral, unaltered and micritized and partly dissolved Halimeda, very pale orange; very fine grained sand to pebble-sized fragments, poorly sorted; pebbles include broken and whole skeletal elements and lithoclasts of well-cemented, Halimeda PACKSTONE; lithoclasts and some coral fragments have moldic porosity. Note: unit differs from overlying unit by apparent absence of moderate-brown corals. Lower contact gradational.
14.3 -	- 18.6	PACKSTONE: rubble, coral; uncemented; mixed-alteration, pale-red (5R6/2) Homotrema, drusy spar on coral, coral fragment with "tea-brown" micrite, spar-replaced coral, very pale orange; silt to pebble-sized fragments, very poorly sorted; one spar-replaced coral bored with mudfilled borings and shelters; Tridacna shell fragment at 18.6 ft; apparently lower part of large, crudely graded bed that includes unit above. Lower contact sharp.
18.6 -	- 21.7	PACKSTONE: skeletal, rubble; uncemented; mixed-alteration, crimson Homotrema, micritized and spar-filled coral; very pale orange; silt to pebble-sized grains, poorly sorted, mostly fine- to medium-grained; small lithoclast of Halimeda on coral with spar infilling shelter beneath Halimeda on grain at 18.7 ft; clearly not graded. Lower

21.7 - 26.0 GRAINSTONE: foraminifer, skeletal; uncemented; mostly or wholly unaltered, common crimson and pale-red (5R6/2)

Homotrema, fresh Halimeda, unaltered molluscs and grayish-pink foraminifers; one pebble of slightly

contact apparently sharp.

altered coral with pale-red (5R6/2) Homotrema at 23.6 ft (may be fall-in); very pale orange; fine-grained sand to pebble-sized fragments, mostly medium- to coarse-grained; slightly finer-grained toward base (reverse-graded bed?). Contains abundant Goniolithon granules and pebbles from 21.7 - 22.3 ft; common Goniolithon and Halimeda grains in remainder of unit.

- 26.0 38.7 GRAINSTONE: foraminifer, Halimeda, skeletal; uncemented; unaltered, grayish-pink foraminifers, unaltered to chalky Halimeda, common crimson Homotrema, colorful molluscs; very pale orange; very fine to very coarse grained, sparse scattered pebble-sized fragments, mostly small corals; mostly medium-to coarse-grained, moderately sorted. Lower contact sharp.
- 38.7 39.5 CORAL HEAD: Astreoproa(?), encrusted with pale-red Homotrema; very pale orange. Note: coral head not badly broken.
- 39.5 41.8 NO RECOVERY.
- 41.8 43.8 FLOATSTONE: coral; matrix sparse PACKSTONE: skeletal; uncemented; mixed-alteration, spar-replaced corals, pale-red, sparse moderate-red (5R4/6), and crimson Homotrema, fresh colorful molluscs; very pale orange; silt to large pebble-sized grains, very poorly sorted; moldic porosity in large coral-coralgal grains; large pebbles include Tridacna shell fragments, unaltered whole colorful gastropod shell, and partly micritized and spar-replaced coral-coralgal grains; contains area with color-retention at 42.4 ft; spar-replaced Porites lutea at base. Note: lowest-observed moderate-red (5R4/6) Homotrema at 43.6 ft.
- 43.8 46.0 NO RECOVERY.
- 46.0 75.0 FLOATSTONE: coral, coralgal, rubble; matrix PACKSTONE: skeletal; uncemented to poorly cemented; slightly to moderately altered, corals partly micritized and sparreplaced; very pale orange; silt to pebble-sized fragments, very poorly sorted; abundant moldic porosity in corals; one dark-yellowish-orange, recrystallized bryozoan at 64.9 ft. Contains Acropora cuneata at 49.5, 52.3 ft.

*** TOTAL DEPTH OF HOLE 75.0 FT ***

BOREHOLE OHT-10

Lat/Long (E/W-1960): 11°36′05.5" N, 162°06′17.5" E

Lat/Long (WGS-1972): 11°36′05.3" N, 162°06′17.5" E

Location (IVY-grid, ft): 124,003 N and 037,195 E

Distance/Bearing from OAK GZ: 1,462 ft, 132.0 deg

Water Depth (H&N): 137.3 ft Hole Depth (bsf): 162.5 ft

Hole Spudded: 06/03/1985 Drilling Ended: 06/04/1985

Sampling: SS, SH Recovery: 40% (64.5 ft)

Logs: GR/NT Date Logged: 06/04/1985

Deviation: No survey run Casing: No casing set

Drilling Mud/Additives: SEP (268 sx) Drillers: R. Weber, P. Sacro

Geologists: B.R. Wardlaw, B.A. Skipp Loggers: C.S. Novinskie,

Paleontologists: T.G. Gibson, R.G. Stamm A. LeBreton

Redescribed: 01/30/1986

D- 11	Dependent	
Depth	Description	
0.0 - 7	PACKSTONE: skeletal, rubble; uncemented; mixed-alteratic crisp and chalky Halimeda, unaltered and corroded foraminifers, very sparse moderate-red (5R4/6) Homotrema, chalky pelecypod, cemented lithoclasts, unaltered (live) Conus shell; very pale orange to yellowish gray (5Y7/2); very poorly sorted with coral and lithoclasts as small pebbles, more abundant and larger coral fragments near base, possibly crudely graded bed. Contains common small pebble- and granul sized moderate-yellowish-brown "Miocene" corals, including Dictyaraea; sparse pebble-sized spar clasts	.s .e-
7.9 - 9	2 NO RECOVERY.	
9.2 - 1	.8 POOR AND NO RECOVERY: recovery consists mainly of mixed	

- 14.8 POOR AND NO RECOVERY: recovery consists mainly of mixed rubble of granule- and pebble-sized coral sticks and fragments and other skeletal debris; uncemented; mixed-

alteration, mainly altered, common chalky and sparse unaltered molluscs, recrystallized and unaltered coral material, including one small stick with small moderate-red (5R4/6) and pale-red (10R6/2) Homotrema; generally very pale orange; contains small "tea-brown" cemented lithoclast and other cemented rock fragments. Originally mixed-rubble FLOATSTONE(?). Note: contains no brown corals.

14.8 - 48.3

FLOATSTONE TO RUDSTONE: rubble; uncemented; mixedalteration, predominantly altered, generally wellcemented lithoclasts of skeletal PACKSTONE with "teabrown" micrite, numerous heavily spar-replaced corals,
fractured and unaltered <u>Conus</u> shell at 33.2 ft; very
pale orange with minor pale yellowish brown; very poorly
sorted, ranging from silt- to cobble-sized material,
abundant angular pebble-sized particles. Contains
abundant fragments of coral heads and small colonies,
including fragments of spar-replaced and only slightly
altered <u>Porites lutea</u> from 47.2 - 47.6 ft. Note: Unit
appears to consist predominantly of Pleistocene
material.

48.3 - 53.5

NO RECOVERY. Drill string dropped suddenly 4 ft within interval.

53.5 - 64.5

PACKSTONE AND FLOATSTONE: upper part mollusc, coral PACKSTONE, becoming coral FLOATSTONE, with PACKSTONE matrix from 59.0 - 62.4 ft; uncemented to poorly cemented, irregularly cemented; mollusc material mostly chalky or preserved as molds and steinkerns, some sparinfilled, sparse color retention; corals micritized with some sparse spar-replacement; very pale orange; poorly sorted, consisting of silt- to pebble-sized particles, with small to large pebble-sized, cemented pieces; may be partly cemented burrows. Contains abraded, bored, chalky oyster at 61.0 ft with small, spiral-shaped, moderate-red (5R4/6) epiphyte attached; corals include Pocillopora(?) at 56.4 ft, Porites lutea with Lithophagus steinkerns at 53.8 ft, and Astreopora(?) and Favia(?) in FLOATSTONE interval. Note: unit appears to be unmixed.

64.5 - 72.9

WACKESTONE: coral, mollusc, <u>Halimeda</u>; like overlying unit but with more corals and silt-sized particles; very pale orange to white; containing skeletal PACKSTONE-filled burrows with some steinkerns and moderate-brown spar. Contains oyster at 71.0 ft.

72.9 - 73.9 FLOATSTONE: coral; skeletal MUDSTONE matrix; uncemented; Porites lutea slightly micritized, with spar-cemented Lithophagus steinkern. Contains small, attached, chalky oyster. WACKESTONE: coral, mollusc; similar to overlying units but 75.1 - 79.2 with more silt-sized particles; uncemented; containing spar-filled gastropod, recrystallized corals; white to very pale orange. 79.2 - 79.8 CORAL HEAD: Porites lutea head, no matrix; containing boring with cemented, mud-filled bottom and spar-filled top (geopetal structure), coral partly micritized; very pale orange. 79.8 - 81.2 NO RECOVERY. FLOATSTONE: coral, with skeletal PACKSTONE matrix; 81.2 - 97.7 uncemented; mixed-alteration, mostly slightly recrystallized corals, some highly friable, sparse others heavily spar-replaced, containing scattered chalky pelecypod shells; silt- to cobble-sized material, unsorted; very pale orange. Large "brain coral" from 91.0 - 91.4 ft, exfoliating, fractured; contains diverse coral fauna including scattered small Porites lutea 97.7 - 98.7 FLOATSTONE: coral, rubble(?); skeletal MUDSTONE matrix; uncemented; corals partly recrystallized, partly sparreplaced; very pale orange. Lithoclast(?) consists of Acropora stick with well-cemented adhering matrix. 98.7 - 123.0 FLOATSTONE: coral, lithoclast (rubble?); skeletal WACKESTONE TO PACKSTONE matrix; like overlying unit, but with sparse cemented lithoclasts, some containing moderate-yellowish-brown ("tea-brown") micrite; unit uncemented; mostly altered skeletal components; very pale orange. Contains lithoclast of pellet, skeletal WACKESTONE with "tea-brown"-filled rhizoliths at 113.2 ft; fragment of former shelter filled with "dog-tooth" spar at 114.5 ft. Contains diverse coral fauna, including Astreopora(?) from 105.3 - 105.6 ft; Porites sp. head from 116.3 - 116.8 ft, partly replaced with coarse, grayish-orange, "dog-tooth" spar; scattered Porites sticks and very sparse Seriatopora. SAMPLE: T @ 116.6 (recrystallized coral).

123.0 - 124.7	NO RECOVERY.
124.7 - 125.8	FLOATSTONE: sparse coral; skeletal WACKESTONE matrix; uncemented; altered skeletal components; very pale orange. Contains <u>Tridacna</u> fragment at top.
125.8 - 129.5	NO RECOVERY.
129.5 - 135.9	FLOATSTONE TO PACKSTONE: sparse coral FLOATSTONE with skeletal PACKSTONE matrix and interbedded with same; poorly cemented to uncemented, irregularly cemented; altered skeletal components, gastropods chalky, corals partly spar-replaced. Contains large Fungia at 130.5 ft; small gastropod at 130.3 ft.
135.9 - 139.3	NO RECOVERY.
139.3 - 145.3	FLOATSTONE: coral, skeletal, mollusc PACKSTONE matrix; uncemented; skeletal material altered, corals partly spar-replaced (minor) and micritized, lithoclasts moderately cemented; unsorted. Contains Acropora cuneata at 144.6 ft, Turbo operculum at 145.0 ft.
145.3 - 149.5	NO RECOVERY.
149.5 - 150.3	poorly to moderately cemented; skeletal components altered, corals partly recrystallized and partly spar-replaced filled; foraminifers bleached, pelecypods chalky, silt to very coarse grained matrix, mostly fine-to medium-grained; very pale orange. Contains common Amphistogina, scattered pelecypods.
150.3 - 155.0	NO RECOVERY.
155.0 - 162.5	FLOATSTONE: coral, with skeletal, mollusc, foraminifer PACKSTONE matrix; altered, molluscs generally chalky or preserved as spar-filled steinkerns, pelecypod at 162.4 ft with partial color retention; foraminifers recrystallized, sparse coralline algae micritized, corals partly spar-replaced; silt to pebble-sized material, generally medium- to coarse-grained; very pale

orange. Contains Acropora sticks, Porites sp. at 155.1 - 155.4 ft, Porites lutea at 156.1 ft, Platygyra sinensis(?) at 161.9 - 162.3 ft; gastropod operculum at 155.6 ft.

*** TOTAL DEPTH OF HOLE 162.5 FT ***

BOREHOLE OIT-11

Lat/Long (E/W-1960): 11°36′07.8" N, 162°06′16.1" E

Lat/Long (WGS-1972): 11°36′07.6" N, 162°06′16.1" E

Location (IVY-grid, ft): 124,230 N and 037,051 E

Distance/Bearing from OAK GZ: 1,206 ft, 128.5 deg

Water Depth (H&N): 155.0 ft Hole Depth (bsf): 286.5 ft

Hole Spudded: 06/05/1985 Drilling Ended: 06/06/1985

Sampling: SS, SH Recovery: 39% (111.5 ft)

Logs: GR/NT Date Logged: 06/06/1985

Deviation: No survey run Casing: No casing set

Drilling Mud/Additives: SEP (435 sx) Drillers: R. Weber, P. Sacro

Geologist: B.R. Wardlaw Paleontologist: T.G. Gibson

Loggers: C.S. Novinskie, A. Reynolds

Redescribed: 10/22/1985

Depth	Description		
0.0 - 0.1	GRAINSTONE: skeletal, uncemented, probably unaltered, moderate-red (5R4/6) Homotrema grains?, very pale orange, very fine to coarse-grained, mostly very fine to fine-grained, moderately well-sorted.		
0.1 - 3.9	FLOATSTONE: tight mixed-rubble, coral, mollusc, lithoclast; matrix skeletal PACKSTONE(?); uncemented; mixed-alteration, fairly unaltered and chalky molluscs, corals slightly micritized and unrecrystallized; very pale orange; coarse- to pebble-sized grains, mostly granule- and pebble-sized; lithoclasts are dominated by chalky molluscs (pelecypods) with cemented PACKSTONE matrix attached. Contains granule-sized, pale-yellowish-brown Seriatopora fragment.		

3.9 - 5.6 PACKSTONE: tight, skeletal, foraminifer; uncemented; mixed-alteration, fresh and recrystallized foraminifers, single grain of moderate-red (5R4/6) Homotrema, chalky Halimeda, spar-filled Halimeda; very pale orange; silt to very coarse grained, generally silt to medium-grained. Lower contact abruptly gradational.

5.6 - 16.7

FLOATSTONE: mixed-rubble; matrix skeletal PACKSTONE; uncemented; mixed-alteration; everything at least slightly altered, chalky molluscs, and one large gastropod fragment with color retention and nacreous layer preserved, spar-replaced coral; very pale orange; silt to pebble-sized particles, very poorly sorted; lithoclasts include medium-gray, moderately to well-cemented, skeletal PACKSTONE; cobble-sized piece (at base) of well-cemented, pellet, skeletal MUDSTONE with "tea-brown" micrite and moldic porosity; pebble-sized clast of "tea-brown"-micrite cemented skeletal PACKSTONE (at 15.8 ft), scattered spar-cemented coral-bearing PACKSTONE. Lower contact sharp.

[TOP OF SEDIMENT PACKAGE 1. Discontinuity indicated by marked change from mixed rubble to unit with stratigraphic integrity with disconformity.]

WACKESTONE: Halimeda, skeletal WACKESTONE to 22.2 ft, becoming Halimeda mollusc, coral WACKESTONE below; uncemented; slightly altered, Halimeda slightly chalky with fresh centers, molluscs with color retention and nacreous layer preserved, corals partly chalky and partly spar-replaced, pale-red (5R6/2) Homotrema grains common; yellowish gray (5Y8/1); silt- to pebble-sized grains, latter corals, coralgae. Contains molluscs, small Fungia Acropora sticks, Astreopora(?); molluscs include several types of thin-shelled pelecypods and small gastropods. Contains sparse dark-gray grains from about 25.6 - 29.4 ft. Lower contact gradational.

WACKESTONE: Halimeda, mollusc; yellowish gray (5Y7/2) in upper part, becoming yellowish gray (5Y7/2) to light olive gray (5Y5/2) downward like unit above but with very common dark-gray, sand-sized ("salt and pepper") grains, increasing downward and increasing in size from sand to granules and small pebbles, probably indicative of mixing of phosphatic(?) unit just below disconformity; grains are olive-gray PACKSTONE, small Fungia common in unit. Disconformity probably at 30.35 ft (may catch just small part of unit immediately underlying surface.

[TOP OF SEDIMENT PACKAGE 2. Disconformity clearly indicated by marked change in color, alteration, and by presence of phosphatic(?) microfossil steinkerns ("salt-and-pepper" sand) and small granules of same in overlying unit.]

30.4 - 31.6 NO RECOVERY.

- 31.6 42.8 WACKESTONE TO PACKSTONE: Halimeda, moderately to poorly cemented; altered skeletal components, Halimeda completely chalky, partly dissolved and spar-filled in better-cemented areas; white to very pale orange, silt to very coarse grained, poorly sorted. Contains very sparse "tea-brown" micrite in upper 0.5 ft. Contains small coral heads at at 38.7 ft and from 40.8 ft to base. Contains moderately to well-cemented, PACKSTONE-

filled burrows from 40.7 ft to base.

PACKSTONE: mollusc, skeletal, foraminifer; alternating tight PACKSTONE and muddy PACKSTONE, generally uncemented to poorly cemented with moderately cemented areas underneath large <u>Cardium</u> shells, molluscs chalky, some minor color retention, <u>Halimeda</u> chalky, slightly altered; very pale orange; silt- to pebble-sized grains, mostly fine- to medium-grained, molluscs as pebble-sized particles with attached cemented matrix (shelters and infillings). Large well-cemented piece at 47.7 ft filled with pelleted, skeletal WACKESTONE, may have been internal sediment of a pelecypod. Contains common <u>Cardium</u> as broken, large, disarticulated valves. SAMPLES: R @ 45.0, 47.3.

49.3 - 49.9 WACKESTONE: mollusc, skeletal; uncemented, slightly altered; similar to unit above, mostly silt to fine-grained, very pale orange to white. SAMPLE: R @ 49.5.

[Disconformity indicated by increase in cementation and common "tea- brown" micrite. The horizon was disrupted by drilling.].

49.9 - 57.8

PACKSTONE: Halimeda, foraminifer, skeletal, moderately to well-cemented in upper 0.2 ft, becoming moderately to poorly cemented, irregularly cemented downward; moderately to strongly altered, Halimeda completely chalky, partly dissolved, some spar-infilled shells; very pale orange with moderate-yellowish-brown stringers; silt- to pebble-sized grains, mostly fine- to medium- and very coarse grained; abundant "tea-brown" micrite scattered throughout; common moldic porosity and common scattered spar. Lower contact gradational. SAMPLES: R @ 52.3, 54.5.

57.8 - 62.1 FLOATSTONE: coral, with skeletal WACKESTONE matrix; poorly to moderately cemented, irregularly cemented; heavily altered, corals chalky, dissolved, and heavily sparreplaced; white (matrix) to pale yellowish brown (spar replaced corals); matrix silt to medium-grained, corals disintegrating to form some coarser grains, broken in sampling; moldic porosity common. Contains several types of corals, including Astreopora(?). Lower contact

gradational.

62.1 - 62.8 PACKSTONE: mollusc, foraminifer, skeletal, generally uncemented to poorly cemented; moderately altered, molluscs chalky, with minor color retention, foraminifers recrystallized; very pale orange to moderate yellowish brown; silt to very coarse grained, mostly fine- to coarse-grained.

[Questionable disconformity indicated by change in cementation, presence of "tea-brown" micrite, and change in lithofacies.]

FLOATSTONE: coral, with skeletal PACKSTONE matrix; 62.8 - 73.0moderately well-cemented in upper 0.4 ft, becoming moderately to poorly cemented, irregularly cemented, downward with "tea-brown" micrite scattered throughout; moderately altered, corals chalky, dissolved and sparsely spar-replaced, pelecypod very chalky, disintegrating; very pale orange, silt to pebble-sized. generally fine-grained, poorly sorted; moldic porosity in corals, some molds spar-lined, pelecypods with cemented infilling. Contains scattered small heads of Porites lutea, Lithophagus steinkerns at 71.0 ft, and other corals. Contains scattered "tea-brown" micrite throughout, on and in corals, and a few moderateyellowish-brown chips of heavily "tea-brown" cemented rocks at 71.7 ft with chalky, partly dissolved Halimeda.

73.0 - 86.5

FLOATSTONE: coral, with skeletal WACKESTONE matrix; uncemented, with moderately cemented burrows near base; moderately altered, Halimeda completely chalky, molluscs chalky, some spar-filled, corals chalky, dissolved, sediment-infilled, and spar-replaced, sparse heavily spar-replaced patches; white to very pale orange; silt with very coarse Halimeda and mollusc grains, corals as pebble-sized grains. Contains Porites lutea head with abundant Lithophagus borings, in growth position, from 73.5 - 75.2 ft.

86.5 - 91.5 PACKSTONE: skeletal; poorly cemented, irregularly cemented; moderately to slightly altered, <u>Halimeda</u> completely chalky, partly dissolved, molluscs chalky,

with cemented fillings and spar fillings, corals chalky, dissolved, partly spar-replaced, some with spar infillings in molds; very pale orange; unsorted, pebbles and granules of cemented martix in silt to coarse grained matrix; better-cemented areas (burrows?) with moldic porosity, molds commonly spar-lined. Lower contact probably gradational.

91.5 - 92.4

PACKSTONE: skeletal, foraminifer; generally uncemented; mostly moderately altered, molluscs very chalky, foraminifers mostly recrystallized; very pale orange; silt to very coarse grained, mostly medium— to coarse—grained; containing several cemented burrows, elongate, like matrix with "tea-brown" micrite cemented centers and the rest spar cemented, one piece of grayish-orange heavily spar-replaced coral at 92.4 ft.

[Possible discontinuity suggested by slight increase in cementation.]

92.4 - 95.4 CORAL HEAD: <u>Porites lutea</u>, shattered but possibly in place, very pale orange; no matrix.

95.4 - 97.8 NO RECOVERY.

97.8 - 141.9

FLOATSTONE: coral, with skeletal WACKESTONE matrix; poorly to moderately cemented; irregularly cemented; skeletal components slightly to moderately altered; corals and molluscs chalky; very pale orange, mostly silt-sized with molluscs as coarse grains and pebble-to cobblesized corals. Contains diverse macrofauna, including whole large Cypraea at 98.5 and 105.5 ft, Turbo operculum at 129.2 ft; sparse colorful pelecypods (Mytilus) with nacreous luster at 101.3 ft; corals include Bikiniastrea at 98.5 and 111.0 ft, small heads of Porites sp., Astreopora(?), Platygyra(?), small Acropora sticks scattered; Fungia at 138.4 ft; molluscs common from 105.3 - 105.6 ft, and from 119.5 ft to base. At 120.1 ft small burrow, filled with sparcemented, Halimeda, mollusc PACKSTONE, Halimeda (completely chalky), at 122.9 ft large burrow, partly broken, with rind of Halimeda, mollusc PACKSTONE and pelleted MUDSTONE center Halimeda (completely chalky and mostly as molds); at 126.6 ft Porites sp. with sparse, weak "tea-brown" micrite on surface (may be rhizolith), sparse small pieces of "tea-brown" cemented granules from 128.8 - 130.2 ft. Unit becoming coral, skeletal WACKESTONE from 117.8 - 123.7 ft and from 128.9 - 130.2 ft.

141.9 - 148.1 CORAL HEADS: corals uncemented, slightly to moderately altered, chalky, with small amount of spar replacement; very pale orange; no matrix; mostly Porites lutea with Astreopora(?). 148.1 - 150.2 NO RECOVERY. 150.2 - 158.7 PACKSTONE: foraminifer skeletal, coral; poorly to moderately cemented, irregularly cemented; moderately altered, corals chalky and partly spar-replaced, evidenced by spar fragments in upper part of unit, some disintegrating Halimeda completely chalky and partly dissolved, molluscs chalky; very pale orange; generally fine- to coarse-grained, ranging in size from silt to very coarse, moderately sorted; containing common wellcemented burrows, like matrix; coralgae encrusting corals, common moldic porosity in corals, corals pebblesized, sand grains mostly broken skeletal debris and large foraminifers. BAFFLESTONE TO FLOATSTONE: coral, matrix skeletal 158.7 - 170.2 PACKSTONE; poorly cemented; moderately altered, corals slightly chalky with minor spar replacement, molluscs chalky; very pale orange, silt- to very coarse sandsized grains in matrix, very poorly sorted. Mostly in place Porites lutea heads with common Lithophagus borings and one colony with abundant small worm borings and possible moldic porosity.

WACKESTONE: coral, skeletal; moderately to poorly cemented, irregularly cemented; moderately altered, coral chalky and partly spar-replaced, molluscs preserved as molds, some spar-filled, some chalky; very pale orange; mostly silt-sized grains with sparse medium- to very coarse grained corals, foraminifers, and molluscs; common moldic porosity, mollusc molds with spar infilling, common well-cemented burrows filled with pellet, skeletal MUDSTONE TO WACKESTONE, sparse PACKSTONE-filled burrows. Contains sparse Stylophora sticks at 174.5 ft.

179.1 - 182.0 CORAL HEADS: sparse, uncemented, skeletal, mollusc, WACKESTONE matrix, poorly sorted. Unit about 50% Porites lutea and 50% Acropora cuneata in growth position; only slightly altered.

- PACKSTONE: coral, mollusc; uncemented with sparse poorly cemented shelters and moderately cemented burrows; slightly to moderately altered, molluscs chalky but some with partial color retention and preservation of nacreous layer, corals chalky, partly spar replaced; very pale orange to white, silt to very coarse grained, mostly very fine to coarse-grained, common foraminifers and micromolluscs; scattered cemented PACKSTONE-filled burrows similar to matrix but mostly medium- to coarse-grained, spar-cemented. Contains several whelks, neretids, and small strombids, nearly whole, near the top. Lower contact abruptly gradational.
- 190.2 193.4 WACKESTONE: mollusc, skeletal; generally uncemented; moderately altered, molluscs chalky, <u>Halimeda</u> chalky, partly dissolved; very pale orange to white; finegrained, mostly silt-sized grains but with scattered mollusc fragments, micromolluscs, and foraminifers as larger grains; contains common, small, cemented, skeletal, <u>Halimeda</u> PACKSTONE-filled burrows. Lower contact abruptly gradational.
- 193.4 193.8 PACKSTONE: skeletal, mollusc; uncemented; molluscs chalky; very pale orange; silt to very coarse, mostly coarseand very coarse grained, moderately to poorly sorted, many grains rounded, including spar grains.
- 193.8 207.5 PACKSTONE TO WACKESTONE WITH FLOATSTONE: generally coral, mollusc, skeletal PACKSTONE TO WACKESTONE; generally poorly cemented to uncemented; corals chalky, partly dissolved, molluscs chalky; very pale orange; silt to very coarse grained, mostly very fine to mediumgrained. Contains common well-cemented burrows, abundant near top, filled with skeletal PACKSTONE, slightly coarser than matrix, medium- to coarse-grained, with abundant spar cement and some drusy spar infilling and lining molds, burrows with moldic porosity, burrows decreasing in abundance and matrix becomes finer grained downward with unit. Unit approaches Seriatopora FLOATSTONE with WACKESTONE matrix from 201.5 - 203.9 ft; matrix very muddy from 203.9 ft to base. Contains abundant foraminifer from 204.7 ft to base; solitary coral at 198.8 ft. Lower contact abruptly gradational.
- 207.5 210.1 MUDSTONE: mollusc, skeletal; uncemented; molluscs chalky; white to very pale orange; mostly silt with broken mollusc fragments as coarse- and very coarse grained sand; contains scattered, small, well-cemented, pelleted, skeletal WACKESTONE- filled burrows.

210.1 - 220.0

WACKESTONE: foraminifer skeletal, mollusc; generally poorly cemented, irregularly cemented; molluscs chalky, sparsely preserved as molds and steinkerns with partial spar infilling, corals chalky; very pale orange; poorly sorted, silt and very fine grained. Contains large well-cemented PACKSTONE-filled burrow from 213.8 - 214.0 ft; foraminifer, mollusc; contains chalky and moldic molluscs, chalky foraminifers.

[Disconformity indicated by increase in alteration of skeletal components, including spar-replaced coral and increase in cementation.]

220.0 - 229.1

PACKSTONE TO WACKESTONE: skeletal, mollusc, coral; generally moderately to poorly cemented, irregularly cemented; molluscs chalky or preserved as molds and spar-filled steinkerns, corals chalky and badly recrystallized, with scattered heavy spar-replacement and infilling of Porites lutea(?) head by large "dogtooth" spar at 223.6 ft and scattered throughout interval from 220.0 - 223.8 ft, geopetal structure in coral? at 226.4 ft. Apparently contains PACKSTONE-filled burrows. SAMPLE: T @ 223.6.

229.1 = 251.0

WACKESTONE WITH FLOATSTONE: generally mollusc, coral WACKESTONE, becoming coral FLOATSTONE with WACKESTONE matrix from 247.9 ft to base; generally uncemented; small molluscs chalky, some with nacreous layer preserved; corals chalky and spar-replaced, some heavily, Halimeda chalky and dissolved, white to very pale orange; silt to very coarse grained, containing some pebble-sized and coarser material (corals and large pelecypods and gastropods), mostly silt and very fine grained sand; burrows common, generally skeletal PACKSTONE with Halimeda grains, some with moderate-brown spar-cemented centers. Contains common fragments of large pelecypods in uppper 2.0 ft, scattered Seriatopora sticks throughout.

[Possible disconformity indicated by increase in moldic porosity and alteration and slight increase in consistency of cementation.]

251.0 - 254.2

WACKESTONE: sparse pellet, skeletal; well-cemented in upper 2.0 ft, becoming moderately cemented downward, cementation decreasing downward; moderately altered, molluscs preserved as molds and steinkerns, some as spar fillings, mostly molds, corals intensely chalky and dissolved, mostly as partial molds, pellets commonly spar-replaced; very pale orange; silt to very coarse grained, mostly silt to medium-grained, corals as small

pebbles and granules; unit partly spar-cemented, with some spar-filled molds and shelters, one coral completely replaced by spar but retaining structure at 251.5 ft. Lower contact imperceptably gradational.

254.2 - 279.8

WACKESTONE: coral, mollusc; poorly to moderately cemented, irregularly cemented; moderately altered, molluscs chalky, corals chalky, some spar replacement, sparse corals heavily spar-replaced, some molluscs preserved as molds and filled with "dog-tooth" spar; very pale orange to white; silt to coarse-grained, mostly silt to fine-grained sand, corals and molluscs and burrows as pebbles; small moderately cemented burrows common, filled with pellet, skeletal PACKSTONE AND MUDSTONE, both spar-cemented, PACKSTONE with brown spar-cemented or -replaced centers.

[TOP SEDIMENT PACKAGE 3. Disconformity indicated by marked increase in cementation, presence of "tea-brown" micrite, and deterioration in skeletal preservation.]

279.8 - 280.2

PACKSTONE: mollusc, skeletal; well-cemented; dark-brown ("tea-brown") micrite sparse; moderately altered, corals chalky and largely preserved as molds, molluscs as molds, foraminifers chalky or spar-replaced; very pale orange; silt to very coarse grained, mostly fine- to coarse-grained; abundant moldic porosity; foraminifers common, fine molds after pellets(?), scattered spar-replacement and infillings.

280.2 - 282.8

NO RECOVERY.

282.8 - 286.5

FLOATSTONE: sparse, with coral skeletal, pellet MUDSTONE matrix; well-cemented, corals highly chalky or preserved as spar-lined molds (dissolved); very pale orange to pale yellowish brown; silt- to pebble-sized grains, mostly silt and very fine grained sand; spar filling and lining vugs and molds, commonly surrounding parts of corals that are not dissolved (completely chalky), vuggy and moldic porosity appears to increase downward. Contains abundant smaller foraminifers.

*** TOTAL DEPTH OF HOLE 286.5 FT ***

BOREHOLE OJT-12

Lat/Long (E/W-1960): 11°36′06.0" N, 162°06′20.9" E

Lat/Long (WGS-1972): 11°36′05.8" N, 162°06′20.8" E

Location (IVY-grid, ft): 124,053 N and 037,527 E

Distance/Bearing from OAK GZ: 1,696 ft, 123.2 deg

Water Depth (H&N): 143.8 ft Hole Depth (bsf): 97.3 ft

Hole Spudded: 06/06/1985 Drilling Ended: 06/07/1985

Sampling: SS, SH Recovery: 57% (53.4 ft)

Logs: GR/NT Date Logged: 06/07/1985

Deviation: No survey run Casing: None set

Drilling Mud/Additives: SEP (120 sx) Drillers: G. Mooney, C. Peltier,

Geologists: B.R. Wardlaw, R.P. Major P. Sacro

Loggers: C.S. Novinskie, A. Reynolds Paleontologists: R.Z. Poore,

Redescribed: 01/30/1986 T.M. Cronin

Depth	Description
0.0 - 3.6	PACKSTONE: skeletal; uncemented; mixed-alteration, dark-yellowish-brown and very pale orange corals and gastropods with chalky and unaltered molluscs, micritized Halimeda, pale-red (5R6/2) Homotrema; very pale orange to pale yellowish brown; graded bed, silt to pebble-sized grains, mostly silt to fine-grained at top, poorly sorted, to mostly medium- to very coarse grained, poorly sorted at bottom, common small pebbles in lower part, scattered burrows(?). Contains dark-colored corals, generally small Seriatopora sticks.
3.6 - 4.3	NO RECOVERY.
4.3 - 5.6	PACKSTONE: as above, graded bed, very pale orange.

5.6 - 6.3	NO RECOVERY.
6.3 - 11.2	PACKSTONE TO GRAINSTONE TO RUDSTONE: mixed-rubble; similar to units above but with more pebbles near base, becoming FLOATSTONE TO RUDSTONE near base, mixing more evident than in overlying units with more pebble-sized lithoclasts that are readily identifiable, spar-replaced coral, sparse moderate-brown and very pale orange corals and gastropods throughout; very pale orange to very pale orange to pale yellowish brown (top to bottom); very poorly sorted at base. Contains moderate-red (5R4/6) Homotrema near base.
11.2 - 12.4	NO RECOVERY.
12.4 - 14.9	FLOATSTONE: rubble-coral, with skeletal WACKESTONE matrix; uncemented; mixed-alteration, spar-replaced coral, lithoclasts with moldic porosity, unaltered molluscs and chalky molluscs; very pale orange; poorly sorted, silt to pebble-sized grains, with common silt to fine-grained constituents. Contains lithoclast with fine, "dogtooth" spar cement.
14.9 - 16.2	NO RECOVERY.
16.2 - 18.5	FLOATSTONE: rubble-coral, matrix, PACKSTONE, skeletal; uncemented; mixed-alteration, sparse crimson Homotrema, spar-replaced corals, chalky corals, unaltered gastropods; very pale orange; unsorted. Lower contact abruptly gradational.
18.5 - 20.4	GRAINSTONE TO PACKSTONE: <u>Halimeda</u> , skeletal; uncemented;

- GRAINSTONE TO PACKSTONE: Halimeda, skeletal; uncemented; unaltered, sparse, small pieces of crimson Homotrema, unaltered molluscs, well-preserved Calcarina spangleri; very pale orange to yellowish gray (5Y7/2), very fine to very coarse grained, mostly very fine to fine-grained. Lower contact abruptly gradational.
- 20.4 20.9 FLOATSTONE: coral, rubble, matrix PACKSTONE, uncemented, mixed-alteration with pale-red (5R6/2) Homotrema, cemented lithoclasts, micritized and partly spar-replaced Halimeda; yellowish gray (5Y7/2); unsorted, silt to pebble-sized grains, upper 0.1 mixed with overlying unit.

Note: Units below 20.9 ft do not appear greatly disturbed, yet no disconformities or normal stratigraphic markers were encountered between 20.9 and 94.2 ft.

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20.9 - 21.7	NO RECOVERY.
21.7 - 28.3	GRAINSTONE: skeletal, foraminifer, Halimeda; uncemented; unaltered, abundant small pieces of crimson Homotrema throughout, unaltered molluscs; very pale orange to grayish orange pink; very fine to very coarse grained, mostly fine-grained, moderately sorted, becoming slightly coarser grained at base. Lower contact gradational.
28.3 - 29.7	PACKSTONE: Halimeda, skeletel; appears to be mixture of units above and below, starting with an increase of Halimeda at top and picking up grayish-green tint of unit below near base; unaltered, pale-red (5R6/2) and crimson Homotrema, pelecypods with nacreous luster; moldic porosity.
29.7 - 31.2	NO RECOVERY.
31.2 - 32.4	WACKESTONE TO PACKSTONE: <u>Halimeda</u> , skeletal; uncemented; unaltered <u>Halimeda</u> , numerous pale-red (5R6/2) <u>Homotrema</u> (no crimson); yellowish-gray (5Y7/2); silt to fine- and very coarse grained. Skeletal elements include micromolluscs, thin finger corals, and foraminifers. Lower contact abruptly gradational.
32.4 - 33.2	PACKSTONE: skeletal; very pale orange; generally similar to unit from 28.3 to 29.7 ft. Lower contact abruptly gradational.
33.2 - 33.7	WACKESTONE: <u>Halimeda</u> ; like unit from 31.2 to 32.4 ft; mixed with overlying PACKSTONE along outer margin of core. Lower contact gradational.
33.7 - 37.7	GRAINSTONE: Halimeda, skeletal; uncemented; apparently unaltered with crimson Homotrema, unaltered molluscs with nacreaous luster, and Halimeda with micritized rind; very pale orange; very fine to very coarse grained, mostly very fine to medium-grained, moderately well-sorted. Lower contact gradational.

37.7 - 39.6

FLOATSTONE: rubble, with skeletal PACKSTONE matrix; mostly uncemented; mixed-alteration, unaltered gastropod with color retention and nacreous luster, micritized Halimeda, completely spar-replaced coral; very pale orange; silt to pebble-sized grains; unsorted, appears gradational with units above and below; rubble mostly corals and molluscs, some lithoclasts, pelecypod with cemented infilling. One coral with minor "tea-brown" stain on exterior. Lower contact apparently gradational.

39.6 - 48.5

FLOATSTONE: rubble; with skeletal PACKSTONE matrix; uncemented; mixed-alteration, mostly altered, common "tea-brown" micrite in corals and lithoclasts, corals chalky and spar-replaced, Porites lutea chalky with some spar-replacement, one completely spar-replaced coral; very pale orange with minor pale yellowish brown and some pale yellowish brown; unsorted, silt to cobble-sized grains, at 39.6 ft lithoclast with "tea brown" micrite horizon beneath heavily chalky and replaced coral, Halimeda, skeletal PACKSTONE with spar-lined gastropod molds, at 46.7 ft Porites sp., chalky with abundant Lithophagus borings, partly micrite-filled and -cemented. Lower contact imperceptably gradational.

48.5 - 54.7

MUDSTONE TO WACKESTONE: upper 0.5 ft WACKESTONE grading downward to MUDSTONE; mollusc; mostly uncemented; moderately altered, molluscs chalky, Halimeda completely micritized, molluscs commonly spar-filled or -lined molds; white to very pale orange; mostly silt-sized grains with coarse grains. Contains burrows, PACKSTONE, skeletal, well-cemented, with sparse spar- and "tea brown"-micrite cement; at 51.1 and 51.4 ft, PACKSTONE-filled burrows with "tea-brown" centers.

54.7 - 67.6

FLOATSTONE: coral, rubble; matrix skeletal MUDSTONE TO WACKESTONE; appears to be mostly in place, mostly broken in sampling; mostly with broken coral and scattered molluscs; uncemented, probably originally poorly to moderately cemented, irregularly cemented; corals chalky with partial spar-replacement, few heavily spar-replaced, chalky molluscs, some spar-lined and -filled (molds), sparse molluscs with attached cemented matrix of pellet MUDSTONE, similar to above (burrows?); white to very pale orange; silt-sized with granule- to cobble-sized corals, molluscs as pebbles.

67.6 - 68.6 NO RECOVERY.

68.6 - 91.4 FLOATSTONE: coral, with skeletal WACKESTONE TO MUDSTONE matrix; uncemented, probably originally poorly cemented to uncemented, irregularly uncemented; skeletal components altered, corals slightly altered with some minor spar-replacement; matrix generally silt to very fine grained sand; white to very pale orange. common Porites sp., heavily bored with Lithophagus, scattered moldic porosity, high-spired gastropods commonly with cemented infilling and spar-linings, matrix commonly with scattered fine Acropora sticks, Bikinastrea at 86.4 ft; Astreopora(?) scattered throughout. 91.4 - 92.0 NO RECOVERY. 92.0 - 93.2 FLOATSTONE: sparse coral, with WACKESTONE matrix; uncemented; corals slightly altered; white to very pale orange. 93.2 - 94.2 NO RECOVERY. [Disconformity indicated by marked increase in cementation and alteration.]

94.2 - 97.3 WACKESTONE: skeletal, coral, pellet; moderately wellcemented in upper part, becoming moderately to poorly
cemented downward; corals completely chalky and partly
dissolved, molluscs chalky and spar replaced, some
pellets dissolved, some spar-replaced; very pale orange
with white mottling (chalky corals and molluscs); mostly
silt and very fine sand; containing few vugs filled with
"dog-tooth"-spar.

*** TOTAL DEPTH OF HOLE 97.3 FT ***

BOREHOLE OKT-13

Lat/Long (E/W-1960): 11°36′09.1" N, 162°06′14.4" E

Lat/Long (WGS-1972): 11°36′08.9" N, 162°06′14.3" E

Location (IVY-grid, ft): 124,362 N and 036,859 E

Distance/Bearing from OAK GZ: 989 ft, 128.8 deg

Water Depth (H&N): 164.7 ft Hole Depth (bsf): 765.0 ft

Hole Spudded: 06/07/1985 Drilling Ended: 06/13/1985

Sampling: SS, SH Recovery: 32% (248.5 ft)

Logs: MCS, GR/DN/CP, GR/NU Date Logged: 06/09/13/1985

Deviation: 0.1 deg @ 200 ft, 1.9 deg @ 300 ft, 3.8 deg @ 470 ft, 3.0 deg

@ 580 ft, 3.7 deg @ 707 ft.

Casing: $8-5/8-in \cdot @ 424 \text{ ft}$, $6-5/8-in \cdot @ 675$ (all casing recovered)

Drilling Mud/Activities: BVS (1,214 sx) Drillers: B. Mooney, C. Peltier,

Geologist: B.R. Wardlaw, R.P. Major P. Sacro

Paleontologists: R.Z. Poore, T.M. Cronin Logger: A. LeBreton

Redescribed: 09/16-17/1985

Depth		Description
0.0 -	0.6	PACKSTONE: skeletal; uncemented; mainly unaltered skeletal material, including moderate-red (5R6/2) Homotrema; very fine grained; yellowish gray (5Y7/2).
0.6 -	1.9	NO RECOVERY.
1.9 -	11.1	GRAINSTONE WITH MUDSTONE AND WACKESTONE: skeletal; uncemented; consisting of mixture of altered and unaltered grains throughout, moderate-red (5R6/4) and pinkish-gray Homotrema fragments, unaltered and chalky Halimeda grains and mollusc fragments, unaltered very pale orange and moderate-yellowish-brown coral clasts. Unit consists of single large graded bed with subunits

as follows: from 1.9 to 2.0 ft, grades from MUDSTONE to WACKESTONE to PACKSTONE with maximum grain size at base very fine grained sand; from 2.0 ft to 6.6 ft, GRAINSTONE, grading progressively from very fine to coarse-grained sand; from 6.6 ft to base, Halimeda, skeletal PACKSTONE, grading progressively to granule-sized particles (maximum) in lower part; very pale orange. SAMPLE: R @ 10.2.

11.1 - 12.3 NO RECOVERY.

12.3 - 26.1 FLOATSTONE: mixed-rubble, matrix PACKSTONE; uncemented; mixed-alteration, containing spar-filled and -replaced corals, scattered medium-gray (phosphatic?) coral fragments, moderate-yellowish-brown corals, unaltered and chalky molluscs, pale-red (5R6/2) Homotrema, spar-infilled gastropod shells; very pale orange; unsorted, silt to pebble-sized with abundant small pebbles and granules; rubble consists of coral fragments, rare lithoclasts with spar and "tea-brown" cement and scattered moderate-yellowish-brown coral sticks, a few scattered mollusc with color retention; from 24.2 ft to 25.4 ft, contains yellowish-gray pieces of uncemented Halimeda PACKSTONE. Lower contact gradational.

SAMPLES: R @ 12.3, 20.1.

GRAINSTONE: Halimeda, mollusc skeletal; uncemented; mixedalteration, pale-red (5R6/2) and moderate-red (5R4/6)
Homotrema, spar- replaced corals, Halimeda with
micritized rind, mostly unaltered molluscs including
whole Olivia shell, unaltered foraminifers, echinoid
spines with color; very pale orange to yellowish gray
(5Y7/2); very fine to coarse-grained, mostly coarseand very coarse grained, very poorly sorted; sparse
lithoclasts of cemented rock with "tea-brown" micrite,

very sparse, dark-gray, phosphatic(?) grains.

PACKSTONE: Halimeda; uncemented; slightly mixedalteration, containing moderately common pale-red (5R6/2) Homotrema, slightly chalky to fresh Halimeda, corroded and largely spar-replaced corals, molluscs with color retention; yellowish gray (5Y7/2) with muddier zones with pale-olive (10Y6/2) tones; silt to fine- and very coarse grained, very poorly sorted, locally muddy. Contains scattered foraminifers and molluscs. SAMPLES: R @ 28.7, 36.0.

42.3 - 53.9 FLOATSTONE: mixed-rubble (coral); skeletal PACKSTONE matrix; uncemented; very pale orange; mixed, mostly moderately altered, some corals spar-replaced, others recrystallized, some pulverized, containing common

chalky molluscs and others with color retention; containing moderately to well-cemented, angular lithoclasts of medium- to coarse-grained PACKSTONE, at 53.5 ft, scattered, well-cemented burrows with "tea-brown" micrite, and medium to very coarse grained, skeletal PACKSTONE. Contains pulverized corals (Astreopora(?) heads) at 44.3 to 44.6 ft and from 49.6 to 49.9 ft. SAMPLE: R @ 51.8.

53.9	_	55.0	NO RECOVERY.
55.0	-	62.6	PACKSTONE: foraminifer, skeletal; generally uncemented with small moderately cemented nodules; slightly to moderately altered, with pale-yellowish-orange foraminifers, chalky molluscs, one spar-replaced Acropora stick; upper part containing silt-to-coarse grained sand, becoming less muddy downward, becoming medium- to coarse-grained in lower 1.0 ft. Contains large moderately cemented nodule at 55.2 ft of tight foraminifers, skeletal PACKSTONE with "tea-brown" micrite and spar cement. SAMPLE: R @ 60.0.
62.6	-	68.2	PACKSTONE: coral, skeletal; uncemented; slightly altered, chalky gastropod shells, corals recrystallized, partly spar-replaced in upper part, corroded; very pale orange to white; poorly sorted, silt- to pebble-sized. Lower contact gradational.
68.2	-	80.0	WACKESTONE: coral, mollusc; mostly uncemented; moderately altered, molluscs white and chalky, one gastropod with partially cemented infilling, corals recrystallized; white to very pale orange; silt to coarse-grained sand, mostly silt to fine-grained sand; sparse cemented PACKSTONE-filled burrows. Contains several types of whole gastropod shells; Astreopora head from 74.3 - 74.6 ft, scattered Acropora sticks.
80.0	-	81.7	NO RECOVERY.
81.7		85.0	FLOATSTONE: rubble, coral; PACKSTONE matrix; uncemented; corals recrystallized, partly spar-replaced; very pale orange; poorly sorted; large spar-replaced coral head (pulverized) from 84.7 - 85.0 ft.
85.0	-	88.7	PACKSTONE: pelecypod, <u>Halimeda</u> , foraminifer; generally uncemented; <u>Halimeda</u> slightly chalky, molluscs slightly chalky, many with some color retention, slightly chalky;

yellowish gray (5Y7/2). Contains Amphistogina, small thin-shelled pelecypods, scattered Caridum and several types of small gastropods. Note: pelecypods fractured but gastropods not fractured. Lower contact gradational.

88.7 -	- 90.4	NO RECOVERY.
90.4 -	- 102.9	PACKSTONE: Halimeda ; generally uncemented, containing poorly cemented pieces; Halimeda chalky, becoming very chalky, slightly disaggregated downward; very pale orange, containing scattered well-cemented burrows(?).
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[Disconfo	ormity indi	cated by marked change in color and presence of phosphatic(?)
102.9	- 106.2	PACKSTONE: coral, mollusc; poorly cemented to moderately cemented, with minor grains impregnated with phosphatic(?) material; corals recrystallized with phosphatic(?) exteriors, molluscs chalky with minor color retention; light olive gray (5Y6/1) with dark-greenish-gray (5GY4/1) tones with dark-gray grains decreasing downward; poorly sorted, silt to granule- to pebble-sized at top, becoming finer grained downward; moldic porosity in corals. Contains common Porites lutea from 102.9 to 103.6 ft with medium-bluish-gray exterior stain; several types of molluscs.
106.2 -	- 108.4	NO RECOVERY.
108.4 -	118.2	PACKSTONE: pelecypod; uncemented with scattered moderately cemented nodules and infillings more common near base; molluscs chalky with some color retention, corals recrystallized; very pale orange in upper part, becoming very pale orange to grayish orange at base. Contains small Favia at top; several types of pelecypods, Cardium at 112.5 ft, Arca at 110.1 ft; several small gastropods.
118.2 -	120.8	NO RECOVERY.
120.8 -	. 124.4	PACKSTONE: foraminifer; generally uncemented; chalky molluscs, pale-yellowish-orange, recrystallized foraminifers; very pale orange; mostly fine to mediumgrained. Contains pebble-sized, moderately cemented nodules in lower 0.5 ft. Lower contact gradational.
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124.4 - 125.5 PACKSTONE: mollusc, skeletal, <u>Halimeda</u>; uncemented; molluscs chalky, <u>Halimeda</u> very chalky; very pale orange; silt- to granule-sized, mostly fine- to medium-grained.

125.5 - 127.0 NO RECOVERY.

FLOATSTONE: coral; skeletal, mollusc PACKSTONE and
WACKESTONE matrix; muddy intervals from 133.2 - 133.6 ft
and 139.3 - 142.7 ft; generally uncemented, containing
minor poorly cemented nodules with molds from top to
131.1 ft; corals slightly altered, molluscs very chalky,
minor spar-filled; very pale orange with muddier
intervals very pale orange to white. Corals include
Porites lutea from top to 127.4 ft, small heads of
Astreopora(?) at 133.5, 140.2, 145.7, 148.6, 151.7 ft;
small heads of Porites sp. at 140.5, 154.8, and 158.0
ft; Acropora cuneata at 136.4 ft; scattered small coral
sticks throughout; Fungia at 145.8 ft, Goniolithon(?) at
131.0 ft. Corals in upper part of unit are badly
fractured in upper part of unit; unit may be rubblized.

Lower contact gradational. SAMPLE: T @ 131.0.

158.3 - 161.8 PACKSTONE: coral, mollusc; generally uncemented;
moderately altered with corals slightly recrystallized,
molluscs chalky; very pale orange with dark-gray,
phosphatic(?) ("salt-and-pepper") sand grains throughout
unit; contains silt to coarse-grained particles, poorlysorted with granule and very coarse skeletal

fragments. Lower contact obscured.

[Disconformity indicated by reworked, phosphatic(?) grains in overlying unit and presence of "tea-brown" micrite scattered below this point.]

FLOATSTONE: coral; skeletal PACKSTONE matrix; corals slightly altered, sparsely partly spar-replaced, molluscs chalky, some spar-filled near top; very pale orange; silt- to pebble-sized material, unsorted.

Contains scattered "tea-brown" micrite in upper 0.7 ft; sparse from 209.2 - 209.9 ft; sparse spar as mollusc pore-fillings, more common in upper part; corals and molluscs appear slightly more altered in upper 0.7 ft, one heavily micritized coral with "tea-brown" patchy exterior; some moderately cemented, pebble-sized pieces scattered thoughout unit. Contains large Tridacna at 167.9, 176.9, and 196.4 ft; Porites common with Porites lutea at 164.7, 177.0, 182.9 (with coralgal crust), 195.4, 197.6, 203.8, and 212.9 ft.

219.3 - 221.0 NO RECOVERY.

221.0	- 23	PACKSTONE WITH GRAINSTONE: generally gastropod, skele PACKSTONE with zone from 224.6 - 225.4 ft becoming foraminifer GRAINSTONE; generally uncemented, with scattered, moderately cemented, PACKSTONE-filled burrows; molluscs slightly chalky, some with nacreo layer preserved; foraminifers white; very pale oran mostly medium- to coarse-grained, poorly sorted; containing sparse "salt-and-pepper" grains from 227 227.9 ft. Contains scattered corals; common small strombids, scattered small whelks, sparse broken pelecypods.	ous ige;
230.5 -	- 23	8 CORAL HEADS: coral, skeletal, mollusc, muddy PACKSTON matrix; uncemented; unaltered; very pale orange. Contains 50% small <u>Porites</u> <u>lutea</u> heads, small branc coral.	
235.8 -	- 24	PACKSTONE: skeletal, forminifer, mollusc; uncemented; molluscs slightly chalky with minor nacreous layer preserved, some with spar infilling, some gastropod with partial cemented matrix infilling and commonly spar-infilling remaining void (geopetal structure); corals slightly recrystallized to partly spar-repla one near top of unit partly dissolved and infilled sediment and cemented with "tea-brown" micrite; ver pale orange to white; silt- to pebble-sized, mostly silt- and very fine- to fine-grained; top to 238.3 contains Acropora sticks and Favia fragments and la gastropods. Lower contact gradational.	s with ced, with
241.6 -	- 24	WACKESTONE: skeletal, mollusc, <u>Halimeda</u> ; uncemented; slightly altered skeletal components; very pale ora to white.	inge
242.5 -	- 24	1 NO RECOVERY.	•
244•1 -	- 24	FLOATSTONE: coral; mollusc, skeletal PACKSTONE matrix uncemented; molluscs slightly chalky, corals slight altered; very pale orange; silt- to pebble-sized material, mostly very fine to medium-grained; very orange. Contains numerous pebble-sized Porites lut heads, sparse abraded and bored coral sticks, small whelk.	ly pale ea
245.0 -		2 NO RECOVERY. * * * * * * * * * * * * * * * * * * *	

[Disconformity based on marked change in alteration of skeletal components and increase of cementation and presence of "tea-brown" micrite below horizon.]

247.2 - 258.0 FLOATSTONE: coral; skeletal, mollusc PACKSTONE matrix; upper part moderately cemented with "tea-brown" micrite, becoming poorly cemented, irregularly cemented downward below 248.0 ft; molluscs chalky, uppermost coral (Favia? sp.) completely spar-replaced with upper surface covered with "tea-brown" micrite; corals becoming less-altered downward with very sparse spar infilling; very pale orange.

258.0 - 259.5 NO RECOVERY.

259.5 - 266.6

FLOATSTONE: coral (Seriatopora), with skeletal WACKESTONE matrix; generally uncemented with sparse moderately cemented nodules; corals micritized, partly spar-replaced, molluscs chalky; very pale orange; mainly silt to very fine grained; becoming skeletal, foraminifer WACKESTONE from 265.7 ft to base. Contains abundant Seriatopora sticks throughout upper part, broken commonly in 0.025 - 0.050 ft lengths, abundant pelecypods (broken) in lower part; large Tridacna shell at top.

[TOP OF SEDIMENT PACKAGE 3. Disconformity based on increase in cementation, increase in skeletal alteration, and common "tea-brown" filled rhizoliths on coral head at top of underlying unit.]

266.6 - 323.6 FLOATSTONE WITH CORAL HEADS: generally coral FLOATSTONE; pervasively recrystallized skeletal WACKESTONE matrix; corals altered, recrystallized, few spar-replaced and -infilled; unit probably well-cemented; highly moldic and vuggy; very pale orange, becoming very pale orange with minor grayish-orange tones from about 317.3 ft to base; very pale orange mottled with very pale orange to pale-yellowish-brown from 271.6 - 281.8 ft and scattered throughout; most corals in upper 3.6 ft with dendritic patterns of "tea-brown" micrite on most surfaces and on scattered mollusc shells; "tea-brown" micrite becoming sparse by 270 ft. Contains abundant molluscs preserved only as molds; some corals preserved and recrystallized (only Porites <u>lutea</u> easily recognizable with heads at 284.5, 297.0, 299.7 ft, and 311.5 - 312.5 ft; Acropora sp. at 302.7 ft; Seriatopora sticks (molds only) scattered throughout.

323.6 - 365.3 FLOATSTONE: coral; pervasively recrystallized skeletal WACKESTONE(?) matrix; similar to unit above but with extensively spar-replaced corals and spar-lined and -filled molds and vugs throughout unit; unit dominated

by spar; unit badly broken, probably very well cemented throughout but with extensive molds and vugs, completely to partially infilled; generally moderate yellowish brown to pale yellowish brown with former color dominating sparry zones. Contains spar-replaced Porites lutea head at top, spar-replaced Favia(?) or Astreopora at 326.0 ft. Lower contact gradational.

365.3 - 367.6 NO RECOVERY.

367.6 - 399.3

FLOATSTONE: coral; skeletal WACKESTONE(?); unit originally well-cemented (now broken by sampling), extensively recrystallized in upper part, becoming moderately cemented, irregularly cemented downward, probably moderately to poorly cemented at base; unit containing large coral molds throughout, becoming slightly chalk-filled in lower part; pale yellowish brown with minor grayish-orange mottling in upper part, becoming pale yellowish brown with very pale orange mottling in lower part. Contains sparse small mollusc molds throughout; common Seriatopora and sparse Acropora sticks throughout.

[Disconformity suggested by increase in alteration of skeletal components, which includes spar-infilling and -replacement of corals.]

399.3 - 414.3

FLOATSTONE: coral; skeletal WACKESTONE(?) matrix; well-cemented; strongly altered, with corals partly dissolved, partly spar-replaced and -infilled; very pale orange to pale yellowish brown with very pale orange mottling in upper part; grayish-orange to moderate-yellowish-brown spar; abundant moldic and vuggy porosity, probably mostly corals. This unit appears more altered than unit above. Contains small coral head from 399.3 - 399.7 ft; small Astreopora(?) head completely spar-replaced from 414.0 - 414.3 ft.

414.3 - 416.4 NO RECOVERY.

416.4 - 432.9

PACKSTONE TO WACKESTONE(?): coral, skeletal, mollusc; corals completely dissolved, disaggregated, minor spar replacement; remaining macrofossils preserved as molds; probably moderately to well-cemented, now broken up badly with collapse of corals partly induced by hammer sampling; unit largely represented by sand- and small pebble-sized particles. Contains very poorly preserved, large, cemented sediment-filling of large articulated pelecypod at 422.3 ft.

432.9 - 434.8	NO RECOVERY.
434.8 - 456.7	PACKSTONE: skeletal; poorly cemented in upper part, becoming less-cemented downward to uncemented by base, irregularly cemented with up to 30 percent small diagenetic nodules throughout; corals recrystallized, chalky, molluscs preserved as molds in upper part of unit, some with chalky shell material downward, with cemented infillings; very pale orange; silt to very coarse grained, mostly very fine grained; "dog-tooth" spar at 438.3 ft. From 450.3 - 450.5 ft, contains angular (discordant) moderate-brown sand dike. Corals include sparse, small Acropora sticks and fragment of Porites andrewsi-type(?).
456.7 - 458.8	
458.8 - 462.8	uncemented; corals chalky and one at top completely spar-replaced, molluscs very chalky to chalky; very pale orange; silt to very coarse grained, mostly very fine to medium-grained. Contains spar-replaced <u>Porites</u> sp. from 459.4 - 459.7 ft, common small acroporid heads throughout.
462.8 - 465.1	NO RECOVERY.
465.1 - 481.2	PACKSTONE: upper part to 471.2 ft foraminifer, mollusc, skeletal, becoming mollusc, skeletal below; uncemented; molluscs relatively unaltered to slightly chalky throughout; very pale orange; generally fine- to coarse-grained, mostly coarse-grained, poorly sorted in upper part, becoming muddy, very fine to fine-grained matrix with abundant large molluscs from 474.2 - 477.2 ft, very fine grained, muddy from 477.2 ft to base. Contains unbroken, thin-shelled pelecypod at top, large bored Strombus at 474.9 ft, other types of molluscs throughout; small very sparse coral sticks scattered in lower part.
481.2 - 483.4	NO RECOVERY.

483.4 - 487.5 FLOATSTONE: coral; matrix skeletal, mollusc PACKSTONE; uncemented; skeletal material slightly altered; very pale orange; silty to coarse-grained, mostly fine- to

medium-grained; very poorly sorted; tight FLOATSTONE to 486.4 ft, becoming sparse FLOATSTONE downward. Contains small <u>Porites</u> sticks, <u>Acropora</u> sticks, and sparse <u>Dictyaraea</u>; several types small gastropods.

487.5 -	-	489.5	NO RECOVERY.
489.5 -		513.8	FLOATSTONE: coral with skeletal, mollusc WACKESTONE TO PACKSTONE matrix; uncemented; most skeletal components slightly altered; very pale orange; silt to mediumgrained, mostly silt. Contains small Porites heads at 501.3 ft and 507.1 ft; large Porites lutea head from 510.1 - 510.4 ft; small Astreopora(?) head at 495.5 ft; abundant Acropora sticks throughout.
513.8 -	-	515.9	NO RECOVERY.
515.9 -	•	537.1	FLOATSTONE: coral; skeletal, mollusc PACKSTONE TO WACKESTONE matrix; uncemented; corals and molluscs slightly chalky; very pale orange; silt to coarsegrained, mainly very fine to fine-grained; alternating intervals of sparse and tight FLOATSTONE. Contains large Porites sp. head from 530.3 - 530.9 ft; scattered small Porites heads throughout; abundant small Acropora sticks, small Porites andrewsi-type head at 519.0 ft, very sparse small sticks of Dictyaraea and Seriatopora.
537.1 -	-	539.1	NO RECOVERY.
539.1 -	-	542.4	WACKESTONE: skeletal; uncemented; gastropod shells with nacreous layers preserved; mostly silt size, minor very fine grained sand; moderately well-sorted; very pale orange. Contains few macrofaunal elements.
542.2 -	-	561.7	PACKSTONE: muddy, skeletal, coral; becoming coral FLOAT-STONE from 551.4 - 552.2 ft; uncemented except for well-cemented diagenetic nodules and small rounded burrows; skeletal components slightly altered; very pale orange; unit muddy, silt to fine-grained sand. Contains small acroporid sticks and other small sticks, including Seriatopora and Dictyaraea, small fish tooth at 545.4 ft.
561.7 -	-	563.8	NO RECOVERY.

563.8 -	567.8	WACKESTONE: skeletal; uncemented, except for scattered, small PACKSTONE-filled, pelleted(?) burrows, especially toward base; silt to fine-grained sand, well-sorted, becoming slightly coarser downward; very pale orange. Contains few macrofossils, abundant microfauna.
567.8 -	570.0	NO RECOVERY.
570.0 -	573.8	PACKSTONE: coral, mollusc, skeletal; uncemented with scattered, small cemented burrows; skeletal components unaltered, gastropod with color retention, nacreous layer preserved; silt to medium-grained sand; pale yellowish brown. Contains small <u>Dictyaraea</u> , <u>Seriatopora</u> , and small solitary coral; <u>Cypraea</u> and other gastropods; sparse <u>acroporid</u> sticks.
573.8 -	576.1	NO RECOVERY.
576.1 -	595.4	PACKSTONE WITH FLOATSTONE: skeletal PACKSTONE with sparse coral FLOATSTONE from 585.4 - 585.6 ft; unit contains sparse well-preserved molluscs; mostly pale yellowish brown to dark yellowish brown. Contains sparse gastropods, scattered corals in FLOATSTONE interval, but including Seriatopora, Dictyaraea, and small acroporid; small piece of lignitic plant tissue at 589.0 ft.
595.4	597.5	NO RECOVERY.
597.5 -	598.5	WACKESTONE: coral, skeletal; uncemented; unaltered skeletal components; pale yellowish brown; very fine grained sand and silt. Contains sparse acroporid sticks and Seriatopora.
598.5 -	600.6	NO RECOVERY.
600.6 -	601.1	FLOATSTONE: coral; skeletal WACKESTONE matrix; uncemented; unaltered skeletal components; pale yellowish brown. Contains Seriatopora, Dictyaraea, and acroporids. Lower contact gradational.

TOP OF SEDIMENT PACKAGE 5.

601.1 -	604.3	WACKESTONE: mollusc, skeletal; generally uncemented with 30% moderately cemented, small nodules from 601.1 - 601.4 ft, sparser to base; unaltered skeletal components; pale yellowish brown. Contains mostly broken mollusc shells; lignitic wood fragment in nodule at 601.2 ft.
604.3 -	606.5	NO RECOVERY.
606.5 -	641.5	PACKSTONE: (locally lignitic) skeletal, mollusc, coral; locally approaching sparse coral FLOATSTONE; uncemented; unaltered skeletal components; generally dark yellowish brown to pale yellowish brown with zone dark yellowish brown to moderate yellowish brown from 616.1 - 620.9 ft; generally very fine to fine-grained matrix; unit contains 10 percent lignitic material from 630.8 - 635.7 ft. Contains large Cypraea at 620.9 ft, scattered other gastropods; corals include very sparse Porites andrewsitype, Acropora sp., and others.
641.5 -	645.5	NO RECOVERY.
645.5 - (666.6	PACKSTONE: skeletal, mollusc, coral; uncemented; unaltered skeletal components, gastropods with nacreous layer preserved; moderate yellowish brown; silt to coarsegrained, mainly very fine to fine-grained, moderately sorted. Contains several types of small gastropods and pelecypods, sparse corals, including Porites andrewsitype .
666.6 - 6	670.7	NO RECOVERY.
670.7 - 6	671.3	CORAL HEAD: <u>Favia(?)</u> in growth position; unaltered; moderate yellowish brown. Broken by sampling.
671.3 - 0	676.6	PACKSTONE: skeletal, mollusc; uncemented; unaltered, skeletal components; moderate yellowish brown to pale yellowish brown. Contains several types small gastropods, small Porites andrewsi-type head at 676.3 ft.
676.6 - 6	680.8	NO RECOVERY.

680.8 -	702.4	PACKSTONE AND FLOATSTONE: skeletal, coral, mollusc PACKSTONE interbedded with coral FLOATSTONE with same matrix; FLOATSTONE from 696.0 - 696.7 and 701.6 - 702.2 ft; uncemented; unaltered skeletal material with nacreous layer preserved on molluscs; generally very fine to medium-grained matrix; dark yellowish brown to pale yellowish brown with moderate-yellowish-brown tones. Contains scattered gasropods; Porites lutea heads from 696.0 - 696.7 ft, small Favia head from 701.6 - 702.0 ft; common Seriatopora, small Porites sticks.
707.4 -	711.6	NO RECOVERY.
711.6 -		CORAL HEAD: Porites lutea head in growth position; moderate yellowish brown.
712.1 -	716.6	NO RECOVERY.
716.6 -	727.7	PACKSTONE WITH FLOATSTONE: mollusc, skeletal, coral; uncemented; unaltered skeletal components; pale yellowish brown to dark yellowish brown; generally very fine to medium-grained matrix. Contains several types small molluscs, large worm tube at 717.0 ft, small Porites lutea head at 727.2.
727.7 -	731.6	NO RECOVERY.
731.6 -	741.8	WACKESTONE: skeletal, mollusc, coral; uncemented; unaltered; pale yellowish brown; more skeletal material in top and basal parts, muddier from 736.7 - 737.2 ft. Contains scattered, very small Porites heads.
741.8 -	765.8	PACKSTONE WITH FLOATSTONE: mollusc, coral, skeletal PACKSTONE with sparse coral FLOATSTONE from 760.1 - 760.8 ft; generally uncemented but with 30 percent medium diagenetic nodules from 746.0 - 746.4 ft; some molluscs with nacreous layer preserved, some slightly chalky; Acropora slightly recrystallized. Contains several types small gastropods and pelecypods, piece of large Strombus at 742.3 ft; corals include scattered Acropora sticks, scattered Dictyaraea.

*** TOTAL DEPTH OF HOLE 765.8 FT ***

OLT-14

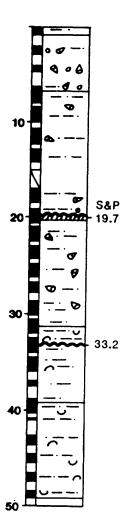


PLATE 19

* Unavoidably, the MOS navigator was not aboard the Knut Constructor while borehole OLT-14 was being drilled. Therefore, the IVY-grid, E/W, and WGS coordinates given on p. 391 are best estimates based both on the position of the ship relative to several nearby prominent submarine features and to the distance and direction that the drill ship was moved from the previous borehole.

BOREHOLE OLT-14

Lat/Long (E/W-1960): 11°36'01.2" N, 162°06'30.5" E*

Lat/Long (WGS-1972): 11°36'01.0" N, 162°06'30.5" E*

Location (IVY-grid, ft): 123,569 N and 038,473 E*

Distance/Bearing from OAK GZ: 2,754 ft, 120.8 deg

Water Depth (H&N): 139.7 ft Hole Depth (bsf): 49.2 ft

Hole Spudded: 06/14/1985 Drilling Ended: 06/14/1985

Sampling: SS, SH Recovery: 55% (27.1 ft)

Logs: None run Deviation: No survey run

Drilling Mud/Additives: BVS (11 sx), Casing: No casing set

PAD (9 gals), DFM (1 gal) Drillers: G. Mooney, C. Peltier,

Geologists: B.R. Wardlaw, R.P. Major P.Sacro

Paleontologists: R.Z. Poore, T.M. Cronin Redescribed: 01/30/1986

*Note: See bottom of preceeding page for footnote.

Depth	Description
0.0 - 0.9	PACKSTONE: skeletal, Halimeda; uncemented; mixed- alteration, generally slightly altered, Halimeda chalky, sparse molluscs with nacreous luster and color retention, pale-red (10R6/2) Homotrema encrusting Porites lutea; yellowish-gray (5Y7/2) to very pale orange; silt to very coarse grained, poorly to moderately sorted, scattered "salt-and-pepper" sand grains; with sparse pebble-sized corals, mostly fine- to medium-grained.
0.9 - 2.2	NO RECOVERY.
2.2 - 6.8	RUDSTONE TO FLOATSTONE: rubble (coral with minor lithoclasts); uncemented; mixed-alteration, nacreous luster on large pelecypod fragments, pale-red (10R6/2) and moderate-red (5R4/6) Homotrema, chalky and crisp Halimeda. Contains heavily bored and slightly recrystallized Porites sp. bored with Lithophagus and pale-red (10R6/2) polychaete worm tubes; mostly very

pale orange with minor olive gray (5Y4/1) tones; unsorted, mostly pebble- to cobble-sized lithoclasts include olive-gray (5Y4/1), phosphatic, cemented PACKSTONE from below first disconformity(?), and well-cemented, skeletal, Halimeda PACKSTONE rubble. Contains two inverted Porites sp. heads.

6.8 - 19.7

WACKESTONE: skeletal, coral, <u>Halimeda</u>; uncemented; unaltered, <u>Halimeda</u> crisp, crimson octocoral fragments, grayish-green (106Y5/2) <u>Heliopora</u>, sparse crimson <u>Homotrema</u>, mostly unaltered molluscs with at least some color retention, foraminifers unaltered; yellowish-gray (5Y7/2) to white, becoming yellowish-gray (5Y7/2) downward; silt- to pebble-size grains, mostly silt to fine, corals as pebbles, mostly <u>Porites</u>, commonly bored; from 17.8 ft to base of unit, dark-gray ("salt-and-pepper") sand grains increase in abundance, containing one dark-gray lithoclast reworked from unit below, grains increase in size downward from coarse-grained sand to granule and small pebble-sized material. Lower contact apparently sharp.

[TOP OF SEDIMENT PACKAGE 2. Disconformity indicated by increase in alteration, partial cementation, presence of reworked phosphatic(?) grains in overlying unit, and marked color change.]

19.7 - 20.3

PACKSTONE: mollusc, skeletal; partially cemented; phosphatic(?), slightly altered, some molluscs chalky, some with cemented PACKSTONE infilling, partial color retention; greenish-gray (5GY6/1), mottled with specks of dark gray; silt to very coarse grained, mostly fine-to very coarse grained; minor moldic porosity; serpulid worm tube on surface of cemented matrix. Lower contact abruptly gradational.

20.3 - 31.3

PACKSTONE: Halimeda, coral, skeletal; poorly cemented; irregularly cemented Halimeda chalky, corals recrystallized or partially recrystallized or sparsely sparreplaced; very pale orange; silt to very coarse to pebbles (corals), mostly fine- to medium-grained; poorly to moderately sorted; corals commonly bored; rock preserved as uncemented matrix and cemented granules and pebbles probably broken in sampling; minor moldic, interparticle and shelter porosity; dark-gray ("salt-and-pepper") (phophatized?) grains from 22.2 - 22.4 ft common in matrix. Contains diverse coral fauna. Lower contact apparently gradational.

31.3 - 33.2 WACKESTONE: mollusc, <u>Halimeda</u>; uncemented; molluscs partly chalky, with some color retention, <u>Halimeda</u> chalky (some not completely); yellowish gray (5Y7/2); silt to very coarse grained, mostly silt to medium-grained; moderately to poorly sorted; some molluscs heavily bored. Contains small <u>Porites lutea</u> head at 32.6 ft bored with Lithophagus.

[Disconformity indicated by increase in cementation and alteration and presence of "tea-brown" micrite.]

PACKSTONE: skeletal, mollusc; moderately to poorly cemented, better cemented in upper 0.3 ft; molluscs chalky and white, Halimeda chalky, moldic, some molluscs bored, becoming less altered downward; very pale orange to yellowish gray (5Y7/2) with faint light-brown (5YR6/4) mottling; silt to very coarse grained, mostly coarse—to very coarse grained; moderately to poorly sorted; containing common scattered "tea-brown" micrite in matrix from 35.3 - 35.5 ft, sparse elsewhere in unit; minor moldic porosity, common interparticle porosity. Lower contact gradational.

WACKESTONE: mollusc, skeletal; poorly cemented; molluscs with nacreous layer preserved, some slightly chalky, some molluscs with color retention and some with dull luster, most molluscs white, grayish-pink Homotrema, corals partially recrystallized; very pale orange to white; silt to very coarse grained, mostly silt to fine-grained; moderately to poorly sorted with scattered cemented patches of matrix; interparticle and minor moldic porosity. Contains common, medium-sized gastropods, scattered small corals.

*** TOTAL DEPTH OF HOLE 49.2 FT ***

BOREHOLE OMT-15

Lat/Long (E/W-1960): 11°36′05.2" N, 162°06′26.4" E

Lat/Long (WGS-1972): 11°36′05.1" N, 162°06′26.3" E

Location (IVY-grid, ft): 123,974 N and 038,068 E

Distance/Bearing from OAK GZ: 2,204 ft, 117.2 deg

Water Depth (H&N): 110.9 ft Hole Depth (bsf): 76.6 ft

Hole Spudded: 06/15/1985 Drilling Ended: 06/15/1985

Sampling: SS, SH Recovery: 48% (36.7 ft)

Logs: GR/NT Date Logged: 06/15/1985

Deviation: No survey run Casing: None set

Drilling Mud/Additives: BVS (14 sx), Drillers: G. Mooney, C. Peltier,

PAD (14 gals), DFM (1.5 gals)
P. Sacro

Geologists: B.R. Wardlaw, R.P. Major Logger: A. LeBreton

Paleontologists: R.Z. Poore, T.M. Cronin Redescribed: 01/30/1986

Depth Description

Note: The hole was unstable, and almost every run contained some fall-in at the tops.

0.0 - 8.9

FLOATSTONE: coral, lithoclast (rubble), with mollusc, skeletal PACKSTONE matrix; uncemented; mixed—alteration, containing common pebbles and granules of phosphatic(?) PACKSTONE, some unaltered molluscs (nacreous luster, colorful), some chalky; mostly very pale orange to light olive gray (5Y6/1) with darker grains; silt to very coarse grained, mostly fine— to medium—grained, poorly sorted; lithoclasts mostly PACKSTONE, moderately cemented, texture similar to matrix but most with dark—gray phosphate grains and some with "tea-brown" micrite; Porites lutea at 4.3 and 8.6 ft (large pebbles); living Halimeda and other algae in upper two samples.

8.9 - 10.6 NO RECOVERY.

10.6 - 15.5

PACKSTONE: mollusc, skeletal, lithoclast (sparse rubble); uncemented; mixed-alteration, most molluscs unaltered, Halimeda generally unaltered, lithoclasts with chalky and partly dissolved Halimeda grains; very pale orange at top grading to light-olive-gray (5Y6/1) at bottom, with scattered dark-gray grains; silt to coarse-grained, mostly medium- to coarse-grained; moderately sorted; pebble-sized lithoclasts of phosphatic(?) PACKSTONE like in overlying unit with interparticle and minor moldic porosity; sparse elongate cemented burrows, similar to matrix. Contains Mytilus, Conus, abundant other gastropods.

15.5 - 16.9 NO RECOVERY.

16.9 - 28.5

FLOATSTONE TO RUDSTONE: rubble, with skeletal PACKSTONE matrix, grading to PACKSTONE from 27.6 ft to base; uncemented; mixed-alteration, mostly altered, chalky Halimeda, partly dissolved chalky coral with some sparinfilling and minor spar-replacement, scattered corals heavily spar-replaced, one unaltered mollusc fragment at 25.3 ft; very pale orange; silt to very coarse grained; unsorted with pebble-sized rubble; rubble is poorly to moderately cemented coral, Halimeda, skeletal PACKSTONE, with interparticle porosity and some intraparticle porosity in corals.

28.5 - 29.4 NO RECOVERY.

29.4 - 29.9

GRAINSTONE: skeletal, <u>Halimeda</u>; uncemented; slightly altered, recrystallized (white) foraminifers (Amphistogina), <u>Halimeda</u> mostly unaltered, some chalky, most molluscs chalky (white) but some with dull luster; very pale orange (slightly darker than unit above); fine- to very coarse grained, mostly medium- to coarse-grained; moderately to poorly sorted; small cemented elongate tubes (burrows) near top of unit (like matrix). Contains scattered sand-sized, "salt-and-pepper" grains.

[TOP OF SEDIMENT PACKAGE 2. Disconformity indicated by phosphatic(?) zone and change in color, increase in cementation and alteration of skeletal components in underlying unit, and reworked grains in overlying unit.]

29.9 - 30.1 PACKSTONE: skeletal; poorly cemented, phosphatic(?); molluscs slightly chalky; olive-gray (5Y4/1) with dark-gray grains; silt to very coarse grained, mostly medium-

to coarse-grained. Note: fragments of this unit occur in upper part of run at 49.3 ft (fall in), and consist of moderately cemented rock.

30.1 - 48.6

PACKSTONE: Halimeda, skeletal; poorly cemented to uncemented (sparse patches of cemented matrix); Halimeda mostly chalky, mostly white; silt to very coarse grained, mostly fine-grained, becoming coarser grained downward; very pale orange to white. Note: appreciable "fall in" at top of sampling runs. SAMPLE: T @ 43.3 (fall-in from 29.9 to 30.1 ft.)

48.6 - 49.2 NO RECOVERY.

49.2 - 53.9 PACKSTONE: (tight) Halimeda, skeletal, foraminifer; uncemented to poorly cemented; Halimeda chalky, molluscs chalky but with dull luster (white); white to yellowish gray (5Y7/2); silt to very coarse grained, mostly coarse grained; moderately sorted. Contains Cerithius at 49.8 ft. Lower contact sharp.

[Possible disconformity; subtle, based on slight increase in cementation and alteration and presence of minor "dog-tooth" spar below.]

PACKSTONE: mollusc, skeletal; poorly to moderately cemented, becoming poorly cemented near base; minor "dog-tooth" spar at top; molluscs mostly colorful, nacreous luster preserved in most molluscs, dull luster in some; Halimeda chalky, foraminifers unaltered; light yellowish gray (5Y7/2) to white; silt to very coarse grained, mostly fine- to medium grained; minor interparticle and minor moldic porosity in lower part of unit. Contains large, well-preserved Cardium; most mollusc fragments are Mytilus.

PACKSTONE: skeletal, coral; poorly to moderately cemented, irregularly cemented; moderately altered, <u>Halimeda</u> completely chalky and disintegrating, corals very chalky and some disintegrating with minor scattered sparreplacement, some molluscs as steinkerns; very pale orange; silt to very coarse grained, mostly coarsegrained. Contains <u>Lithophagus</u> steinkern at 61.6 ft. Small Astreopora(?) from 63.8 - 64.1 ft, small Porites

sp., and Acropora sticks.

71.0 - 72.6 NO RECOVERY.

[Disconformity; indicated by presence of "tea-brown" micrite and phosphatic(?) grains.

72.6 - 73.9

PACKSTONE: mollusc, skeletal; uncemented to poorly cemented; corals chalky, pelecypods chalky but with minor color retention, Halimeda chalky; yellowish gray (5Y7/2) with dark-gray (phasphatic?) grains; silt to very coarse grained, mostly fine- to medium-grained; moderately to poorly sorted. Contains common Mytilus.

73.9 - 75.5 NO RECOVERY.

75.5 - 76.6

PACKSTONE: skeletal; poorly cemented with "tea-brown" micrite scattered throughout, slightly increasing toward bottom of unit; skeletal components altered, Halimeda completely chalky, molluscs white with dull luster; very pale orange to moderate yellowish brown to grayish orange; silt to very coarse-grained; moderately to poorly sorted.

*** TOTAL DEPTH OF HOLE 76.6 FT ***

BOREHOLE ONT-16

Lat/Long (E/W-1960): 11^o36'07.6" N, 162^o06'23.4" E

Lat/Long (WGS-1972): 11^o36'07.4" N, 162^o06'23.3" E

Location (IVY-grid, ft): 124,215 N and 037,767 E

Distance/Bearing from OAK GZ: 1,827 ft, 114.8 deg

Water Depth (H&N): 135.1 ft Hole Depth (bsf): 152.3 ft

Hole Spudded: 06/15/1985 Drilling Ended: 06/16/1985

Sampling: SS, SH Recovery: 48% (36.7 ft)

Logs: GR/NT Date Logged: 06/16/1985

Deviation: No survey run Casing: None set

Drilling Mud/Additives: BVS (16 sx), Drillers: G. Mooney, C. Peltier

PAD (6 gals), DFM (2 gals)

P. Sacro

Geologists: B.R. Wardlaw, R.P. Major Logger: A. LeBreton

Paleontologists: R.Z. Poore, T.M. Cronin Redescribed: 01/30/1986

Description Depth 0.0 - 12.9 PACKSTONE TO FLOATSTONE: coral, mixed-rubble; uncemented; mixed-alteration, fresh to chalky corals, molluscs unaltered, colorful to dull, white, chalky Halimeda; very pale orange; silt to pebble-sized particles; moderately to poorly sorted near top becoming unsorted near base of unit. Lithoclasts mostly moderately to well-cemented, skeletal PACKSTONE, containing scattered phosphatic(?) grains and granules; with interparticle and minor moldic porosity; some with "tea-brown" micrite; lithoclast at 8.3 ft is "tea-brown"-filled rhizolith. Contains very pale orange Seriatopora, Acropora sticks, small Porites lutea fragment, but no brown corals. Lower contact abruptly gradational.

12.9 - 14.7PACKSTONE: Halimeda; uncemented; mixed-alteration, Halimeda slightly chalky, very sparse moderate-red (5R4/6) Homotrema; light olive gray (5Y6/1); silt to very coarse grained, mostly fine-grained. Lower contact abruptly gradational. 14.7 - 17.0 FLOATSTONE: coral, mixed-rubble, with skeletal PACKSTONE matrix; partially cemented; mixed-alteration, sparfilled pelecypod steinkerns, sparse moderate-red (5R4/2) Homotrema, corals partially recrystallized, sparse spar replacement, unaltered molluscs; very pale orange; silt to very coarse grained and pebble-sized; poorly sorted to unsorted. Some lithoclasts with "tea-brown" micrite; lithoclasts mostly PACKSTONE. Contains only very pale orange corals, including Seriatopora with light-red (10R6/2), encrusting Homotrema; high-spired gastropod. Lower contact abruptly gradational. 17.0 - 20.9 PACKSTONE: Halimeda, coral, mollusc, rubble; uncemented; mixed-alteration (slight), sparse crimson Homotrema. pelecypods slightly chalky, Halimeda slightly chalky, corals chalky; yellowish gray (5Y7/2) to white; silt to very coarse grained, mostly fine-grained; pelecypod filled with poorly cemented, dark-gray, phosphatic(?) grains at 18.8 ft. 20.9 - 22.2 NO RECOVERY. FLOATSTONE: sparse coral, rubble, with skeletal, Halimeda 22.2 - 23.2 PACKSTONE matrix; uncemented; mixed-alteration, molluscs white and chalky, pale-red (5R6/2) Homotrema on partly spar-replaced Acropora, chalky Halimeda; very pale orange; silt to pebble-sized, mostly medium-grained sand; very poorly sorted; scattered dark-gray phosphatic(?) grains; lithoclasts with "tea-brown" micrite; interparticle porosity in lithoclasts; this unit appears to be transitional with respect to mixing in units above and below. 23.2 - 24.1NO RECOVERY. 24.1 - 41.6 FLOATSTONE: coral, mixed-rubble, with matrix of skeletal PACKSTONE; uncemented; skeletal components altered, corals slightly chalky to recrystallized to partly sparreplaced, some partially dissolved, molluscs chalky but

some with color retention, <u>Halimeda</u> completely chalky and disintegrating, pale-red (5R6/2) Homotrema at 30.0

ft, crimson Homotrema grain at 26.4 ft, some molluscs apparently unaltered, several Lithophagus preserved as steinkerns; very pale orange; silt to cobble-sized material, matrix mostly coarse-grained; poorly sorted; interval from 29.9 - 30.7 ft with abundant "tea-brown" micrite cemented lithoclasts and "dog-tooth" spar, one fine-grained spar lining at 28.4 ft; scattered spar throughout; from 31.8 - 32.2 ft, mostly unaltered Porites lutea. Lower contact apparently gradational.

41.6 - 50.4

FLOATSTONE: coral, with Halimeda PACKSTONE matrix; poorly cemented to uncemented, irregularly cemented; mixed-alteration, corals chalky, some corals dissolved, sparse spar-replacement; sparse molluscs unaltered with color retention, most molluscs white, chalky, slightly dissolved, common steinkerns, some steinkerns partly spar-replaced, several spar-filled molds, Halimeda completely chalky and disintegrating; very pale orange; silt to pebble-sized material, matrix mostly coarsegrained sand, very poorly sorted; containing scattered lithoclasts of cemented PACKSTONE otherwise similar to unit matix; no obvious mixed lithoclasts. Contains unaltered molluscs including Turbo operculum at 46.3 ft; Bikiniastrea at 49.4 ft.

50.4 - 51.8 NO RECOVERY.

51.8 - 52.8

WACKESTONE: coral, skeletal; poorly to moderately cemented, irregularly cemented; moderately altered, corals chalky, molluscs chalky and spar-lined and -filled, Halimeda completely chalky; very pale orange; silt to very coarse grained, mostly silt to fine-grained; moderately well-sorted; interparticle and minor moldic porosity; "tea-brown" micrite scattered on exterior of coral fragments and on one burrow filled with well-cemented, Halimeda WACKESTONE.

52.8 - 54.7 NO RECOVERY.

54.7 - 55.4

WACKESTONE: mollusc, <u>Halimeda</u>, uncemented to poorly cemented, irregularly cemented; moderately altered, <u>Halimeda</u> chalky and partly dissolved, molluscs white and chalky, corals chalky and some are recrystallized; very pale orange to white; silt to coarse-grained, mostly silt to fine-grained, moderately well-sorted; one burrow of well-cemented WACKESTONE, similar to matrix of unit.

55.4 - 57.6 NO RECOVERY.

57.6 - 73.7 FLOATSTONE TO WACKESTONE: coral, skeletal; poorly to moderately cemented, irregularly cemented; corals chalky, some corals partly replaced, molluscs chalky and partly dissolved, Halimeda completely chalky; very pale orange; silt to very coarse grained, mostly silt to fine-grained; interparticle porosity in corals and burrows; burrows scattered throughout and abundant at 69.4 - 70.4 ft, burrows of skeletal WACKESTONE (similar to those in unit above), are large, elongate, and consist of interconnecting networks; one burrow heavily filled with "tea-brown" micrite at top. Contains Porites lutea in growth position from 58.0 - 58.8 and 67.1 - 67.4 ft, diverse coral fauna also includes scattered Seriatopora(?), acroporids, and small Fungia at 70.2 ft.

73.7 - 75.5 NO RECOVERY.

75.5 - 76.5 CORAL HEAD: broken fragments of <u>Porites lutea</u> in apparent growth position, with cemented borings; <u>Lithophagus</u> steinkerns with partially chalky, disintegrating shell material; small borings and worm tubes; very pale orange.

76.5 - 78.7 NO RECOVERY.

78.7 - 100.7

FLOATSTONE: coral, generally with skeletal WACKESTONE matrix; poorly cemented to uncemented, irregularly cemented; corals chalky and partly dissolved, Halimeda completely chalky, molluscs chalky and occurring as molds and steinkerns (partially dissolved); very pale orange to white; silt to coarse-grained, mostly silt; MUDSTONE matrix interval from 82.8 - 86.1 ft; interparticle and intraparticle porosity in corals; scattered well-cemented burrows of skeletal WACKESTONE. Contains Tridacna fragment at 87.9 ft. Lower contact obscurred by drilling.

100.7 - 101.9 PACKSTONE: skeletal, coral; poorly cemented to uncemented; altered skeletal grains; very pale orange; containing scattered "salt-and-pepper" sand grains in upper part, more common downward; dark-gray stain on coral fragment at 101.7 ft.

403

101.9 - 103.5 NO RECOVERY.

[Disconformity indicated by "salt-and-pepper" grains in overlying unit.]

103.5 - 120.3 FLOATSTONE: sparse coral, with skeletal PACKSTONE matrix; poorly cemented, irregularly cemented; corals chalky, molluscs partly dissolved and some recrystallized, molluscs chalky with one at top of unit having good color retention, some molluscs preserved as steinkerns with micritized rind, micritized coralline algae; very pale orange; silt to very coarse grained, mostly coarsegrained, poorly sorted; porosity in corals; scattered cemented matrix, matrix is fragmented where cemented; minor "tea-brown" micrite on surface of coral at 103.9 ft.

120.3 - 122.1 NO RECOVERY.

122.1 - 132.5 FLOATSTONE: coral, with skeletal PACKSTONE matrix; poorly to moderately cemented; corals chalky and partly dissolved, corals partially replaced by "tea-brown" micrite with some completely replaced by fine spar, molluscs white and mostly chalky, common infilling, some molluscs dissolved and some completely replaced and infilled with fine spar; very pale orange; matrix is silt to very coarse grained, very poorly sorted; common interparticle and intraparticle porosity, minor moldic porosity. Contains Turbo operculum at 134.0 ft;

Acropora cuneata at 122.6 ft, small Porites lutea at 122.2 ft.

132.5 - 134.5 NO RECOVERY.

[Disconformity suggested by increase in cementation.]

134.5 - 143.5 FLOATSTONE: coral; with skeletal PACKSTONE matrix; moderately well to moderately cemented in upper part, with common spar-cement, becoming moderately to poorly cemented, irregularly cemented downward; skeletal components moderately to heavily altered, including heavily spar-replaced Porites lutea head at 135.0 - 135.2 ft; pale yellowish brown to very pale orange in upper part with grayish-orange sparry areas, becoming very pale orange downward. Lower contact abruptly gradational.

PACKSTONE: coral, skeletal; poorly uncemented; molluscs very chalky, some corals very chalky, <u>Porites lutea</u> slightly recrystallized; very pale orange; silt to very coarse grained, mostly medium— to coarse—grained; moderately sorted; <u>Porites lutea</u> heads at 146.1 - 146.4 ft, 149.0 - 149.4 ft, and 152.0 - 152.3 ft.

*** TOTAL DEPTH OF HOLE 152.3 FT ***

throughout, sparse molluscs with color retention throughout; generally very fine grained to fine-grained, muddy matrix but with very coarse Halimeda grains throughout, very poorly sorted; yellowish-gray (5Y7/2) with minor yellowish-gray (5Y7/2) to light-olive-gray (5Y6/1) areas; containing scattered coarse-grained to very coarse grained, dark-gray phosphate(?) clasts from 66.2 ft to base; ("salt-and-pepper" sand). Contains scattered larger foraminifers throughout; several types of moderately common small gastropods and pelecypods; corals include sticks of Acropora and Seriatopora and several types of small colonies, including Porites lutea at 26.0 and 38.2 ft (latter colony bored with Lithophagus which retains shell color) and small encrusting Favia(?) at 31.5 ft. SAMPLE: X @ 1.1, 11.7, 31.0, 52.0, 58.6, 69.0; R @ 35.1.

69.5 - 70.7 NO RECOVERY.

[TOP OF SEDIMENT PACKAGE 2. Disconformity indicated by presence of dark-gray phosphate(?) grains in lower part of overlying unit and by similar coating on surface of coral colony at top of underlying sequence. Additional evidence includes absence of moderate-red (5R4/6) Homotrema below this surface, appearance of minor cement and increase in alteration of skeletal components in underlying sequence and by the presence of rhizolith(?) in same.]

70.7 - 71.3 CORAL HEAD: small colonies and fragments of <u>Porites lutea</u> heavily bored by several types of organisms, including <u>Lithophagus</u>; outer (upper?) surfaces and some borings with medium-dark-gray to dusky-blue phosphatic(?) material. SAMPLE: T@71.1.

71.3 - 72.8 NO RECOVERY.

PACKSTONE: Halimeda, skeletal; poorly cemented to uncemented, irregularly cemented; Halimeda chalky, minor chalky coral, molluscs with dull luster, pinkish-gray (bleached) Homotrema scattered throughout unit; very pale orange to white; generally silt to very fine grained sand; common interparticle porosity in cemented areas. Contains small rhizolith(?) at 74.2 ft with thin "tea-brown" micrite coating. Corals sparse in unit; contains minor Amphistogina. SAMPLES: T @ 80.4, X @ 73.1, 80.4, 88.0, 96.5; M @ 100.7 - 101.4.

[Discontinuity marked by increase in cementation, increase in alteration of skeletal components, and appearance of very sparse "tea-brown" micrite below surface.]

BOREHOLE OOR-17

Lat/Long (E/W-1960): 11°35′24.3" N, 162°05′34.3" E

Lat/Long (WGS-1972): 11°35′24.0" N, 162°05′34.3" E

Location (IVY-grid, ft): 119,843 N and 032,899 E

Distance/Bearing from OAK GZ: 6,058 ft, 212.0 deg

Water Depth (H&N): 55.2 ft Hole Depth (bsf): 1,091.1 ft

Hole Spudded: 06/16/1985 Drilling Ended: 06/25/1985

Sampling: SS, SH Recovery: 52% (563.5 ft)

Logs: MCS, GR/DN/CP, GR/NU, CSV, BHG Date Logged: 06/25/1985

Deviation: 0.8 deg @ 406 ft, 2.5 deg @ 625 ft, 3.0 deg @ 726 ft, 1.0 deg

@ 675 ft, 2.5 deg @ 726 ft, 2.0 deg @ 1071 ft.

Casing: 10-3/4-in @ 117 ft, 8-5/8-in @ 459 ft; 8-5/8-in. lowered to 740 ft*

Drilling Mud/Additives: BVS (310 sx), PAD (190 gals), DFM (40 gals, LCM (13 sx)

Geologist: B.R. Wardlaw, R. P. Major, Drillers: G. Mooney, C. Peltier

T.W. Henry, W.E. Martin

P. Sacro

Paleontologists: R.Z. Poore, T.M. Cronin Logger: A. LeBreton

Gravimeter Specialist: L. Prado, D. Joiner, A. Cogbill

Core redescribed: 09/10/1985

* All casing recovered.

Depth Description

[TOP OF SEDIMENT PACKAGE 1.]

0.0 - 69.5 PACKSTONE TO WACKESTONE: Halimeda, skeletal; uncemented;

Halimeda grains, other skeletal components unaltered,

common moderate-red (5R4/6) and pale-red (5R6/2)

Homotrema grains and encrusting small colonies

PACKSTONE: skeletal, mollusc; moderately to poorly cemented, irregularly cemented, containing sparse "teabrown" micrite throughout; corals chalky and partially spar-replaced, Halimeda very chalky, partially disaggregated; generally very pale orange with sparse light-brown (5YR6/4) mottling in upper part, becoming white to very pale orange below 109.2 ft; generally fine- to very coarse grained; common interparticle porosity, moldic porosity in better-cemented areas. SAMPLES: T@ 106.6; X@ 102.7, 109.0; M@ 104.5 - 105.2.

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[Discontinuity marked by hard layer that damaged Shelby tube.]

111.0 - 116.5 PACKSTONE: mollusc, skeletal; generally poorly to moderately cemented, becoming irregularly cemented in lower part, containing minor "tea-brown" micrite in upper part of unit; mollusc shells chalky, partially disaggregated and sparsely preserved as steinkerns, corals chalky and partially dissolved; very pale orange in upper part, becoming very pale orange to pale yellowish brown below 116.2 ft; interparticle and moldic porosity.

PACKSTONE: mollusc, skeletal, moderately cemented, containing sparse "tea-brown" micrite; mollusc fragments white, chalky, some partially dissolved, others containing cemented PACKSTONE internal infillings; very pale orange; silt to very coarse-grained, mostly mediumto coarse-grained, moderately sorted; interparticle and minor moldic porosity. SAMPLE: X @ 122.3.

122.6 - 125.5 GRAINSTONE TO PACKSTONE: skeletal; poorly cemented in upper part, becoming uncemented downward; few mollusc fragments white, dull, partially dissolved, minor chalky Halimeda, containing well-preserved Amphistogina; very pale orange to very coarse grained, mostly mediumgrained, moderately to well-sorted with mud content decreasing downward.

125.5 - 127.8 NO RECOVERY.

[Discontinuity marked by increase in cementation, "dog-tooth"-spar infilling, and "tea-brown" micrite concentrated in light-brown (5YR6/4) horizon.]

127.8 - 132.2 PACKSTONE: coral, mollusc; moderately cemented, irregularly cemented; corals chalky and partially dissolved, molluscs white with dull luster, sparse Halimeda completely chalky and disaggregated; generally very pale orange; containing light-brown (5YR6/4) zone

from 128.1 - 128.2 ft; generally fine- to mediumgrained; cemented portions containing interparticle porosity, partially dissolved coral fragments with intraparticle porosity, "dog-tooth"-spar infilling small cavity in coral fragment near top of unit. Contains Conus with color retention at top. SAMPLE: X @ 131.1.

132.2 - 136.4 NO RECOVERY. [Disconformity suggested by 2-ft thick hard zone reported by driller, which was not recovered and which damaged Shelby tube.] 136.4 - 136.6 PACKSTONE: skeletal, mollusc; moderately well cemented; very pale orange. SAMPLE: T @ 136.4. WACKESTONE: skeletal; uncemented; very pale orange; 136.6 - 137.4 generally silt to fine-grained sand. SAMPLE: X @ 137.0. NO RECOVERY. 137.4 - 139.1 139.1 - 148.8 PACKSTONE: mollusc, coral, skeletal; generally uncemented to poorly cemented; molluscs white with dull luster, corals chalky, some small, disaggregated Halimeda fragments, coral at 142.3 ft slightly recrystallized; very pale orange; silt to very coarse grained, mostly fine- to medium-grained, moderately sorted; sparse poorly cemented zones with abundant interparticle porosity. SAMPLE: M @ 139.5 - 140.2. 148.8 - 150.7 NO RECOVERY. 150.7 - 156.9 PACKSTONE TO WACKESTONE: coral, mollusc, Halimeda; generally uncemented; corals chalky with minor dissolution, molluscs mostly white with dull luster, sparse molluscs retain some original color, sparse Halimeda grains slightly chalky but more commonly disaggragated; very pale orange; silt to very coarse grained, mostly medium-grained, very poorly sorted; becoming finer grained and better sorted near base. Contains Acropora sticks, and several types of pelecypods. Lower contact gradational [Note: interval from 151.0 - 151.3 ft may be material from uphole.] SAMPLE: X @ 152.0.

WACKESTONE: skeletal; uncemented; minor chalky and disaggregated Halimeda, minor spar-replacement of skeletal grains, mostly mollusc fragments; mostly silt to fine-grained, moderately sorted; very pale orange to white; contains few granule- to pebble-sized, PACKSTONE-filled burrows; mostly fine- to medium-grained; common interparticle, minor moldic porosity with scattered, spar-filled mollusc molds.

159.7 - 162.5 NO RECOVERY.

162.5 - 182.1 FLOATSTONE: coral; skeletal, mollusc WACKESTONE matrix; uncemented; corals chalky and commonly partially recrystallized, molluscs mostly white with dull luster, fragmented, one mollusc (Mytilus?) with original color at 181.0 ft; very pale orange; silt to coarse-grained, generally very fine grained. Contains diverse coral assemblage, including Acropora sticks, Fungia, small heads of Porites, including small Porites lutea, commonly bored with Lithophagus; large echinoid fragment at 178.5 ft. SAMPLES: X @ 169.7, 178.5; M @ 181.4 -

182.1.

182.1 - 190.7

PACKSTONE: coral; uncemented to poorly cemented; corals chalky, partially dissolved, minor molluscs mostly white with dull luster, commonly fragmented; very pale orange; silt- to granule-sized grains, mostly sand-sized grains, very poorly sorted; containing scattered, dark-gray, phosphatic(?) sand grains from 190.3 - 190.7 ft.

Porites lutea fragments common at 190.4 - 190.7 ft; minor coralgae encrusting coral at 187.2 - 187.5 ft.

190.7 - 193.6 NO RECOVERY.

[Discontinuity marked by increase in cementation and sparse "tea-brown" micrite on surface of recrystallized corals below this point.]

PACKSTONE TO WACKESTONE: coral, skeletal; poorly to moderately cemented, irregularly cemented; corals chalky, partially dissolved, some partially spar-replaced, minor mollusc fragments white, chalky; very pale orange; silt to very coarse grained, mostly silt to medium-grained, poorly sorted; minor sparse "tea-brown" micrite on surface of coral fragments near top of unit. SAMPLES: T@ 193.9; X@ 200.2; M@ 196.9 - 197.6.

200.4 - 201.2 WACKESTONE: skeletal, poorly cemented; mollusc fragments commonly recrystallized; very pale orange; silt to coarse-grained, mostly silt to fine-grained, moderately sorted. SAMPLE: M @ 203.3 - 203.9. 201.2 - 203.1 NO RECOVERY. 203.1 - 210.2 PACKSTONE: coral, skeletal; poorly to moderately cemented, irregularly cemented; corals chalky, partially dissolved, some partially spar-replaced; minor mollusc fragments white, chalky; very pale orange. SAMPLE: X @ 209.6. 210.2 - 212.4NO RECOVERY. 212.4 - 216.0FLOATSTONE: coral; matrix skeletal PACKSTONE; poorly cemented, irregularly cemented; corals chalky, bored, some partially dissolved; minor mollusc fragments white, chalky, minor Halimeda chalky, partially disaggregated; very pale orange; silt- to granule-sized grains, mostly sand-sized, very poorly sorted; cemented portions have high interparticle porosity, minor moldic porosity; from 215.5 - 215.9 ft, mollusc fragments, Halimeda more common, coral fragments less common; containing higher amount of silt and fine-grained sand in same interval; moderately cemented burrow at 215.9 ft. 216.0 - 218.6 NO RECOVERY. [Disconformity indicated by increase in cementation, small rhizoliths, scattered "tea-brown" micrite filling lining and filling same.] 218.6 - 219.4 PACKSTONE: mollusc, Halimeda; moderately to well-cemented; better cemented near top, becoming less-cemented downward; molluscs commonly white with dull luster, cemented PACKSTONE infillings in molluscs common, Halimeda completely chalky and commonly disaggregated; very pale orange, silt to very coarse-grained, mostly fine- to medium-grained, moderately well-sorted; interparticle and minor moldic porosity in cemented

219.4 - 221.6 NO RECOVERY.

SAMPLE: X @ 220.0; M @ 218.8 - 219.4.

portions of unit, spar-filled mollusc steinkerns common near top of unit; sparse spar replacement of coral.

221.6 - 226.3 PACKSTONE: <u>Halimeda</u>, skeletal; moderately to moderately well-cemented, irregularly cemented; <u>Halimeda</u> grains very chalky, partially disaggregated; very pale orange. SAMPLE: T @ 225.1.

226.3 - 227.6 NO RECOVERY.

227.6 - 233.7

PACKSTONE: mollusc, <u>Halimeda</u>, coral; moderately to poorly cemented, irregularly cemented; molluscs white, chalky; commonly molluscs have micrite steinkerns, some replaced by spar; <u>Halimeda</u> very chalky and commonly disaggregated; coral fragments chalky, partially dissolved, some coral fragments partially replaced by spar, cementation and replacement by very pale orange spar common throughout unit; very pale orange; silt to very coarse grained, mostly silt to fine-grained sand, moderately sorted; minor moldic porosity in well-cemented portions of unit; spar-replaced gastropod at 226.2 ft. SAMPLE: X @ 231.0; M @ 227.9 - 228.7.

[Disconformity indicated by increase in cementation and increase in "tea-brown" micrite.]

233.7 - 250.9

FLOATSTONE: coral; skeletal PACKSTONE matrix; moderately to moderately well-cemented; corals partially chalky, mostly spar-replaced, most other skeletal grains unrecognizable; mostly very pale orange with darker spar-replaced zones, silt to very coarse grained, very poorly sorted; minor vuggy porosity throughout with local "dog-tooth" spar infilling same in better-cemented portions of unit. Contains Porites lutea at 242.3 - 242.6, 237.0 - 237.2 ft, and 245.0 ft; Lithophagus steinkern at 239.6 ft; laminated, spar-replaced shell at 274.6 - 274.8 ft. SAMPLES: T@ 233.7, 242.0; X@ 242.3; M@ 236.3 - 237.0.

250.9 - 253.3 NO RECOVERY.

[Disconformity indicated by marked increase in "tea-brown" micrite.]

253.3 - 271.5

PACKSTONE: coral, mollusc; moderately cemented, irregularly cemented from top to 261.5 ft, becoming poorly to moderately cemented from 261.5 ft to base; corals mostly recrystallized, partially dissolved, or spar-replaced, mollusc fragments commonly spar-replaced, some molluscs partially to completely dissolved (as molds); upper 0.3 ft pale yellowish brown to moderate yellowish brown, becoming very pale orange with darker spar and micrite zones below; silt to very coarse

grained, mostly coarse-grained, moderately sorted; vuggy porosity common, some moldic porosity. Contains <u>Porites</u>
lutea(?) at 261.8 - 262.1 ft. SAMPLES: T @ 253.3; M @
264.5 - 265.2, 270.6 - 271.3.

throughout. SAMPLE: X @ 273.4; M @ 276.1 - 276.8.

271.5 - 273.00 NO RECOVERY.

273.0 - 285.9 PACKSTONE: coral, mollusc; poorly cemented, irregularly cemented; corals, chalky, partially dissolved, molluscs white, dull luster, some chalky, partially dissolved; very pale orange; silt to coarse-grained, mostly mediumto coarse-grained, moderately well-sorted; from 273.0 - 273.6 mostly uncemented with sparse coral fragments. Contains bored Porites lutea fragments from 279.0 - 279.5 ft; sparse mollusc steinkerns scattered

285.9 - 288.4 NO RECOVERY.

288.4 - 289.7 PACKSTONE: mollusc, coral, skeletal; uncemented; abundant pelecypods white with dull luster, corals chalky, partially dissolved; very pale orange; silt to very coarse grained, mostly coarse-grained, moderately well-sorted; one completely spar-filled mollusc mold.

Contains dusky-blue stained coral fragments at 288.7 ft. SAMPLE: X @ 289.0.

289.7 - 291.5 NO RECOVERY.

[Disconformity indicated by marked increase in cementation, alteration, and "tea-brown" micrite below surface.]

291.5 - 291.8 PACKSTONE(?): skeletal; very well cemented; containing moderately common "tea-brown" micrite; very pale orange to moderate yellowish brown; containing very pale orange spar, vuggy porosity possible solution-enlarged mollusc molds.

291.8 - 295.7 PACKSTONE: mollusc, skeletal; poorly to moderately cemented; molluscs white, chalky, corals chalky, partially dissolved; very pale orange; silt to coarsegrained, mostly very fine to fine-grained, moderately

sorted; mollusc steinkerns scattered throughout; unit becoming skeletal WACKESTONE from 294.7 to 295.0 ft, containing minor spar-lined vugs at 296.0 t. SAMPLE: M @ 295.0 - 295.7.

295.7 - 297.9 NO RECOVERY. 297.9 - 304.7 PACKSTONE: mollusc, skeletal; uncemented; molluscs white with dull luster, high-spired gastropod with original color at 299.3 ft; very pale orange; very fine to finegrained, moderately well-sorted. Contains scattered echinoid spines. SAMPLE: X @ 299.0; M @ 300.9 - 302.8. 304.7 - 307.9 WACKESTONE: skeletal; uncemented; scattered chalky, partially dissolved coral fragments; white to very pale orange; silt to fine-grained; contains cemented nodules like matrix at 305.8 ft. [Discontinuity marked by increase in cementation and appearance of common spar below surface.] 307.9 - 314.2 PACKSTONE: skeletal; moderately cemented, corals largely spar-replaced in lower part of unit, moldic to 314.2 ft; white; grains difficult to distinguish, apparently fine; minor vuggy porosity, probably mostly solution-enlarged mollusc molds; small, spar-replaced skeletal fragment at 308.0 ft. SAMPLE: T @ 308.3. 314.2 - 317.0 NO RECOVERY. PACKSTONE: mollusc, coral, skeletal; generally moderately 317.0 - 331.2 cemented in upper part of unit, becoming moderately to poorly cemented, irregularly cemented downward; molluscs white, chalky, partially dissolved, some partially spar-

331.2 - 331.5 PACKSTONE: skeletal; uncemented; minor mollusc fragments

white, chalky, one mollusc fragment with cemented infilling of PACKSTONE (similar to matrix); very pale orange; geneally medium- to coarse-grained, moderately sorted.

replaced, corals with minor dark-grayish-orange spar infilling molds, partially replacing <u>Lithophagus</u> steinkerns and replacing coral; very pale orange; generally medium-grained but ranging from silt to coarse-grained, moderately sorted; interparticle and solution-enlarged moldic porosity, common micromollusc steinkerns, abundant fine moldic porosity. SAMPLES: T @ 317.0, 323.4; X @ 317.0, 321.0; M @ 330.5 - 331.2.

331.5 - 333.0 NO RECOVERY.

333.0 - 348.2

PACKSTONE TO GRAINSTONE: foraminifer, skeletal; moderately to poorly cemented, spar cement in GRAINSTONE, irregularly cemented; extensively recrystallized; very pale orange with minor patches of very pale orange to pale yellowish brown; common moldic porosity. Contains large foraminifers. SAMPLES: T@ 345.8, 346.0; X@ 333.3, 345.5.

348.2 - 350.5 NO RECOVERY.

[TOP OF SEDIMENT PACKAGE 3. Disconformity indicated by change of facies, increase in alteration and cementation.]

350.5 385.7

FLOATSTONE: coral; matrix of skeletal PACKSTONE with minor WACKESTONE(?); generally moderately cemented; unit pervasively recrystallized, corals mostly moldic but some spar replacement, gastropods preserved as molds and steinkerns; mottled very pale orange and pale yellowish brown to grayish orange, silt to very coarse grained, mostly medium— to coarse—grained, yellowish—gray spar increasing downward as cement and infillings in corals; contains large coral molds and enlarged molds to small vugs, partially spar—infilled. [Zone from 370.7 to 371.7 contains corals not extensively altered.] Contains several types of Acropora sticks, Seriatopora. SAMPLES: T@ 362.6, 373.7, 379.6; X@ 356.5, 362.6, 365.2, 371.0, 373.7, 379.6.

[Possible disconformity indicated by presence of "tea-brown" micrite(?) and dark colored spar below surface.]

385.7 - 436.5

FLOATSTONE AND PACKSTONE: coral FLOATSTONE with mollusc, skeletal PACKSTONE matrix in upper part of unit, becoming mollusc, skeletal, coral PACKSTONE downward; generally well-cemented, but with moderately cemented zone from 435.5 - 438.5 ft; corals partially dissolved, recrystallized, some spar-replaced, molluscs mostly dissolved; generally very pale orange with minor moderate-brown (5R4/4) areas; moldic porosity common. Contains several types of large pelecypods, Seriatopora, and other corals. SAMPLES: T @ 385.9, 391.0, 417.3, 432.5; X @ 386.0, 401.0, 415.0, 426.0, 436.0.

436.5 - 438.5 NO RECOVERY.

[Disconformity indicated by marked increase in "tea-brown" micrite associated with spar linings and cement, presence of rhizoliths(?).]

438.5 - 444.9 FLOATSTONE: coral; matrix of mollusc, skeletal PACKSTONE; well-cemented; corals partially dissolved and mostly chalky, molluscs mostly dissolved, some molluscs spar-replaced, sparse chalky, broken mollusc fragments; generally very pale orange, some mottling; matrix, grain size and sorting indeterminate. Contains partly spar-replaced Favia head at 441.90 - 442.3 ft. SAMPLES: T @ 438.5, 444.8.

444.9 - 446.8 NO RECOVERY.

446.8 - 449.8 PACKSTONE: mollusc; moderately cemented; corals chalky, molluscs mostly chalky, disaggregated; very pale orange. SAMPLES: T @ 447.4; X @ 447.0, 447.4.

449.8 - 450.7 PACKSTONE: skeletal; poorly to moderately cemented; components badly disaggregated; very pale orange;

components badly disaggregated; very pale orange; containing moldic porosity in cemented pieces.

450.2 - 452.6 NO RECOVERY.

452.6 - 453.4 PACKSTONE: coral, mollusc; well-cemented; corals partially dissolved, commonly spar-replaced, moluscs commonly dissolved; very pale orange. SAMPLES: T @ 452.6; X @ 453.0.

453.4 - 460.7 NO RECOVERY: driller reports Shelby tube dropped 3 ft with only 26 blows, perhaps indicating sand-filled void at 453.4 - 456.4 ft; downhole logs show no differences in density.

PACKSTONE WITH WACKESTONE: mollusc, coral; moderately to well-cemented; corals mostly dissolved, some chalky coral fragments remain (unit locally approaching coral FLOATSTONE), molluscs commonly dissolved and preserved as molds or steinkerns; minor thin spar lining of molds toward bottom of unit; very pale orange; size and sorting of matrix indeterminate; abundant moldic and solution-enlarged moldic porosity; moderate-yellowish-brown "crust", 3 - 4 mm thick and composed of fine spar, on well-cemented rock at 467.5 ft (possible vug lining), some micrite replacement of matrix, especially toward

bottom of unit. Contains Seriatopora and Acropora sticks; several types of pelecypods; scattered gastropods. SAMPLES: T @ 467.3, 474.9; X @ 470.7, 474.9.

NO RECOVERY. 475.5 - 477.3

477.3 - 484.3 PACKSTONE: coral, mollusc; generally poorly cemented with areas moderately cemented from 482.9 - 483.4 ft; corals chalky and mostly dissolved; mollusc mostly dissolved; very pale orange; silt to coarse-grained, mostly fineto medium-grained, poorly sorted (cementation obscures grain size and sorting for most of unit); abundant vuggy and slightly solution-enlarged moldic porosity; rock somewhat pulverized during sampling, coral sticks abundant from 482.9 - 483.4 ft SAMPLES: T @ 482.9; X @ 478.4; M @ 480.6 - 481.3.

484.3 - 495.3

PACKSTONE TO WACKESTONE: coral, mollusc PACKSTONE except in interval from 484.4 - 489.9 ft; generally moderately cemented with irregular well-cemented areas; molluscs chalky, partially to mostly dissolved, generally present as molds; very pale orange; abundant moldic and solution-enlarged moldic porosity. Burrowed(?) at 492.4 ft. SAMPLES: T @ 486.1, 492.4.

495.3 - 497.2 NO RECOVERY.

[TOP OF SEDIMENT PACKAGE 4. Disconformity suggested by slight increase in cementation and presence of abundant spar-infilling of molds below surface. Slight density increase shown on logs at about 496 ft.]

497.2 - 523.7

FLOATSTONE(?) TO PACKSTONE: coral, FLOATSTONE with skeletal PACKSTONE matrix; containing possible disaggregated, large coral heads from 508.3 - 509.5 ft; well-cemented from top to 505.7 ft, becoming generally less cemented downward, moderately cemented at base. Containing small Porites head and Acropora sticks at 505.5 - 505.7 ft; gastropods preserved as spar-filled molds and steinkerns from top to 506.6 ft. SAMPLES: T @ 500.2; X @ 500.2, 503.5, 523.3.

523.7 - 525.5 NO RECOVERY.

PACKSTONE: coral, mollusc, skeletal; moderately cemented 525.5 - 570.6 in upper part of unit, becoming poorly cemented by about 534.0 ft, uncemented by 547.9 ft; contains scattered pebble-sized, well-cemented burrows(?) from 523.7 ft to

base; from top of unit to 505.7 ft many spar-filled or spar-lined molds, chalky shell material preserved in molluscs at 528.6 ft and downward; very pale orange; some dark-yellowish-brown to pale-yellowish-brown spar in upper part. Contains <u>Porites</u> head at 563.6 - 563.8 ft. Lower probably gradational. SAMPLES: T @ 550.8 (burrow?); X @ 531.0, 547.7, 550.8, 563.4.

570.6 - 572.9 NO RECOVERY.

572.9 - 654.6

PACKSTONE AND WACKESTONE: skeletal, mollusc, coral, PACKSTONE alternating with skeletal, mollusc WACKESTONE; uncemented except or scattered burrows(?); mollusc shells slightly chalky and with nacreous luster sparsely preserved, corals generally slightly altered but with large, open frameowrk; partially grayish-orange spar replaced and spar-filled at 592.0 - 594.8 ft (pristine fragment of the same type of open-framework coral lying adjacent to it), minor color retention on low-spired gastropod at 605.9 ft; PACKSTONES very pale orange to pale yellowish brown, WACKESTONES very pale orange; below 628.0 ft even WACKESTONES very pale orange with minor pale-yellowish-brown tones. Contains coral at 579.9 ft, very pale orange to pale yellowish brown; thin shelled pelecypod at 619.4 ft with original color and nacreous luster preserved; several types of large colonial corals, Seriatopora; pecten at 608.6 ft; small Porites head at 638.8 ft (Porites lutea?); Dictyaraea(?) and Acropora sticks scattered throughout unit; one highspired gastropod at 648.8 ft; thin shelled pelecypod with color retention and nacareous layer preserved at 653.6 ft. Subunits as follows: 572.9 - 573.8 ft, WACKESTONE; 573.8 - 588.3 ft, PACKSTONE; 588.3 - 588.7 ft, WACKESTONE; 588.7 - 591.0 FT, PACKSTONE; 591.0 -592.0 ft, WACKESTONE; 592.0 - 593.9 ft, PACKSTONE; 593.9 - 602.1 t, WACKESTONE; 602.1 - 607.8 ft, PACKSTONE; 607.8 - 613.6 ft, WACKESTONE; 613.6 - 625.4 ft, PACKSTONE; 625.4 - 625.7 ft, WACKESTONE; 625.7 - 628.6 ft, PACKSTONE; 628.6 - 631.7 ft, coral-rich WACKESTONE; 631.7 - 632.4 ft, PACKSTONE with abundant cemented burrows(?); 632.4 - 635.1 ft, no recovery; 635.1 - 638.7 ft, WACKESTONE; 638.7 - 641.5 ft, PACKSTONE; 641.5 -651.3 ft, WACKESTONE; 651.3 - 654.6 PACKSTONE. SAMPLES: T @ 648.8 (spar-filled, high-spired gastropod), S @ 593.8 - 595.0; T @ 608.6; X @ 573.1, 597.5, 608.6, 611.6, 645.0.

654.6 - 656.5 NO RECOVERY.

PACKSTONE AND FLOATSTONE, with minor WACKESTONE: generally 656.5 - 682.9 skeletal PACKSTONE and coral FLOATSTONE with PACKSTONE matrix; uncemented; corals slightly recrystallized, molluscs generally unaltered, some with nacreous luster, gastropod with color retention at 679.8 ft; very pale orange to pale yellowish brown; generally silt to very fine grained sand; containing scattered, well-cemented (pelleted?) PACKSTONE-filled burrows; large burrow at 682.0 ft contains dolphin(?) tooth; corals include Seratopora and Dictyaraea sticks; scattered Porites andrewsi-type corals; bryozoan(?) at 676.4 ft; several types of small gastropods and scattered small thinshelled pelecypods; cemented burrow with minor "spar" in Porites andrewsi-type coral adhering to burrow at 665.2 Subunits as follows: 656.5 - 664.8 ft, FLOATSTONE with WACKESTONE matrix; 664.8 - 667.6 ft, coral PACKSTONE; 667.6 - 673.5 ft, FLOATSTONE with WACKESTONE matrix; 673.5 - 678.9 ft, sparse FLOATSTONE with PACKSTONE matrix; 678.9 - 682.9 ft, sparse FLOATSTONE with WACKESTONE to PACKSTONE matrix. SAMPLES: T @ 665.2, 682.0; X @ 668.5, 682.0, 682.6.

682.9 - 684.6 NO RECOVERY.

684.6 - 687.6 FLOATSTONE: sparse coral; mollusc, WACKESTONE matrix; uncemented; molluscs with color retention and nacareous luster, corals well-preserved and unabraded; unit contains abundant silt and fine-grained particles, plastic; contains abundant <u>Dictyaraea</u> and <u>Seriatopora</u> sticks; lignite fragments recovered from near base; very pale orange with minor tones of pale yellowish brown. Lower contact apparently sharp. SAMPLE: T @ 685.3.

687.6 - 688.2 PACKSTONE: coral, skeletal; uncemented; skeletal components unaltered; very pale orange to pale yellowish brown to grayish orange; generally fine-grained sand, well-sorted. SAMPLES: T @ 687.6.

688.2 - 690.2 NO RECOVERY.

690.2 - 693.8 FLOATSTONE: sparse coral, mollusc, matrix skeletal PACKSTONE; Strombus with nacareous layer preserved at 690.8 ft; very pale orange to pale yellowish brown.

[Note: vertebrate fragments from washed materials at top run at top of interval.]

693.8 - 695.8 NO RECOVERY.

695.8	-	696.9	PACKSTONE: skeletal, mollusc, slightly muddy, containing small gastropods and small pelecypods, scattered sticks of <u>Dictyaraea</u> and <u>Stromatopora</u> ; pale yellowish brown to moderate yellowish brown; generally fine-grained sand. SAMPLE: X @ 696.3.
696•9	_	706.4	NO RECOVERY.
706.4	_	712.1	PACKSTONE: coral, mollusc; uncemented; unaltered skeletal components; pale yellowish brown to very pale orange; generally silt and very fine grained sand; contains small cemented burrows. SAMPLE: X @ 707.1.
[TOP OF	SE	DIMENT	PACKAGE 5.]
712.1	_	716.7	NO RECOVERY.
716.7	_	723.1	WACKESTONE TO PACKSTONE: mollusc, coral, skeletal; uncemented; unaltered; pale yellowish brown to very pale orange; silt and very fine grained sand; contains scattered small cemented burrows.
723.1		729.3	NO RECOVERY.
729•3	_	730.3	FLOATSTONE: sparse coral, mollusc; matrix PACKSTONE to WACKESTONE; uncemented; unaltered; pale yellowish brown to very pale orange; containing small cemented burrows; silt and very fine grained sand. SAMPLE: X @ 730.0.
730.3		734•4	NO RECOVERY.
734•4	_	740.0	FLOATSTONE: coral; matrix PACKSTONE, mollusc, skeletal; uncemented; unaltered; generally pale yellowish brown with minor pale yellowish brown to dark yellowish brown, becoming dark yellowish brown with darker streaks at 739.0 ft (corresponding to gamma peak in logs); matrix generally very fine to fine-grained sand. Contains several types of small gastropods and thin-shelled pelecypods; corals include Porites andrewsi-type, Acropora sp., sticks of Seriatopora, small colony of Favia(?) at 739.9 ft. Lower contact sharp, undulatory. SAMPLE: X @ 739.0.

[Note: Corals above 740.0 ft are about same color as matrix; from 740.0 - 747.3 ft, corals are lighter than matrix; and below 747.3 ft, corals are distinctly lighter than matrix.]

776.8 FLOATSTONE: tight coral; mollusc, skeletal PACKSTONE 740.0 matrix, very fine grained; uncemented; unaltered; many mollusc shells with color retention, nacreous layer preserved; generally pale yellowish brown to moderate yellowish brown, interval from 740.0 - 747.3 ft dark yellowish brown to dusky yellowish brown, grading downward to dark yellowish brown to 748.4 ft, grading downward to pale yellowish brown to moderate yellowish brown; generally very fine grained to fine-grained Contains abundant Porites andrewsi-type from 740.0 - 747.3, 756.1 - 759.9, 774.3 - 776.4 ft, and scattered throughout unit; Seriatopora and Acropora sticks scattered throughout; small Porites lutea head 752.4 - 752.8 ft; large worm tube from 756.9 - 757.5 ft; Astreopora(?) head from 763.1 - 763.6 ft; pelecypods generally thin-shelled with color retention; gastropods include cyrithids and neritids; several types of gastropods, mainly small gastropods; large Strombus at 774.1 ft. Subunits as follows: 740.0 - 754.4 ft, tight FLOATSTONE; 754.4 - 763.1 ft, FLOATSTONE; 763.1 - 763.6 ft, coral head; 763.6 - 769.8 ft, FLOATSTONE; 769.8 -

748.4, 757.0, 771.0.

771.5 ft, PACKSTONE TO sparse FLOATSTONE, mainly

mollusc; 771.5 - 772.0 ft, FLOATSTONE; 772.0 - 774.3 ft, PACKSTONE TO sparse FLOATSTONE, mollusc-rich; 774.3 - 776.8 ft, tight FLOATSTONE. [Note: logs show washed-out interval at about 750.0 ft.] SAMPLE: X @ 740.4,

776.8 - 780.0 NO RECOVERY. Downhole logs shows high gamma-, low density-, and washed-out interval at this point; may be lignitic WACKESTONE or LIGNITE.

780.0 - 781.5 CORAL HEAD: <u>Astreopora(?)</u>; matrix like overlying unit; pale-yellowish-brown to moderate-yellowish-brown matrix, grayish-orange coral.

781.5 - 785.2 PACKSTONE: skeletal, mollusc, coral; uncemented, wellcompacted; skeletal components unaltered; pale yellowish
brown; matrix generally silt and very fine to finegrained sand. Contains small <u>Seriatopora</u> sticks and
other corals; several types of small gastropods; large
pelecypod at 782.2 ft; large aragonite-lined worm tube
at 782.2 - 782.4 ft; phosphatic (dusky-brown) shark's
tooth and scattered vertebrate fragments from 781.8 782.0 ft. Lower contact gradational. SAMPLE: X @
785.0.

785.2 - 791.5 FLOATSTONE: coral, mollusc; upper part of unit coral FLOATSTONE, becoming mollusc, tight coral FLOATSTONE below 790.1 ft with skeletal, mollusc PACKSTONE matrix; uncemented; unaltered, unabraded skeletal components; pale yellowish brown to very pale orange in upper and lower parts becoming very pale orange to pale yellowish brown in middle. Macrofauna includes sticks of Seriatopora, scattered Acropora, solitary scleractinian at 789.3 ft, small colonies of Porites lutea(?) in lower part, and other corals; several types of gastropods, including neritids; scattered, broken, thin-shelled pelecypods. Lower contact gradational. CORAL HEADS: Porites lutea(?), small heads in growth 791.5 - 792.4 position, bored with Lithophagus; matrix mollusc, skeletal PACKSTONE; uncemented; unaltered; very pale orange to pale yellowish brown. 792.4 - 794.0 FLOATSTONE: coral; matrix skeletal, mollusc PACKSTONE; uncemented; unaltered; molluscs with nacreous layer and original color preserved; very pale orange to pale yellowish brown; burrows sparse. Contains several types of corals, small gastropods, and broken, thin-shelled pelecypods. CORAL HEADS: Porites lutea, heavily bored with 794.0 - 795.9 Lithophagus, in growth position; very pale orange; contains matrix of very pale orange to pale yellowish brown, skeletal PACKSTONE from 794.4 - 794.9 ft. FLOATSTONE: coral; matrix skeletal, mollusc PACKSTONE; 795.9 - 808.6 uncemented; unaltered skeletal components; pale yellowish brown to very pale orange in upper part, grading gradually downward to pale yellowish brown to moderate yellowish brown in lower part. Corals include Porites sp., Porites andrewsi-type (sparse), sticks of Seriatopora and Acropora (sparse), and others; molluscs extremely common, diverse, including several types of gastropods, including small turetellids, neritids, scattered cyrithids and large Strombus sp. at 797.6 -798.0, 808.3 - 808.6, 807.3 ft; several types of thinshelled pelecypods. [Note: dark-yellowish-brown to dusky-blue Porites sp. head at 806.9 ft; remainder of unit colored like the matrix]. SAMPLE: X @ 797.4. 808.6 - 810.3 CORAL HEAD: Porites lutea in growth position, heavily bored by Lithophagus.

810.3 - 815.4 FLOATSTONE: coral; matrix mollusc, skeletal PACKSTONE; uncemented; unaltered; moderate yellowish brown to dark yellowish brown. Contains Conus(?) at 811.6 ft; Strombus (large) at 811.3 ft; Cyprea at 812.0 ft; numerous other types of gastropods; small Porites lutea head at 813.9 ft, Seriatopora sticks, and other small corals. SAMPLE: X @ 815.0. NO RECOVERY. Probably like adjacent units. 815.4 - 818.5 818.5 - 823.0 FLOATSTONE: coral, matrix PACKSTONE, mollusc, skeletal; uncemented; unaltered; pale yellowish brown to moderate yellowish brown; generally silt- to fine-grained sand matrix. Contains small Porites lutea heads scattered in upper part, minor Seriatopora, abundant sticks of Acropora sp. (interior stained dusky blue); molluscs consist of several types of small gastropods, including Cypraea at 819.3 ft, fragment of Strombus at 819.3 ft, small thin-shelled pelecypods. SAMPLE: M @ 820.3 -821.1. Lower contact gradational. 823.0 - 825.2 PACKSTONE: mollusc, coral, skeletal; small gastropods abundant; uncemented; unaltered; pale yellowish brown to dark yellowish brown; predominantly very fine to finegrained; contains small, scattered, cemented burrows. 825.2 - 827.0 NO RECOVERY. CORAL HEAD: Porites lutea, in growth position, bored with 827.0 - 828.0 Lithophagus; very pale orange to pale yellowish brown; minor moderate yellow brown to dark yellowish brown, skeletal, PACKSTONE infilling. 828.0 - 836.3 FLOATSTONE: coral, matrix mollusc, skeletal PACKSTONE; very fine to fine-grained; uncemented; unaltered; well consolidated; dark yellowish brown to pale yellowish brown, becoming pale yellowish brown downward, minor streaks of dark yellowish brown to dusky yellowish brown from 832.0 - 832.2 ft. Contains about 20% small cemented burrows from 832.2 - 833.2 ft and scattered to base. Contains small Porites lutea heads from 828.0 -828.9 ft, Porites andrewsi-type from 831.8 - 833.8 and 836.1 ft, scattered small Porites sp. sticks and Dictyaraea scattered throughout, minor Seriatopora scattered throughout; mollusc include several types of small gastropods, small thin-shelled pelecypods, large fragment of Strombus at 829.4 ft, several molluscs with

original color preserved. Subunits as follows: 828.0 - 828.9 ft, FLOATSTONE; 828.9 - 831.7 FT, sparse, molluscrich FLOATSTONE; 831.7 - 834.2 ft, tight FLOATSTONE; 834.2 - 836.1 ft, FLOATSTONE. SAMPLE: X @ 834.0.

836.3 - 838.5 NO RECOVERY.

838.5 - 842.6

PACKSTONE TO FLOATSTONE: mollusc, coral, matrix PACKSTONE, uncemented; unaltered; pale yellowish brown; muddier than adjacent units. Contains abundant diverse mollusc from 840.0 - 840.9 ft, gastropods include large Strombus at 839.2 - 839.6 ft; corals include scattered sticks of Porites sp., Seriatopora scattered throughout, abundant Dictyaraea throughout; about 10 - 15% well-cemented burrows from 836.1 - 837.6 and 839.6 - 840.0 ft; very minor infilling of gastropods, gastropods well-preserved with aragonitic shells; pelecypod shell at 838.7 ft contains infilling of cemented micrite with well-preserved aragonitic shell. SAMPLES: T @ 839.6; X @ 839.6.

842.6 - 846.8

FLOATSTONE: coral, matrix PACKSTONE, mollusc, skeletal; uncemented; unaltered; moderate yellowish brown to pale yellowish brown. Dominated by small <u>Seriatopora</u> and small <u>Porites</u> sticks.

846.8 - 850.2 NO RECOVERY.

850.2 - 855.9

FLOATSTONE: tight coral, dominated by small heads of <u>Porites lutea</u> bored by <u>Lithophagus</u>, matrix PACKSTONE TO WACKESTONE, skeletal, mollusc; pale-yellowish-brown matrix; uncemented.

855.9 - 864.3

PACKSTONE TO WACKESTONE: coral, mollusc, skeletal; uncemented; unaltered; PACKSTONE grading downward to WACKESTONE from 855.9 - 856.8 ft, becoming sparse WACKESTONE at 860.7 - 864.2 ft, uncemented WACKESTONE from 864.2 - 864.3; 0.1 ft thick, well-cemented, very sparse-skeletal WACKESTONE burrow(?) at 864.1 ft; pale yellowish brown to moderate yellowish brown in upper part, becoming pale yellowish brown to very pale orange by 860.1 ft and downward. Contains small Porites heads and other corals; several types of large pelecypods; cemented, small PACKSTONE- TO WACKESTONE- filled burrows. Gap in core from 864.3 - 864.1 ft. Lower contact abruptly gradational. SAMPLES: T @ 862.0, 864.1 (burrow?); X @ 857.1, 864.1.

PACKSTONE TO FLOATSTONE: coral, mollusc PACKSTONE TO sparse coral FLOATSTONE; uncemented; unaltered; pale yellowish brown to dark yellowish brown; silt—and very fine grained sand matrix. Contains small <u>Porites</u> heads, sticks of <u>Dictyaraea</u>, scattered <u>Cycloserus</u>, and moderately common scab—like scleractinians, <u>Favia(?)</u> at 866.5 - 866.7 ft; very sparse, small cemented burrows; gastropod shell with preserved aragonite and original color lined with spar at 869.2 ft. SAMPLES: S @ 868.6

870.4 - 871.6 CORAL HEAD: <u>Porites lutea</u> in growth position; grayish orange to very pale orange.

- 869.4; X @ 866.0.

871.6 - 878.7 FLOATSTONE: coral, sparse, with intervals tight; matrix PACKSTONE, skeletal, mollusc; generally uncemented, minor irregularly cemented areas and small burrows from 873.7 - 875.6 ft, areas of cement are moderately to moderately well cemented; pale yellowish brown to dark yellowish brown; generally silt- and very fine grained sand-sized matrix. Contains small Porites lutea(?) heads, Cycloceres, abundant small Acropora sticks, sparse small Seriatopora sticks; several types of small molluscs, mainly gastropods, scattered thin-shelled pelecypods, generally broken. [Note: small Porites lutea heads from 873.6 - 876.4 ft contain abundant small borings.] Subunits as follows: 871.6 - 872.4 ft, sparse FLOATSTONE; 872.4 - 876.4 ft, Porites tight FLOATSTONE; 876.4 - 878.7 ft, Acropora FLOATSTONE. Base gradational. SAMPLE: S @ 873.7 - 874.3.

878.7 - 906.0 FLOATSTONE and PACKSTONE: coral, mollusc, matrix PACKSTONE, skeletal, mollusc, generally uncemented with small scattered, poorly cemented areas; unaltered skeletal components; pale yellowish brown to moderate yellowish brown; generally very fine grained sand. Contains scattered, small cemented burrows; Acropora sticks and small heads of Porties lutea, one Porites lutea head at 896.7 ft, small Favia head at 901.8 ft, Seriatopora sparse, Astreopora(?) at 890.8 ft; abundant small gastropods throughout, large pelecypods particularly common at 897.6 - 897.9 ft and 905.7 -906.0 ft, Cypraea at 891.0 ft. Small cemented burrows as follows: 887.4 - 890.0 ft, sparse; 891.4 - 892.4 ft, approximately 30%; 892.4 - 906.0 ft sparse. Lithic subunits as follows: 878.7 - 879.6 ft, sparse FLOATSTONE; 879.6 - 882.6 ft, PACKSTONE; 882.6 - 891.0 ft, FLOATSTONE; 891.0 - 894.9 ft, PACKSTONE; 894.9 -900.1 ft, FLOATSTONE; 900.1 - 901.6 ft, PACKSTONE; 901.6 - 905.3 ft, FLOATSTONE; 905.3 - 905.8 ft, PACKSTONE; 905.8 - 906.0 ft, FLOATSTONE. Cementation as follows: irregular areas moderately cemented beginning 891.3 ft, moderately cemented from 905.3 - 906.0 ft. Lower contact sharp and approximately at 25 degree angle to vertical in core. SAMPLE: S @ 905.2 - 906.0; X @ 884.0.

[TOP OF SEDIMENT PACKAGE 6. Possible unconformity indicated by sharp increase in cementation.]

906.0 - 908.2 GRAINSTONE: skeletal, foraminifer; well cemented;
unaltered skeletal components; grayish orange to very
pale orange and pale yellowish brown; generally mediumto coarse-grained sand with abundant larger skeletal
components; medium porosity, minor shelter, fenestral,
and interparticle porosity; geopetal structure in
gastropod shells (some fine spar lining void in upper
part of gastropod shells) and shelter porosity suggest
"block" rotated approximately 90 degrees from vertical
in core. [Note: this is probably a slump block.]
Basal contact sharp and approximately at 20 degrees to
vertical in core. SAMPLES: S@ 906.0 - 906.5, 906.5 907.4; X@ 907.7.

[Geophysical logs show below this point general decay in gamma-activity from generally high level of organic-rich zone.]

908.2 - 910.9 PACKSTONE: skeletal, mollusc, coral; uncemented; unaltered skeletal components; pale yellowish brown; matrix predominantly very fine grained sand and silt. Containing small cemented nodules filled with skeletal PACKSTONE from 908.2 - 909.2 ft (Note: sequence here is like sequence above 906.0 ft). Contain small Porites sp. heads in upper part of unit; scattered small gastropods and pelecypods. Cobble (lithoclast like overlying unit, 0.2 ft in diameter) at 908.4 ft. upper 1.2 ft of this unit may be characterized [Note: as FLOATSTONE.] Lower contact gradational. T @ 908.4 (lithoclast), 908.5 (small cemented burrow), 908.8 (larger cemented burrows), 910.7; X @ 908.4, 910.7.

910.9 - 923.4 BAFFLESTONE: coral; matrix PACKSTONE mollusc, skeletal; generally uncemented, well-consolidated; partially altered skeletal components; pale yellowish brown; very fine grained to fine-grained. Contains digitate Porites sp. predominantly in growth position, other types of corals very sparse; small irregular well-cemented WACKESTONE-filled burrows(?) scattered throughout

unit. [Note: some <u>Porites</u> are irregularly and partially infilled with fine-grained spar.] Lower contact gradational. SAMPLES: T @ 920.4; X @ 920.0, 920.4.

923.4 - 924.5

PACKSTONE: skeletal, mollusc; uncemented, wellconsolidated; unaltered; pale yellowish brown; predominantly very fine grained sand. Lower contact gradational.

924.5 - 936.2

FLOATSTONE: coral (some tight), matrix PACKSTONE, mollusc, skeletal; generally uncemented, common small cemented nodules and irregular well-cemented patches to 929.8 ft, including cemented shelter at 925.1 ft; pale yellowish brown; matrix mainly silt to very fine grained sand. Contains corals in upper part of unit, irregular and partially infilled with finely crystalline cement; gastropods with nacreous shell layers to 929.1 (even cemented areas and diagenetic nodules include some original shell mateial); mollusc become moldic downward; selected open-framework corals become progressively more altered so that in basal 2.0 ft a coral like Porites andrewsi is almost completely dissolved, leaving very poorly defined, easily overlooked molds; corals mainly toppled digitate Porites sp. throughout unit, very scattered Seriatopora, Acropora cuneata from 930.4 -930.9 ft, Favia(?) at 932.8 and Porites andrewsi-type(?) from 934.4 - base of unit, few corals may be in growth position, most are not; echnoid spine at 935.6 ft. Lower contact apparently gradational. SAMPLES: S@ 927.8 - 928.0; X @ 935.7.

936.2 - 948.2

PACKSTONE WITH WACKESTONE: skeletal; predominantly uncemented; skeletal components seemingly preserved as steinkerns and internal molds; very pale orange to grayish orange; scattered cemented diagenetic nodules(?) from 936.2 - 940.7 ft, containing cemented foraminifer PACKSTONE like underlying unit, irregular moderately cemented areas from 942.9 - 943.3 ft. Contains Cardium internal mold at 936.2 ft; large spar-filled mollusc mold at 940.0 ft; very scattered corals; small Porites from 943.2 - 944.0 ft. Subunits as follows: 944.6 - 944.8 ft, muddy, very fine grained, approaching WACKESTONE; 947.1 ft - base, WACKESTONE TO PACKSTONE, very fine grained, plastic. Lower contact sharp, at approximately 35 - 40 degrees from vertical in core. SAMPLES: T @ 936.2, 937.0; X @ 937.0, 938.0, 947.5.

[Disconformity indicated by sharp contact, pronounced increase in cementation, presence of "tea-brown" micrite in underlying unit, and apparent change in lithic type at this horizon.]

948.2 - 953.1 GRAINSTONE(?) TO PACKSTONE: foraminifer, skeletal; very well cemented throughout, contains minor "tea-brown" micrite in non-burrowed areas; aragonitic mollusc shells and corals preserved as internal molds, mottled, lighter areas (burrows or diagenetic nodules?) very pale orange to pale yellowish brown, interburrow areas very pale orange to grayish orange to pale yellowish brown with moderate yellowish brown ("tea-brown"); burrows filled with apparently well-sorted, medium-grained foraminifer GRAINSTONE, interburrow areas probably poorly-sorted skeletal PACKSTONE; porosity low, moldic. Contains abundant, irregular, branching diagenetic nodules; numerous types of large foraminifers, including very sparse Lepidocyclina. Driller reported no recovery 949.6 - 950.8 ft, drilled rapidly (soft). SAMPLES: S @ 948.6 - 949.6, 951.8 - 952.6.

953.1 - 956.3

NO RECOVERY. Driller reported this interval very soft; downhole logs show very low density zone at this point; may be sand-filled cave.

956.3 - 960.2

PACKSTONE WITH GRAINSTONE: skeletal, foraminifer, mollusc, coral; very well cemented from 956.3 - 958.6 ft, becoming moderately cemented downward, poorly cemented at base of unit; most mollusc fragments and most corals mainly preserved as molds; mottled very pale orange and very pale orange to pale yellowish brown; generally very poorly sorted except for foraminifer GRAINSTONE-filled nodules or burrows(?); porosity moderate to low, moldic (includes large molds of corals). Contains scattered Lepidocyclina(?); several types of corals; diverse gastropod fauna. Lower contact probably gradational. SAMPLE: X @ 958.2.

960.2 - 961.0 NO RECOVERY.

961.0 - 969.2

PACKSTONE TO WACKESTONE: skeletal; uncemented; microfossils with some shell material preserved; very pale orange to pale yellowish brown; very fine grained to silty, grades to WACKESTONE from 967.1 - 969.2 ft, plastic. Lower contact apparently sharp. [Note: cemented fragment at 965.8 ft in bag is probably fall-in.] SAMPLE: S @ 963.7 - 964.3; X @ 968.7.

[TOP OF SEDIMENT PACKAGE 7. Disconformity indicated by marked increase in cementation and presence of "tea-brown" micrite.]

969.2 - 970.6 PACKSTONE TO GRAINSTONE(?): foraminifer, skeletal; very well cemented; molluscs and corals preserved as molds; very pale orange to pale yellowish brown, large areas of moderate yellowish brown to dark yellowish brown ("teabrown" cement); generally very fine to medium-grained, moderately to poorly sorted; minor moldic porosity.

Contains Lepidocyclina and abundant other large foraminifers; flakes of lignite in base of recovery at 970.6 ft. SAMPLE: S @ 969.2 - 969.9.

- 970.6 972.1 NO RECOVERY. Driller reported very soft material, drilled quickly; logs show very low density zone.
- 972.1 973.1 MUDSTONE: strongly laminated; uncemented; upper 0.2 ft contains approximately 6-mm-thick, dusky-yellow-brown lignite lamina, upper part and remainder of unit pale yellowish brown, thicker funds with minor dusky-yellow-brown laminae up to approximately 8-mm-thick, 2 dark laminae in basal 0.3 ft contain scattered, unaltered shell material; upper laminae offset about 1 cm by microfaulting. Lower contact gradational.
- 973.1 979.6 PACKSTONE TO WACKESTONE: skeletal; uncemented to very poorly cemented, except for approximately 30% cemented diagenetic nodules(?) throughout; skeletal components preserved as molds; very pale orange to pale yellowish brown; mainly silt and fine-grained sand, muddy in interval from 976.9 977.3 ft, minor moldic porosity. Contains almost no large skeletal components, sparse corals. Lower contact gradational.
- 979.6 980.6 MUDSTONE: poorly laminated; uncemented, becoming plastic in lower part; thin to very thick, poorly defined laminae, darker laminae at maximum 45 degree angle to vertical in core from 979.8 980.2 ft; predominantly very pale orange to pale yellowish brown; band from 979.8 980.2 ft, pale yellowish brown and slightly coarser silt to very fine grained sand; base of unit very pale orange; very sparse skeletal debris, shells preserved. Lower contact gradational. SAMPLE: X @ 980.0.
- 980.6 982.5 WACKESTONE TO PACKSTONE: skeletal, coral; uncemented to poorly cemented with moderately well-cemented diagenetic

nodules(?); skeletal material preserved as molds; very pale orange; upper 0.5 ft WACKESTONE, plastic; lower part of unit PACKSTONE; minor moldic porosity.

[Possible disconformity indicated by increase in cementation, increased alteration of skeletal components, and possible rhizoliths.]

982.5 - 988.8 FLOATSTONE: coral; matrix PACKSTONE to GRAINSTONE, mollusc, coral, foraminifer, skeletal; generally well cemented; coral and molluscs preserved exclusively as molds, some foraminifers preserved as molds; very pale orange; predominantly fine- to medium-grained sand, some coarse sand, very poorly sorted; moderately high moldic porosity (many corals dissolved); upper 0.4 ft of unit contains small rootlets(?) with minor pale-yellowish-brown stain. Contains slightly recrystallized, inverted Porites lutea head from 929.0 - 929.3 ft; several other types of large corals, including branching corals; large pelecypods; large foraminifers include Lepidocyclina. Lower contact abruptly gradational. SAMPLE: S @ 982.7 - 983.0; X @ 987.6.

988.8 - 994.9 PACKSTONE: coral, mollusc, skeletal; generally poorly cemented, except for small well-cemented diagenetic nodules; skeletal components preserved exclusively as molds; very pale orange; moldic porosity. Biotic components similar to overlying unit except corals sparse. SAMPLE: X @ 994.5; M @ 990.7 - 991.5.

994.9 - 997.2 NO RECOVERY.

997.2 - 997.8 PACKSTONE: like overlying unit except moderately cemented.

997.8 - 999.2 PACKSTONE: coral, mollusc, skeletal; poorly cemented, except for small, moderately cemented diagenetic nodules; skeletal components preserved exclusively as molds; very pale orange; moldic porosity.

999.2 - 1003.9 NO RECOVERY.

1003.9 - 1029.7 PACKSTONE: skeletal, gastropod, foraminifer(?); generally uncemented with minor very poorly cemented zones, containing scattered, well-cemented diagenetic nodules throughout; generally very fine to fine-grained, moderately sorted; low moldic porosity; generally very

pale orange, zone from 1008.4 - 1016.9 ft, very pale orange to grayish orange, mottled [this zone in part

contains poorly cemented areas with fine spar having a moderate-yellowish-brown, radial structure]. Zones of cemented nodules as follows: 1003.9 - 1006.6 ft, approximately 20% small diagenetic nodules: 1006.9 -1009.3 ft, very sparse diagenetic nodules; 1009.3 -1011.6 ft, approximately 20% diagenetic nodules; 1011.6 - 1023.0 ft, very sparse diagenetic nodules; 1023.0 -1029.7 ft, approximately 20% very well cemented diagenetic nodules. Muddy zones as follows: 1007.9 ft, 1011.6 - 1013.8 ft, 1016.0 - 1016.4 ft. Contains abundant, recrystallized Lepidocyclina from about 1008.9 ft to base. Lower contact gradational. SAMPLE: S @ 1015.1 - 1016.4 (spar-rich material, several pieces taken over this depth interval); X @ 1010.3, 1015.1, 1025.3.

1029.7 - 1036.9

PACKSTONE AND WACKESTONE: mollusc, coral, skeletal; irregularly cemented with cementation as follows: from top to 1031.0 ft, approximately 50% of unit well-cemented diagenetic nodules; from 1031.0 -1036.9 ft, about 30% well-cemented diagenetic nodules(?); internodule areas poorly cemented to uncemented; most skeletal components molds; mottled very pale orange and very pale orange to moderate yellowish brown; moldic porosity. Contains several types of corals, including branching Porites; several types of pelecypods. [Note: fines washed out from 1030.3 - 1031.0 ft.] Lower contact gradational. SAMPLE: S @ 1030.8 - 1031.0; X @ 1030.8.

1036.9 - 1049.4

PACKSTONE: skeletal, coral, mollusc; moderately cemented with irregular patches well-cemented, below 1044.2 ft becomes poorly to moderately cemented downward to base of unit, lower 0.3 ft moderately well-cemented; skeletal components moldic; very pale orange mottled with well-cemented areas pale yellowish brown to very pale orange; grain size difficult to determine because of alteration. Contains small "tea-brown" lined rhizoliths from 1039.8 - 1040.2 ft, other small rhizoliths(?) scattered from 1040.4 - 1042.6 ft; large cylindrical worm tube from 1046.7 - 1047.2 ft; contains scattered large pelecypods and corals preserved as molds. Lower contact disturbed by drilling. SAMPLE: S @ 1037.4; T @ 1042.6; X @ 1037.4, 1047.0.

[TOP OF SEDIMENT PACKAGE 8. Disconformity suggested by abrupt change in cementation and presence of "tea-brown" calcite(?) in underlying unit. Geophysical lows show an increase in sonic velocity and density at this point.]

1049.4 - 1049.9 PACKSTONE TO WACKESTONE: foraminifer, skeletal; moderately to well-cemented, browner areas with massive, crypto-crystalline cement; very pale orange mottled with pale yellowish brown. Lower contact sharp, undulatory.

SAMPLE: S @ 1049.4 - 1049.6; X @ 1049.4.

[This surface is probably closely related to the one at 1049.4 ft above (may represent invagination of same hardground.]

1049.9 - 1051.7 PACKSTONE: skeletal, foraminifer; moderately to wellcemented; skeletal components preserved exclusively as molds; very pale orange with very pale orange to moderate yellowish brown; upper surface apparently laminated crust, upper 0.1 ft laminated crust of cryptocrystalline cement, uppermost part very pale orange grading to pale yellowish brown to moderate yellowish brown to dark yellowish brown with patches dark yellowish brown to dusky yellowish brown. Unit has had an apparently complex cementation history, possibly involving "tea-brown" micrite, moderately-yellowishbrown palisade(?) cement [Note: may be some very pale orange rinds on grains preceeding "palisade" cement.]. Contains 1 in diameter hole lined with moderateyellowish-brown cryptocrystalline cement at 1051.1 ft; large gastropods; Lepidocyclina and other large foraminifers. Lower contact sharp. SAMPLES: T@ 1051.1 (cavity lining), S @ 1049.9 - 1050.1 (includes part of upper unit); T @ 1051.1.

1051.7 - 1061.0 WACKESTONE TO PACKSTONE: foraminifer, skeletal, mollusc; well-cemented in upper part, becoming progressively less-cemented downward, moderately cemented at base; all skeletal components preserved as molds; generally very pale orange, mottled with minor pale yellowish brown. Contains several types of large gastropods, small thinshelled pelecypods, and scattered corals. Contains large amount of "tea-brown" calcite in upper part of unit, becoming very scattered downward; upper 0.2 ft contains area with abundant "tea-brown" micrite in laminated zone, areas of pale yellowish brown interspersed with areas of dark yellowish brown to moderate brown, bored(?). [Note: dark-yellowish-orange stain on outside broken surface of core from 1056.4 -1056.6 ft.] Lower contact gradational. SAMPLE: S @ 1051.6 - 1052.4 (contains part of overlying unit); X @ 1055.1.

1061.0 - 1067.3 WACKESTONE TO PACKSTONE: skeletal, foraminifer, mollusc;
like overlying unit except generally poorly to
moderately cemented, except for moderately well cemented
interval from 1062.5 - 1063.1 ft. Contains several

types of corals preserved only as internal molds and tending to be associated with zones of moderate-yellowish-brown cement. Lower contact gradational. SAMPLE: S @ 1062.7 - 1063.1; X @ 1065.3.

1067.3 - 1083.0

FLOATSTONE: coral, matrix skeletal PACKSTONE OR WACKESTONE: generally irregular cemented, but with cementation increasing downward in unit, moderately well cemented with minor areas well-cemented from top to 1077.3 ft, well-cemented from 1077.3 - 1078.7 ft, very well cemented from 1078.7 - 1079.3 ft, pervasively cemented with partial infilling of molds from 1079.3 -1081.9 ft, and moderately cemented from 1081.9 ft - base (Note: darker areas better-cemented than lighter areas); skeletal components preserved exclusively as molds; grain size and sorting of matrix obscured by cementation; mottled very pale orange to pale yellowish brown; moldic porosity. Contains molds selectively spar-reduced and partially filled by pale-yellowishbrown and dark-yellowish-brown spar. Contains several types of corals, including small stick corals and small heads of several types, including Porites. Base apparently sharp. SAMPLES: S @ 1069.0 - 1069.6, 1080.3 - 1080.9; X @ 1079.3

1083.0 - 1084.8

BAFFLESTONE: coral; matrix skeletal PACKSTONE OR WACKESTONE; well-cemented; corals preserved exclusively as molds; mottled very pale orange with pale yellowish brown, minor moderate-yellowish-brown ("tea-brown") stain; moldic porosity, mainly coral molds. Corals apparently in growth position; may contain coralgal coatings; contains <u>Carpenteria</u>. SAMPLES: S@ 1083.0 - 1083.3, 1083.3 - 1084.1, 1084.2 - 1084.5; X@ 1083.0, 1085.4.

1084.8 - 1085.6 NO RECOVERY.

1085.6 - 1091.1

POOR RECOVERY: may be continuation of overlying unit; common moderate-yellowish-brown spar-infilling of coral molds. SAMPLES: S@approximately 1086.6 - 1086.9, 1090.8 - 1091.1; T@1089.0; X@1089.0, 1090.8.

*** TOTAL DEPTH OF HOLE 1091.1 FT. ***

BOREHOLE OPZ-18

Lat/Long (E/W-1960): 11°6′13.3" N, 162°06′09.3" E

Lat/Long (WGS-1972): 11°36′13.1" N, 162°06′09.4" E

Location IVY-grid, ft): 124,789 N and 036,383 E

Distance/Bearing from OAK GZ: 335 ft, 125.0 deg

Water Depth (H&N): 201.9 ft Hole Depth (bsf): 748.6 ft

Hole Spudded: 06/29/1985 Drilling Ended: 07/03/1985

Sampling: SS, SH Recovery: 26% (188.1 ft)

Logs: GR/DN/CP, GR/NU, BHG Date Logged: 06/3-6/1985

Deviation: 0.0 deg @ 182 ft, 2.5 deg @ 270 ft, 1.0 deg @ 720 ft

Casing: 8-5/8-in. @ 186.5 ft; 6-5/8-in. @ 216 to 741.5 ft (gap between csg.)

Drilling Mud/Additives: BVS (76 sx), PAD (42 gals), DFM (11 gals), LCM (2 sx)

Geologists: T.W. Henry, R.P. Major Drillers: G. Mooney, C. Peltier,

Paleontologist: E. Brouwers P. Sacro

Gravimeter Specialists: L. Prado, Logger: A. LeBreton

D. Joiner, A. Cogbill Redescribed: 09/14-15/1985

* Only 8-5/8-in. casing recovered; remainder shot-off in hole.

Depth	Description
0.0 - 44.6	MUDSTONE TO WACKESTONE: uncemented; very pale orange; upper part MUDSTONE, grading to muddy WACKESTONE below 35.8 ft, becoming progressively coarser grained downward to very fine grained sand in lower part of unit; plastic. Contains common moderate-red Homotrema (5R4/6) below 6.3 ft, especially at 17.8 ft; small brownish-black, lignite? flakes (charcoal?) scattered throughout; notable absence of larger skeletal components. Lower contact gradational. SAMPLE: X @ 31.1; R @ 35.2.

44.6 - 74.3 GRAINSTONE: uncemented; generally very pale orange; grades imperceptably downward from very fine grained sand at

top to medium- to coarse-grained sand at base (not much mud). Unit contains moderate-red (5R4/6) Homotrema and moderate-brown (5R4/4) grains scattered throughout; small granule-size piece of brownish-black charcoal with adhering moderate-yellowish-brown foraminifers at 25.5 ft, scattered grayish-black flecks between 50.4 - 51.2 ft, 2-cm-long piece of charcoal at 64.9 ft. Lower contact gradational. SAMPLES: X @ 48.0, 64.4; R @ 60.8, 74.3.

74.3 - 135.3

GRAINSTONE: uncemented; moderate-yellowish-brown, altered, large foraminifers filled with brown crystalline(?) material at top of unit, moderate-brown (5YR4/4) sand-sized grains throughout, altered and unaltered Halimeda grains throughout, small gastropod with original color and nacreous luster at 110.9 ft; moderate-red, (5R4/6) sand-sized Homotrema 132.0 ft - base; generally very pale orange; medium- to coarse-grained sand, very slightly muddy sand at top becoming coarse- to very coarse grained downward, becoming more poorly sorted downward; strong hydrogen sulfide smell throughout. Interval from 133.9 - 135.3 approaches PACKSTONE. SAMPLES: X @ 76.0, 93.0, 112.0, 129.2; R @ 76.8, 91.8, 99.2, 112.2, 125.2.

135.3 - 160.0

PACKSTONE: mixed-rubble; uncemented; unstratified; very pale orange; mainly very coarse grained, granule-bearing sand. Unit contains granule-size coral fragments, some moderate-yellowish-brown stained, other types of coral fragments not altered, including pebble-sized piece at 157.8 ft; a mixture of different types of granule-size lithoclasts. Lower contact gradational. SAMPLES: X @ 145.5; R @ 148.4, 160.0.

160.0 - 188.7

PACKSTONE: mixed-rubble; unstratified; uncemented; mainly very pale orange; granule- to pebble-size grains, consisting of a wide variety of rubble; mixedalteration; unit coarsens gradually from top to 175.1 ft; from 175.1 ft to base, contains several very muddy intervals; mostly very pale orange with pale-yellowishbrown, altered skeletal fragments and lithoclasts. Contains small pebble-size fragment of pale-yellowishbrown Dictyaraea at 160.4 ft, pebble of pale-yellowishbrown Porites lutea at 163.7 ft, small pebble-size fragment of very pale orange Porites lutea at 166.3 ft; mixed, unaltered gastropod shells and highly altered skeletal fragments; lithoclasts include brown rock fragments; some small lithoclasts with sparse "teabrown" micrite. Base distrubed by drilling but appears relatively sharp, at approximately 30 degrees to vertical in core. SAMPLES: S @ 163.7 (pale-yellowishbrown Porites lutea), 166.3 (very pale orange Porites lutea). SAMPLES: X @ 160.0, 174.5; R @ 172.6, 186.0.

188.7	-	198.7	PACKSTONE: Halimeda, foraminifer, skeletal; uncemented; generally yellowish gray (5Y7/2) to light olive gray (5Y6/1); clasts granule-size and smaller. Contains abundant foraminifers, moderate-red (5R4/6) Homotrema throughout; abundant well-preserved molluscs; Halimeda plates crisp, seemingly unaltered; unaltered coral fragments; abundant coral sticks, Acropora coral fragments up to pebble size with encrusting, moderate-
			red (5R4/6) Homotrema. SAMPLES: X @ 192.0; R @ 191.8.
198.7	_	201.1	NO RECOVERY.
201.1		208.3	PACKSTONE: skeletal; yellowish-gray (5Y7/2) to light olive-gray (5Y6/1); appears to contain mixed components.
208.3	_	210.4	NO RECOVERY.
210.4		211.0	FLOATSTONE: mixed-rubble; with PACKSTONE matrix; contains several types of lithoclasts, spar-infilling of mollusc; very pale orange; lower contact smeared into underlying unit, at about 30 degrees to core.
211.0		214.5	PACKSTONE: skeletal, <u>Halimeda</u> , foraminifer; yellowish-gray (5Y7/2) like unit 188.7 - 198.7 ft.
214.5		217.0	NO RECOVERY.
217.0	-	230.2	uncemented; unstratified; mixed alteration of skeletal components; very pale orange; granule— to small pebble—size lithoclasts of angular, moderately well—cemented limestone. Contains scattered fresh shell fragments, and altered shell fragments; pebble—sized fragment of moderate—yellowish—brown coral at 226.8 ft; angular pebble—sized lithoclast of grayish—orange, sparry calcite at 220.4 ft; scattered pelecypod steinkerns. SAMPLES: T @ 220.4, 226.8 (coral); X @ 217.0; R @ 220.2.
230.2		232.6	NO RECOVERY.
232.6	_		PACKSTONE: <u>Halimeda</u> , foraminifer, skeletal; uncemented; mainly unaltered components, including sparse moderate-red (5R4/6) <u>Homotrema</u> (like unit 188.7 - 198.7 ft);

yellowish gray (5Y7/2) to grayish green (10GY5/2). Lower contact smeared into underlying unit over approximately 0.1 ft, partially disrupted by drilling.

FLOATSTONE: mixed-rubble with PACKSTONE matrix: 233.3 - 295.1 uncemented; skeletal components generally slightly altered; very pale orange; silt to large pebble size, unsorted. Lithoclasts predominantly spar-cemented GRAINSTONE and skeletal PACKSTONE, some well-cemented; well-cemented WACKESTONE clast at 245.5 ft; abundant granules of moderate-yellowish-brown spar and small pebbles of same from 271.0 - 274.6 ft; coarse pebblesize well-cemented lithoclast, containing unaltered molluscs and some spar cement at 285.9 ft; cemented burrow(?) at 254.0 ft; scattered coral fragments throughout; larger mollusc shells relatively unaltered, including broken fragments of a large pelecypod at 239.2, 248.3 and 263.0 ft; corals partially infilled with spar. From 294.8 to 295.1 ft, pulvarized coral head. SAMPLES: T @ 285.9 (cemented lithoclast); X @ 251.0, 274.0, 290.0; R @ 251.0.

[Discontinuity suggested by color change and "tea-brown" micrite coating skeletal grains and rhizoliths(?) in several brecciated pieces in core.]

295.1 - 295.5 FLOATSTONE: rubble; PACKSTONE matrix; uncemented; some well-preserved, broken mollusc material; very pale orange to pale yellowish brown. Contains pebble-sized, angular clasts of well-cemented skeletal PACKSTONE to GRAINSTONE, with areas of moderate-yellowish-brown ("tea-brown") calcite and areas of "tea-brown" micrite coating skeletal grains and small rhizolith(?).

SAMPLE: T @ 295.3 [clast with rhizolith(?) and "tea-brown" micrite].

295.5 - 305.6 PACKSTONE: rubble, mollusc; uncemented; gastropod and pelecypod shells fragmented, slightly altered, locally partially filled with moderate-yellowish-brown spar; very pale orange; lithoclasts mainly moderately well-to well-cemented GRAINSTONE and PACKSTONE; scattered moderately well-preserved coral fragments, partially spar-infilled.

305.6 - 316.5 FLOATSTONE: rubble with PACKSTONE matrix; identical to unit above but from top to 306.3 ft very muddy, approaching WACKESTONE matrix; uncemented; very pale orange. SAMPLE: T @ 305.6 [clast with "tea-brown" micrite-lined rhizoliths(?).]

316.5 - 320.5 NO RECOVERY.

320.5 - 362.6 PACKSTONE: mollusc; uncemented; contains abundant spar associated with skeletal fragments from 356.7 - 357.2 ft; scattered spar-filled gastropod steinkerns with adhered altered shell material from 347.2 ft - base: clast containing "core" of moderate-yellowish-brown micrite at 326.2 ft; very pale orange. SAMPLES: X @ 315.8, 331.2, 357.0. 362.6 - 367.0 NO RECOVERY. [Disconformity possibly indicated by 0.1-ft thick zone well-cemented to very well cemented skeletal WACKESTONE to PACKSTONE, very pale orange with slight pale-yellowish-brown ("tea-brown") stained rhizoliths. Contains foraminifers and spar-lined molluscs.] 367.0 - 372.6 FLOATSTONE: rubble, skeletal, with PACKSTONE matrix; uncemented; shell material more altered than in overlying unit; very pale orange; contains small cemented PACKSTONE nodules(?). SAMPLE T @ 367.0 (well-cemented pebble-size piece with minor "tea-brown" micrite). 372.6 - 376.7 NO RECOVERY. 376.7 - 377.2 GRAINSTONE: mollusc, foraminifer, skeletal; uncemented; most skeletal grains unaltered to very slightly altered, some mollusc fragments retain original color, abundant microgastropods with color retention; grayish orange to very pale orange; predominantly medium- to coarsegrained sand, moderately to poorly sorted, grains slightly rounded. Contains Calcarina. SAMPLE: X @ 377.0. 377.2 - 381.4 NO RECOVERY. 381.4 - 381.9 GRAINSTONE TO PACKSTONE: skeletal, mollusc, uncemented; containing slightly more altered components than overlying unit; very pale orange with minor grayishorange tones. Contains slightly altered large mollusc shell with adhered poorly-cemented skeletal PACKSTONE; matrix consists of broken shell fragments. 381.9 - 386.2 NO RECOVERY. 386.2 - 387.0 PACKSTONE: skeletal, mollusc, rubble (muddy); uncemented;

very pale orange, lithoclass of moderately well-cemented

skeletal PACKSTONE. Contains large shattered mollusc shell with nacreous layer preserved; very pale orange to moderate yellowish brown with dark-yellowish-brown, adhering matrix.

387.0 - 391.1 NO RECOVERY.

[TOP OF SEDIMENT PACKAGE 3. Disconformity indicated by radical increase in cementation of clasts, presence of moldic porosity, spar-replaced corals and moderate "tea-brown" micrite.]

391.1 - 414.7 RUDSTONE: rubble with little or no matrix; uncemented; contains angular, broken pieces up to large-pebble size of well-cemented to very well cemented, skeletal PACKSTONE or coral FLOATSTONE; fragments of "tea-brown" micrite in upper part of unit. Original rock contained abundant moldic porosity, corals etched and partially replaced by moderate-yellowish-brown spar, vugs partially lined by spar; grayish orange to very pale orange. SAMPLES: T @ 391.1; X @ 391.6, 400.6, 414.5.

414.7 - 418.9 NO RECOVERY.

418.9 - 461.4 FLOATSTONE: rubble with PACKSTONE matrix; uncemented; all skeletal components altered; very pale orange; similar to overlying unit except for mud in matrix, clasts lighter color, less abundant less pervasively cemented and with less spar (especially below 434.6 ft).

Contains clasts of PACKSTONE to coral FLOATSTONE, abundant spar from 434.1 - 434.6 ft, very muddy matrix from 439.3 - 455.6 ft, less muddy matrix from 460.6 - 461.4 ft. SAMPLES: X @ 429.7, 449.8.

461.4 - 465.9 NO RECOVERY.

465.9 - 466.6 PACKSTONE: uncemented; unaltered pelecypod shell fragments with nacreous layer preserved; very pale orange to pale yellowish brown. Contains up to small pebble-sized pieces of well-preserved, grayish-orange coral; small fish tooth at 466.2 ft. [Note: unit may be a dike.] SAMPLE: X @ 466.6.

466.6 - 471.1 NO RECOVERY.

471.1 - 517.1 FLOATSTONE: rubble with PACKSTONE matrix; uncemented; very pale orange; containing granule- to pebble-size, angular clasts of rock which was originally coral FLOATSTONE

with a well-cemented WACKESTONE to PACKSTONE matrix (clasts like lower part of unit at 439.3 - 461.4 ft). Contains corals preserved exclusively as molds; abundant granule- to pebble-size pieces of spar-replaced coral from 486.9 - 487.6 ft (grayish-orange sparry calcite); rounded clasts of well-cemented skeletal PACKSTONE. SAMPLE: T @ 516.9; X @ 507.3.

lower than overlying sequence.] SAMPLE: X @ 518.0.

517.1 - 518.2 RUDSTONE: rubble with no mud matrix; very pale orange with minor of pale-yellowish-brown tones; coarse granule- to very coarse sand size, angular clasts of well-cemented WACKESTONE. [Note: material may have been washed by drilling or fallen in from uphole; density log slightly

518.2 - 521.6 NO RECOVERY.

[TOP OF SEDIMENT PACKACE A A probable disconformity is represented in this

[TOP OF SEDIMENT PACKAGE 4. A probable disconformity is represented in this interval.]

521.6 - 555.6 FLOATSTONE: rubble with PACKSTONE matrix; uncemented; very pale orange. Upper part of unit contains clasts of material similar to clasts in overlying unit, but probably never as well-cemented. Skeletal components preserved almost exclusively as molds, clasts become less common downward in unit, in lower part of unit only remaining clasts may have been small cemented burrows. Large piece of Porites lutea(?), extensively recrystallized, very pale orange to grayish orange from 550.1 - 550.5 ft. SAMPLE: X @ 535.8.

555.6 - 559.8 NO RECOVERY.

559.8 - 587.6 PACKSTONE WITH WACKESTONE: coral, skeletal, mollusc; uncemented; skeletal components various stages of alteration, generally less-altered downward; very pale orange; no clasts Contains several fragments of slightly recrystallized, branching Porites(?) from 565.0

- 565.7 ft; recrystallized Porites lutea(?) from 565.0 - 565.7 ft; recrystallized Porites lutea(?) from 570.6 - 570.8 ft; slightly altered mollusc shells from 575.6 ft to base; large chalky gastropod shell and small cemented burrows or diagenetic nodules at 581.6 ft. Unit approaches WACKESTONE from 570.1 - 570.8 ft. [Note: unit may have been poorly, irregularly cemented.] SAMPLE: X @ 565.0.

587.6 - 592.1 NO RECOVERY.

592.1 - 607.7 PACKSTONE: skeletal; uncemented; unaltered; very pale orange in upper part, becoming very pale orange with minor pale-yellowish-brown tones from 606.9 ft to base. Contains scattered Dictyaraea sticks; scattered cemented burrows or diagenetic nodules. SAMPLE: X @ 592.1, 607.1. [TOP OF SEDIMENT PACKAGE 5.] NO RECOVERY. 607.7 - 611.6 611.6 - 626.9 PACKSTONE: coral, mollusc; like above unit except pale yellowish brown, becoming dark yellowish brown to pale yellowish brown from 626.1 - 622.9 ft. Contains unaltered molluscs; Dictyaraea sticks. SAMPLE: X @ 611.7, 621.3. 626.9 - 630.9 NO RECOVERY. PACKSTONE: mollusc; uncemented; unaltered; dark yellowish 630.9 - 631.9 brown with minor dusky-yellowish-brown tones. Contains thin dusky-brown lignite streaks, large, broken pelecypod and several types of gastropod shells with nacreous layer preserved; branching bryozoans; lignitic wood fragments. SAMPLE: X @ 631.0. 631.9 - 635.6 NO RECOVERY. PACKSTONE: skeletal, mollusc; uncemented; unaltered; pale-635.6 - 646.1 yellowish-brown from 635.6 - 636.2 ft, becoming progressively darker downward to dark yellowish brown from 645.4 - 646.1 ft. Contains small wood fragment at 640.9 ft, scattered larger wood fragments from 645.4 -646.1 ft, small wood fragments from 640.9 ft. [Strong gamma peak at 642 - 645 ft on logs corresponds to interval of NO RECOVERY from 641.1 - 645.4; may be highly lignitic.] 646.1 - 650.3 NO RECOVERY. 650.3 - 665.2 PACKSTONE TO WACKESTONE: mollusc, skeletal, coral; uncemented; unaltered; pale yellowish brown to dark yellowish brown from top to 650.7 ft, pale yellowish brown from 650.7 ft to base; approaching coral FLOATSTONE from 650.3 - 650.7 ft; very muddy from 650.3 - 650.7 ft and 664.4 - 665.2 ft. Contains abundant

unaltered shells. SAMPLES: X @ 650.3, 664.9.

665.2 - 669.3	NO RECOVERY.
	CORAL HEAD: Astroporea(?); very pale orange to grayish orange. SAMPLE: X @ 669.6.
670.1 - 674.2	
674.2 - 679.8	PACKSTONE: skeletal, mollusc; uncemented; unaltered; pale yellowish brown to dark yellowish brown.
679.8 - 683.9	NO RECOVERY.
683.9 - 694.9	WACKESTONE TO FLOATSTONE: skeltal, mollusc, coral, matrix WACKESTONE to PACKSTONE and interbedded with same; pale yellowish brown. Contains common <u>Dictyaraea</u> sticks, small <u>Astroporea</u> head; several types of molluscs, including several types of small gastropods, with color retention; small piece of wood at 684.2 ft.
694.9 - 699.5	NO RECOVERY.
699.5 - 700.0	PACKSTONE: mollusc; pale-yellowish-brown. Contains abundant pelecypod fragments; large Strombus(?) fragment with nacreous layer preserved; shells are fractured. Unit is distinctive because it is coarser than overlying unit.
700.0 - 704.9	NO RECOVERY.
704.9 - 721.6	PACKSTONE to WACKESTONE to FLOATSTONE: mollusc, skeletal, coral; uncemented; unaltered; pale yellowish brown from 704.9 - 710.9 ft, pale yellowish brown from 715.8 ft - base; muddier from 715.8 - 716.3 ft.
721.6 - 748.6	NO RECOVERY. Casing set to 748.6 ft for borehole gravimeter.

*** TOTAL DEPTH OF HOLE 748.6 FT ***

BOREHOLE OQT-19

Lat/Long (E/W-1960): 11°36′02.0" N, 162°06′00.9" E

Lat/Long (WGS-1972): 11°36′01.8" N, 162°06′00.9" N

Location (IVY-grid, ft): 123,651 N and 035,545 E

Distance/Bearing from OAK GZ: 1,444 ft, 202.9 deg.

Water Depth: 117.5 ft Hole Depth (bsf): 701.5 ft

Hole Spudded: 07/07/1985 Drilling Ended: 07/10/1985

Sampling: SS, SH Recovery: 18% (126.0 ft)

Logs: MCS, GR/DN/CP, GR/NU, BHG Date Logged: 07/10-11/1985

Deviation: 1.8 deg @ 63 ft, 1.5 deg @ 130 ft, 3.3 deg @ 168 ft, 1.0 deg @ 195

ft, 1.0 deg @ 360 ft, 0.8 deg @ 701.5 ft

Casing: 8-5/8-in. @ 131 ft; 6-5/8-in. to 701.5 ft (all 8-3/8-in. casing pulled)

Drilling Mud/Additives: BVS (152 sx), PAD (71 gals), DFM (11.5 gals),

LCM (24 sx)

Geologists: T.W. Henry, R.P. Major Drillers: G. Mooney, C. Peltier,

Paleontologist: E. Brouwers P. Sacro

Gravimeter Specialists: L. Prado, D. Joiner Logger: A. LeBreton.

Redescribed: 09/15/1985

Depth

Description

[TOP OF SEDIMENT PACKAGE 1.]

0.0 - 5.7

GRAINSTONE: skeletal, <u>Halimeda</u>; uncemented; unaltered; very pale orange; slightly muddy, upper part fine to fine-grained, lower 0.3 ft very coarse grained, upper part moderately well-sorted, becoming poorly sorted downward. Contains scattered moderate-red (5R4/6)

<u>Homotrema</u>, abundant large <u>Halimeda</u>, small coral fragments. Lower contact gradational.

5.7 - 6.4 PACKSTONE: skeletal, <u>Halimeda</u>; uncemented; unaltered skeletal components, yellowish gray (5Y7/2) with minor light-olive-gray (5Y7/2) tones; very fine to very coarse grained, generally poorly sorted. Contains scattered moderate-red (5R4/6) <u>Homotrema</u>; scattered small coral sticks including Seriatopora; crisp Halimeda.

- 6.4 10.3 NO RECOVERY.
- _______
 - 10.3 10.7 GRAINSTONE: similar to unit at top of borehole, becoming coarser grained downward; very pale orange with minor light-olive-gray (5Y6/1) tones. Contains whole, unabraded small mollusc shells. Lower contact gradational.
- 10.7 A6.6 DACUCTONE LITTLE DICATETONE. compl. Holdmode. cholotel
 - PACKSTONE WITH FLOATSTONE: coral; Halimeda; skeletal PACKSTONE matrix; uncemented; unaltered skeletal grains; yellowish gray (5Y7/2) to light olive gray (5Y6/1). Contains some skeletal components with original color, particularly molluscs; moderate-red (5R4/6) Homotrema; small Porites head from 15.5 to 15.8 ft, fragments of Porites lutea at 36.9 ft, scattered Acropora sticks from 15.8 20.9 ft; Astreopora head 41.5 41.8 ft. FLOATSTONE intervals as follows: 15.5 20.9 ft, 36.6 42.1 ft. Contains very scattered dark-greenish-gray (phosphatic?) ostrocode and foraminifer molds and granule-size coral fragments beginning at 15.6 ft and continuing to base.

46.6 - 50.5 NO RECOVERY.

[TOP OF SEDIMENT PACKAGE 2. Disconformity indicated by phosphatic(?) surfaces on corals, reworked material in overlying unit, slight increase in cementation, and increase in alteration of skeletal components.]

PACKSTONE WITH FLOATSTONE: coral, skeletal, Halimeda, mollusc; unit poorly cemented to 65.8 ft, poorly cemented to uncemented downward to base; generally very pale orange in upper part except for stain as noted below, very pale orange with minor pale-yellowish-brown tones from top to 53.4 ft. Skeletal components moderately altered from top to 72.0 ft; Halimeda very chalky; mollusc shells slightly chalky; grayish-pink (bleached) Homotrema; scattered pelecypods with color retention and mollusc shells less altered from 72.0 ft to base; coral and other skeletal fragments with dark-greenish-gray stain on surface (phosphatic?) from top to 53.4 ft. Sparse FLOATSTONE intervals as follows: 50.5 - 62.7, 69.4 - 70.2 ft. Corals as follows: broken

<u>Astreopora</u> head at 56.2 ft. Contains large pelecypods from 62.7 ft to base; foraminifer steinkerns in phosphatic(?) zone near top of unit. SAMPLE: T @ 50.5 - 51.0.

72.9 - 75.4 NO RECOVERY.

[Disconformity indicated by increase in cementation, minor "tea-brown" cement, appearance of small-scale moldic porosity, small rhizoliths(?), and increased alteration of skeletal components.]

75.4 - 88.5

PACKSTONE TO WACKESTONE: mollusc, Halimeda; poorly cemented in upper part of unit, poorly cemented, irregularly cemented downward; small skeletal components in upper part of unit moldic, minor "tea-brown" cement along small rhizoliths(?) in upper 0.4 ft, Halimeda very chalky; very pale orange. Subunits as follows:

WACKESTONE from 85.4 - 86.1 ft; remainder PACKSTONE. SAMPLES: T @ 75.4, 75.7.

[Disconformity indicated by increase in cementation and spar, and minor "teabrown" micrite.]

PACKSTONE WITH WACKESTONE: skeletal, coral, mollusc; upper part poorly cemented, becoming very poorly cemented to uncemented downward; very pale orange. Contains minor "tea-brown" micrite and minor moderate-yellowish-brown spar-infillings of mollusc molds from 90.7 - 91.2 ft; small moderately cemented fragment with "tea-brown" micrite 94.5 ft; very chalky Halimeda, almost unrecognizable; small gastropods preserved as steinkerns in upper part of unit; Seriatopora sticks 88.5 ft; large Astreopora(?) 91.2 ft; large Cypraea partially replaced by spar 93.8 ft. SAMPLES: T @ 88.5, 90.7.

99.8 - 103.3 NO RECOVERY.

103.3 - 104.4 POOR RECOVERY: cuttings of poorly cemented rock like overlying unit and shell fragments. Lower 0.2 ft like overlying unit with mud (all possibly fall-in).

104.4 - 108.2 NO RECOVERY.

108.2 - 116.4 PACKSTONE TO WACKESTONE: skeletal, foraminifer; uncemented; skeletal components slightly altered to unaltered; generally very pale orange, very pale orange with minor pale-yellowish-brown tones from 108.2 - 109.4

ft. Contains scattered cemented GRAINSTONE(?)-filled burrows(?); burrows(?) with minor "tea-brown" micrite stain 109.3 ft; large GRAINSTONE-filled burrows(?) including articulated <u>Cardium</u> with original color at 113.8 ft. Subunits as follows: PACKSTONE from top - 109.1 ft; PACKSTONE TO GRAINSTONE, generally very fine grained, generally well-sorted from 109.1 - 114.2 ft; WACKESTONE from 114.2 ft - base. SAMPLES: T @ 113.8.

[Disconformity indicated by marked increase in cementation, increased alteration of skeletal components, "tea-brown" micrite, and "dog-tooth"- spar infilling.]

116.4 - 148.5 FLOATSTONE AND PACKSTONE TO WACKESTONE: coral; matrix mollusc, skeletal PACKSTONE TO WACKESTONE; top of unit to 118.6 ft, moderately to well-cemented, becoming poorly cemented downward; alteration of skeletal components varys widely, some mollusc shells preserved in upper part of unit, others as molds; top of unit to 118.6 ft, very pale orange with large areas of paleyellowish-brown to moderate-yellowish-brown ("teabrown") micrite and moderate-yellowish-brown spar-filled molluscs; unit becoming very pale orange downward. Contains abundant Porites lutea fragments from 122.2 -124.3 ft; small Porites lutea head bored with Lithophagus from 129.0 - 129.7 ft; scattered Porites lutea from 133.8 - 134.0 ft; Astreopora(?) from 138.6 -138.8; small coral heads from 147.5 - 148.5 ft.

ft. SAMPLE: T @ 116.7.

Intervals of FLOATSTONE as follows: 121.2 - 124.3, 129.0 - 129.7 (coral head), 133.8 - 134.2, 142.5 - 148.5

148.5 - 152.0 NO RECOVERY.

152.0 - 157.2 PACKSTONE: skeletal, uncemented to very poorly cemented; mixture of unaltered microfossils and sparse, small, medium-bluish-gray mollusc steinkerns; very pale orange. Lower contact disrupted by drilling, probably sharp.

157.2 - 157.6 PACKSTONE: mollusc, skeletal, coral; poorly cemented; skeletal components almost exclusively molds, very minor shell material preserved, corals altered; very pale orange to pale yellowish brown; generally very fine to medium-grained. Lower contact abruptly gradational.

SAMPLE: T @ 157.3.

PACKSTONE WITH FLOATSTONE: skeletal, mollusc; moderately to poorly cemented from top to 167.9 ft, becoming poorly to very poorly cemented downward; gastropod shells in upper part of unit preserved as spar-filled steinkerns with minor chalky material, preservation improving downward in unit, with nacreous material preserved at 172.4 ft; very pale orange; FLOATSTONE interval from 167.2 - 167.9 ft. Contains minor "tea-brown" micrite in top 1.0 ft; Astreopora(?) from 167.6 - 167.9 ft, branching Acropora at 172.2 ft; Olivia at 162.0 ft; Polinices at 172.4 ft; mollusc fragments scattered throughout. Lower contact sharp, disrupted by drilling.

[Disconformity indicated by increase in cementation, change in alteration of skeletal components, presence of "tea-brown" micrite and large rhizoliths.]

179.4 - 221.6 FLOATSTONE: coral (probably in growth position, disrupted by drilling); skeletal PACKSTONE matrix; moderately to well-cemented from top to 183.9 ft, moderately to poorly cemented downward to base; fossils throughout moldic, minor shell material preserved in lower part of unit; very pale orange with small very pale orange to paleyellowish-brown areas, fairly large pale-yellowish-brown to dark-yellowish-brown areas in upper part of unit. Contains common "tea-brown" micrite with large rhizoliths from 183.3 - 183.4 ft, minor "tea-brown" cement scattered downward to 212.0 ft; some corals generally partially spar-replaced in upper part of unit to 205.0 ft. Corals as follows: P. lutea 199.6 -199.8, 208.2 - 208.8, 211.3 - 211.7 ft; large and small Favia(?) 202.4 ft; large Favia(?) head (upright) from 217.0 - 217.3 ft.

221.6 - 227.9 PACKSTONE: mollusc, skeletal; uncemented to very poorly cemented; mollusc shells sllightly chalky; very pale orange. Contains several types of pelecypods, including large thick-shelled pelecypod (oyster?) at 226.7 ft; scattered small coral sticks.

227.9 - 231.6 NO RECOVERY.

231.6 - 232.4 FLOATSTONE: coral; skeletal, mollusc PACKSTONE matrix; uncemented; skeletal components chalky; very pale orange. Contains small Porites lutea heads throughout. Lower contact gradational.

232.4 - 238.4 PACKSTONE: mollusc, skeletal; uncemented; original color preserved in mollusc shells; fine- to very fine grained, moderately sorted. Contains diverse molluscs.

238.4		242.0	NO RECOVERY.
242.0	_	247.8	PACKSTONE TO GRAINSTONE: mollusc, skeletal; uncemented; abundant, diverse molluscs with original color retention and nacreous layer preserved; coarse—to very coarse grained, poorly sorted. Contains common to scattered sand—and granule—sized, medium—bluish—gray (phosphatic?) particles (various kinds of skeletal particles and composite grains), some clasts bored, 242.0 ft to base; Polinices at 242.3 ft. Lower contact disrupted by drilling.
* * * *	*	* * * * *	* * * * * * * * * * * * * * * * * * * *
			ated by phosphatic(?) material in overlying unit, increased tation in underlying material.].
247.8	-	253.6	PACKSTONE: mollusc; coral; poorly to moderately cemented (now disaggregated), minor spar cement in remaining clasts; mollusc shells chalky; very pale orange.
253.6	-	262.1	NO RECOVERY. Driller reported void from 256.6 - 261.6 ft; density log shows marked decrease in density; caliper shows wash-out zone.
262.1	-	263.5	PACKSTONE: like unit from 247.8 - 253.6 ft, including clasts. Contains large piece Astreopora at base.
263.5	_	266.4	NO RECOVERY.
266.4	-	267.0	CORAL HEAD: Porites lutea; matrix like overlying recovered unit.
267.0	_	282.3	PACKSTONE: mollusc, skeletal; poorly to moderately cemented in upper part, becoming poorly cemented downward; gastropod shells chalky, steinkerns partially spar-lined; very pale orange. Contains several types of gastropods; fragments of Pocillopora stained moderate-yellowish-brown and partially spar-infilled from 276.2 - 276.5 ft.
282.3		285.9	NO RECOVERY.
285.9	_	290.8	PACKSTONE (coral FLOATSTONE with PACKSTONE matrix from 285.9 - 287.0 ft): skeletal, coral; uncemented; skeletal components altered; top 0.4 ft very pale orange with grayish-orange-pink tones, becoming very pale orange downward.

290.8 - 292.0 WACKESTONE: skeletal; uncemented with minor cemented nodules in lower part; very pale orange.

292.0 - 295.8 NO RECOVERY.

[TOP OF SEDIMENT PACKAGE 3. Disconformity indicated by increase in cementation, presence of "tea-brown" micrite, and rhizoliths.]

295.8 - 301.4 FLOATSTONE: sparse coral with skeletal WACKESTONE matrix; very well cemented; "tea-brown" micrite associated with small rhizoliths from 295.8 - 296.3 ft, "tea-brown" micrite becoming sparse downward; very pale orange mottled with very pale orange to pale yellowish brown with medium-yellowish brown to dark-yellowish-brown ("tea-brown") areas; moldic porosity. Unit may be

burrowed. Lower contact gradational. SAMPLE: T @ 296.2, 301.2.

301.4 - 325.6 WACKESTONE to MUDSTONE(?): skeletal, coral; mostly
WACKESTONE; poorly cemented to uncemented, scattered
well-cemented PACKSTONE(?)-filled burrows; gastropod
fragments preserved only as moderate-yellowish-brown,
spar-filled steinkerns in lower part of unit, corals
moderately well-preserved (not spar-replaced); very pale
orange. Contains several small coral heads, scattered
Seriatopora sticks, small gastropods.

325.6 - 329.7 NO RECOVERY.

[Disconformity indicated by spar-replaced corals, increased alteration of corals, and marked increase in cementation.]

329.7 - 340.7

FLOATSTONE coral; with coral, mollusc, skeletal WACKESTONE matrix; moderately- to well-cemented (broken by sampling); very pale orange with minor yellowish-brown, containing very pale orange to grayish-orange and moderate-yellowish-brown, spar-replaced corals; moldic porosity. Contains large, completely spar-replaced Porites lutea head from top of unit to 330.7 ft. Unit burrowed. SAMPLES: T@ 330.2 (spar replaced coral), 340.4.

340.7 - 344.8 NO RECOVERY.

[Discontinuity indicated by marked increase in amount of "tea-brown" micrite and change from spar-replaced corals to molds.]

344.8	-	371.5	FLOATSTONE: coral; PACKSTONE to WACKESTONE matrix; top to 345.9 ft very well cemented with abundant "tea-brown" micrite; 349.9 ft and downward, moderately cemented; fossils preserved exclusively as molds (corals poorly preserved by not moldic at 366.3 ft); upper part of unit very pale orange to pale yellowish brown with minor dark-yellowish-brown mottling. Unit is burrowed(?). Contains Porites lutea from 345.0 - 345.2 ft; Acropora sticks(?). SAMPLE: T @ 344.8.
371.5		376.7	NO RECOVERY.
376.7	-	382.6	CORAL HEAD(?): extensively recrystallized, matrix indeterminate; very pale orange to grayish orange; broken into coarse-grained to granular sand. [Note: unit may have been large coral head.]
382.6		387.4	NO RECOVERY.
387•4	_	407.3	FLOATSTONE: coral; mollusc, skeletal PACKSTONE or WACKESTONE(?) matrix; moderately to well-cemented; fossils preserved exclusively as molds; very pale orange, minor very pale orange to pale-yellowish-brown areas in upper part; moldic porosity, probably vuggy. SAMPLE: T @ 387.5 ft.
407.3		411.7	NO RECOVERY.
411.7	400 em 400	416.6	FLOATSTONE: coral; WACKESTONE matrix; very well cemented; fossils preserved exclusively as molds; very pale orange with very pale orange to pale-yellowish-brown mottling; probably vuggy. Contains predominantly Seriatopora sticks. SAMPLE: T @ 416.3.
416.6		427.4	FLOATSTONE(?): coral; mollusc, skeletal PACKSTONE matrix; moderately to well-cemented; very pale orange; probably vuggy. Contains several types of corals throughout; abundant large pelecypods from 426.3 - 426.7 ft.
	*		NO RECOVERY. * * * * * * * * * * * * * * * * * * *

[TOP OF SEDIMENT PACKAGE 4.]

430.8 - 435.9	FLOATSTONE: completely spar-replaced; Favia (?)-type coral; grayish-orange to moderate-yellowish-brown, coarsely crystalline PACKSTONE(?) matrix; probably vuggy.
435.9 - 451.1	FLOATSTONE: coral; PACKSTONE matrix; well-cemented in upper part, becoming moderately cemented downward; fossils preserved exclusively as molds (spar absent in this unit); very pale orange with areas with very pale orange to pale-yellowish-brown mottling; high moldic porosity. Contains several types of corals; a couple types of gastropods; Dictyopora ; Seriatopora dominates corals from 440.6 ft to base. Lower contact gradational. SAMPLES: T @ 440.6, 445.5, 446.0.
451.1 - 522.3	FLOATSTONE(?): coral (probably sparse); skeletal, mollusc PACKSTONE to WACKESTONE(?) matrix; originally moderately to poorly cemented (less-cemented than overlying unit), becoming less-cemented and -altered downward; upper part very pale orange grading downward to very pale orange to grayish orange. Contains Seriatopora and other corals generally preserved as molds, except Porites lutea heads at 501.4, 522.0 - 522.3 ft; molluscs preserved as molds in upper part of unit, some preserved gastropod shell material beginning at 501.2 ft.
522.3 - 532.5	NO RECOVERY.
532.5 - 562.8	PACKSTONE TO WACKESTONE: coral, mollusc; very fine grained sand and silt matrix; uncemented; unaltered; very pale orange grading downward to very pale orange with minor pale-yellowish-brown tones. Contains several types of gastropods with aragonite shells and nacreous layers preserved; small well-cemented WACKESTONE-filled burrows at 542.5 ft; well-preserved Dyctaraea sticks from 542.5 ft; very well preserved Acropora stick at 562.3 ft. Subunits as follows: WACKESTONE from top to 542.8 ft; NO RECOVERY from 542.8 - 551.8 ft; PACKSTONE from 551.8 ft to base.
532.5 - 562.8	PACKSTONE TO WACKESTONE: coral, mollusc; very fine grained sand and silt matrix; uncemented; unaltered; very pale orange grading downward to very pale orange with minor pale-yellowish-brown tones. Contains several types of gastropods with aragonite shells and nacreous layers preserved; small well-cemented WACKESTONE-filled burrows at 542.5 ft; well-preserved Dyctaraea sticks from 542.5 ft; very well preserved Acropora stick at 562.3 ft. Subunits as follows: WACKESTONE from top to 542.8 ft; NO RECOVERY from 542.8 - 551.8 ft; PACKSTONE from 551.8 ft to base.
532.5 - 562.8 562.8 - 572.0	PACKSTONE TO WACKESTONE: coral, mollusc; very fine grained sand and silt matrix; uncemented; unaltered; very pale orange grading downward to very pale orange with minor pale-yellowish-brown tones. Contains several types of gastropods with aragonite shells and nacreous layers preserved; small well-cemented WACKESTONE-filled burrows at 542.5 ft; well-preserved Dyctaraea sticks from 542.5 ft; very well preserved Acropora stick at 562.3 ft. Subunits as follows: WACKESTONE from top to 542.8 ft; NO RECOVERY from 542.8 - 551.8 ft; PACKSTONE from 551.8 ft to base.

581.9	-	602.8	PACKSTONE: mollusc, skeletal, coral; very fine grained sand and silt matrix; uncemented; unaltered; gastropods have nacreous layer preserved; very pale orange to pale yellowish brown in upper part, becoming pale yellowish brown to very pale orange downward. Contains several types of molluscs, including small strombids; <u>Dictyaraea</u> at 592.5 ft.
602.8	_	622.3	PACKSTONE: like overlying unit except pale yellowish brown with minor dark-yellowish-brown tones from 621.4 ft to base. Contains scattered cemented burrows(?), large aragonitic molluscs, shattered pelecypods.
622.3	_	631.2	NO RECOVERY.
631.2	_	632.4	PACKSTONE: coral, skeletal; uncemented; unaltered skeletal components; pale yellowish brown; generally very fine grained sand and silt. Contains small Porites at 631.9 ft.
632.4	_	641.1	NO RECOVERY.
641.1	_	642.2	WACKESTONE: skeletal; uncemented; unaltered skeletal components; very pale orange with minor pale-yellowish-brown tones; contains few larger skeketal grains, almost exclusively silt and very fine sand.
642.2		649.0	NO RECOVERY.
[TOP SE	D IM	ENT PACKAG	E 5.]
649.0	-	650.6	NO RECOVERY. [Note: very strong gamma-ray kick at 649 ft; may have been lignitic bed.]
650.6	-	651.5	FLOATSTONE: coral; skeletal, mollusc PACKSTONE matrix; uncemented; unaltered skeletal components; gastropods with nacreous layer preserved and color retention; dark-yellowish-brown. Contains scattered dusky-yellowish-brown wood fragments and rootlets(?); several types of gastropods and small thin-shelled pelecypods; Porites andrewsi-type coral at base.
651.5	_	655.5	NO RECOVERY.

655.5	-	656.5	FLOATSTONE: coral; lignitic (in part); skeletal, mollusc PACKSTONE matrix; uncemented; unaltered, unabraded skeletal components, small whole gastropods with color retention. Subunits as follows: from 655.5 - 655.7 ft (approximately), lignitic, dusky yellowish brown to dark yellowish brown; from 655.7 - 656.2 ft, moderate yellowish brown to dark yellowish brown with scattered wood fragments; from 656.2 - 656.5 ft, lignitic, dusky yellowish brown to dark yellowish brown. Contains diverse mollusc fauna including thin- and thick-shelled pelecypods (broken) and several types of gastropods; corals include small Porites lutea(?) head, scattered Seriatopora sticks.
656.5	_	660.3	NO RECOVERY.
660.3	_	661.2	PACKSTONE: mollusc; uncemented; unaltered shells including gastropods with nacreous layer and original color preserved; dark yellowish brown. Contains diverse gastropod fauna.
661.2	_	665.2	NO RECOVERY.
665.2		666.1	FLOATSTONE to PACKSTONE: sparse coral; uncemented; unaltered skeletal components; pale yellowish brown with minor very pale orange tones. Contains small Porites Lutea (?) head; other coral sticks; several types of gastropods.
666.1	-	670.1	NO RECOVERY.
670.1			FLOATSTONE: coral; skeletal, mollusc PACKSTONE matrix; uncemented; unaltered skeletal material but with several fragments of pale-yellowish-brown to very pale orange coral FLOATSTONE(?) with corals preserved as molds in top of unit [may have fallen from uphole?]; pale yellowish brown. Contains Porites andrewsi-type small corals .
671.0	_	680.2	NO RECOVERY.
680.2	_		FLOATSTONE: coral; skeletal PACKSTONE matrix; uncemented; unaltered, unabraded skeletal components; dark yellowish brown to pale yellowish brown. Contains Seriatopora sticks; scattered molluscs.

680.8 - 690.3	NO RECOVERY.
690.3 - 690.7	CORAL HEAD: <u>Porites lutea(?)</u> , bored with <u>Lithophagus</u> ; pale yellowish brown to very pale orange.
690.7 - 691.4	PACKSTONE: mollusc; uncemented; unaltered; gastropods with nacreous layer preserved; pale yellowish brown. Contains predominantly small high-spired gastropods.
691.4 - 700.3	NO RECOVERY.
700.3 - 701.5	PACKSTONE: mollusc, skeletal; uncemented; unaltered; dark yellowish brown. Contains sparse dusky-yellowish-brown lignitic streaks, scattered gastropods.

*** TOTAL DEPTH OF HOLE 701.5 FT ***

BOREHOLE ORT-20

Lat/Long (E/W-1960): 11°35'58.6" N, 162°05'58.8" E

Lat/Long (WGS-1972): 11°35'58.4" N, 162°05'58.9" E

Location (IVY-grid, ft): 123,303 N and 035,339 E

Distance/Bearing from OAK GZ: 1,845 ft, 204.6 deg.

Water Depth (H&N datum): 101.4 ft Hole Depth (bsf): 491.8 ft

Hole Spudded: 07/12/85 Drilling Ended: 07/14/1985

Sampling: SS, SH Recovery: 15% (74.3 ft)

Logs: GR/DN/CP, BHG Date Logged: 07/14-15/1985

Deviation: 3 deg @ 225 ft; 2 deg @ 480 ft

Casing: 7-5/8-in. @ 244.2 ft; 6-5/8-in. @ 471 ft (casing shot off at 15 ft below mudline, left in hole)

below mudiline, left in note,

Geologists: T.W. Henry, R.P. Major Drillers: G. Mooney, C. Peltier

Paleontologist: E. Brouwers P. Sacro

Gravimeter Specialist: L. Prado, D. Joiner Logger: A. LeBreton

Redescribed: 09/15-16/1985

	Depth			Description		
•			DIMENT 1.2	PACKAGE 1.] GRAINSTONE: foraminifer, skeletal; uncemented; unaltered containing moderate-red (5R4/6) Homotrema grains; very pale orange; very fine to medium-grained; moderately well-sorted.		
1.	. 2	_	5.0	NO RECOVERY.		
5	.0	_	5.9	GRAINSTONE: may have been washed at top; mollusc, Halimeda, skeletal; uncemented; unaltered, mollusc fragments well-preserved with some original color,		

moderate-red (5R4/6) Homotrema, unaltered Halimeda

grains, very pale orange to yellowish gray (5Y7/2); very fine to very coarse grained, becoming finer grained downward, poorly sorted. Contains scattered corals sticks encrusted with moderate Homotrema.

5.9 - 14.9 NO RECOVERY.

PACKSTONE TO WACKESTONE: <u>Halimeda</u>; uncemented; crisp

<u>Halimeda</u> grains, generally unaltered skeletal
components, containing very sparse moderate-red (5R4/6)

<u>Homotrema</u> grains; yellowish gray (5Y7/2) to light olive
gray (5Y5/2); hydrogen sulfide odor from 39.6 - 41.2 ft;
NO RECOVERY from 15.1 - 19.8 ft. Contains scattered
coral sticks throughout; small <u>Favia</u>-type from 39.6 -

39.7 ft and from 19.8 - 19.9 ft.

41.2 - 44.6 NO RECOVERY.

PACKSTONE: Halimeda, mollusc, coral, skeletal, uncemented; unaltered Halimeda, moderately broken pelecypod shells with color retention, moderate-red (5R4/6) Homotrema grains scattered throughout; very pale orange to yellowish gray (5Y7/2); containing medium-gray to medium-bluish-gray (phosphate?) grains, up to coarse sand-sized fragments moderately common from 54.1 - 55.3 ft but occurring very scattered higher in unit. Contains small Favia-type heads from 45.3 - 45.4, 55.0 - 55.3 ft; Astreopora(?) from 54.1 - 54.2 ft; Heliopora from 47.9 - 48.1; scattered small coral sticks; pectin

53.4 ft; slight hydrogen sulfide odor from 51.1 - 55.3 ft.

55.3 - 59.2 NO RECOVERY.

[TOP OF SEDIMENT PACKAGE 2. Disconformity indicated by abundant medium-gray to medium-bluish-gray stain on and in underlying unit; reworked grains in base and upward in overlying unit; increase in underlying unit in cementation downward in unit; and increase in alteration of skeletal components. Disconformity could be as low as 59.2 ft.]

59.2 - 76.5

PACKSTONE: mollusc, skeletal, coral; molluscs bleached,

<u>Halimeda</u> chalky, bleached <u>Homotrema</u>; phosphate(?)—
stained grains, medium gray to medium bluish gray from
59.2 - 60.0 ft, piece at 59.9 ft has pitted surface on
cemented PACKSTONE with medium-bluish-gray stain,
abundant internal filling of shells, phosphatic (?);
molluscs, including several types of gastropods and
pelecypods, with nacreous layer preserved, some whole

shells toward base of unit; generally poorly to moderately cemented, irregularly cemented from top to 64.8 ft, becoming generally uncemented downward; generally very pale orange, upper part of unit contains medium-gray to medium-bluish-gay stains with minor light-brown (5YR6/4) to moderate-yellowish-brown tones. Contains small Astreopora(?) head 64.2 - 64.4 ft; small Porites lutea from 72.3 - 72.5 ft; Heliopora from 75.3 - 75.4 (color retained), may not be in place (abraded while drilling). SAMPLES: T@59.6, 59.9, 60.3, 75.3; X@59.6 (for dark grains).

[Disconformity indicated by marked increase in cementation.].

Disconformity indicated by marked increase in cementation.].

76.5 - 84.7 PACKSTONE: mollusc, skeletal; moderately to poorly and irregularly cemented in upper part; molluscs bleached but with nacreous layer preserved throughout; generally very pale orange but with grayish-orange tones in upper part. Contains several types of whole large pelecypods scattered from top to 79.5 ft; small broken Porites lutea fragments from 83.4 - 83.6 ft.

84.7 - 88.5 NO RECOVERY.

88.5 - 89.7

WACKESTONE: mollusc, skeletal; uncemented; slightly altered skeletal components, mollusc shells chalky; very pale orange. Contains Heliopora (rounded, fragments, possibly not in place) at 88.7 ft.

89.7 - 93.5 NO RECOVERY.

[Disconformity indicated by increase in cementation and coral infilling in underlying unit.]

93.5 - 111.9

FLOATSTONE WITH PACKSTONE: coral FLOATSTONE with skeletal, mollusc PACKSTONE matrix and interbedded with same; poorly cemented in top of unit, becoming uncemented downward; very minor "tea-brown" micrite scattered to 99.1 ft; becoming muddier downward; becoming less altered downward; cryptocrystalline calcite infilling corals in upper part of unit; generally very pale orange. Contains Heliopora(?) at top (may or may not be in place; Porites lutea from 98.6 - 98.8 ft, 99.3 - 99.5 ft (with Lithophagus borings and shells), 110.0 - 110.2 ft; "tea-brown" micrite 109.0 ft on scab-like coral(?); Astreopora(?) from 109.3 - 109.6 ft, 111.7 - 111.9 ft. Lower contact gradational. SAMPLES: T @ 93.5, 93.7, 99.1.

111.9 - 112.7 PACKSTONE: skeletal, mollusc; uncemented; unaltered skeletal components with nacreous layer preserved in gastropods; very pale orange; fine- to medium-grained, moderately well-sorted.

112.7 - 114.8 NO RECOVERY.

[Possible disconformity indicated by change in cementation and increased alteration of skeletal components.]

114.8 - 118.2 CORAL HEADS: skeletal PACKSTONE matrix from 114.8 - 115.9

ft with minor poorly cemented fragments; generally very
pale orange with minor grayish-orange tones. Contains
broken <u>Astreopora(?)</u> heads from 114.8 - 115.9 ft; broken
Porites <u>lutea</u> head from 117.8 - 118.2 ft.

118.2 - 120.8 NO RECOVERY

[Possible disconformity indicated by increase in cementation and increase in alteration of gastropods.]

120.8 - 122.0 PACKSTONE: skeletal, mollusc; poorly to very poorly cemented; gastropod steinkerns with minor very chalky shell material preserved; very pale orange with grayish-orange tones in upper part; minor(?) microspar cementation in rock and replacing small coral at 121.5 ft. Contains small, dense Lithophagus-bored massive coral in upper part of unit. SAMPLE: T @ 121.5.

122.0 - 130.9 NO RECOVERY.

FLOATSTONE coral; skeletal WACKESTONE and PACKSTONE to
WACKESTONE matrix: generally uncemented with minor
moderately cemented PACKSTONE-filled burrows(?); corals
bored and slightly more altered than overlying unit;
very pale orange. Contains abundant small Porites lutea
heads from 130.9 - 131.6, 141.9 ft 142.1 ft;
Astreopora(?) from 151.8 - 151.9; small coral head from
132.0 - 132.2 ft. Subunits as follows: 130.9 - 132.2
ft, FLOATSTONE WITH WACKESTONE matrix; from 132.2 140.9 ft, NO RECOVERY; from 140.9 - 142.1 ft, sparse
FLOATSTONE with WACKESTONE matrix; from 142.1 - 151.1
ft, NO RECOVERY; from 151.1 - 151.9 ft, FLOATSTONE with
PACKSTONE matrix; from 151.9 - 152.4 ft, sparse
FLOATSTONE with WACKESTONE matrix.

152.4 - 161.0 NO RECOVERY.

161.0 - 161.3	PACKSTONE: skeletal, mollusc; uncemented; moderately altered skeletal components, chalky fragments; generally very pale orange. Lower contact disrupted by drilling.
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	ated by change in color, increase in degree of cementation, wn" micrite and rhizoliths(?) in underlying unit.]
161.3 - 162.4	PACKSTONE: skeletal, coral; poorly cemented to uncemented; moderately abundant "tea-brown" micrite coating and within bored coral and small rhizoliths(?); very pale orange to pale yellowish brown at top, becoming very pale orange downward. Contains Astreopora (?) head from 161.6 - 161.9 ft.
162.4 - 171.0	
171.0 - 172.1	WACKESTONE TO PACKSTONE: skeletal; generally uncemented with several moderately cemented pieces containing minor "tea-brown" micrite associated with unlined worm tubes(?) at 171.0 ft; very pale orange with small areas of moderate-yellowish-brown to dark-yellowish brown stain; gastropod shells with nacreous layer preserved. SAMPLE: T @ 171.0.
172.1 - 181.1	NO RECOVERY.
181.1 - 191.8	PACKSTONE: coral, mollusc, skeletal; poorly cemented, irregularly cemented with minor areas moderately cemented (burrows?); minor grayish-orange spar at 191.1 ft associated with large <u>Trochus</u> with minor color retention but chalky shell; very pale orange. Contains <u>Acropora</u> stick at top of unit. SAMPLE: T@191.3.
191.8 - 201.0	
201.0 - 201.9	
201.9 - 210.9	
210.9 - 211.2	CORAL HEAD: Porites lutea; very pale orange.

211.2 - 235.0 PACKSTONE: mollusc, skeletal, coral; poorly to moderately cemented; fossils preserved as molds in upper part of unit, gastropods with slightly chalky shells from 230.7 ft to base; very pale orange. Contains medium-sized, high-spired gastropods; scattered corals of different types, including small coral sticks. Lower contact disrupted by drilling.

[Possible disconformity indicated by slight increase in cementation and appearance of "tea-brown" micrite in underlying unit.]

PACKSTONE: skeletal, coral; generally poorly to moderately cemented, with well-cemented pieces at top of unit with "tea-brown" micrite, becoming uncemented at base of unit; corals partially dissolved, mollusc fragments in lower part of unit very chalky; scattered medium-gray to medium-bluish-gray, "salt and pepper", phosphatic(?) grains at 245.0 ft to base; muddy from 244.6 - 244.9 ft; slightly muddy from 239.6 - 240.0 ft. Corals include Porites sticks. SAMPLE: T @ 235.0.

[Disconformity indicated by reworked phosphatic(?) grains in overlying unit, with medium-gray to medium-bluish-gray stain and minor "tea-brown" micrite in underlying unit, and by increase in cementation.]

245.3 - 245.6 PACKSTONE: mollusc, skeletal; small pieces moderately cemented, with "tea-brown" micrite and medium-gray to medium-bluish-gray stain; some molds of gastropods; generally very pale orange but with stain as described and with minor medium-yellowish-brown ("tea-brown") tones. SAMPLE: T @ 245.3.

245.6 - 249.7 NO RECOVERY.

249.7 - 255.8 GRAINSTONE: mollusc, skeletal, coral; muddy; uncemented throughout; contains unaltered skeletal fragments and whole gastropods with nacreous layer preserved throughout unit; contains medium-gray to medium-bluish-gray sand-sized internal molds from 249.7 - 250.4 ft, these grains are not present below 250.4 ft (NO RECOVERY from 250.4 - 254.8 ft); very pale orange; upper part of unit fine- to medium-grained, moderately sorted, lower part of unit very fine to fine-grained, slightly muddy. Contains fragment of pelecypod shell with adhering medium-yellowish-brown spar and cemented grains at 254.9 ft; small whole strombids in lower part of unit and fragments of gastropods; pelecypods in upper part of unit; digitate Porites at 250.4 ft.

255.8 - 265	O NO RECOVERY.
265.0 - 266	
266.1 – 275	0 NO RECOVERY.
275.0 - 296	PACKSTONE: mollusc, skeletal; uncemented except for scattered, poorly to moderately cemented burrows; most mollusc fragments slightly altered; very pale orange. Contains large pelecypod fragment at 285.7 ft; scattered small coral sticks and small fragments of coral heads.
296.5 - 300	5 NO RECOVERY.
300.5 - 306	PACKSTONE: skeletal, mollusc; muddier than unit from 275.0 - 296.5 ft; uncemented, contains small, rounded, well-cemented PACKSTONE-filled burrows(?); very pale orange to white in upper part, becoming very pale orange downward.
306.5 - 310	3 NO RECOVERY.
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this depth, in	IT PACKAGE 3. Major disconformity somewhere in the interval above dicated by marked increase in cementation, change in rock type, altered skeletal material to exclusively molds.]
310.3 - 326	

[Discontinuity marked by change in preservation of skeletal components, with abundant spar-replaced corals, increase in moldic and solution-enlarged moldic porosity, and presence of "tea-brown" micrite in underlying unit.]

FLOATSTONE(?): coral; mollusc, skeletal WACKESTONE TO
PACKSTONE matrix; well-cemented, becoming irregularly
well- to moderately cemented downward; extensively
altered, corals recrystallized and partially sparreplaced, molluscs preserved exclusively as molds and
solution enlarged molds; very pale orange with very pale
orange to medium-yellowish-brown mottling; extensive
"tea-brown" (dark-yellowish-brown) micrite from 330.6 335.8 ft, scattered downward, moderately common from
351.5 - 351.6 ft, associated with rhizoliths(?) moldic
and solution-enlarged porosity. SAMPLES: T @ 330.6,
351.5.

351.9 - 360.5 NO RECOVERY.

360.5 - 390.5 FLOATSTONE(?): coral, with coral heads like overlying unit(?); skeletal WACKESTONE TO PACKSTONE(?) matrix; pervasively recrystallized, corals extensively recrystallized; driller reported void from 360.7 - 363.4 ft (karst?); fragments well-cemented; extensively replaced Porites lutea from 360.5 - 360.7, 363.4 - 363.7, 370.4 - 370.6 ft; very pale orange to pale yellowish brown mottled with pale yellowish brown.

390.5 - 400.0 NO RECOVERY.

400.0 - 410.5 FLOATSTONE: coral; with skeletal WACKESTONE TO PACKSTONE matrix and CORAL HEADS: well-cemented, probably irregularly cemented; molds and solution-enlarged molds of corals, recrystallized and spar-replaced coral heads with spar decreasing downward; very pale orange to pale yellowish brown, with moderate-yellowish-brown spar. Contains Astreopora(?) from 400.0 - 400.2 ft.

410.5 - 420.1 NO RECOVERY.

420.1 - 441.4 FLOATSTONE: coral; mollusc, skeletal WACKESTONE TO
PACKSTONE matrix; moderately-cemented, probably
irregularly cemented; corals and molluscs preserved as
molds, no spar; very pale orange. Corals are mainly
sticks, including Seriatopora.

441.4 - 450.6 NO RECOVERY.

orange.

*** TOTAL DEPTH OF HOLE 491.8 ***

BOREHOLE OSR-21

Lat/Long (E/W-1960): 11°32′07.4" N, 162°05′37.3" E

Lat/Long (WGS-1970): 11°35′28.8" N, 162°05′37.3" E

Location (IVY-grid, ft): 120,320 N and 033,197 E

Distance/Bearing from OAK GZ: 5,495 ft, 212.0 deg

Water Depth (H&N datum): 84.0 ft Hole Depth (bsf): 354.3 t

Hole Spudded: 07/16/1985 Drilling Ended: 07/17/1985

Sampling: SS, SH Recovery: 18% (63.9 ft)

Logs: GR/DN/CP, BHG Date Logged: 07/17-18/1985

Deviation: 1.8 deg @ 315 Ft

Casing: $8-5/8-in \cdot 0$ to 41 ft, $6-5/8-in \cdot 0$ to 352.9 ft*

Drilling Mud/Additives: BVS (60 sx), PAD (30 gals), DFM (5.5 gals), LCM (10 sx)

Geologists: T.W. Henry, R.P. Major Drillers: G. Mooney, C. Peltier,

Paleontologist: E. Brouwers P. Sacro

Gravimetry Loggers: L. Prado, D. Joiner Logger: A. LeBreton

Redescribed: 09/17/1985

* All casing recovered

Depth	Description
[TOP OF SEDIMEN	
V-V 11.5	unaltered grains, including sparse moderate-red (5R4/6) Homotrema, unaltered Halimeda grains; yellowish gray (5Y7/2) with minor-light-olive gray (5Y5/2) tones. Contains sparse coral sticks; minor hydrogen sulfide odor. SAMPLE: M @ 10.3 - 11.1.
11.5 - 15.3	NO RECOVERY.

15.3 - 32.2 PACKSTONE: like unit from 0.0 - 11.5 ft. Contains scattered mollusc fragments; yellowish gray (5Y7/2) with minor intervals of yellowish gray (5Y7/2) with minor intervals of yellowish gray (5Y7/2) to light olive gray (5Y5/2); containing minor hydrogen sulfide odor. Contains more Halimeda from 15.3 - 16.4 ft than lower in unit; scattered coral sticks and heads; Porites sp. head from 15.3 - 15.5 ft. 32.2 - 35.9NO RECOVERY. PACKSTONE TO FLOATSTONE: coral, Halimeda, mollusc; 35.9 - 37.3 uncemented; unaltered skeletal components, Halimeda unaltered; light yellowish gray (5Y7/2). Contains small Porites lutea head with moderate-red (5R6/4) Homotrema from 36.8 - 37.0 ft. 37.3 - 41.0 NO RECOVERY. [TOP OF SEDIMENT PACKAGE 2. Disconformity indicated by increase in cementation and alteration of skeletal material and by marked color change.] 41.0 - 41.4 FLOATSTONE: coral, mollusc; skeletal PACKSTONE matrix; uncemented; unaltered; pinkish-gray ("bleached") Homotrema on coral; very pale orange. Contains large Tridacna shell, partially recrystallized, heavily bored. 41.4 - 46.9 NO RECOVERY. 46.9 - 47.5 PACKSTONE: skeletal, mollusc; poorly cemented, irreglarly cemented; skeletal components, microfossils in part preserved as phosphatic(?), molds, in part partly replaced and chalky; light olive gray (5Y5/2) with olive-gray (5Y3/2) grains. Contains particles cemented with olive-gray, phosphatic(?) material; several types of pelecypods including broken Arca. SAMPLE: T @ 47.5. 47.5 - 52.3 NO RECOVERY. PACKSTONE TO FLOATSTONE: coral FLOATSTONE with Halimeda, 52.3 - 62.7 mollusc, skeletal PACKSTONE matrix and interbedded with same; poorly cemented, irregularly cemented; skeletal grains, Halimeda grains chalky, Astreopra(?) head from 57.8 - 58.2 ft partially spar-infilled and recrystallized; very pale orange. Contains scattered small coral heads, including small Porites lutea at

base.

62.7 - 66.7 NO RECOVERY.

PACKSTONE: mollusc, <u>Halimeda</u>, coral; moderately to poorly cemented in upper part of unit, becoming very poorly cemented downward, irregularly cemented; <u>Halimeda</u> slightly chalky to very chalky (in cemented material), molluscs very chalky, spar-filled gastropod steinkern at 79.8 ft; generally very pale orange, very pale orange with grayish-orange tones from 71.5 - 72.0 ft; becoming coral FLOATSTONE from 77.0 ft to base. Contains several types of pelecypods, including some small whole shells; <u>Astreopora</u>(?) head from 77.0 - 77.4 ft. Lower contact sharp; much more apparent before sample was split. SAMPLE: M @ 76.3 - 77.0.

[Disconformity indicated by sharp contact, appearance of "tea-brown" micrite, and increased alteration of skeletal components. Driller reported hard layer at this point.]

PACKSTONE: muddy, mollusc, skeletal; upper part moderately to poorly cemented, irregularly cemented, becoming poorly to very poorly cemented downward, minor "teabrown" micrite at top of unit and very scattered to 79.5 ft; skeletal components altered, with gastropods very chalky to moldic; very pale orange with minor darkyellowish-brown tones at top of unit, becoming very pale orange to white downward. Contains several types of gastropods; Astreopora from 77.5 - 77.6 ft; small Porites lutea at 82.8 ft; Astreopora(?) with Lithophagus borings from 82.0 - 82.2 ft. SAMPLE: T @ 77.5.

83.1 - 86.8 NO RECOVERY.

[Disconformity indicated by abundant "tea-brown" micrite in underlying unit, increase in cementation, large rhizolith(?), corals in underlying unit partly infilled with spar and exhibiting increased alteration.]

PACKSTONE: mollusc, Halimeda, skeletal; moderately to well-cemented, irregularly cemented, with abundant "teabrown" micrite in upper part of unit to 99.5 ft (large piece at 99.5 ft), becoming poorly to very poorly cemented downward; upper part of unit containing chalky Halimeda and partially spar-replaced corals, becoming less altered downward, whole gastropods shells chalky below 103.3 ft; very pale orange to pale yellowish brown in upper part with dark-yellowish-brown, "tea-brown"

micrite in upper part, becoming very pale orange to grayish-orange downward. Contains rhizolith at 86.8 ft; Turbo operculum 100.2 ft, scattered small corals. SAMPLES: M @ 102.5 - 103.3.

106.2 - 114.3 NO RECOVERY.

114.3 - 156.0

WACKESTONE TO FLOATSTONE: sparse coral FLOATSTONE with skeletal WACKESTONE matrix in upper part becoming skeletal WACKESTONE downward; poorly cemented, irregularly cemented in upper part of unit, becoming uncemented downward except for well-cemented, skeletal PACKSTONE-filled burrows scattered throughout; molluscs slightly chalky in upper part of unit, becoming less altered downward, color retention and nacreous layer preserved in <u>Turbo</u> at 155.2 ft; very pale orange to white. Contains <u>Porites lutea</u> from 144.5 - 144.6, 145.3 - 145.6 and 154.7 - 154.8 ft; <u>Astreopora</u> at 156.0 ft; other small corals scattered throughout.

156.0 - 164.9 NO RECOVERY.

[Disconformity indicated by marked increase in cementation and alteration of skeletal components.]

164.9 - 176.5

FLOATSTONE: coral; skeletal PACKSTONE matrix; moderately to well-cemented at top, irreglarly cemented, becoming poorly cemented downward; in upper part of unit, skeletal components preserved as molds (slightly-enlarged?), partially spar-infilled, corals partially spar-replaced and infilled (grayish-orange spar), minor "tea-brown" micrite; skeletal components not as altered downward; very pale orange with minor moderate-yellowish-brown tones. Contains several types of small coral heads, including <u>Astrepora</u> and <u>Porites lutea(?)</u>.

176.5 - 185.4 NO RECOVERY.

185.4 - 197.0

FLOATSTONE: sparse coral; skeletal WACKESTONE matrix; poorly cemented in upper part, becoming uncemented downward; minor skeletal alteration in upper part of unit, becoming less altered downward with crisp Halimeda; very pale orange to white. Contains small Porites lutea from 185.4 - 185.6, 186.5 - 186.8, and 196.3 - 196.5 ft; Tridacna from 196.2 - 196.3 ft.; small Cyprea at 186.0 ft.

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197.0 - 206.1	NO RECOVERY. Log indicates soft layer.
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[Disconformity indicate skeletal components.]	ted by increase in cementation and change in alteration of
206.1 - 223.1	matrix; moderately cemented, irregularly cemented in upper part of unit, decreasing downward, becoming moderately to poorly cemented at base; small skeletal grains preserved as molds in upper part of unit; generally very pale orange but with zones very pale orange with minor moderate-yellowish-brown. Contains small Acropora stick at top; Favia(?) head from 206.2 206.9 ft; Porites lutea from 219.9 - 220.6 ft; Acropora cuneata from 220.6 - 220.8 ft.
223.1 - 232.3	CORAL HEADS: skeletal PACKSTONE matrix; poorly cemented, becoming less well-cemented downward; some corals are partially spar-infilled, smaller skeletal components in upper part of unit preserved as molds; minor "tea-brown" micrite at top of unit; very pale orange. Contains Porites lutea heads at 223.1 - 223.9, 226.0 - 226.7, 229.0 - 229.4, 230.0 - 230.2 ft; Favia(?) at 229.4 - 230.0, 232.1 - 232.3 ft.
232.3 - 237.5 I	PACKSTONE WITH FLOATSTONE: coral; skeletal, mollusc PACKSTONE matrix and interbedded with same; poorly cemented; skeletal components slightly altered with minor color retention in gastropods; minor small well-cemented skeletal PACKSTONE-filled burrows; very pale orange. Contains small Porites lutea with Lithophagus borings from 236.6 - 236.7 ft; Turbo operculum at 237.1 ft. Lower contact gradational.
	CORAL HEAD: Porites lutea; sparsely bored; very pale orange; not recrystallized.
237.9 - 241.7	
241.7 - 242.4	CORAL HEAD: like unit from 237.5 - 237.9 ft.
242.4 - 243.1 I	FLOATSTONE: coral; skeletal PACKSTONE matrix; poorly cemented; mollusc fragments slightly chalky; very pale orange.
243.1 - 246.8 P	

246.8 - 252.9

WACKESTONE: skeletal; uncemented except for sparse well-cemented burrows; mollusc shells slightly chalky; becoming fine- to medium-grained, muddy, foraminifer PACKSTONE to 247.6 - 248.1 ft; very pale orange to white. Contains small Porites lutea head from 252.1 - 252.4 ft.

252.9 - 256.5 NO RECOVERY.

256.5 - 257.7

CORAL HEADS AND FLOATSTONE: coral; matrix poorly cemented to uncemented skeletal PACKSTONE; corals not recrystal-lized, molluscs with shell material preserved; very pale orange. Contains small Porites lutea head 256.5 - 256.7 ft; PACKSTONE below 256.7 ft; Astreopora(?) head 257.0 - 257.7 ft.

257.7 - 259.4 NO RECOVERY.

259.4 - 260.2

PACKSTONE: skeletal, coral, mollusc; uncemented; gastropod (<u>Turbo</u>?) with color retention; very pale orange.

Contains small <u>Porites lutea</u> at 260.0 ft. Lower contact disturbed by drilling, probably sharp.

[Disconformity indicated by increase in cementation, slight increase in alteration of skeletal grains, presence of rhizoliths(?).]

260.2 - 288.0

FLOATSTONE AND PACKSTONE: coral FLOATSTONE with skeletal PACKSTONE matrix and interbedded with same; cementation varies as follows: moderately well-cemented with minor rhizoliths(?) and with very sparse "tea-brown" micrite stain and minor moldic porosity from 260.2 - 260.4 ft, poorly cemented with very scattered moderately cemented nodules from 260.4 - 268.0 ft, moderately to moderately well-cemented with nodules from 268.0 - 268.3 ft. moderately to poorly cemented from 268.3 - 269.2 ft, poorly cemented from 269.2 - 288.0 ft; generally very pale orange, except very pale orange to pale yellowish brown in top 0.2 ft. Contains pecten at 260.3 ft; Acropora cuneata at 278.3 and 287.8 - 288.0 ft. Subunits as follows: PACKSTONE from 260.2 - 262.7 ft; CORAL HEADS (Porites lutea and Favia(?) from 262.7 -263.2; PACKSTONE from 263.2 - 266.0 ft; CORAL HEAD Porites lutea) from 266.0 - 266.3 ft; coral FLOATSTONE with muddy skeletal PACKSTONE matrix from 266.3 - 288.0 ft. SAMPLES: M @ 268.3 - 269.0.

288.0	-	288.3	WACKESTONE: skeletal; uncemented; very fine grained, silty; very pale orange to white.
288.3	_	299•3	FLOATSTONE: sparse coral with skeletal PACKSTONE matrix in upper part, WACKESTONE matrix from 298.3 - 299.3 ft; uncemented to poorly cemented with sparse, broken well-cemented burrows(?); muddier with very pale orange in upper part, becoming very pale orange to white in power part. Contains several types of corals, including branching Acropora sp. with minor calcite infilling from 298.1 - 298.2 ft.
299.3	_	307.7	NO RECOVERY. [Driller reported the bit dropped from 300 to 304 ft; logs indicate a wash-out here; probably WACKESTONE.]
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	pr	esence of	KAGE 3. Disconformity indicated by marked increase in very sparse "tea-brown" micrite, and increase in alteration
307.7	-	308.0	WACKESTONE(?): skeletal; well-cemented, irregularly cemented; recrystallized, very pale orange.
308.0	-	317.6	NO RECOVERY. [Driller reported "harder material" below 313.5 ft.]
317.6	-	318.8	CORAL HEADS WITH WACKESTONE(?) AND MUDSTONE(?) matrix: Porites lutea both relatively unaltered (at top) and extensively recrystallized (below 317.5); well-cemented rock fragments, otherwise loose sand; (possible fall-in) very pale orange and very pale orange to pale yellowish brown.
318.8	_	327.4	NO RECOVERY.
327.4	-	327.6	MUDSTONE(?): very well cemented; very pale orange; shattered by hammer sampling; conchoidal fracture; small pelecypod shell spar-infilling.
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[Possib]	le d	discontinu	ty indicated by change in color and rock type.]
327.6	-	327.9	WACKESTONE: sparse foraminifer, skeletal; very well cemented in upper 0.2 ft, becoming poorly cemented downward; moldic porosity in cemented portions; very pale orange to pale-yellowish-brown mottled with pale-yellowish-brown.

327.9	- 337.3	NO RECOVERY. Driller reported bit dropped from 333.0 - 337.0 ft.
337.3	- 337.7	FLOATSTONE(?): coral; skeletal WACKESTONE matrix; much of material uncemented but fragments moderately well cemented with skeletal molds and coral molds; very pale orange. Uncemented material probably fall-in or void filling.
337.7	- 347 . 1	NO RECOVERY.
347.1	- 348.0	FLOATSTONE(?): coral, skeletal WACKESTONE(?) or PACKSTONE(?) matrix; matrix well-cemented and broken; extensively recrystallized, corals recrystallized and partly to completely spar-replaced; grayish-orange spar in gastropod steinkern; very pale orange.
348.0	- 354.3	NO RECOVERY. Driller reported void at approximately 351 ft, almost stuck drill string.

*** TOTAL DEPTH OF HOLE 354.3 ***

BOREHOLE OSM-22

Lat/Long (E/W-1960): 11^o35'28.9" N, 162^o05'36.6" E

Lat/Long (WGS-1972): 11°35′28.7" N, 162°05′36.6" E

Location (IVY-grid, ft): 120,313 N and 033,127 E

Distance/Bearing from OAK GZ: 5,539 ft, 212.6 degrees

Water Depth (HN& Datum): 76.0 ft Hole Depth: 127.7 ft bsf

Hole Spudded: 07/19/1985 Drilling Ended: 07/20/1985

Sampling: SS Recovery: 24% (30.6 ft)

Logs: None Deviation: No survey run

Casing: No Casing Set

Drilling Mud/Additives: BVS (20 sx) Drillers: G. Mooney, C. Peltier,

PAD (13 gals), DFM (2.5 gals)
P. Sacro

Geologists: R.P. Major, W.E. Martin Redescribed: 09/17/1985

Depth

Description

[Note: This borehole was drilled for material properties samples. Geologic summary based on examination of unsplit core only.]

[TOP OF SEDIMENT PACKAGE 1.]

0.0 - 54.1

PACKSTONE WITH WACKESTONE: <u>Halimeda</u>, coral, skeletal; becoming more coral-rich, approaching coral FLOATSTONE downward; uncemented; unaltered. Sample from 49.4 - 50.3 ft contains scattered, dark-gray, phosphatic(?) ("salt-and-pepper"), sand-sized grains.

[TOP OF SEDIMENT PACKAGE 2. Disconformity indicated by dark-gray "salt-and-pepper" grains in sample from lower part of overlying unit and by dark-gray surface stain on fragments of <u>Porites lutea</u> head in upper part of underlying unit, by appearance of cement, and by concurrent increase in alteration of skeletal components in underlying unit.

54.1 - 78.5 PACKSTONE TO FLOATSTONE: skeletal; poorly cemented; skeletal components slightly altered; very pale orange. Contains broken pieces of Porites lutea in upper part of unit with dark-gray stain on some surfaces, including walls of Lithophagus borings.

[Possible disconformity indicated by color change.]

78.5 - 87.7 PACKSTONE: skeletal; poorly cemented; grayish orange.

[Disconformity indicated by appearance of sparse "tea-brown" micrite and by increase in cementation.]

87.7 - 116.9 PACKSTONE (muddy): skeletal; moderately cemented and containing sparse "tea-brown" micrite from 88.5 -88.6 ft, generally becoming less-cemented downward; containing sparse "tea-brown" micrite on Favia(?) from 102.2 - 102.9 ft; unit generally becoming muddier downward.

116.9 - 127.7 WACKESTONE: very muddy.

TOTAL DEPTH OF HOLE 127.7 FT *** ***

BOREHOLE OTG-23

Lat/Long (E/W-1960): 11^o36'07.5" N. 162^o06'04.5" E

Lat/Long (WGS-1972): 11^o36'07.3" N, 162^o06'04.5" E

Location (IVY-grid, ft): 124,204 N and 035,899 E

Distance/Bearing from OAK GZ: 804 ft, 195.1 deg

Water Depth (H&N Datum): 164.0 ft Hole Depth (bsf): 587.3 ft

Hole Spudded: 07/20/1985 Drilling Ended: 07/22/1985

Sampling: RB, SS, SH Recovery: 1% (7.1 ft)

Logs: BHG, GR/CP Date Logged: 07/22/1985

Deviation: 2.5 deg @ 400 ft; 2.3 ft @ 545 ft

Casing: 8-5/8 in. to 250.6 ft; 6-5/8 in. from 238 to TD; (casing shot 15 ft

below mudline; left in hole)

Drilling Mud/Additives: BVS (60 sx), PAD (36 gals), DFM (1 gal), LCM (2 sx)

Geologists: R.P. Major, W.E. Martin Drillers: G. Mooney, C. Peltier,

Paleontologist: E. Brouwers P. Sacro

Gravimetry Loggers: L. Prado, D. Joiner Loggers: A. LeBreton

Redescribed: 09/17/1985

Depth

Description

[Note: Although this borehole was drilled as a gravimetry hole, geologic samples were taken in the lower part. The upper 276.2 ft was rock-bitted; the remainder of the hole was sampled in a ratio of 1 to 30.]

[LOWER PART OF SEDIMENT PACKAGE 2.]

276.2 - 276.9

PACKSTONE: mollusc, skeletal; unit generally poorly cemented, irregularly cemented, with moderately cemented nodules; molluscs with dull luster to slightly chalky, with moderate-yellowish-brown to grayish-orange steinkerns; unit generally very pale orange with moderate-yellowish-brown to grayish-orange micrite

cement. Contains large, altered fragment of <u>Tridacna</u> at top of unit; chalky mollusc with spar-infilling at 276.7 ft. Contains large partially spar-filled <u>Polinices</u> at base.

276.9			NO RECOVERY.
	-F		FFFF
308.3			PACKSTONE TO GRAINSTONE: mollusc, skeletal, containing sparse granule-size, moderately cemented rock fragments; unit uncemented; mixed-alteration, some mollusc fragments with nacreous layer preserved, others with dull luster to slightly chalky; unit pale yellowish brown; mostly medium- to coarse-grained, poorly sorted. Contains sparse, abraded coral fragments. [Note: unit is almost certainly a sand dike.]
	-F		-FFFFF
309.2	_	320.0	NO RECOVERY.
[APPROXI	MA'	TE TOP	SEDIMENT PACKAGE 3, BASED ON DOWNHOLE LOGS.]
320.0	-	339.3	NO RECOVERY.
339.3	-	339.8	WACKESTONE: mollusc; well-cemented; extensively recrystallized, skeletal fragments preserved as molds or steinkerns, others partially replaced by dark-yellowish-brown to moderate-yellowish-brown micrite, sparse coral molds; very pale orange. Contains myalinids.
339.8	_	371.1	NO RECOVERY.
371.1		371.7	FLOATSTONE: coral, skeletal WACKESTONE matrix; uncemented; coral fragments partially dissolved, replaced by very pale orange micrite or moderate-yellowish-brown to grayish-orange spar, many corals almost unrecognizable; unit generally very pale orange.
371.7		402.4	NO RECOVERY.
402.4	_	403.2	MUDSTONE TO WACKESTONE: coral, skeletal; well-cemented; corals preserved as molds; very pale orange.

403.2	_	433.7	NO RECOVERY.
433.7	-	434.4	WACKESTONE TO PACKSTONE; skeletal; well-cemented; recrystallized, microfossils preserved as molds, gastropod steinkerns; very pale orange.
434.4	_	455.0	
[APPROX	IMA'	ге тор	OF SEDIMENT PACKAGE 4.]
455.0	-	464.5	NO RECOVERY. weak gamma kick at 455.0 ft.
464.5		464.8	PACKSTONE: mollusc, skeletal; moderately cemented, irregularly cemented; skeletal components altered, mostly preserved as molds, one mollusc(?) mold infilled with dark-yellowish-brown spar; very pale orange.
464.8	-	495.3	NO RECOVERY.
495.3	-	495.9	PACKSTONE: coral, skeletal; uncemented with sparse, moderately cemented nodules; corals abraded, partially dissolved; very pale orange; generally very fine grained sand. Contains some foraminifers, but most sand-sized material unrecognizable.
495•9	_	524.9	NO RECOVERY.
524.9		525.6	FLOATSTONE: coral; muddy PACKSTONE matrix; generally uncemented, sparse moderately cemented burrows(?), corals very slightly altered; very pale orange to pale yellowish brown. Contains moderately cemented pebble-size burrow(?) at top of unit, filled with PACKSTONE with bleached but otherwise well-preserved microgastropods. Contains Seriatopora sticks.
525.6	_	555.6	NO RECOVERY.
555•6	-	556.3	

586.7 - 587.3 PACKSTONE: mollusc, coral; uncemented, except for sparse poorly cemented burrows(?); molluscs with nacreous luster; very pale orange to pale yellowish brown; containing sparse burrows(?). Contains small pelecypods (one "razor clam") and gastropods.

*** TOTAL DEPTH OF HOLE 587.3 FT ***

BOREHOLE OUT-24

Lat/Long (E/W-1960): 11^o36'20.4" N, 162^o05'59.7" E

Lat/Long (WGS-1972): 11°36′20.2" N, 162°06′00.0" E

Location (IVY-grid, ft): 125,499 N, and 035,424 E

Distance/Bearing from OAK GZ: 858 ft, 307.1 degrees

Water Depth (H&N datum): 147.0 ft Hole Depth: 351.1 bsf

Hole Spudded: 07/23/1985 Drilling Ended: 07/25/1985

Sampling Types: SS, SH Recovery: 16% (56.8)

Logs: GR-NU Date Logged: 07/25/1985

Deviation: No survey run Casing: 8-5/8-in. to 107.6 ft*

Drilling Mud/Additives: BVS (30 sx), PAD (22 gals)

Geologists: R.P. Major, W.E. Martin Paleontologist: None

Drillers: G. Mooney, C. Peltier, P. Sacro Logger: A. LeBreton

Redescribed 09/18/1985

*Casing shot off at mudline, left in hole.

Depth Description

O.O - 23.7 GRAINSTONE: Halimeda, mollusc, skeletal; uncemented; containing unaltered and altered skeletal components, including common fresh and sparse chalky Halimeda grains, small molluscs and fragments with nacreous layer preserved, moderate-red (5R6/4) and (less common) pinkish-gray Homotrema fragments scattered throughout; contains predominantly altered skeletal material and scattered lithoclasts in lower part; very pale orange to grayish orange near top becoming very pale orange downward; fine- to medium- grained, well-sorted at top, becoming progressively coarser-grained downward (unit is large graded bed), lower part containing coarse-grained-sand- to granule-sized particles. Contains sparse, very dusky reddish purple, broken echinoid spines, small

dark-gray grains of undetermined origin throughout (some may be Heliopora fragments, others phosphatic grains). Subunits as follows: 0.0 - 8.4 ft, GRAINSTONE, predominantly fine-grained at top becoming coarsegrained at bottom; 8.4 - 10.4 ft, NO RECOVERY; 10.4 - 20.9 ft, GRAINSTONE, becoming coarser-grained, less well-sorted downward; 20.9 - 22.8 ft, NO RECOVERY; 22.8 - 23.7 ft, PACKSTONE, containing sparse, granule-sized, poorly to moderately cemented clasts containing chalky Halimeda grains.

23.7 - 25.9 NO RECOVERY.

25.9 - 26.5 FLOATSTONE: mixed-rubble; matrix consisting of Halimeda, mollusc PACKSTONE; uncemented; unsorted; grains consisting of mixture of altered and unaltered components, including moderate-red (5R6/4) Homotrema scattered throughout, unaltered and chalky Halimeda grains, mollusc fragments with nacreous generally preserved; granule- to pebble-sized, poorly to moderately cemented, very pale orange to grayish-orange Halimeda, skeletal PACKSTONE; unit generally very pale orange. Contains abraded coral stick and coralgal material encrusting unidentified substrate.

26.5 - 29.4 NO RECOVERY.

GRAINSTONE: Halimeda, foraminifer; uncemented; Halimeda and foraminifers unaltered, with moderate-red (5R6/4) and moderate-orange-pink Homotrema, very pale orange coral fragments, sparse mollusc fragments with nacreous layer preserved; from 29.4 - 30.0 ft, medium- to very coarse grained with Acropora sticks; from 30.0 - 31.6 ft, NO RECOVERY; from 31.6 - 32.2 ft, fine- to medium-grained at top, grading downward to coarse-grained; from 32.2 ft to base, very coarse grained, poorly sorted with coral fragments, scattered granule- to pebble-sized, poorly cemented lithoclasts (rubble) at base of unit. [Note: unit consists predominantly of unaltered

components.]

32.8 - 34.5 NO RECOVERY.

34.5 - 59.4 FLOATSTONE TO PACKSTONE: mixed-rubble, coral; FLOATSTONE with Halimeda, foraminifer PACKSTONE matrix, interbedded with PACKSTONE; uncemented; contains sparse moderate-red (5R6/2) Homotrema, altered and unaltered skeletal components, including sparse mollusc fragments with

nacreous layer preserved; generally very pale orange, becoming very pale orange to white from 58.8 to 59.4 ft; rubble generally moderately cemented PACKSTONE and coral fragments, with sparse, moderate-yellowish-brown, cemented lithoclasts from 37.4 to 40.9 ft and grayish-orange to dark-yellowish-orange, sparry, pelecypod steinkern at 38.0 ft. Subunits as follows: 34.5 - 43.7 ft, rubble FLOATSTONE; 43.7 - 46.0 ft, NO RECOVERY; 46.0 - 53.5 ft, coral, rubble FLOATSTONE; 53.5 - 49.5 ft, rubble PACKSTONE TO FLOATSTONE. Fossils include Cypraea at 38.0 ft; fragments of Porites lutea from 46.5 - 46.6 ft, 53.3 - 53.4 ft, and58.5 - 48.7 ft; sparse echinoid spines at 48.8 ft. SAMPLES: T@ 40.8.

59.4 - 63.0 NO RECOVERY.

63.0 - 68.5

FLOATSTONE TO PACKSTONE: coral FLOATSTONE with foraminifer, skeletal PACKSTONE matrix; uncemented; skeletal components unaltered, with moderate-red (5R6/2) Homotrema, sparse small molluscs and mollusc fragments with nacreous layer preserved; very pale orange. Contains large coral fragments from 63.0 - 63.1 ft and 63.3 - 63.4 ft; abundant unaltered Amphistogina.

68.5 - 72.5 NO RECOVERY.

72.5 - 107.1

FLOATSTONE: coral; matrix Halimeda, foraminifer GRAINSTONE; uncemented; contains mixture of altered and unaltered skeletal grains, including common unaltered and sparse chalky Halimeda grains, scattered moderatered (5R6/2) Homotrema grains and unaltered foraminifers throughout, sparse mollusc fragments with nacreous layer and original coloration preserved, heavily bored mollusc fragment with minor medium-bluish-gray stain and encrusting moderate-red (5R6/2) Homotrema at 73.1 ft, light-brown (5YR6/4) sparry-calcite gastropod steinkern at 93.2 ft; coral fragment with minor medium-bluish-gray stain at 88.3 ft; unit very pale orange to pale yellowish orange; generally very coarse grained to granular material with few grains smaller than mediumgrained sand throughout. Rubble consists of granule- to pebble-sized pieces of moderately cemented, light-brown (5YR6/4) PACKSTONE from 88.2 - 88.6 ft. Contains fragments of Porites <u>lutea(?)</u> from 73.8 - 74.0 ft. [Note: unit appears to consist predominantly of Holocene material.]

107.1 - 111.6 NO RECOVERY.

111.6 - 117.8	GRAINSTONE: Halimeda, foraminifer, skeletal; uncemented; contains unaltered skeletal grains, including fresh Halimeda, moderate-red (5R6/4) and pale-red (5R6/2) Homotrema; unit very pale orange to pale yellowish orange; fine- to very coarse grained, moderately sorted, with few very fine grains and few granule-sized grains. Contains scattered very dusky red purple echinoid spines.
117.8 - 121.9	NO RECOVERY.
121.9 - 127.6	
127.6 - 131.6	NO RECOVERY.
131.6 - 133.0	GRAINSTONE: Halimeda, mollusc, skeletal; uncemented; containing unaltered skeletal components, fresh Halimeda grains, mollusc fragments with nacreous layer, original color preserved, scattered pale-red (5R6/2) Homotrema; unit yellowish-gray (5Y7/2); very coarse grained. Contains several large coral sticks at top of unit, sparse echinoid spines.
133.0 - 141.0	NO RECOVERY.
141.0 - 142.5	GRAINSTONE: Halimeda, lithoclast, skeletal; uncemented; generally unaltered skeletal components; very pale orange. Contains scattered granule-sized lithoclasts of well-cemented PACKSTONE, some with "tea-brown" micrite. [Note: unit does not contain moderate-red (5R4/6) Homotrema or shell fragments with original coloration, althrough the grains do not appear to be altered; most of the skeletal material may be upper Pleistocene in age. This unit appears to mark base of slump feature.]
142.5 - 150.8	NO RECOVERY.

150.8	-	151.7	FLOATSTONE: sparse rubble; matrix <u>Halimeda</u> PACKSTONE; uncemented; contains granule- to pebble-sized clasts of moderately cemented skeletal PACKSTONE; very pale orange.
151.7	_	160.7	NO RECOVERY.
160.7	_	181.6	FLOATSTONE: rubble; matrix Halimeda, coral PACKSTONE; rubble consists of poorly to moderately cemented coral PACKSTONE (predominant in upper part of unit) and sparse Halimeda PACKSTONE (predominant in lower part of unit); uncemented; skeletal components altered, corals partially dissolved and recrystallized, and partially spar-replaced, Halimeda chalky; very pale orange. Contains partially dissolved Porites lutea fragments from 171.7 - 171.9 ft.
181.6	_	190•1	NO RECOVERY.
190.1	_	191.8	PACKSTONE: skeletal; uncemented, containing sparse, small well-cemented nodules near base; very pale orange to very pale orange to white. Contains altered skeletal components, slightly chalky mollusc at 191.4 ft.
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191.8	_	199.9	NO RECOVERY.
199.9	_	201.3	FLOATSTONE: coral; matrix skeletal PACKSTONE TO WACKESTONE; coral partially dissolved, partially replaced Acropora sticks with minor PACKSTONE matrix cemented to same; unit uncemented; very pale orange to very pale orange to white. Contains pebble-sized fragment of well-cemented Halimeda PACKSTONE with moderate-yellowish-brown micrite stain at top.
201.3	_	209•4	NO RECOVERY.
209•4	_	210.6	WACKESTONE: skeletal; generally uncemented with well- cemented nodules (burrows?); skeletal components altered, chalky; white to very pale orange.
210.6	-	219.3	NO RECOVERY.

219.3 - 220.3 WACKESTONE: skeletal; generally uncemented with wellcemented nodules containing moldic porosity, constituting about 30 percent of unit; white to very pale orange. 220.3 - 226.0 NO RECOVERY: drilled easily. [Disconformity indicated by appearance of "tea-brown" micrite in first-recovered unit below this point and presence of hard layer by driller.] 226.0 - 229.1 NO RECOVERY. [Note: Probably like underlying unit; driller noted hard layer from 226.0 - 229.1 ft.] 229.1 - 230.2 PACKSTONE: skeletal; generally poorly cemented; irregularly cemented, with moderately well-cemented nodules; piece of moderate-yellowish-brown to darkyellowish-brown, well-cemented PACKSTONE at top, skeletal fragments altered in poorly cemented portions, preserved generally as molds, Halimeda fragments almost completely dissolved; very pale orange. Contains scattered Seriatopora molds. 230.2 - 239.0 NO RECOVERY. [Disconformity indicated by presence of "tea-brown" micrite and spar below surface.] 239.0 - 239.8 PACKSTONE: Halimeda skeletal, coral; well- to moderately cemented; Acropora sticks partially spar-replaced, partly chalky disaggregated; Halimeda grains very chalky, partially disaggregated, gastropods preserved as steinkerns; very pale orange with grayish-orange tones and moderate-yellowish-brown to dark-yellowish-brown, "tea-brown" micrite from 239.10 - 239.2 ft, 239.6 -239.8 ft, and scattered throughout. SAMPLE: T @ 239.0. 239.8 - 249.2 NO RECOVERY. 249.2 - 250.0 FLOATSTONE: coral; matrix skeletal PACKSTONE; probably moderately to poorly cemented; corals partially sparinfilled; small skeletal material preserved exclusively as molds; very pale orange mottled with pale yellowish brown.

NO RECOVERY.

250.0 - 259.4

259.4 - 260.0 PACKSTONE(?): skeletal; probably moderately to poorly cemented, irregularly cemented; very pale orange.
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[Disconformity suggested by increase in "tea-brown" micrite and increase in cementation.]
260.0 - 260.3 FLOATSTONE(?): coral; matrix heavily recrystallized, probably skeletal PACKSTONE; well-cemented to moderatel; well cemented, containing "tea-brown" micrite; coral sticks almost completely spar-replaced, others chalky, moldic; very pale orange to pale yellowish brown with very pale orange to grayish-orange spar.
260.3 - 269.4 NO RECOVERY.
269.4 - 270.3 PACKSTONE: skeletal, foraminifer; poorly cemented with moderately cemented nodules; skeletal components altered, foraminifers recrystallized; very pale orange.
270.3 - 279.6 NO RECOVERY.
279.6 - 280.1 FRAMESTONE(?): coralgal material; matrix skeletal PACKSTONE(?); well-cemented, minor "tea-brown" micrite; extensively recrystallized; micromoldic porosity; very pale orange with minor pale-yellowish-brown mottling. May contain small extensively recrystallized Porites lutea head, Carpenteria(?)-type of encrusting foraminifer with coralgal material. SAMPLE: T @ 279.6
280.1 - 289.8 NO RECOVERY.
289.8 - 290.4 FLOATSTONE(?): coral; matrix skeletal PACKSTONE(?); corals partially spar-replaced, skeletal grains generally moldic, partly replaced; moderately to well-cemented(?) containing minor "tea-brown" micrite; very pale orange to pale yellowish brown. SAMPLE: T @ 289.8.
290.4 - 300.0 NO RECOVERY.

300.0	-	300.6	PA	CKSTONE(?): skeletal; generally poorly cemented with well-cemented nodules (burrows?) of skeletal WACKESTONE TO PACKSTONE containing micromoldic porosity; material in matrix poorly preserved, recrystallized; very pale orange.
300.6				RECOVERY.
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310.1	_	311.3	PAG	CKSTONE: coral, skeletal; generally poorly to moderately cemented, containing scattered "tea-brown" micrite throughout; sparse molds lined with spar; skeletal material slightly recrystallized; very pale orange.
311.3	-	320.3	NO	RECOVERY: Neutron-neutron log shows decrease in porosity from 316 ft downward.
320.3	_	320.9	FL(DATSTONE(?): sparse coral; matrix skeletal WACKESTONE; corals preserved as molds; well-cemented; matrix pervasively(?) recrystallized; micromoldic porosity in well-cemented pieces; very pale orange. SAMPLE: T@ 320.6.
320.9	_	330•2	NO	RECOVERY. Nuetron-neutron log shows very high porosity zone just above here; possibly a cave(?).
330•2	_	331.0	FL(DATSTONE(?): coral; matrix skeletal WACKESTONE TO PACKSTONE; well-cemented, irregularly cemented; abundant moldic porosity; very pale orange.
331.0	_	340.3	NO	RECOVERY.
340.3	_	348.8	FLO	PACKSTONE: coral; matrix skeletal WACKESTONE TO PACKSTONE; well-cemented, probably irregularly cemented; corals exclusively preserved as molds in upper part of unit, partly chalky, largely disaggregated by base; micromoldic porosity throughout; contains small piece of spar-cemented matrix (atypical) at 344.6 ft; unit very pale orange, mottled with very pale orange to pale yellowish brown. Contains several types of coral sticks, including abundant Seriatopora from 344.6 - 345.5 ft. SAMPLES: T@ 344.6, 344.9.

348.8 - 351.1 PACKSTONE(?): skeletal; moderately well-cemented; abundant moldic porosity; contains very minor spar cement; very pale orange to pale yellowish brown.

*** TOTAL DEPTH OF HOLE 351.1 FT ***

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UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Pacific Enewetak Atoll Crater exploration (PEACE) Program Enewetak Atoll, Republic of the Marshall Islands

Part 1: Drilling operations and descriptions of boreholes in vicinity of KOA and OAK craters

Open-File Report 86-419

APPENDIX I

Sample Interval and Recovery Data Phase II of PEACE Program

by

B. R. Wardlaw, T. W. Henry, and R. G. Stamm

U. S. Geological Survey
Washington, D. C. and Reston, Virginia

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APPENDIX I:

SAMPLE INTERVAL AND RECOVERY DATA, PHASE II OF PEACE PROGRAM

B.R. Wardlaw¹, T.W. Henry², R.G. Stamm¹

U. S. Geological Survey

INTRODUCTION

The following appendix consists of a set of tables in which interval and recovery data are presented for every sample core or run made from the geologically described boreholes drilled on Enewetak Atoll during Phase II of the PEACE Program. These computer records, compiled both onsite and stateside, are based primarily on the records made during the drilling/sampling operations by the McClelland Engineers geologists and on the drillers' notes. These data were modified by U.S. Geological Survey (USGS) personnel onsite to include pertinent comments regarding sample integrity, to note the very sparse mismarked samples, and to convey other similar kinds of information. When the core/samples were redescribed by USGS geologists in Denver, Colorado, minor additional inconsistancies in labeling and marking also were found and noted; these are included in the comments in this set of tables.

These data form the raw base from which part of the statistics for the summary sampling tables (tables 12 and 13) in the main body of the text of the current report, on the introductory page for each of the borehole description in the text of the main report, and in the sample-recovery columns of Plates 1 - 29, accompanying the geologic description in the section Borehole Descriptions. The minor differences between the sample-recovery column of Plates 1 - 29 in the USGS geologic descriptions and the analogous columns in Plates 3 - 36 of McClelland's boring logs (Appendix II of this report -- Geotechnical Investigations, Phase II of PEACE Program by G. L. Holloway and A. G. Young) reflect the fact that McClelland compilation did not have the benefit of the Denver relook and redescription of the Enewetak material.

TABLE COLUMNS

The tables consist of the following five data columns for each of the runs or samples: (1) the <u>interval</u> penetrated (marked in ft below the seafloor or top of the borehole); (2) the <u>length</u> of the run or penetration (in ft); (3) how the <u>sample</u> actually is <u>marked</u> on the D-tubes, D-tube sleeves, styrofoam spacers, cardboard boxes, and wooden coreboxes (4); how much core/sample

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actually was <u>recovered</u> (in ft) during the run; and (5) <u>recovery</u> (defined as amount of sample recovered divided by the length of the sample run). The data tables for boreholes KAR-1 and KBZ-4 also contain an unmarked "run-number" column beside some of the SAMPLE MARKED columns (and marked S1, S2, etc.); the initial practice of marking the run numbers on the D-tubes and -sleeves was not followed consistantly and was discontinued after borehole KBZ-4 was drilled.

The material-properties samples and the samples that were taken onsite for density measurements are designated as such in each table. The deposition of this two types of samples is illustrated by the following two examples (see p. I-5, the data tables for the core log for KAR-1). For the first example, a core run was made in borehole KAR-1 penetrating the interval from 482.0 to 486.6 ft below the top of the hole. Only 1.4 ft of core was recovered, marked 482.0 to 483.4. From this 1.4 ft of recovery, a 1.0-ft-long materialproperties sample was taken (and marked 482.0 - 483.0). Thus, only the portion of the core from 483.0 to 483.4 is present in the appropriate D-tubes containing the archive and working half of the geologic core; the unslabbed material-properties sample was turned over to appropriate stateside laboratories for testing. For the second example, 5.3-ft long core run was made from 362.8 to 368.1 ft below the top of the hole. From this interval, 4.8 ft of core was recovered. From this 4.8 ft, a density measurement was made onsite for the part of the core from 366.9 to 367.4 ft. Thus, in the Dtubes (archive and working half), only the portions of this material from 362.8 to 366.9 ft and from 367.4 to 367.6 ft occur in stratigraphic order. Since the onsite density measurements are nondestructive, the portion of the core that was tested onsite generally was placed in the last set of D-tubes packed for the respective boreholes and clearly labeled as onsite density samples.

KAR-1 CORE LOG

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
water near other unique maps made made unique with other term with vising near	mere yang yang yang unip darir trap unip teleb yang darir dalip u	0.0 - 0.5 (S1) 2.0 - 2.2 (S2) 3.5 - 3.8 (S3) 5.0 - 5.8 (S4) 7.0 - 7.8 (S5) NO RECOVERY 8.75 - 9.25 (S4) 9.25 - 9.75 (S7) 10.75 - 11.65 (S8) 12.75 - 13.55 (S9) 13.55 - 14.4 (S10) 14.75 - 15.4 (S11) 16.75 - 17.25 (S12) 17.25 - 17.75 (S13) 18.75 - 19.85 (S14) 20.75 - 20.95 (S15) 22.75 - 23.75 (S16) 23.75 - 25.75 (S17) 25.75 - 27.75 (S18) 27.75 - 28.75 (S17) 25.75 - 27.75 (S18) 27.75 - 28.75 (S19) 28.75 - 30.25 (S20) 30.25 - 32.25 (S21) 32.25 - 34.25 34.25 - 35.25 (S23) 35.25 - 35.75 (S24) 35.75 - 36.25 (S23) 35.25 - 36.25 (S26) 38.25 - 40.25 (S27) 40.25 - 41.75 (S29) 41.75 - 42.25 (S28) 42.25 - 44.25 (S28)	Man along Miles Mager Print and Alber Julius Man Miles Along Albert Miles Albert Miles	name was the man man time was man tage that the day of
0.0 - 2.0	2.0	0.0 - 0.5 (S1)	0.5	0.25
2.0 - 3.5	1.5	2.0 - 2.2 (S2)	0.17	0.11
3.5 - 5.0	1.5	3.5 - 3.8 (S3)	0.33	0.22
5.0 - 7.0	2.0	5.0 - 5.8 (S4)	0.83	0.42
7.0 - 8.5	1.5	7.Ø - 7.8 (S5)	0. 83	0.55
8.5 8.75	0.25	NO RECOVERY	0.0	0.00
8.75 - 10.75	2.0	8.75 - 9.25 (S6)	1.37	0.69
		9.25 - 9.75 (S7)		
10.75 - 12.75	2.0	10.75 - 11.65 (S8)	0.9	0.45
12.75 - 14.75	2.0	12.75 - 13.55 (S9)	1.65	0.83
		13.55 - 14.4 (S10)		
14.75 - 16.75	2.0	14.75 - 15.4 (S11)	0.65	0.33
16.75 - 18.75	2.0	16.75 - 17.25 (S12)	1.0	0.50
	DENSITY	17.25 - 17.75 (S13)	DENSITY	
18.75 - 20.75	2.0	18.75 - 19.85 (S14)	1.1	0.55
20.75 - 22.75	2.0	20.75 - 20.95 (S15)	0.2	0.10
22.75 - 23.75	1.0	22.75 - 23.75 (S16)	0.25	0.25
23.75 - 25.75	2.0	23.75 - 25.75 (817)	1.1	0.55
25.75 - 27.75	2.0	25.75 - 27.75 (818)	0.5	0.25
27.75 - 28.75	1.0	27.75 - 28.75 (819)	0.152	0.15
28 75 - 30 25	1 5	28.75 - 30.25 (920)	1 0	0.47
30.25 - 32.25	2.0	30.25 - 32.25 (921)	1.6	0.80
72 25 - 74 25	2.0	70 05 - 74 05 (COO)	0.4	0.30
MATERIAL PRO	DEDTIECEN	77 75 - 74 75	MATERIAL DRODE	DTIEC
74 25 - 74 25	2 0	74 95 - 35 95 (COS)	7 D	1 0101
34.25 36.25	DENETTY	75 75 _ 75 75 (C7A)	DENETTY	1.00
	DENOTI	75 75 _ 74 75 (COS)	DENGTI	
74 75 - 70 75	2 B	74 75 - 30 25 (C24)	2 A	1 (2)(2)
30.23 - 30.23	2.0	30.23 - 30.23 (320)	10	a 50
10.2J - 40.2J	2.0	40 25 - 41 75 (227)	2.0	1 00
40.25 - 42.25	2.0	40.20 - 41.70 (827)	2.0	1.00
40.05 44.05	~ ~	41.75 - 42.25 (828)		1 (3/2)
42.20 - 44.20	2.0	42.20 - 44.20 (830)	2.0	1.00
44.25 - 45.25	1.6	44.25 - 45.25 (831)	0.25	0.25
45.25 - 46.25	1.0	45.25 - 46.25 (832)	0.45	0.45
46.25 - 48.25	2.0	46.25 - 48.25 (833)	2.0	1.00
48.25 - 50.25	2.0	48.25 - 50.25 (834)	2.0	1.00
50.25 - 52.25	2.0	50.25 - 52.25 (835)	1./	Ø.85
52.25 - 54.25	2.0	52.25 - 54.25 (836)	2.0	1.00
54.25 - 56.25	2.0	54.25 - 54.85 (S37)	1.6	0.80
		54.85 - 55.85 (\$38)		
56.25 - 58.25	2.0	56.25 - 56.75 (S39)	1.5	0.75
		56.75 - 57.75 (S4Ø)		
58.25 - 60.25	2.0	58.25 - 58.9 (S41)	0.45	Ø.33
60.25 - 62.25	2.0	60.25 - 60.95 (S42)	0.7	0.35
62.25 - 64.25	2.0	62.25 - 63.15 (543)	0.9	0.45
64.25 - 66.25	2.0	64.25 - 64.85 (544)	1.2	0.60
	DENSITY	64.85 - 65.35*(S45)	DENSITY	
66.25 - 68.25	2.0	66.25 - 67.25 (S46B	1.8	0.90
		40.25 - 41.75 (S29) 41.75 - 42.25 (S28) 42.25 - 44.25 (S30) 44.25 - 45.25 (S31) 45.25 - 46.25 (S32) 46.25 - 48.25 (S33) 48.25 - 50.25 (S35) 52.25 - 54.25 (S36) 54.25 - 54.85 (S37) 54.85 - 55.85 (S38) 56.25 - 56.75 (S39) 56.75 - 57.75 (S40) 58.25 - 58.9 (S41) 60.25 - 63.15 (S43) 64.25 - 64.85 (S44) 64.85 - 65.35*(S45) 66.25 - 67.25 (S468) 67.25 - 68.05 (S47)		

^{*} SAMPLE MISLABELED, SHOULD BE <u>65.45</u>
** CONSISTS OF CAVINGS ON TOP OF SAMPLE

KAR-1 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED RI	ECOVERED	RECOVERY
		68.25 - 69.80 (S48) 70.25 - 70.45 (S49B) 72.25 - 72.45 (S50B) 73.25 - 73.65 (S51) 74.75 - 75.15 (S52) 79.75 - 80.45 (S53) ND RECOVERY 82.5 - 82.7 (S54) NO RECOVERY 91.75 - 92.45 (S55) 94.25 - 96.25*(S56) 99.75 - 107.0 NO RECOVERY 115.3 - 117.8 125.0 - 127.25 130.45 - 132.95 140.15 - 143.65 150.45 - 152.95 157.25 - 158.25 162.1 - 164.6 171.8 - 173.7 174.2 - 175.45 174.6 - 175.0 176.2 - 181.5		
68.25 - 70.25	2.0	68.25 - 69.80 (S48)	1.55	0.78
70.25 - 72.25	2.0	70.25 - 70.45 (S49B)	0.2	0.10
72.25 - 73.25	1.0	72.25 - 72.45 (S50B)	0.2	0.20
73.25 - 74.75	1.5	73.25 - 73.65 (951)	0.4	0.27
74.75 - 79.75	5.0	74.75 - 75.15 (S52)	0.4	0.08
79.75 - 81.75	2.0	79.75 - 80.45 (S53)	0.7	0.35
81.75 - 82.5	0.75	NO RECOVERY	0.0	0.00
82.5 - 83.0	0.5	82.5 - 82.7 (S54)	0.2	0.40
83.0 - 91.75	8.75	NO RECOVERY	0.0	0.0
91.75 - 94.75	3.0	91.75 - 92.45 (S55)	0.7	0.23
94.75 - 99.75	5.0	94.25 - 96.25*(556)	1.5	0.30
99.75 - 109.25	9.5	99.75 - 107.0	7.25	0.76
109.25 - 115.30	6 .0 5	NO RECOVERY	0.0	0.0
115.30 - 125.0	9.7	115.3 - 117.8	2.5	0.26
125.0 - 130.45	5.45	125.0 - 127.25	2.25	0.41
130.45 - 140.15	9.7	130.45 - 132.95	2.5	0.26
140.15 - 150.45	10.3	140.15 - 143.65	3.5	0.34
150.45 - 157.25	6.8	150.45 - 152.95	2.5	0.37
157.25 - 162.1	4.85	157.25 - 158.25	1.0	0.21
162.1 - 171.8	9.7	162.1 - 164.6	2.5	0.26
171.8 - 174.2	2.4	171.8 - 173.7	1.9	0.79
174.2 - 176.2	2.0	174.2 - 175.45	1.25	0.63
	DENSITY	174.6 - 175.0	DENSITY	
176.2 - 178.2	2.0	176.2 - 177.9	1.7	0.85
178.2 - 182.1	3.9	178.2 - 181.5	3.3	0.85
182.1 - 186.7	4.6	182.1 - 184.4	2.3	0.50
186.7 - 191.3	4.6	186.7 - 191.3	4.6	1.00
191.3 - 195.8	4.5	191.3 - 195.8	4.5	1.00
195.8 - 202.3	6.5	195.8 - 202.0	6.2	0.95
202.3 - 210.6	8.3	202.3 - 209.6	7.3	0.88
210.6 - 221.2	10.6	210.6 - 217.9	7.3	0.69
221.2 - 228.3	7.1	221.2 - 226.4	5.2	0.73
228.3 - 233.75	5.45	228.3 - 233.5	5.2	0.95
233.75 - 238.65	4.9	233.75 - 238.65	4.9	1.00
238.65 - 243.5	4.85	238.65 - 242.85	4.2	0.87
243.5 - 248.1	4.6	243.5 - 247.6	4.1	0.89
248.1 - 252.6	4.5	NO RECOVERY	0.0	0.00
252.6 - 254.1	1.5	252.6 - 253.85	1.25	0.83
254.1 - 258.9	4.8	254.1 - 256.1	2.0	0.42
258.9 - 259.0	0.1	NO RECOVERY	0.0	0.00
259.0 - 262.0	3.0	259.0 - 260.25	1.25	0.42
262.0 - 267.5	5.5	262.0 - 263.75	1.75	0.32
267.5 - 272.9	5.4	267.5 - 269.9	2.4	0.44
272.9 - 278.1	5.2	NO RECOVERY	0.0	0.00
278.1 - 281.2	3.1	174.6 - 175.0 176.2 - 177.9 178.2 - 181.5 182.1 - 184.4 186.7 - 191.3 191.3 - 195.8 195.8 - 202.0 202.3 - 209.6 210.6 - 217.9 221.2 - 226.4 228.3 - 233.5 233.75 - 238.65 238.65 - 242.85 243.5 - 247.6 NO RECOVERY 252.6 - 253.85 254.1 - 256.1 NO RECOVERY 259.0 - 260.25 262.0 - 263.75 267.5 - 269.9 NO RECOVERY 278.1 - 279.9**	1.8	0.58
281.2 - 283.5	2.3	281.2 - 283.4**	2.2	0.96
283.5 - 284.0	0.5	283.5 - 284.0	0.5	1.00
284.0 - 288.15	4.15	284.0 - 286.0	2.0	0.48
288.15 - 288.5	0.35	NO RECOVERY	0.0	0.00
288.5 - 291.65	3.15	288.5 - 290.0	1.5	0.48
291.65 - 293.95	2.3	291.65 - 293.15	1.5	0.48
293.95 - 297.6	3.65	NO RECOVERY	0.0	0.00
297.6 - 301.0	3.4	297.6 - 299.7	2.1	0.62

^{*} SAMPLE MISLABELED, SHOULD BE 95.75 ** VOIDS, BIT DROPPED 1.5 FT FROM 278.5 - 281.2 FT

KAR-1 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
301 0 - 302 A	1 6	301 0 - 302 4	1.4 1.4 0.0 1.7 3.0 1.3 DENSITY 1.5 2.4 4.0 5.1 4.5 3.4 0.6 4.7 5.4 0.4 0.8 7 1.5 4.5 7 1.5 4.7 7 1.5 4.7 7 1.5 4.7 7 1.7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	Ø 00
307 4 - 304 4	2.0	301.0 - 302.4	1 4	0.00
304 4 - 307 4	2.0 7 (7)	NO DECOUEDY	0 0	0.70
307 6 - 309 3	1 7	707 6 - 700 T	1 7	1 (2)(2)
309.3 - 314.1	4.8	309.3 - 312.3	τ. ή	דא מ
314 1 - 314 2	2.1	314 1 - 315 4	1.3	0.00
01,11	DENSITY	314.2 - 314.8	DENSITY	0.02
314.2 - 318.3	2.1	316.2 - 318.1	1.9	01.901
318.3 - 319.8	1.5	318.3 - 319.8	1.5	1 00
319.8 - 322.6	2.8	319.8 - 322.2	2.4	0.86
322.6 - 326.6	4.0	322.6 - 326.6	4.0	1.00
326.6 - 331.7	5.1	326.6 - 331.7	5.1	1.00
331.7 - 336.9	5.2	331.7 - 336.2	4.5	0.87
336.9 - 341.5	4.6	336.9 - 341.4	4.5	0.78
341.5 - 345.1	3.6	341.5 - 344.9	3.4	0.94
345.1 - 346.5	1.4	NO RECOVERY	0.0	0.00
346.5 - 349.6	3.1	346.5 - 349.1	2.6	0.84
349.6 - 352.1	2.5	349.6 - 350.6	1.0	0.40
352.1 - 352.6	0.5	352.1 - 352.5	0.4	0.80
352.6 - 355.4	2.8	352.6 - 353.4	0.8	0.29
355.4 - 360.1	4.7	355.4 - 360.1	4.7	1.00
360.1 - 362.8	2.7	360.1 - 361.6	1.5	0.56
362.8 - 368.1	5.3	362.8 - 367.6	4.8	0.91
	DENSITY	366,9 - 367.4	DENSITY	
368.1 - 368.9	0.8	368.1 - 368.4	0.3	0.38
368.9 - 373.6	4.7	368.9 - 373.4	4.5	0.96
373.6 - 376.4	2.8	373.6 - 375.0	1.4	0.50
376.4 - 381.7	5.3	376.4 - 380.3	3.9	0.74
381.7 - 383.3	1.6	ND RECOVERY	0.0	0.00
383.3 - 388.9	5.6	383.3 - 387.6	4.3 (+1.0)	0.95
388.9 - 393.6	4.7	387.9 - 393.6	5.7	1.00
393.6 - 398.4	4.8	393.6 - 397.35	3.75 (+1.0)	0.99
398.4 - 399.1	0.7	397.4 - 399.1	1.7	1.00
399.1 - 403.5	4.4	399.1 - 402.6	3.5	0.80
403.5 - 406.9	3.4	403.5 - 404.6	1.1	0.32
406.9 - 411.7	4.8	406.9 - 407.7	0.8	0.17
411.7 - 413.8	2.1	411.7 - 413.2	1.5	0.71
413.8 - 418.4	4.6	413.8 - 414.5	1.5 0.7 2.5 2.3 2.6 4.7 0.0 1.4	0.15
418.4 - 423.9	5.5	418.4 - 420.9	2.5	0.45 0.47
423.9 - 428.8	4.7	423.7 - 426.2	2.3	Ø.47 Ø.68
428.8 - 432.6	J. 8	420.8 - 431.4	Z. C	Ø.9Ø
432.0 ~ 437.0	3.2	432.0 - 437.3	7.7	0.70
437.6 - 440.2	1.4	440 2 - 441 A	1 4	1.00
441.6 - 443.8	2.7	441.6 - 442.4	Ø.8	0.36
443.8 - 450.9	7.1	443.8 - 449.5	5.7	0.80
450.9 - 457.2	6.3	450.9 - 456.7	5.8	0.92
457.2 - 462.9	5.7	457.2 - 462.8	5.6	0.78
462.9 - 468.7	5.8	462.9 - 468.4	5.5	0.75
468.7 - 476.1	7.4	468.7 - 468.9	0.2	0.03
476.1 - 481.0	4.9	NO RECOVERY	0.0	0.00
481.0 - 482.0	1.0	481.0 - 482.0	1.0	1.00
482.0 - 486.6	4.6	482.0 - 483.4	1.4	0.30
MATERIAL PRO		482.0 - 483.0	MATERIAL PROPERTIES	
486.6 - 487.4	0.8	486.6 - 487.4	Ø . 8	1.00

KAR-1 CORE LOG (cont.)

		SAMPLE MARKED		RECOVERY
407 4 - 400 4	7 0	487.4 - 488.6 490.4 - 492.2 492.2 - 496.2 497.4 - 498.9 502.4 - 504.3 507.7 - 509.7 510.1 - 510.7 513.6 - 520.2 519.0 - 520.0 520.2 - 522.5 521.5 - 522.3 NO RECOVERY NO RECOVERY 537.4 - 538.0 539.2 - 540.3 541.6 - 542.6 543.2 - 544.0	1.2	01 401
407.4 - 470.4	3.6	400 4 - 400 0	1 0	1 00
470.4 - 472.2	I.O	470.4 - 472.2 400.0 - 404.0	4.0	0.77
472.2 - 477.4 407 A - 500 A	5.2	497 4 - 499 9	1.5	0.30
500 4 - 507 7	5. T	502.4 - 504.3	1.9	0.36
507 7 - 510.1	2.4	507.7 - 509.7	2.0	0.83
510.1 - 513.4	3.5	510.1 - 510.7	0.6	0.17
513.4 - 520.2	6.6	513.6 - 520.2	6.6	1.00
MATERIAL PROF	PERTIES	519.0 - 520.0	MATERIAL PROPERTI	ES
520.2 - 527.7	7.5	520.2 - 522.5	2.3	0.31
DENSITY		521.5 - 522.3	DENSITY	
527.7 - 528.6	0.9	NO RECOVERY	Ø. Ø	0.00
528.6 - 533.5	4.9	NO RECOVERY	0.0	0.00
533.5 - 534.3	0.9	NO RECOVERY	0.0	0.00
534.3 - 536.6	2.3	NO RECOVERY	0.0	0.00
536.6 - 537.4	Ø.8	NO RECOVERY	0.0	0.00
537.4 - 539.2	1.8	537.4 - 538.0	0. 75	0.42
539.2 - 541.6	2.4	539.2 - 540.3	1.1	0.46
541.6 - 543.2	1.6	541.6 - 542.6	1.0	0.63
543.2 - 548.5	5. 3	543.2 - 544.Ø	Ø . 8	0.15
548.5 - 5 50 .8	2.3	548.5 - 550.1	1.6	0.70
550.8 - 556.3	5.5	550.8 - 556.0	5.2	0.95
MATERIAL PROF	PERITES**	543.2 - 544.0 548.5 - 550.1 550.8 - 554.0 552.8 - 553.8 554.3 - 558.3 561.4 - 561.9* NO RECOVERY NO RECOVERY NO RECOVERY NO RECOVERY S75.1 - 575.3 NO RECOVERY NO RECOVERY 584.3 - 585.5 NO RECOVERY 590.1 - 593.9 NO RECOVERY 403.8 - 604.6 605.8 - 606.3 606.3 - 606.8	MATERIAL PROPERTI	ES
556.3 - 561.4	5.1	556. 3 - 558. 3	2.0	0.39
561.4 - 563.3	1.9	56 <u>1</u> .4 - 561.9*	0.4	0.21
563.3 - 564.0	0.7	NO RECOVERY	0.0	0.00
564.0 - 568.9	4.9	NO RECOVERY	0.0	0.00
568.9 - 570.5	1.6	568.9 - 57 0. 5	1.6	1.00
570.5 - 571.2	0.7	NO RECOVERY	Ø. Ø	0.00
571.2 - 575.1	3.9	NO RECOVERY	0.0	0.00
575.1 - 576.6	1.5	575.1 - 575.3	0.2	0.13
576.6 - 579.3	2.7	NO RECOVERY	0.0	0.00
579.3 - 584.3	5.0	NO RECOVERY	0.0	0.00
584.3 - 585.5	1.2	584.3 - 585.5	1.2	1.00
585.5 - 590.05	4.55	NO RECOVERY	a. b	0.00
590.05 - 593.7	3.6	590.1 - 591.9	1.8	0.50
593./ - 598.6	4.9	573./ - 573.7	0.2	0.04
578.6 - 603.8	5.2	NU RECUVERY	Ø. Ø	0.00 0.40
603.8 - 603.8 (a.e. 0 / 60 7	2.0	003.8 - 004.6	Ø.G	1.00
OWD.B - OWO.S	W.D	- 405 C - 404 T	MATERIAL BROBERT	1.66
THIERIAL PRUP	2 0	404 3 - 404 0	O =	0.17
400.3 - 007.4 400 9 - 417 95	4.7 4.05	606.3 - 606.8 NO RECOVERY 613.25 - 614.35	0 O	0.0
607.2 - 613.20 613 95 - 614 35	1 1	613.25 - 614.35	1.1	1.00
614.35 - 616.25	1.9	NO RECOVERY	0.0	0.00
614.35 - 617.35	1.1	616.25 - 617.35	1.1	1.00
617.35 - 626.4	9.05	NO RECOVERY	0.0	0.00
626.4 - 626.9	0.5	626.4 - 626.9	Ø.5	1.00
626.9 - 634.9	8.0	626.9 - 627.3	0.4	0.05
634.9 - 635.5	0.6	634.9 - 635.5	0.6	1.00
635.5 - 638.9	3.4	635.5 - 636.6	1.1	0.32
638.9 - 644.5	5.6	NO RECOVERY	ø.ø	0.00
644.5 - 645.6	1.1	644.5 - 645.6	1.1	1.00
U-7:U U7U:O		37710 - U7010	• * •	- 4

^{*} SAMPLE MISLABELED, SHOULD BE 561.8
** SAMPLED, BUT NOT FOUND FOR SHIPPING, MAY BE LOST!

KAR-1 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MAR	RECOVERED	RECOVER
MATERIAL PROF	PERTIES*	644.5 - 645	MATERIAL PROPER 9.0 0.5 0.8 0.0 1.5 1.0 1.7 1.4 1.3 MATERIAL PROPER	TIES
645.6 - 654.7	9.1	NO RECOVER	Y Ø.Ø	0.00
654.7 - 655.5	Ø.8	654.7 - 655	5.5 0.8	1.00
55.5 - 664.9	9.4	655.5 - 657	'.0 1.5	0.16
64.9 - 668.9	4.0	664.9 - 665	5.9 1.0	0.25
68.9 - 679.1	9.2	668.9 - 670	1.7	Ø.18
79.1 - 688.4	9.3	679.1 - 680	1.3	Ø.14
MATERIAL PROF	ERTIES*	679.4 - 680	.1 MATERIAL PROPER	TIES
88.4 - 695.6	7.2	688.4 - 692	1.8 4.4 1.8 5.2 7.0 MATERIAL PROPER 1.5 4.7	0.61
95.6 - 700.8	5.2	695.6 - 700).8 5.2	1.00
MATERIAL PROF	ERTIES*	696.2 - 697	'.Ø MATERIAL PROPER'	TIES
00.8 - 710.75	9.95	700.8 - 705	j.5 4.7	Ø.47
10.75 - 715.75	5.0	710.75 - 713	3.6 2.8	0.56
15.75 - 719.6	4.85	715.8 - 718	4.7 2.8 2.9 3.3 0.7 4.4 2.3 8.8 1.8 4.8 2.1 5.1 6.4 MATERIAL PROPER	0.60
19.6 - 722.1	2.5	719.6 - 720	0.7	0.28
22.1 - 727.0	4.9	722.1 - 724	.4 2.3	0.47
27.0 - 732.2	5.2	727.0 - 728	1.8	0.35
32.2 - 737.0	4.8	732.2 - 737	'.Ø 4.8	1.00
37.0 - 742.1	5.1	737.0 - 742	2.1 5.1	1.00
MATERIAL PROF	ERTIES	739.8 - 740	0.6 MATERIAL PROPER 0.6 4.5	TIES
42.1 - 747.2	5.1	742.1 - 746	4.5	Ø.88
47.2 - 752.1	4.9	747.2 - 748	1.3	0.27
52.1 - 756.75	4.65	752.1 - 754	2.5	0.54
56.75 - 761.85	5.1	756.75 - 761	.75 5.0	Ø.98
MATERIAL PROF	PERTIES	75 8.0 - 758	1.5 1.3 1.6 2.5 1.75 5.0 1.9 MATERIAL PROPER	TIES
61.85 - 766.7	4.9	761.8 - 766	4.9 .0 4.3 .9 6.9 .4 5.5	1.00
66.7 - 771.0	4.3	766.7 - 771	00 4.3	1.00
71.0 - 777.9	6.9	771.0 - 777	'.9 <u>6.9</u>	1.00
77.9 - 787.1 DENSITY	9.2	777.9 - 783	5.4 5.5	0.60
DENSITY		779.7 - 780	DENSITY 4.3 4.9	
87.1 - 793.3	6.2	787.1 - 791	.4 4.3	0.69
93.3 - 798.4	5.1	793.3 - 798	4.9	0.96
MATERIAL PROF	PERTIES	797.1 - 798 798.4 - 802	.0 MATERIAL PROPER	TIES
98.4 - 803.5	5.1	798.4 - 802	2.7 4.3	Ø.84
03.5 - 808.4	4.9	803.5 - 807	'.2 3. 7	0.76
08.4 - 813.3	4.9	808.4 - 809	1.4	0.29
13.3 - 818.2	4.9	813.3 - 818	1.7 4.3 1.2 3.7 1.8 1.4 3.2 4.9 5.0 4.8 7.9 4.9 2.8 4.9	1.00
18.2 - 823.0	4.8	818.2 - 823	.Ø 4.8	1.00
23.0 - 827.9	4.9	823.0 - 82 7	4.9	1.00
27.9 - 833.2	5.3	827.9 - 832	2.8 4.9	0.92
33.2 - 840.0	6.8	833.2 - 840	1.0 6.8 3.2 MATERIAL PROPER	1.00
MATERIAL PROF	PERTIES	833.2 - 834	.2 MATERIAL PROPER	TIES
40.0 - 845.9	5.9	840.0 - 845	5.0 MATERIAL PROPER 5.0 5.0 8.6 6.7	0.85
45.9 - 853.0	7.1	845.9 - 852	6.7	0.94
53.0 - 861.6	8.6	853.0 - 861	.3 8.3	Ø.97
61.6 - 869.5	7.9	861.6 - 868	6.8	Ø.86
69.5 - 877.8	8.3	869.5 - 876	6.7	0.81
77.8 - 886.0	8.2	877.8 - 885		0.89
886.0 - 892.1	6.1	886. 0 - 892		1.00
92.1 - 900.05	7.95	892.1 - 900		1.00
00.05 - 909.55	9.5	900.05 - 909		1.00
09.55 - 914.2	4.65	909.55 - 914		1.00

^{*} PROBABLY SAMPLED, BUT NO SUBSEQUENT RECORD EXISTS AND IT WAS NOT SHIPPED

KAR-1 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
914.2 - 924.0	9.8	914.2 - 924.0		1.00
924.0 - 934.4	10.4	924.0 - 933.4 934.4 - 938.1	9.4 3.7	0.90
934.4 - 942.8	8.4	934.4 - 938.1	3.7	Ø.44
942.8 - 948.3	5.5	942.8 - 946.6 944.6 - 945.6	3.8	0.69
MATERIAL PROF	PERTIES	944.6 - 945.6	MATERIAL PROPERTIE	S
		948.3 - 953.9	5.6	1.00
953.9 - 959.9	6.0	953.9 - 959.9	6.0	1.00
959.9 - 966.8	6.9	959.9 - 963.4	6.0 3.5	0.51
966.8 - 972.1 972.1 - 979.2	5.3	966.8 - 971.2		
972.1 - 979.2	7.1	972.1 - 977.7	5.6	0.79
979.2 - 984.3	5.1	972.1 - 977.7 979.2 - 983.7 980.5 - 981.4	4.5	Ø.88
MATERIAL PROF	PERTIES	980.5 - 981.4	MATERIAL PROPERTIE	5
984.3 - 990.4	6.1	984.3 - 990.1	5.8	0.95
990.4 - 996.4	6.0	984.3 - 990.1 990.4 - 996.4	5.8 6.0	1.00
996.4 - 1001.2	4.8	996.4 - 1001.2 1001.2 - 1006.0	4.8 4.8	1.00
996.4 - 1001.2 1001.2 - 1007.0	5.8	1001.2 - 1006.0	4.8	0.83
1007.0 - 1011.8	4.8	1007.0 - 1011.7 1009.2 - 1010.2	4.7	Ø.98
MATERIAL PROF		1009.2 - 1010.2	MATERIAL PROPERTIE	S
1011.8 - 1017.1	5.3		4.5	Ø.85
1017.1 - 1022.0	4.9		4.4	0.90
1022.0 - 1027.0	5.0	1022.0 - 1026.8	4.4 4.8	0.96
1007 0 - 1030 0	5 D	1027.0 - 1029.5	2.5	0.50
1032.0 - 1037.8	5.8	1027.0 - 1029.5 1032.0 - 1036.0	2.5 4.0	0.69
MATERIAL PROF	PERTIES	1033.0 - 1034.0 NO RECOVERY	MATERIAL PROPERTIE	S
1037.8 - 1040.4	2.6	NO RECOVERY	Ø. Ø	0.00
1040.4 - 1041.5	1.1	1040.4 - 1041.2	0.8	0.73
1041.5 - 1046.5	5.0	1040.4 - 1041.2 $1041.5 - 1046.0$	0.8 4.5	0.90
1046.5 - 1053.4	6.9	1046.5 - 1052.6	6.1 DENSITY	0.88
DENSITY		1050.1 - 1050:6	DENSITY	
1053.4 - 1060.7	7.3	1053.4 - 1060.7	7.3	1.00
MATERIAL PROF	ERTIES	1046.5 - 1052.6 1050.1 - 1050.6 1053.4 - 1060.7 1055.9 - 1056.9	MATERIAL PROPERTIE	S
1060.7 - 1067.4	6.7	1060.7 - 1066.4	5.7	0.85
1067.4 - 1071.2	3.8	• 1067.4 - 1068.8	1.4	Ø.37
1071.2 - 1072.7	1.5	1060.7 - 1066.4 • 1067.4 - 1068.8 NO RECOVERY	0.0	0.00
1072.7 - 1081.5	8.8	1072.7 - 1077.2	4.5	0.51
1081.5 - 1086.3	4.8	1072.7 - 1077.2 1081.5 - 1085.6	4.5 4.1	0.85
1086.3 - 1093.9	7.6	1086.3 - 1093.9	7.6	1.00
1093.9 - 1104.0	10.1	1086.3 - 1093.9 1093.9 - 1103.5	7.6 9.6	0.95
1104.0 - 1111.1	7.1	1104.0 - 1110.4 $1111.1 - 1120.5$	6.4 9.4	0.90
1111.1 - 1121.8	10.7	1111.1 - 1120.5	9.4	Ø.88
1121.8 - 1131.9	10.1	1121.8 - 1130.6	8.8	0.87
1131.9 - 1136.5	4.6	1131.9 - 1136.5	4.6	1.00
1136.5 - 1146.2	9.7	1136.5 - 1146.0	9.5	Ø.98
MATERIAL PROF	PERTIES	1111.1 - 1120.5 1121.8 - 1130.6 1131.9 - 1136.5 1136.5 - 1146.0 1141.1 - 1142.1	MATERIAL PROPERTIE	S

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KBZ-4 CORE LOG

INTERVAL 0.0 - 5.0 5.0 - 10.0 10.0 - 15.0 15.0 - 20.0 MATERIAL PRO 25.0 - 28.0 25.0 - 28.0 25.0 - 34.0 30.0 - 32.0 30.0 - 34.0 MATERIAL PRO 34.0 - 36.0 35.0 - 38.0 38.0 - 43.0 MATERIAL PRO 48.0 - 53.0 53.0 - 58.0 MATERIAL PRO 48.0 - 53.0 53.0 - 58.0 MATERIAL PRO 58.0 - 63.0 68.0 - 73.1 MATERIAL PRO 58.0 - 68.0 68.0 - 73.1 MATERIAL PRO 73.1 - 78.1 78.1 - 83.0 88.0 - 92.8 MATERIAL PRO 77.7 - 102.7 102.7 - 103.0 103.0 - 107.9 107.9 - 112.9 118.0 - 122.7 122.7 - 127.6 MATERIAL PRO 18.0 - 156.5 156.5 - 161.3 161.3 - 166.4 MATERIAL PRO 166.4 - 171.7 171.7 - 176.8	LENGTH	SAMPLE	MARKEI) 	RECOVERED	RECOVERY
0.0 - 5.0	5.0	0.0 -	1.4		1.4	0.28
5.0 - 10.0	5.0	5.0 -	6.5	(S1)	1.5	0.30
10.0 - 15.0	5.0	10.0 -	11.5	(S2)	1.5	0.30
15.0 - 20.0	5.0	15.0 ~	16.5	(S3)	1.5	0.30
MATERIAL PRO	OPERTIES	15.7 -	16.5		MATERIAL	PROPERTIES
20.0 - 25.0	5.0	20.0 -	21.5	(54)	1.5	0.30
25.0 - 28.0	3.0	25.0 -	26.5	(S5)	1.5	0.50
28.0 - 30.0	2.0	28.0 -	29.2	(56)	1.2	0.60
30.0 - 32.0	2.0	30.0 -	31.0		1.0	0.50
32.0 - 34.0	2.0	32.0 -	33.0		1.0	0.50
MATERIAL PRO	OPERTIES	32.0 -	32.5	(SBA)	MATERIAL	PROPERTIES
		32.5 -	33.0	(S8B)		
34.0 - 36.0	2.0	34.0 -	35.0	(S9)	1.0	0.50
36.0 - 38.0	2.0	36.0 -	37.0	(S1Ø)	1.0	0.50
38.0 - 43.0	5.0	38.0 -	39.5		1.5	0.30
MATERIAL PRO	OPERTIES	38.0 -	38.7	(S11A)	MATERIAL	PROPERTIES
		38.7 -	39.5	(S11B)	, =	
43.0 - 48.0	5.0	43.0 -	44.5	(S12)	1.5	0.30
48.0 - 53.0	5.0	48.0 -	49.0	(\$13)	1.0	0.20
53.0 - 58.0	5.0	53.0 -	54.2		1.2	0.24
MATERIAL PRO	PERTIES	53.0 -	57.6	(5144)	MATERIAL	PROPERTIES
111716-114716-1111	J. C	53.A -	54.2	(S14B)	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	1 1107 1111 2 110
50 0 - 43 0	5 0	58 0 -	50 A	(915)	0.4	Ø. 12
10.0 - 00.0 47 0 - 40 0	50	72.01 -	44.7	(614)	1 7	0 34
40 0 - 73 1		70 W =	40 0	(017)	1 12	0.37
MATERIAL PR	DEDTIES	40.0 -	40 7	(0170)	MATERIAL	PONDEDTIES
77 1 - 70 1	5 0	77 1 -	7/1 3	(31/0)	1 2	0.24
70 1 - 07 0	7 D	701 -	70 5		1 4	0.27
70.1 - 00.0	4.7 E.0	/D.I -	0/0		1.7	0.27
00.0 - 00.0	J. 60	60.0	00 5		1.6	0.20
MATERIAL PR	T.O	00.0	07.0		MATERIAL	PROPERTIES.
NAIEKIAL FAI	7.5	00.0	07.4		UH 1 EV 1 HF	PROFERITES 0 10
72.8 - 7/./	4.7	72.8 -	73.4		0.0	0.12
97.7 - 102.7	5.0	9/./ -	78.1		Ø. 4	W. WB
102.7 - 103.0	0.3	NO RECUV	ERY			
103.0 - 107.9	4.9	103.0 -	103.9		0. 9	0.18
107.9 - 112.9	5.0	107.9 -	109.5		1.4	0.28
112.9 - 118.0	5.1	112.9 -	114.1		1.2	0.24
118.0 - 122.7	4.7	118.0 -	119.2		1.2	2. 26
122.7 - 127.6	4.9	122.7 -	124.0		1.3	0.27
MATERIAL PRO	OPERTIES	122.7 -	123.5	ı	MATERIAL PR	ROPERTIES
127.6 - 132.2	4.6	127.6 -	129.4		1.8	0.39
132.2 - 137.0	4.8	132.2 -	133.5		1.3	Ø. 27
137.0 - 142.0	5.0	137.0 -	138.1		1.1	0.22
142.0 - 146.6	4.6	142.0 -	143.0		1.0	0.22
146.6 - 151.6	5.0	146.6 -	147.6		1.0	0.20
151.6 - 156.5	4.9	151.6 -	152.2		0.6	0.12
156.5 - 161.3	4.8	156.5 -	157.2		0.7	0.15
161.3 - 166.4	5.1	161.3 -	162.7		1.4	Ø.27
MATERIAL PRO	OPERTIES	162.0 -	162.7	١	MATERIAL PR	ROPERTIES
166.4 - 171.7	5.3	166.4 -	167.4		1.0	0.19
171.7 - 176.8	5.1	171.7 -	172.7		1.0	0.20

KBZ-4 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
176.8 - 181.9	5.1	176.8 - 177.8 181.9 - 183.0 182.4 - 183.0	1.0	0.20
181.9 - 187.0	5.1	181.9 - 183.0	1.1	0.22
MATERIAL PRO	PERTIES	182.4 - 183.0	MATERIAL PROPE	RTIES
187.0 - 191.8	4.8	187.0 - 188.2 191.5 - 192.7 192.7 - 193.4 194.3 - 195.0 196.3 - 197.3	1.2	0.25
191.5 - 192.7	1.2	191.5 - 192.7	1.2	1.00
192.7 - 194.3	1.6	192.7 - 193.4 194.3 - 195.0 196.3 - 197.3 201.2 - 202.2 206.1 - 207.1 206.5 - 207.1 210.9 - 212.1 215.2 - 216.5 219.2 - 221.4 224.8 - 226.3 224.8 - 225.5	0. 7	Ø.44
194.3 - 196.3	2.0	194.3 - 195.0	Ø.7	0.35
196.3 - 201.2	4.9	196.3 - 197.3	1.0	0.20
201.2 - 206.1	4.9	201.2 - 202.2	1.0	0.20
206.1 - 210.9	4.8	206.1 - 207.1	1.0	0.21
MATERIAL PRO	PERTIES	206.5 - 207.1	MATERIAL PROPE	RTIES
210.9 - 215.2	4.3	210.9 - 212.1	1.2	0.28
215.2 - 219.2	4.0	215.2 - 216.5	1.3	Ø.33
219.2 - 224.8	5.6	219.2 - 221.4	2.2	0.39
224.8 - 229.8	5.0	224.8 - 226.3	1.5	0.30
MATERIAL PRO	PERTIES	210.9 - 212.1 215.2 - 216.5 219.2 - 221.4 224.8 - 226.3 224.8 - 225.5	MATERIAL PROPE	RTIES
229.8 - 232.7	2.9	229.8 - 231.2 232.7 - 234.0 234.9 - 236.3	1.4	0.48
232.7 - 234.9*	2.2	232.7 - 234.0	1.3	0.59
234.9 - 240.3	5.4	234.9 - 236.3	1.4	0.26
240.3 - 246.1	5.8	240.3 - 241.5	1.2	0.21
246.1 - 251.1	5.0	240.3 - 241.5 246.1 - 247.3 246.4 - 247.0 251.1 - 252.1 256.3 - 257.6 259.5 - 259.6 NO RECOVERY 261.6 - 261.9	1.2	0.24
MATERIAL PRO	PERTIES	246.4 - 247.0	MATERIAL PROPE	RTIES
251.1 - 256.3	5.2	251.1 - 252.1	1.0	0.19
256.3 - 259.5	3.2	256.3 - 257.6	1.3	0.41
259.5 ~ 259.6	0.1	259.5 - 259.6	Ø. 1	1.00
259.6 - 261.6	2.0	NO RECOVERY	0.0	0.00
261.6 - 264.3	2.7	261.6 - 261.9	Ø.3	0.11
264.3 - 267.9	3.6	NO RECOVERY	Ø.Ø	0.00
264.3 - 267.9 267.9 - 269.9	2.0	NO RECOVERY 267.9 - 268.7 269.9 - 270.5 273.0 - 273.2 273.2 - 273.4	0.8	0.40
269.9 - 273.0	3.1	269.9 - 270.5	0.6	0.19
273.0 - 273.2	0.2	273.0 - 273.2	0.2	1.00
273.0 - 273.2 273.2 - 273.4	0.2	273.2 - 273.4	0.2	
273.4 - 275.8	2.4	273.4 - 273.8	0.4	0.19
273.4 - 275.8 275.8 - 278.3	2.5	273.4 - 273.8 NO RECOVERY	0.0	0.00
278.3 - 279.4	1.1	278.3 - 278.9	0.5	0.45
270.3 277.4 279 A - 279 A	0.2	NO RECOVERY 278.3 - 278.9 279.4 - 280.4** NO RECOVERY NO RECOVERY NO RECOVERY NO RECOVERY 288.2 - 288.6 292.3 - 292.6	0.0	0.00
2778 4 - 280 4	1 0	NO RECOVERY	0.0	0.00
200 4 - 202 9	2.0	NO RECOVERY	0.0	0.00
200.0 _ 201.0	2 6	NO RECOVERY	0.0	0.00
202.0 - 200.7	2.0	NO RECOVERY	0.0	0.00
200.4 - 200.2	2.0 A 1	288 2 - 288 A	0.4	0.10
200.2 - 272.3	0 8	292.3 - 292.6	Ø.3	0.38
297 1 - 295 7	2.6	292.3 - 292.6 NO RECOVERY 295.7 - 296.6	0.0	
205 7 - 206 6	A 9	295 7 - 296 A	0.9	0.00 1.00
296.6 - 300.5	3.9	NO RECOVERY	Ø.ø	0.00
300.5 - 301.0	Ø.5	300.5 - 301.0	0.5	1.00
301.0 - 304.0	3.0	301.0 - 301.8***	0.00	1.00
304.0 - 304.9	0.9	304.0 - 304.9	0.9	1.00
MATERIAL PRO		304.4 - 304.9	MATERIAL PROPE	
304.9 - 309.8	4.9	304.9 - 307.2	2.3	0.4 7
MATERIAL PRO		304.7 - 307.2	MATERIAL PROPE	
309.8 - 311.7	1.9	309.8 - 310.4	0.6	0.32
311.7 - 315.4	3.7	NO RECOVERY	0.0	0.00
311./ - 315.4 315.4 - 317.8	2.4	315.4 - 316.4	1.0	Ø.42
217.4 - 21/.8	Æ • **	313.7 - 310.4	A = %J	₩. 7£

^{*} DRILLER NOTED HARD LAYER AT ABOUT 231.5

** 1.0 FT FALL-IN RETAINED. *** 0.8 FT FALL-IN RETAINED

KBZ-4 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
317.8 - 322.6	4.8	317.8 - 319.5 322.6 - 325.6 324.1 - 324.9	1.7	0.35
322.6 - 326.8 MATERIAL PR	4.2	322.6 - 325.6	3.0	0.71
MATERIAL PR	OPERTIES	324.1 - 324.9	MATERIAL PROPE	RTIES
326.8 - 332.2	5.4	328.8 - 330.7 332.2 - 338.1 338.1 - 340.1 NO RECOVERY	1.9	0.37
332.2 - 338.1	5.9	332.2 - 338.1	5.9	1.00
338.1 - 342.6	4.5	338.1 - 340.1	2.0	0.44
342.6 - 348.0	5.4	NO RECOVERY	0.0	0.00
348.0 - 352.4	4.4	NO RECOVERY 352.4 - 353.3	0.0	0.00
352.4 - 353.3	0.9	352.4 - 353.3	0.9	1.00
353.3 - 358.8	5.5	NO RECOVERY	0.0	0.00
358.8 - 343.1	Δ . ₹	NO RECOVERY	Ø. Ø	0.00
363.1 - 364.1	1.0	363.1 - 363.3	0.2	0.20
364.1 - 369.7	5.6	NO RECOVERY NO RECOVERY	0.0	0.00
369.7 - 370.3	0.6	NO RECOVERY	0.0	0.00
370.3 - 371.6	1.3	370.3 - 371.4 371.6 - 373.8	1.1	0.85
371.6 - 376.4	4.8	371.6 - 373.8	2.2	Ø.46
376.4 - 380.1	3.7	376.4 - 377.4	1.0	Ø.27
376.4 - 380.1 380.1 - 385.1	5.0	NO RECOVERY	0.0	0.00
		SAMPLING CHANGE		
385.1 - 386.3	1.2	NO RECOVERY	0.0	0.00
386.3 - 388.3	2.0	386.3 - 387.5	1.3	Ø.65
MATERIAL PR	OPERTIES	386.3 - 387.5 386.6 - 387.2	MATERIAL PROPE	RTIES
388.3 - 399.6	11.3	NO RECOVERY	0.0	0.00
399.6 - 401.6	2.0	399.6 - 401.2	1.6	0.80
401.6 - 429.7	28.1	NŌ RECOVERY	0.0	0.00
429.7 - 431.7	2.0	429.7 - 431.3	1.6	0.80
MATERIAL PR	OPERTIES	386.6 - 387.2 NO RECOVERY 399.6 - 401.2 NO RECOVERY 429.7 - 431.3 430.1 - 430.7	MATERIAL PROPE	RTIES
431.7 - 458.7	27.0	NO RECOVERY	Ø. Ø 1.5	0.00
431.7 - 458.7 458.7 - 460.7	2.0	458.7 - 460.2	1.5	0.75
		NO RECOVERY 488.9 - 489.9	0.0	0.00
488.9 - 490.9	2.0	488.9 - 489.9	1.0	0.50
MATERIAL PR	OPERTIES	NO RECOVERY 488.9 - 489.9 488.9 - 489.4	MATERIAL PROPE	RTIES
490.9 - 520.5	29.6	NO RECUVERY	6.6	0.00
520.5 - 522.5	2.0	52 0. 5 - 522.4	1.9	0.95
522.5 - 551.8	29.3	NO RECOVERY	0.0	0.00
551.8 - 553.8	2.0		1.3	0.65
MATERIAL PR	OPERTIES	551.8 - 553.1 551.8 - 552.4 NO RECOVERY	MATERIAL PROPE	RTIES
553.8 ~ 555.0	1.2	NO RECOVERY	0.0	0.00
555.0 - 557.0	2.0	555. 0 - 5 56.3	1.3 Ø.Ø	Ø.65
555.0 - 557.0 557.0 - 558.2	1.2	NO RECOVERY	0.0	0.00
558.2 - 560.2	2.0	555.0 - 556.3 NO RECOVERY 558.2 - 559.9 NO RECOVERY	1.7	0.85
E/A A E/4 A	1.0	NO RECOVERY	Ø. Ø	0.00
561.2 - 563.2	2.0	561.2 - 562.5 NO RECOVERY	1.3	0.65
563.2 - 564.6	1.4	NO RECOVERY	0.0	0.00
564.6 - 566.6	2.0	564.6 - 565.7	1.1	Ø.55
566.6 - 568.2	1.6	NO RECOVERY	0.0	0.00
568.2 - 570.2	2.0	568.2 - 569.4	1.2	0.60
570.2 - 571.6	1.4	NO RECOVERY	0.0	0.00
571.6 - 573.6	2.0	571.6 - 572.6	1.0	0.50
573.6 - 575.0	1.4	NO RECOVERY	0.0	0.00
575.0 - 577.0	2.0	575.0 - 576.2	1.2	0.60
MATERIAL PR		575.6 - 576.2	MATERIAL PROPE	
577.0 - 591.5	14.5	NO RECOVERY	0.0	0.00
591.5 - 593.5	2.0	591.5 - 592.2	Ø.7	Ø.35
593.5 - 600.9	7.4	NO RECOVERY	0.0	0.00
J. J. L. L. L			<u> </u>	-

KBZ-4 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
00.9 - 602.9	2.0	600.9 - 601.9 NO RECOVERY 610.5 - 611.6 NO RECOVERY 621.4 - 622.6 621.9 - 622.6	1.0	0.50
02.9 - 610.5	7.6	NO RECOVERY	0.0	0.00
10.5 - 612.5	2.0	610.5 - 611.6	1.1	0.55
12.5 - 621.4	8.9	NO RECOVERY	0.0	0.00
21.4 - 623.4	2.0	621.4 - 622.6	1.2	0.60
MATERIAL P	ROPERTIES	621.9 - 622.6	MATERIAL PROP	ERTIES
23.4 - 632.4	9.0	NO RECOVERY 632.4 - 633.4 NO RECOVERY 643.9 - 644.8 NO RECOVERY 654.2 - 653.3 654.6 - 655.3	0.0	0.00
32.4 - 634.4	2.0	632.4 - 633.4	1.0	0.50
34.4 - 643.9	9.5	NO RECOVERY	0.0	0.00
3.9 - 645.9	2.0	643.9 - 644.8	0.8	0.40
15.9 - 654.2	8.3	NO RECOVERY	01.0	0.00
4.2 - 454.2	2.0	454.2 - 453.3	1.1	0.55
MATERIAL P	ROPERTIES	454 A 455 T	MATERIAL PROP	FDTIES
34 2 - 445 2	9 0	NU BECUVERA	0 0	0.00
55.2 ~ 667 2	2.0	NO RECOVERY 665.2 - 665.7 NO RECOVERY 674.0 - 675.2 NO RECOVERY 685.2 - 686.6 686.0 - 686.6 NO RECOVERY	0.5	Ø. Ø6
57 7 - 474 M	Z. W	NU DECUNEDA	מ מ	w.∠:: n. n.n.
74 01 L7L 0	2.0	A74 0 - 475 0	4 7	01 T U
74 0 40E 0	2.0	8/7.8 - 8/J.Z NO DECOUEDY	1 · ∠	0.00 0.00
'6.0 ~ 083.∠	7.2	NO RELOVERY	0.0	0.00
10.2 - 68/.2	2.0	685.2 - 686.6	1.4	۵./۵
MAIERIAL PI	RUPERTIES	686.0 - 686.6	MATERIAL PROP	FKIIFR
37.2 - 695.8	8.6	NO RECOVERY	0.0	0.00
5.8 - 697.8	2.0	695.8 - 696.5	0.7	0.35
77.8 - 708.1	10.3	NO RECOVERY	0.0	0.00
18.1 - 710.1	2.0	708.1 - 708.4	0.3	0.15
10.1 - 718.6	8.5	NO RECOVERY	0.0	0.00
18.6 - 720.6	2.0	718.6 - 719.2	0.6	0.30
20.6 - 728.1	7.5	NO RECOVERY	0.0	0.00
28.1 - 730.1	2.0	728.1 - 728.4	0.3	0.15
30.1 - 737.9	7.8	NO RECOVERY	0.0	0.00
37.9 - 739.9	2.0	737.9 - 738.7	0.8	0.40
39.9 - 743.6	3.7	NO RECOVERY	0.0	0.00
13.6 - 745.6	2.0	686.0 - 686.6 NO RECOVERY 695.8 - 696.5 NO RECOVERY 708.1 - 708.4 NO RECOVERY 718.6 - 719.2 NO RECOVERY 728.1 - 728.4 NO RECOVERY 737.9 - 738.7 NO RECOVERY 743.6 - 744.3 SAMPLING CHANGE	0.7	0.35
Agents stated a		SAMPLING CHANGE 745.6 - 749.3 749.8 - 753.4 754.6 - 758.3 759.8 - 761.2 760.4 - 761.0 761.3 - 765.5 765.8 - 767.2 772.3 - 776.9 776.9 - 781.8 785.7 - 790.1 785.9 - 784.8		****
15.6 - 749.8	4.2	745.6 - 749.3	3.7	0.88
19.8 - 754.6	4.8	749.8 - 753.4	3.6	0.75
54.6 - 759.8	5.2	754.6 - 758.3	3.7	0.71
59.8 - 761.3	1.5	759.8 - 761.2	1.4	0.93
MATERIAL P	ROPERTIES	760.4 - 761.0	MATERIAL PROP	ERTIES
1.3 - 765.8	4.5	761.3 - 765.5	4.2	0.93
55.8 - 772.3	6.5	765.8 - 767.2	1.4	0.22
72.3 - 776.9	4.6	772.3 - 776.9	1.2	0.26
76.9 - 785.7	8.8	776.9 - 781.8	4.9	0.57
35.7 - 790.8	5.1	785.7 - 790.1	4.4	Ø.86
MATERIAL PI	ROPERTIES	785.9 - 786.6	MATERIAL PROP	ERTIES
0.8 - 795.1	4.3	790.8 - 794.8	4.0	0.93
5.1 - 800.0	4.9	795.1 - 798.7	3.6	0.73
00.0 - 805.8		800.0 - 802.0	2.0	0.34
5.8 - 811.7		805.8 - 809.5	3.7	0.63
11.7 - 817.4		811.7 - 815.6	3.9	0.68
17.4 - 822.6		817.4 - 821.4	4.0	0.77
MATERIAL P		819.4 - 820.1	MATERIAL PROP	
22.6 - 828.0	5.4	822.6 - 828.0	5.4	1.00
28.0 - 833.1	5.1	828.0 - 830. 0	2.0	2.39
33.1 - 838.9		833.1 - 833.9	5.8	1.00
MATERIAL PI	701EZ 11E3	836.9 - 837.6	MATERIAL PROP	EU 150

KBZ-4 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE I	MARKED	RECOVE	RED RECO	JERY
070 0 044 4		070 0	044.4			3 0
838.9 - 844.4 844.4 - 852.0	J.J	0.40.4	050 0	J. J	1.0	2) (2) 2) (2)
050 0 - 057 5	/.O	057 0 -	052.0	/.Q	1.4	מעט מעט
852.0 - 857.5 857.5 - 865.5	2.3	057.5 -	D45 85	5.5	1.0	20 (Z) 20 (Z)
857.5 - 865.5 865.5 - 868.3 868.3 - 871.8 871.8 - 877.4 877.4 - 882.8 882.8 - 884.5 884.5 - 891.5 MATERIAL PROF 891.5 - 896.6 895.7 - 905.7	2.6	037.3 -	040 3	2.0	1 - 6	2) (Z).
040 7 _ 071 0	Z.O	063.3 -	071 7	Z.O	1.4	242 24
071 0 077 4	J.J	000.3	0/1.3	5.0	w. c	30 37
977 4 - 999 9	5.0	077 4 -	000 4	5.4	ω	70
077.4 - 002.0	3.4	0//•4 -	002.4	3.0	۷.`	7.3 30
882.8 - 884.3	7.7	882.8 T	884.5	1./	1.0	שש
884.5 - 871.5	7.0	884.5 -	890.2	D./	V. N	51
MATERIAL PROP	PERILES	885.8 ~	886.5	MATERIAL	PRUPERTIES	
891.5 - 896.6	5.1	891.5 -	896.6	5.1	1.6	200
876.6 - 705.7	9.1	896.6 -	905.5	8.9	U .	78
905.7 - 909.5	3.8	905.7 -	909.5	3.8	1.5	שט
909.5 - 912.4	2.9	909.5 -	911.8	2.3	Ø. :	79
912.4 - 915.2	2.8	912.4 -	913.9	1.5	Ø.;	54
915.2 - 926.0	10.8	915.2 -	925.6	10.4	0.9	76
996.6 - 905.7 905.7 - 909.5 909.5 - 912.4 912.4 - 915.2 915.2 - 926.0 MATERIAL PROF 926.0 - 935.4 935.4 - 944.5 944.5 - 949.3 949.3 - 956.6	PERTIES	921.8 -	922.8	MATERIAL	PROPERTIES	
926.0 - 935.4	9.4	926.0 -	935.1	9.1	0.9	77
935.4 - 944.5	9.1	935.4 -	939.0	3.6	0.4	10
944.5 - 949.3	4.8	944.5 -	949.2	4.7	0.9	78
949.3 - 956.6	7.3	949.3 -	956.6	7.3	1.0	00
1164 1 25 1 7 2 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		/ w/ de / de	/	11111 1011 1011		
THIS NEXT INTER						
DISCREPENCIES IN	1 THE CORE	LABELING - TI	HIS LOG	SHOULD APPR	ROXIMATE THE	
DISCREPENCIES IN CORRECTED CORE : 956.6 - 965.6 965.6 - 971.9 971.9 - 979.0 979.0 - 983.7 MATERIAL PROF 983.7 - 990.2	INTERVALS.					
956.6 - 965.6	9.0	956.6 -	965.6	9.0	1.0	00
965.6 - 971.9	6.3	965.6 -	971.9	6.3	1.0	90
971.9 - 979.0	7.1	971.9 -	978.9	7.0	0.9	77
979.00 - 983.7	4.6	979.0 -	983.7	4.7	(+0.1) 1.0	00
MATERIAL PROF	PERTIES	980.9 -	981.5	MATERIAL	PROPERTIES	
983.7 - 990.2	6.5	983. 7 -	990.2	6.5	1.0	90
990.2 - 999.5	9.3	990.2 -	999.5	9.3	1.0	20
999.5 - 1009.3	9.8	999.5 -	1009.3	9.8	1.0	00
MATERIAL PROF 983.7 - 990.2 990.2 - 999.5 999.5 - 1009.3 MATERIAL PROF 1009.3 - 1018 PROF 1018.7 - 1026.3 1026.3 - 1036.8 MATERIAL PROF 1036.8 - 1045.9	PERTIES	1006.0 -	1007.0	MATERIAL	PROPERTIES	
1009.3 - 1018.7	9.4	1009.3 -	1018.7	9.4	1.0	90
MATERIAL PROF	PERTIES	1017.9 - 3	1018.4	MATERIAL	PROPERTIES	
1018.7 - 1026.3	7.6	1018.7 -	1026.2	7.5	2.9	79
1026.3 - 1036.8	10.5	1026.3 - 3	1035.0	8.7	Ø.8	3.3
MATERIAL PROF	PERTIES	1030.3 -	1031.3	MATERIAL	PROPERTIES	
1036.8 - 1045.9	9.1	1036.8 - 3	1045.3	8.5	20.9	73

KCT-5 CORE LOG

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
0.0 - 3.0	3.0	0.0 - 1.0	1.0	0.33
3.0 - 6.0			1.3	0.43
6.0 - 7.0	3.10	6.0 - 7.3	1.3	0.43
9.0 - 12.0	3.0	9.0 - 10.3	1.3	0.43
12.0 - 15.0	3.0	9.0 - 10.3 12.0 - 13.1 12.0 - 12.7 15.0 - 16.0 18.1 - 18.7 21.1 - 21.7 23.5 - 23.9 26.6 - 27.8 29.5 - 30.4	1.1	0.36
MATERIAL PRO	PERTIES	12.0 - 12.7	MATERIAL PROPE	RTIES
15.0 - 18.1	3. i	15.0 - 16.0	1.0	0.32
18.1 - 21.1	3.0	18.1 - 18.7	0.6	0.20
21.1 - 23.5	2.4	21.1 - 21.7	0.6	0.25
23.5 - 26.6	3.1	23.5 ~ 23.9	0.4	0.13
26.6 - 29.5 29.5 - 32.4	2.9	26.6 - 27.8	1.2	0.41
29.5 - 32.4	2.9	29.5 - 30.4	0.9	0.31
MATERIAL PRO 32.4 - 35.8	PERTIES	29.5 - 30.2	MATERIAL PROPE	RTIES
32.4 - 35.8	3.4	26.6 - 27.8 29.5 - 30.4 29.5 - 30.2 32.4 - 34.2	1.8	0.53
35.8 - 38.9	3.1 3.1	35.8 - 37.2 38.9 - 40.4	1.4 1.5	
38.7 - 42.0	J. 1	38.9 - 40.4	1.5	Ø.48
42.0 - 45.2	3.2	42.0 - 43.4	1.4	0.44
45.2 - 48.4	3.2	42.0 - 43.4 45.2 - 46.4 45.2 - 45.7 48.4 - 49.9	1.2	Ø.38
MATERIAL PRO	PERTIES	45.2 - 45.7	MATERIAL PROPE	RILES
48.4 - 51.4	3.0	48.4 - 49.9	1.5	Ø.5Ø
51.4 - 54.5	3.1	51.4 - 52.7	1.3	
54.5 - 57.2 57.2 - 60.7	2./	34.3 - 36.1	1.6 1.0	Ø.59
3/.2 - 60./	3.3	57.2 ~ 58.2	1.6	Ø.29
60.7 - 63.6 63.6 - 66.5	2.7	57.2 ~ 58.2 60.7 ~ 61.8 63.6 ~ 64.9 64.2 ~ 64.9 66.5 ~ 68.1 69.3 ~ 70.5	1.1	0.38 0.45
MATERIAL PRO	2.7 DEDITE	63.6 - 64.7	MATERIAL PROPE	0.4 3
66.5 - 69.3	2 0	44.2 - 49.1	1 4	0.57
40 3 - 72 3		AO 3 - 70 5	1.2	Ø.4Ø
69.3 - 72.3 72.3 - 75.1		70 7 77 0	0 0	0 32
75.1 - 77.9	2.8	75.1 - 76.4 75.7 - 76.4 77.9 - 79.1 80.8 - 82.1 83.3 - 84.7	1-3	0.46
MATERIAL PRO	PERTIES	75.7 - 76.4	MATERIAL PROPE	RTIES
77.9 - 80.8	2.9	77-9 - 79-1	1.2	0.41
80.8 - 83.3	2.5	80.8 - 82.1	1.3	0.52
83.3 - 86.2	2.9	83.3 - 84.7	1.4	0.48
86.2 - 89.1	2.9	86.2 - 86.6	0.4	0.14
86.2 - 89.1 89.1 - 93.2	2.9 4.1	86.2 - 86.6 89.1 - 90.2	Ø.4 1.1	0.27
		93.2 - 94.2	1.0	0.38
93.2 - 95.8 MATERIAL PRO 95.8 - 98.6	PERTIES	93.2 - 94.2 93.2 - 93.9	MATERIAL PROPE	RTIES
95.8 - 98.6	2.8	95.8 - 96.7 98.6 - 99.7 101.6 - 102.8	0.9	0.32
98.6 - 101.6	3.0	98.6 - 99.7	1.1	0.37
101.6 - 104.6	3.0	101.6 - 102.8	1.2	0.40
104.6 - 107.7	3.1	104.6 - 105.9	1.3	0.42
107.7 - 110.9	3.2	107.7 - 108.7	1.0	0.31
110.9 - 114.2	3.3	110.9 - 112.2	1.3	0.39
MATERIAL PRO		111.5 - 112.2	MATERIAL PROPER	TIES
114.2 - 117.4	3.2	114.2 - 114.8	0.6	0.19
117.4 - 120.8	3.4	117.4 - 118.3	0.9	0.26
120.8 - 123.9	3.1	120.8 - 121.9	1.1	0.35
123.9 - 127.0	3.1	123.9 - 125.1	1.2	0.39
127.0 - 130.4	3.4	127.0 - 128.5	1.5	0.44
130.4 - 133.5	3.1	130.4 - 131.7	1.3	0.42
133.5 - 136.6	3.1	133.5 - 134.3	0.8	0.26

KCT-5 CORE LOG (cont.)

tend land with time land land land land land upon land upon, with upon, who were the		ويها ويما فيما فيما فيما منت ويها حيب فيما فيما فيما ويما ويما ويما ويما ويما	ه المحافظة	ها فدة هذا فقد وبيا فدة وده وبيا ويت منس فدة وبيا.
INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
ada lad lad om, ata del om, aus lad lad lad lad 186 196 19		المنط الحال ا		
136.6 - 139.6	3.0	136.6 - 138.6 139.6 - 141.3 140.5 - 141.3	2.0	0.67
139.6 - 143.6	4.0	139.6 - 141.3	1.7	0.43
MATERIAL PRO	PERTIES	140.5 - 141.3	MATERIAL PROPE	RTIES
143.6 - 146.5	2.9	143.6 - 145.1 146.5 - 147.8	1.5	Ø.52
146.5 - 149.5	3.0	146.5 - 147.8	1.3	Ø.43
149.5 - 152.3	2.8	149.5 - 150.7 152.3 - 153.6	1.2	Ø.43 Ø.46
152.3 - 155.1	2.8	152.3 - 153.6		
155.1 - 157.9	2.8	155.1 - 156.0	0.9	0.32
157.9 - 161.0	3.1	157.9 - 159.2	1.3	0.42
MATERIAL PRO	PERTIES	155.1 - 156.0 157.9 - 159.2 158.5 - 159.2 161.0 - 162.5 163.9 - 165.2	MATERIAL PROPE	RTIES
161.0 - 163.7	2.9	161.0 - 162.5	1.5	0.46
165.9 - 166.7	2.0	165.7 - 165.2	1.3	0.40
140 4 - 177 4	2.7	166.7 - 167.8 169.6 - 170.8	1.1	0.38 0.43
107.0 - 172.4	7.0	177 4 - 173 0	1.2	Ø.43
MATERIAL DR	DEDTIES	172.4 - 173.9 173.2 - 173.9 175.4 - 176.7 177.8 - 179.2	MATERIAL PROPE	DTIEC
175 A - 177 B	2 A	175 4 - 176 7	1 3	01 SA
177 8 - 180 5	2 7	177.8 - 179.2	1 4	Ø. 52
180.5 - 183.3	2-8	180.5 - 181.9	1 - 4	0.50
183.3 - 186.2	2.9	180.5 - 181.9 183.3 - 185.0	1.7	. 0.59
186.2 - 189.0	2.8	186.2 - 187.9	1.7	0.61
189.0 - 192.7	3.7	189.0 - 190.8	1.8	0.49
192.7 - 195.3	2.6	192.1 - 193.5	1.4	0.54
MATERIAL PRO	PERTIES	192.8 - 193.5	MATERIAL PROPE	RTIES
195.3 - 198.4	3.1	195.3 - 196.6	1.3	0.42
198.4 - 201.5	3.1	183.3 - 183.0 184.2 - 187.9 189.0 - 190.8 192.1 - 193.5 192.8 - 193.5 195.3 - 194.4 198.4 - 199.4 201.5 - 203.4	1.0	0.32
201.5 - 204.7	3.2	201.5 - 203.4	1.9	0.59
204.7 - 207.9	3.2	204.7 - 206.6 207.9 - 208.8	1.8	Ø.56
207.9 - 211.1	3.2	207.9 - 208.8	Ø . 9	Ø. 28
211.1 - 214.2	3.1	211.1 - 211.9 214.2 - 215.5	0.8 1.3	0.20
214.2 - 217.2	3.1	214.2 - 215.5	1.3	Ø.42
MATERIAL PRO	PERTIES	214.8 - 215.5 214.8 - 215.5 217.2 - 218.3 220.6 - 221.6	MATERIAL PROPE	RTIES
217.2 - 220.6	3.4	217.2 - 218.3	1.1	Ø.32
220.6 - 223.9	3.3	220.6 - 221.6	1.0	0.30
223.9 - 227.0	3.1	223.9 - 225.1 227.0 - 228.0	1.2	6.57
227.0 - 230.4	3.4	227.0 - 228.0	1.0	0.29
230.4 - 233.6 233.6 - 236.1	3.2	230.4 - 231.3 233.6 - 235.0	0.9 1.4	0.28
233.6 - 236.1	2.5	233.6 - 235.0	1.4	0.56
MATERIAL PRO	PERTIES	233.6 - 234.2 233.6 - 234.2 236.1 - 237.5 239.7 - 241.2 242.6 - 244.1 245.5 - 246.7 248.4 - 249.0	MAJERIAL PROPE	KITER
230.1 - 237.7	J.6	236.1 - 237.5	1.4	0.39 0.52
237./ ~ 242.0	2.7	237.7 - 241.2	1.0	Ø.52 Ø.52
242.0 - 24J.J	2.7	242.0 - 244.1	1.3	0.41
243.3 - 240.4 249.4 - 240.9	1. Δ	243.3 - 246.7 248 4 - 249 Ø	0 4	0.43
249.8 - 252.2	2.4	249.8 - 250.6	0.8	Ø.33
252.2 - 254.7	2.5	252.2 - 253.0	0.8	Ø.32
254.7 - 257.3	2.6	254.7 - 256.2	0.5	0.19
257.3 - 260.1	2.8	257.3 - 257.8	0.5	Ø.18
260.1 - 263.3	3.2	260.1 - 260.6	0.5	0.16
263.3 - 266.5	3.2	263.3 - 263.5	0.2	0.06
266.5 - 269.7	3.2	266.5 - 267.2	0.7	0.22
269.7 - 273.0	3.3	269.7 - 270.0	0.3	0.09
273.0 - 276.3	3.3	273.0 - 274.0	1.0	0.30
276.3 - 279.8	3.5	276.3 - 276.4	0.1 .	0.03

KCT-5 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
279.8 - 283.8	4.0	279.8 - 280.4	Ø.6	0.15
283.8 - 286.7	2.9	283.8 - 284.2	0.4	0. 14
286.7 - 291.9	5.2	286.7 - 287.7	1.0	0.19
291.9 - 297.0	5.i	291.9 - 292.7	Ø.8	0.17
297.0 - 300.1	3.i	NO RECOVERY*	0.0	0.00
300.1 - 302.0	1.9	300.1 - 300.4**	0.3	0.16
302.0 - 306.5	4.5	302.0 - 302.8	0.8	0.17
306.5 - 306.6	0.1	306.5 - 306.6	Ø. i	1.00

* CUTTINGS **CUTTINGS RETAINED ##########

KDT-6 CORE LOG

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
000 000 tem may 000 feet may get may be tem 100 feet 100				
0.0 - 3.2	3.2	0.0 - 1.4	1.4	0.44
3.2 - 6.0	2.8	3.2 - 4.4	1.2	0.43
6.0 - 9.0	3.0	6.0 - 7.3	1.3	0.43
9.0 - 12.1	3.1	9.0 - 10.4	1.4	Ø.45
12.1 - 15.1	3.0	12.1 - 13.4	1.3	0.43
15.1 - 18.0	2.9	15.1 - 16.1	1.0	0.34
18.0 - 20.9	2.9	18.0 - 19.4	1.4	0.48
MATERIAL PRO			MATERIAL PRO	
20.9 - 23.7	2.8	20.9 - 21.9	1.0	0.36
23.7 - 26.5	2.8	23.7 - 24.9	1.2	0.43
26.5 - 29.3	2.8	26.5 - 27.4	0.9	0.32
29.3 - 32.2	2.9	29.3 - 30.1	0.8	0.28
32.2 - 36.1	3.9	32.2 - 32.9	0.7	0.18
36.1 - 39.7	3.6	36.1 - 36.9	0.8	0.22
39.7 - 43.1	3.4	39.7 ~ 40.1	0.4	0.12
43.1 - 45.8	2.7	43.1 - 44.6	1.5	0.55
MATERIAL PR		43.9 - 44.6	MATERIAL PRO	
45.8 - 49.8	4.0	NO RECOVERY	0.0	0.00
49.8 - 52.9	3.1	49.8 - 51.2	1.5	0.48
52.9 - 57.3	3.4	52.9 - 54.9	2.0	0.58
57.3 - 59.2	1.9	57.3 - 58.7	1.4	0.73
59.2 - 61.9	2.7	59.2 - 59.7	0.5	0.19
61.9 - 64.3	2.4	NO RECOVERY	0.0	0.00
64.3 - 67.6	3.3	NO RECOVERY	0.0	0.00
67.6 - 70.5	2.9	67.6 - 68.1	Ø.5	0.17
70.5 - 73.1	2.6	70.5 - 71.3	0.8	0.31
73.1 - 75.9	2.8	73.1 - 74.0	0.9	0.32
MATERIAL PRO		73.1 - 73.8	MATERIAL PRO	
75.9 - 78.6	2.7	75.9 - 77.2	1.3	0.48
78.6 - 81.5	2.9	78.6 - 79.7	1.1	0.38
81.5 - 84.3	2.8	81.5 - 82.7	1.2	0.43
84.3 - 87.1	2.8	84.5 - 85.7	1.2	0.43
87.1 - 89.9	2.8	87.1 - 88.1	1.0	0.36
89.9 - 92.5	2.6	89.9 - 90.5	0.6	0.23
92.5 - 95.1	2.6	92.5 - 93.5	1.0	0.38
95.1 - 97.7	2.6	95.1 - 96.2	1.1	0.42
97.7 - 99.2	1.5	97.7 - 98.7	1.0	0.66
MATERIAL PRO		97.7 - 98.3	MATERIAL PRO	
	2.8	99.2 - 100.3	1.1	0.39
102.0 - 105.0	3.0	102.0 - 103.1	1.1	0.37
105.0 - 108.3	3.3	105.0 - 105.9	0.9	0.27
108.3 - 116.3		108.3 - 116.3	8.0	1.00
MATERIAL PRO			MATERIAL PROPE	
116.3 - 123.8	7.5	116.3 - 123.8	7.5	1.00

KET-7 CORE LOG

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
0.0 - 3.9	3.9	0.0 - 1.1	1.1	0.28
3.9 - 6.8	2.9	3.9 - 4.5	0.6	0.21
6.8 - 9.4	2.6	6.8 - 7.8	1.0	0.38
9.4 - 12.1	2.7	9.4 - 10.4	1.0	0.37
12.1 - 15.0	2.9	12.1 - 12.8	0.7	0.24
15.0 - 17.6	2.6	15.0 - 16.1	1.1	0.42
17.6 - 20.4	2.8	17.6 - 18.4	0.8	0.29
20.4 - 25.1	4.7	20.4 - 21.3	0.9	0.19
25.1 - 27.9	2.8	25.1 - 26.0	0.9	0.32
27.9 - 30.5	2.6	27.9 - 28.9	1.0	0.38
80.5 - 33.3	2.8	30.5 - 31.7	1.2	0.43
33.3 - 36.0	2.7	33.3 - 34.4	1. i	0.41
6.0 - 38.7*	2.7	36.0 - 36.8	0.8	0.30
88.7 - 41.0	2.3	38.7 - 39.2	0.5	0.22
11.0 - 41.4	0.4	41.0 - 41.4	0.4	1.00

* DRILLER NOTED HARD THIN LAYER AROUND 37.0

KFT-8 CORE LOG

		نيد فقد کيد چيد لخيد مان لنيد ۱۹۹۰ لخيد چيد لنيد منيد مان چيد لنيد منيد پير پيرو لخيد اس		
INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
Ø.Ø - 3.2	3.2	0.0 - 0.9	Ø . 9	0.28
0.0 - 3.2 3.2 - 6.3 6.3 - 9.5	3.1	32-48	1.6	0.52
43 05	3.1	3.2 - 4.8 6.3 - 7.9	1.6	0.50
			1.6 1.6 MATERIAL P	PUPERTIES
05 - 17 A	2 0	95 - 11 2	1.7	0.59
12 4 - 15 4	Z. 7	17 4 - 14 3	1.9	0.63
15.4 - 10.4	3.U 7.7	7.2 - 7.9 9.5 - 11.2 12.4 - 14.3 15.4 - 17.2 18.7 - 20.5 21.9 - 26.3 25.1 - 26.3	1.8	2.5 5
10.7 - 21.0	3.3	10.7 - 20.5	1.8	0.56
21.7	3.2	21 0 - 26 3	1.8 1.2 1.2	Ø.53
21.7 - 20.1	7 1	21.7 - 20.3	1.2	
25.1 - 28.2 MATERIAL PRO 28.2 - 31.4	J.I DEDITE	25.1 - 26.3	MATERIAL BRO	DEDTIEC
MATERIAL PRO	1 CK 11C2	20.7 - 20.3	MATERIAL FRO	W 10
28.2 - 31.4	3.2	20.2 - 20.0	Ø.6	0.19 0.23
31.4 - 34.5	3.1	31.4 - 32.1	0.7	0.23
34.5 - 38.1	3.6	25.1 - 26.3 25.7 - 26.3 28.2 - 28.8 31.4 - 32.1 34.5 - 35.3 38.1 - 38.9 NO RECOVERY* 40.6 - 41.8 43.8 - 45.0 47.5 - 48.8	Ø.8	0.22
38.1 - 38.9	W.8	38.1 - 38.7	W.8	1.00
38.9 - 40.6	1./	NU RECUVERY*	0.0	0.00
40.6 - 43.8	3.2	40.6 - 41.8	1.2	0.38
43.8 - 47.5	3./	43.8 - 45.0	1.2	0.32
47.5 - 53.6	6.1	47.5 - 48.8	1.3	0.21
53.6 - 56./	3.1	53.6 - 55.0	1.4	₽ 1 → 0
56.7 - 60.2	3.5	56.7 - 57.7	1.0	0.29
60.2 - 63.1	2.9	60.2 - 61.0	0.8	0.28
63.1 - 66.4	3.3	63.1 - 64.1	1.0	0.30
66.4 - 69.8	3.4	38.1 - 38.9 NO RECOVERY* 40.6 - 41.8 43.8 - 45.0 47.5 - 48.8 53.6 - 55.0 56.7 - 57.7 60.2 - 61.0 63.1 - 64.1 64.4 - 67.1 69.8 - 71.1 70.4 - 71.1 72.9 - 77.4 76.0 - 77.3 79.2 - 80.2 82.0 - 82.8 83.9 - 85.6 86.8 - 88.3 86.8 - 87.5 89.7 - 90.7 92.6 - 93.9	Ø.7 1.3	0.21
69.8 - 72.9	3.1	69.8 - 71.1	1.3	0.42
MATERIAL PRO	PERTIES	70.4 - 71.1	MATERIAL PRO	PERTIES
72.9 - 76.0	3.1	72.9 - 77.4	1.5	0.48
76.0 - 79.2	3.2	76.0 - 77.3	1.3	0.41
79.2 - 82.0	2.8	79.2 - 80.2	1.0	0.36
82.0 - 83.9	1.9	82.0 - 82.8	0.8	0.42
83.9 - 86.8 86.8 - 89.7 MATERIAL PRO	2.9	83.9 - 85.6	1.7	0.59
86.8 - 89.7	2.9	86.8 - 88.3	1.5	0.52
MATERIAL PRO	PERTIES	86.8 - 87.5	MATERIAL PRO	PERTIES
89.7 - 92.6 92.6 - 95.5 95.5 - 98.1	2.9	89.7 - 90.7	1.0	0.34
92.6 - 95.5	2.9	92.6 - 93.9 95.5 - 96.5	•	
95.5 - 98.1	2.6	<i>9</i> 5.5 - 96.5	1.0	0.38
98.1 - 100.4	2.3	98.1 - 99.3 100.4 - 101.7 103.2 - 104.3	1.2	Ø.52
100.4 - 103.2	2.8	100.4 - 101.7	1.3	0.46
103.2 - 106.0	2.8	103.2 - 104.3	1.1	0.39
MATERIAL PRO	PERTIES	103.7 - 104.3	MATERIAL PROPE	RTIES
106.0 - 108.8	2.8	106.0 - 107.5	1.5	0.54
108.8 - 111.6	2.8	108.8 - 110.4	1.6	0.57
111.6 - 114.4	2.8	111.6 - 113.2	1.6	0.57
114.4 - 116.6	2.2	114.4 - 115.6	1.2	0.54
116.6 - 119.3	2.7	116.6 - 118.1	1.5	0.56
119.3 - 122.2	2.9	103.2 - 104.3 103.7 - 104.3 106.0 - 107.5 108.8 - 110.4 111.6 - 113.2 114.4 - 115.6 116.6 - 118.1 119.3 - 120.5 119.9 - 120.5 122.2 - 123.9 125.1 - 126.7 128.0 - 129.5 131.3 - 132.9	1.2	0.41
MATERIAL PRO	PERTIES	119.9 - 120.5	MATERIAL PROPE	RTIES
122.2 - 125.1	2.9	122.2 - 123.9	1.7	0.5 9
125.1 - 128.0	2.9	125.1 - 126.7	1.6	0.55
128.0 - 131.3	3.3	128.0 - 129.5	1.5	0.45
131.3 - 135.2	3.9	131.3 - 132.9	1.6	0.55

^{*} CUTTINGS ONLY

KFT-8 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVER
83.7 - 289.0	5.3	283.7 - 285. 3	1.6	0.30
MATERIAL PR	OPERTIES	284.5 - 285.3	MATERIAL PROPE	RTIES
39.0 - 294.2	5.2	289.0 - 290.5	1.5	0.28
74.2 - 299.9	5.7	294.2 - 295.3	1.1	0.19
79.9 - 303.0	3.1	299.9 - 300.9	1.0	0.32
3.0 - 310.1	7.1	303.0 - 304.0	1.0	0.14
0.1 - 317.6	7.5	310.1 - 311.1	1.0	0.13
7.6 - 317.9	0.3	317.6 - 317.9	0.3	1.00

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OAR-2 CORE LOG

mage from mage toppe from 1980 toppe hade from table days plan table from 1980		MPT SEEN TONG SEEN LAND SEEN SEEN SEEN SEEN SEEN SEEN SEEN SE		
INTERVAL	LENGTH	SAMPLE MARKED	RECOVERE	D RECOVERY
			`	
401.6 - 409.0	7.4	401.6 - 406.2 409.0 - 410.5 414.1 - 416.6 418.9 - 420.2 423.7 - 525.5 428.6 - 430.0 430.4 - 432.5	4.6	2. 62
409.0 - 414.1	5.1	409.0 - 410.5	1.5	0.29
414.1 - 418.9	4.8	414.1 - 416.6	2.5	0.52
418.9 - 423.7	4.8	418.9 - 420.2	1.3	0.27
423.7 - 428.6	4.9	423.7 - 525.5	1.8	0.37
428.6 - 430.4	1.8	428.6 - 430.0	1.8 1.4	0.78
430.4 - 437.9	7.5		2.1	0.28
437.9 - 442.5	7.5 4.6	NO BECOVERY		
442.5 - 448.1		442.5 - 446.2	3.7	0.66
MATERIAL PRO		442.5 - 446.2 444.3 - 444.8	MATERIAL PI	ROPERTIES
		448.1 - 449.1	1.0	0.21
452.8 - 455.7	2.9	448.1 - 449.1 452.8 - 454.3	1.5	0.52
455.7 - 462.6	6.9	455.7 - 460.7		
467.6 - 467.9	5 X	455.7 - 460.7 462.6 - 466.4	3.8	(A) 70
467.9 - 470.2	2.3	467 0 - 460 T	0.4	0.17
470.2 - 475.6	5.4	467.9 - 468.3 470.2 - 474.9 472.2 - 472.9	4 7	Ø. 87
MATERIAL PRO	DEDTIEC	470 0 - 470 0	MATERIAL DE	ONDERTIES
	0 7	475 4 - 495 1	0 5	0.98
MATERIAL DRO	7./ DEDTIEC	475.6 - 485.1 483.4 - 484.4	MATERIAL PE	0.70 CADEDITES
485.3 - 488.8	7 5	405 7 - 400 0	7 K	1.00
488.8 - 492.8	4.0	485.3 - 488.8 488.8 - 492.7	7.0	7.00
	7.0	400.0 - 472./	7.7	1.00
492.8 - 500.6 500.6 - 504.7	/.0	492.8 - 500.6 NO RECOVERY	7.8	
300.6 - 304.7	4.1	NO RECOVERY 504.7 - 506.0 509.7 - 513.4	4	2.21
504.7 - 509.7	5.0 5.7	504.7 - 506.0	1.5	0.26
509.7 - 515.4	5.7	509.7 - 513.4	2.5	0.49
515.4 - 520.2	4.8	515.4 - 516.6 520.2 - 521.8 521.0 - 521.8	1.2	0.25
520.2 - 524.9	4.7	520.2 - 521.8	1.6	
MATERIAL PRO	PERTIES	521.0 - 521.8	MATERIAL PI	ROPERTIES
524.9 - 529.7	4.8	524.9 - 527.4 529.7 - 538.2	2.5	Ø.52
529.7 - 539.9		529.7 - 538.2	8.5	
539.9 - 545.1 545.1 - 550.2	5.2	539.9 - 543.1 ND RECOVERY	3.2	0.62
545.1 - 550.2	5.1	ND RECOVERY		
550.2 - 560.9 560.9 - 571.0	10.7	550.2 - 557.5 560.9 - 571.0	7.3	0.48
560.9 - 571.0	10.1	560.9 - 571.0	10.1	1.00
MATERIAL PRO	PERTIES	562.8 - 563.8	MATERIAL PR	ROPERTIES
571.0 - 580.9	9.9	571.0 - 580.6 580.9 - 589.6 589.6 - 599.0 594.2 - 595.2	9.6	Ø.97
580.9 - 589.6	8.7	580.9 - 589.6	8.7	1.00
589.6 - 599.0	9.4	589.6 - 599.0	9.4	1.00
MATERIAL PRO	PERTIES	594.2 - 595.2	MATERIAL PR	ROPERTIES
599.0 - 606.9	7.9	599.0 - 606.9 606.9 - 611.9 611.9 - 621.0	7.9	1.00
606.9 - 611.9	5.0	606.9 - 611.9	5.0	1.00
611.9 - 621.0	9.1	611.9 - 621.0 615.8 - 616.8	9.1	1.00
MATERIAL PRO	PERTIES	615.8 - 616.8	MATERIAL PR	ROPERTIES
621.0 - 631.3	10.3	621.0 - 631.3	. 10.3	1.00
631.3 - 640.6	9.3	631.3 - 640.6	9.3	1.00
MATERIAL PRO	PERTIES	636.9 - 637.9	MATERIAL PR	
640.6 - 649.4	8.8	640.6 - 649.4	8.8	1.00
649.4 - 658.1	8.7	649.4 - 654.5	5.1	0.59
658.1 - 667.9	9.8	658.1 - 667.9	9.8	1.00
MATERIAL PRO	PERTIES	667.1 - 667.9	MATERIAL PR	ROPERTIES
667.9 - 679.1	11.2	667.9 - 678.2	9.9	Ø.92
679.1 - 689.6	10.5	679.1 - 689.4	10.3	0.98

OAR-2 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
589.6 - 696.4	6.8	689.6 - 696.4 696.4 - 705.4 701.8 - 703.1	6.8	1.00
696.4 - 705.9	9.5	696.4 - 705.4	9.0	0.95
MATERIAL PRO	DPERTIES	701.8 - 703.1	MATERIAL PROPE	RTIES
705.9 - 712.1	6.2	705.9 - 712.1 712.1 - 718.4	6.2	1.0101
712.1 - 718.7	6.6	712.1 - 718.4	6.3	0.95
718.7 - 724.4	5.7	712.1 - 718.4 718.7 - 722.4 724.4 - 728.5 729.8 - 734.5 732.1 - 732.8 738.4 - 746.3	3.7	0.65
724.4 - 729.8	5.4	724.4 - 728.5	4.1	0.76
729.8 - 738.4	8.6	729.8 - 734.5	4.7	0.55
MATERIAL PRO	DPERTIES	732.1 - 732.8	MATERIAL PROPE	RTIES
/38.4 - /4/.6	9.2	738.4 - 746.3	7.9	0.86
747.6 - 754.1	6.5	732.1 - 732.8 738.4 - 746.3 747.6 - 754.1 751.1 - 752.0 754.1 - 760.5	6.5	1.00
MATERIAL PRI	JPERTIES	751.1 - 752.0	MATERIAL PROPE	RITES
754.1 - 760.5	6.4	754.1 - 760.5	6.4	1.00
760.5 - 766.5		760.5 - 764.1 766.5 - 769.6	3.6	0.60
766.5 - 770.7	4.2	766.5 - 769.6	3.1	0.74
770.7 - 776.4	5.7	770.7 - 776.4	5.7	1.00
776.4 - 784.7	8.3	766.5 - 769.6 770.7 - 776.4 776.4 - 784.7 778.7 - 779.9 784.7 - 789.1	8.3	1.00
MATERIAL PRO	DPERTIES	778.7 - 779.9	MATERIAL PROPE	RTIES
784.7 - 790.1	5.4	784.7 - 789.1	4.7	Ø.87
/90.1 - /96./	6.6	/90.1 ~ /96./	6.6	1.00
796.7 - 806.4	9.7	796.7 - 806.4 806.4 - 813.8	9.7	1.00
306.4 - 813.8	7.4	806.4 - 813.8 807.2 - 808.8	7.4	1.00
MATERIAL PRO 813.8 - 821.3	OPERTIES	807.2 - 808.8	MATERIAL PROPE	RTIES
813.8 - 821.3	7.5	813-8 - 821.3	7.5	1 . 2727
321.3 - 825.7	4.4	821.3 - 825.7	4.4	1.00
325.7 ~ 833.2	7.5	821.3 - 825.7 825.7 - 830.5 826.6 - 827.5 833.2 - 834.4	4.8	0.64
MATERIAL PRO	OPERTIES	826.6 ~ 827.5	MATERIAL PROPE	RTIES
333.2 - 834.9	1.7	833.2 - 834.4 834.9 - 838.9 835.7 - 836.3	1.2	0.70
334.9 - 844.4	9.5	834.9 - 838.9	4.0	0.42
MATERIAL PRO	OPERTIES	835.7 - 836.3		
344.4 - 849.5	5.1	844.4 - 846.8	2.4	0.47
349.5 - 852.6	3.1	849.5 - 851.9 852.6 - 853.7	2.4	0.77
	1.5	852.6 - 853.7	1.1	0.73 .
354.1 - 855.1	1.0	854.1 - 854.9 855.1 - 855.4	0.8	0.80
355.1 - 855.5	0.4	855.1 - 855.4	0.3	0.75
855.5 - 856.5	1.0	NO RECOVERY 856.5 - 857.1	0.0	0.00
356.5 - 857.1	0.6	856.5 - 857.1	0.6	1.00
357 . 1 - 871.7	14.6	NO RECOVERY 871.7 - 875.2	0.0	0.00
371.7 - 875.4				0.94
875.4 ~ 878.0	2.6	875.4 - 877.4	2.0	0.77
378.0 - 880.7	2.7	878.0 - 860.7	2.7	1.00
380.7 - 884.7	4.0	880.7 - 884.7	4.0	1.00
MATERIAL PRO	OPERTIES	875.4 - 877.4 878.0 - 880.7 880.7 - 884.7 883.3 - 884.0 884.7 - 885.6	MATERIAL PROPE	RTIES
384 7 - 885 A	01.9	994.7 - 995.4	Ø 9	1.00

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OAR-2A CORE LOG

		المرة المالة المرة المالة المرة المالة المرة المالة المرة المالة المرة المرة المرة المرة المرة المرة		
INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
	3.0	0.0 - 1.1	1.1	0.37
3.0 - 5.8		3.0 - 4.2	1.2 0.8	0.43
5.8 - 8.7	2.9	5.8 - 6.6		0.28
8.7 - 11.4		<b>9.</b> 7 - 9.8	1.1	0.41
11.4 - 14.3	2.9	11.4 - 13.1	1.7	Ø.59
14.3 - 17.1	2.8 2.7	14.3 - 15.8 17.1 - 18.3	1.5 1.2	0.54
17.1 - 19.8	2.7	17.1 - 18.3	1.2	Ø.44
19.8 - 22.7 22.7 - 25.4	2.9	19.8 - 21.4 22.7 - 24.2	1.6 1.5	<b>0.5</b> 5
22.7 - 25.4	2.7	22.7 - 24.2		0.56
25.4 - 28.4	3.0 2.7	25.4 - 26.3 28.4 - 29.3	0.9	0.30
28.4 - 31.1	2.7	28.4 - 29.3	0.9	0.30
31.1 - 34.0		31.1 - 32.2	1.1 MATERIAL PROF	0.35
MATERIAL PRO		31.1 - 31.8	MATERIAL PROF	PERTIES
34.0 - 36.7	2.7	34.0 - 35.4	1.4	0.52
36.7 - 39.B	3.1	36.7 - 38.4 39.8 - 40.6	1.7	0.55
39.8 - 41.7	2.9	39.8 - 40.6	0.8	0.28
41.7 - 46.7	5.0	41.7 - 43.8	2.1 0.2	0.42
45.7 - 51.9	5.2	46.7 - 46.9	0.2	0.04
51.9 - 57.0	5.1 5.2	51.9 - 52.0 57.0 - 57.2	Ø. 1	0.02
57.0 - 62.1	5.2	57.0 - 57.2	0.2	0.05
62.1 - 66.4	4.3	62.1 - 65.3	3.2	0.74
66.4 - 71.2	4.3 4.8	62.1 - 65.3 66.4 - 67.1	0.7	0.15
71.2 - 76.3	5.1	71.2 - 76.3	5.1	1.00
76.3 - 81.0	A 77	NO DECOVEDY	0.0	0.00
81.0 ~ 85.6	4.6	81.0 - 81.6 NO RECOVERY 90.4 - 91.0	0.6	0.13
85.6 - 90.4	4.8 4.8	NO RECOVERY	0.0	0.00
90.4 - 95.2	4.8	90.4 - 91.0	0.6	0.13
95.2 - 100.0	4.8	95.2 - 96.4 100.0 - 101.1	1,2	0.25
100.0 - 105.1	5.1	100.0 - 101.1	1.1	0.22
105.1 - 109.8	4.7 4.4	105.1 - 106.3 109.8 - 110.6	1.2	0.26
109.8 - 114.2	4.4	109.8 - 110.6	Ø.8	0.18
114.2 - 119.2	5.0	114.2 - 115.9 119.2 - 119.4	1.7	0.34
119.2 - 124.5	5.3	119.2 - 119.4	0.3	0.06
124.5 - 132.5	8.0	126.6 - 132.5	<b>5.</b> 9	0.74
132.5 - 139.9	7.4	177 5 - 174 7	77	0.30
139.9 - 147.9	8.0	139.9 - 141.2	1.3	0.16
147.9 - 155.2	7.3 7.1	147.9 - 149.5 155.2 - 157.9	1.6	0.22
155.2 - 162.3	7.1	155.2 - 157.9	2.7	0.38
162.3 - 171.2	8.9	162.3 - 163.0 171.2 - 171.6	0.7	0.08
171.2 - 175.9	4.7		Ø. 4	0.09
175.9 - 180.2	4.3	175.9 - 179.2	3.3	0.77
180.2 - 184.9	4.7	175.9 - 179.2 180.2 - 184.3	4.1	0.87
184.9 - 189.5	4.6	184.9 - 188.6	3.7	0.80
189.5 - 194.3	4.8	184.9 - 188.6 189.5 - 190.7	1.2	0.25
194.3 - 198.9	4.6	194.3 - 195.4	1.1	0.24
198.9 - 203.4	4.5	198.9 - 203.2	4.3	0.96
203.4 - 208.2	4.8	203.4 - 206.9	3.5	0.73
208.2 - 212.8	4.6	208.2 - 212.7	4.5	Ø.98
212.8 - 217.9	5.1	212.8 - 217.3	4.5	0.88
217.9 - 223.4	5.5	217.9 - 219.0	1.1	0.20
223.4 - 228.8	5.4	223.4 - 228.3	4.9	0.91
228.8 - 234.2	5.4	228.8 - 233.8	5.0	0.93

DAR-2A CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
234.2 - 239.6	5.4	234.2 - 239.2	5.0	0.93
239.6 - 248.9	9.3	239.6 - 248.1	8.5	0.91
248.9 - 255.2	6.3	248.9 - 251.9	3.0	0.48
255.2 - 263.0	7.8	255.2 - 255.5	0.3	0.04
263.0 - 267.6	4.6	263.0 - 267.6	4.6	1.00
267.6 - 273.4	5.8	255.2 - 255.5 263.0 - 267.6 267.6 - 273.4 273.4 - 274.5	5.8	1.00
273.4 - 278.0	4.6	273.4 - 274.5	1.1	0.24
278.0 - 282.9	4.9	278.0 - 282.9	4.9	1.00
282.9 - 289.7	6.8	282.9 - 289.5	6.6	0.97
289.7 - 295.0	5.3	289.7 - 291.5	1.8	0.34
295.0 - 300.1	5.1	295.0 - 298.8	3.8	0.75
300.1 - 303.8	3.7	300.1 - 300.9	Ø.8	0.22
803.8 - 307.0	3.2	303.8 - 305.8	2.0	0.63
807.0 - 309.7	2.7	307.0 - 307.6	0.6	Ø.22
309.7 - 314.8		309.7 - 310.4		0.14
14.8 - 319.4		314.8 - 315.4	0.6	0.13
319.4 - 323.8	4.4	319.4 - 320.7	1.3	0.30
323.8 - 327.6	3.8	323.8 - 326.5	2.7	0.71
327.6 - 331.3	3.7	327.6 - 328.9	1.3	0.35
31.3 - 336.0	4.7	331.3 - 334.1	2.8	0.60
36.0 - 340.4	4.4	336.0 - 340.4	4.4	1.00
40.4 - 345.0	4.4 4.6	340.4 - 342.8	2.4	0.52
345 <b>.0</b> - 349.9	4.9	345.0 - 347.4	2.4	0.49
49.9 - 355.2	5.3	349.9 - 351.9	2.0	Ø.38
55.2 - 360.2	5.0	355.2 - 356.0	0.8	0.16
60.2 - 364.8	4.6	360.2 - 363.0	2.8	0.61
64.8 - 370.0	5.2	364.8 - 367.5	2.7	0.52
	7.2	370.0 - 372.7	2.7	0.38
77.2 - 382.5	5.3	377.2 - 379.7	2.5	0.47
		NO RECOVERY		0.00
85.8 - 390.9		385.8 - 386.4		0.12
90.9 - 396.1	5.2	390.9 - 395.6	4.7	0.90
		396.1 - 405.1		
		405.6 - 406.6		0.20

OBZ-4 CORE LOG

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
0.0 - 2.6	2.6	NO RECOVERY	0.0	0.00
2.6 - 5.7	*** 4	2.6 - 4.1	1.5	0.48
5.7 - 8.7	3.0	5.7 - 7.4	1.7	0.56
8.7 - 11.7	3.0	C 7 - 10 A	1.7	0.56
11.7 - 14.7	3.0 3.0	11.7 - 13.4	1.7	0.56
14.7 - 17.8	3.0	14.7 - 16.4	1.7	0.54
	3.1 3.0	17.8 - 19.5	1,7	0.56
20.8 - 23.8	3.0 3.0 3.0 3.0	20.8 - 22.5		0.56
23.8 - 26.8	3.0	23.8 - 25.5	1,7	0.56
26.8 - 29.8	3.0	26.8 - 28.5	1.7	Ø.56
29.8 - 32.8	3.0	29.8 - 31.5	1.7	0.56
32.8 - 36.4	3.0 3.6	32.8 - 34.5	1.7	0.47
36.4 - 39.3	2.9	36.4 - 37.3	0.9	0.31
39.3 - 42.4	2.9 3.1	39.3 - 41.0	1.7	Ø.54
42.4 - 45.4	3.0	42.4 - 44.0	1.6	0.53
45.4 - 48.4	3.0 3.0	45.4 - 47.1	1.7	Ø.56
	2.6	48.4 - 50.1	1.7	Ø.58
51.3 - 54.2	2.9 2.9	51.3 - 53.0	1.7	0.58
54.2 - 57.2	2.7 7 D	54.2 - 55.9	1.7	0.56
	3.0 2.9	57.2 - 58.9	1.7	Ø.58
57.2 - 60.1 60.1 - 63.1 63.1 - 65.9	3.0	60.1 - 61.8	1.7	Ø.56
43 1 - 45 9	2.8	63.1 - 64.8	1.7	0.60
65.9 - 69.0	3.1	65.9 - 67.7	1.7	0.54
	3.0	69.0 - 70.7	1.7	0.56
69.0 - 72.0 72.0 - 74.9	2.9	72.0 - 73.7	1.7	0.58
74.9 - 77.9	T 0	74.9 - 76.6	1.7	0.56
77.9 - 80.9	3.0 3.0	77.9 - 79.6	1.7	0.56
8 <b>0.9 - 83.</b> 7	2.8	80.9 - 82.4	1.7	0.60
77 7 6/ /		80.9 - 82.6 83.7 - 85.4	1.7	0.58
96.6 - 89.6 89.6 - 92.6	3.0	86.6 - 88.3	1.7	0.56
39.6 - 92.6	3.0	89.6 - 91.3	1.7	Ø.56
92.6 - 95.6	3.0	92.6 - 94.3	1.7	0.56
75.6 - 98.2	2.6	95.6 - 96.6	1.0	0.38
78.2 - 101.1	2.6 2.9	98.2 - 99.3	i.i	0.38
01.1 - 104.1	3.0	NO RECOVERY	ø.ø	0.00
04.1 - 107.1	3.0 3.0	104.1 - 105.1	1.0	0.33
27.1 - 109.1	2.0	107.1 - 108.0	0.9	0.45
09.1 - 112.0	2.0 2.9	109.1 - 110.4	1.3	0.45
12.0 - 115.0	3.0	112.0 - 113.2	1.2	0.40
15.0 - 117.9	3.0 2.9	115.0 - 116.6	1.6	0.55
	2.9	117.9 - 119.5	1.6	Ø.55
20.8 - 123.7	2.9 2.9	120.8 - 122.3	1.5	0.51
23.7 - 126.6	2.9	123.7 - 125.4	1.7	0.58
26.6 - 129.6	3.0	123.7 - 125.4 126.6 - 128.0	1.4	0.46
29.6 - 132.5	2.9	129.6 - 130.8	1.2	0.41
32.5 - 135.5	3.ø	132.5 - 134.2	1.7	0.56
35.5 - 138.5	3.0	135.5 - 137.4	1.9	0.63
38.5 - 141.4	2.9	138.5 - 140.1	1.6	Ø.55
41.4 - 144.4	3.0	141.4 - 142.7	1.3	0.43
44.4 - 147.3	2.9	144.4 - 145.9	1.5	0.51
	3.5		1.5	0.42
47.3 - 150.8		147.3 - 148.8		V1 AL /

OBZ-4 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
MATERIAL PRO	PERTIES	150.8 - 151.5		
ST Q - 1SA Q	7 1	157 0 - 154 0	1 1	0.35
53.8 - 156.9 56.9 - 159.9	3.1	153.8 - 154.9 156.9 - 158.1	1.7	0.40
SO O _ 147 7	3. W	156.9 - 158.1 159.9 - 161.2 163.3 - 164.7 166.5 - 168.0 169.5 - 170.6 172.5 - 173.3 175.4 - 176.3 178.3 - 179.1 181.3 - 182.7 183.7 - 184.7 186.6 - 187.2 190.1 - 191.1 193.1 - 194.0 196.0 - 196.8 198.9 - 199.9	1.2	0.38
.U7.7 - 103.3	3.7	147 7 - 144 7	1.3 1.3	0.40
44 5 - 140 5	3.2	165.5 - 167.7	1.5	0.50
.00.3 - 107.3 .00 E - 170 E	3. W	100.3 ~ 100.0	1.5 1.1	0.36
70 5 175 4	3.0	107.5 ~ 1/0.6	1.1	0.35
72.0 - 170.4	2.7	1/2.5 ~ 1/3.3	Ø.9	
75.4 - 178.3	2.9	1/0.4 - 1/6.3	0.9	0.31
78.3 - 181.3	3.0	1/8.3 - 1/9.1	Ø.8	0.26
81.3 - 183./	2.4	181.3 - 182.7	1.4	0.58
83.7 - 186.6	2.9	183./ - 184./	1.0	0.34
86.6 - 190.1	2.5	186.6 - 187.2	0.6 1.0	0.24
90.1 - 193.1	3.0	190.1 - 191.1	1.0	0.33
93.1 - 196.0	2.9	193.1 - 194.0	0.9 0.8	0.31
96.0 - 198.9	2.9	196.0 - 196.8	0.8	Ø.27
98.9 - 201.9	3.0	198.9 - 199.9	1.0	0.33
01.9 - 204.7	2.8	198.9 - 199.9 201.9 - 203.2	1.0	0.46
04.7 - 207.6	2.9	204.7 - 205.7	1.0	0.34
07.6 - 210.5	2.9	201.9 - 203.2 204.7 - 205.7 207.6 - 208.1 210.5 - 211.8 213.5 - 214.2 216.4 - 217.3 219.0 - 219.8 222.1 - 223.2	Ø.5	0.17
10.5 - 213.5	3.0	210.5 - 211.8	1.3	0.43
13.5 - 216.4	2.9	213.5 - 214.2	0.7	0.24
16.4 - 219.0	2,6	216.4 - 217.3	0.9	0.34
19.0 - 222.1	3.1	219:10 - 219.8	0.8	0.25
22.1 - 225.2	3.i	222.1 - 223.2	1.1	0.35
25.2 - 228.2	3.0	225.2 - 226.3	1.1	0.36
28.2 - 231.3	3.1	225.2 - 226.3 228.2 - 229.3	1.1 1.1	0.35
31.3 - 234.4	3.1	231.3 - 232.0	Ø. 7	0.22
34.4 - 237.5	3.1	231.3 - 232.0 234.4 - 235.3	Ø.7 Ø.9	0.29
37 5 - 240 7	3.1	277 5 270 7	Ø.8	0.25
40 7 - 243 7	3.2	24/13 - 241 5	7.0	0.26
10.7 <u>2</u> 13.7	3.0	243.7 - 241.0	Ø.8 1.1	0.36
16.7 - 240.7 16.7 - 240.0	7 1	234.4 - 235.3 237.5 - 238.3 240.7 - 241.5 243.7 - 244.8 246.7 - 247.6 249.8 - 250.6 252.7 - 253.4 255.7 - 256.4	0.9	0.29
10 0 - 257 T	3.1	240.7 - 247.0	0.8	0.27
77.0 - ZUZ./	2.7	247.0 - 2JU.6	0.7	0.23
UZ./ ~ ZUU./	3.0	202.7 - 200.4	0.7	0.23
55.7 - 256.9	3.4	200.7 - 200.4	w. /	
58.9 ~ 261.9 61.9 ~ 265.1	3.0	258.9 - 260.0 261.9 - 263.1	1.1 1.2	0.36
61.7 - 263.1	3.2	261.9 - 263.1	1.2	0.37
65.1 - 268.0	2.9	265.1 - 266.6 268.0 - 268.8	1.5 Ø.8	0.51
68.0 - 270.9	2.9	268.0 - 268.8	ø. 8	0.27
70.9 - 273.8	2.9	270.9 - 272.1	1.2	0.41
73.8 - 276.7	2.9	273.8 - 274.6	Ø.8	U. Z/
76.7 - 279.6	2.9	270.9 - 272.1 273.8 - 274.6 276.7 - 277.5 279.6 - 280.6	0.8	0.27
79.6 - 282.4	2.8	279.6 - 280.6	1.0	0.35
82.4 - 285.3	2.9	282.4 - 283.7	1.3	0.44
85.3 - 288.2	2.9	285.3 - 287.1	1.8	0.62
88.2 - 291.0	2.8	288.2 - 288.8	0.6	0.21
91.0 - 293.9	2.9	291.0 - 291.7	0.7	0.24
93.9 - 296.8	2.9	293.9 - 294.7	Ø.8	0.27
96.8 - 299.7	2.9	296.8 - 298.3	1.5	0.51
99.7 - 302.7	3.0	299.7 - 300.8	1.1	0.36
02.7 - 305.7	3.0	302.7 - 303.5	0.8	0.26
05.7 - 308.6	2.9	305.7 - 306.5	Ø.8	0.27
08.6 - 311.7	3.1	308.6 - 309.4	0.8	0.25

OBZ-4 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
0010 2000 0001 2000 0001 0001 0001 0001		314.6 - 315.5 317.6 - 318.4 320.4 - 321.4 323.6 - 324.6 326.7 - 327.9 329.8 - 331.0 332.9 - 334.1 336.1 - 337.2 339.6 - 340.8 343.1 - 344.3 346.4 - 347.4 349.5 - 350.6 352.7 - 353.7 356.1 - 357.1		
314.6 - 317.6	3.10	314.6 - 315.5	0.9	0.30
317.6 - 320.4	2.8	317.6 - 318.4	0.8	0.28
320.4 - 323.6	3.2	320.4 - 321.4	1.0	0.31
323.6 - 326.7	3.1	323.6 - 324.6	1.0	0.32
326.7 - 329.8	3,1	326.7 - 327.9	1.2	0.38
329.8 - 332.9	3.1	329.8 - 331.0	1.2	0.38
332.9 - 336.1	3.2	332.9 - 334.1	1.2	0.37
336.1 - 339.6	3.5	336.1 - 337.2	1.1	0.31
337.6 - 343.1	3.3	339.6 - 340.8	1.2	0.34
343.1 - 346.4	3.3	343.1 - 344.3	1.2	0.36
346.4 - 347.3	3.1	340.4 - 347.4	1.10	0.32
347.0 - 302./	J.∠	347.5 - 350.6	1.1	0.34
332./ - 336.1	3.4	352./ - 353./	1.0	0.29
356.1 - 359.1 359.1 - 362.4	3.0	356.1 - 357.1 359.1 - 359.8	1.0	
337.1 - 362.4	3.3	337.1 - 357.8	0.7	0.21
362.4 - 363.3	3.1	362.4 - 363.2 365.5 - <b>3</b> 66.5	<b>v.</b> 8	0.25
363.3 - 368.7	3.2	365.5 - 366.5	1.0	0.31
368./ - 3/1.7	3.2	365.5 - 366.5 368.7 - 369.7 371.9 - 372.9 374.9 - 375.5 377.3 - 377.9 380.1 - 381.2 383.0 - 383.6 385.8 - 386.0 388.6 - 389.3 391.4 - 392.1	1.0	0.31
3/1.9 - 3/4.9	3.0	3/1.9 - 3/2.9	1.0	0.33
3/4.9 - 3//.3	2.4	3/4.9 - 3/5.5	0.6	0.25
3//.3 - 380.1	2.8	3//.3 - 3//.9	V. 6	0.21
380.1 - 383.0	2.9	380.1 - 381.2	1.1	Ø.38
383.0 - 383.8	2.8	383.0 - 383.6	W.6	0.21
383.3 - 388.6	2.8	383.8 - 386.0	0.2	0.07
388.6 - 391.4	2.8	388.6 - 389.3	0.7	0.25
391.4 - 394.3	2.9	391.4 - 392.1	0.7	0.24
394.3 - 397.2 397.2 - 400.1	2.9	394.3 - 395.0 397.2 - 398.1	0.7	0.24
397.2 - 400.1	2.9	397.2 - 398.1	0.9	0.31
400.1 - 402.8	2.7	400.1 - 400.9 400.1 - 403.2 405.3 - 405.6 408.1 - 408.8 NO RECOVERY 412.3 - 414.6 NO RECOVERY	W.8	0.29
402.8 - 405.3	2.5	402.8 - 403.2	0.4	0.16
405.3 - 408.1	2.8	400.3 - 400.6	W.3	0.10
408.1 - 408.8	V. /	408.1 - 408.8	W. /	1.00
408.8 - 412.3	3.5	NU RECOVERY	0.0	0.00
412.3 - 416./	4.4	412.3 - 414.6	2.3	0.52
416.7 - 423.W	8.3	NO RECOVERY	W. W	0.00
423.0 - 423.7	Ø.7 E 2	425.0 - 425.4 425.9 - 426.1	0.4 0.2	Ø.44
423.7 - 431.1	J. Z	423.7 ~ 426.1	W. Z	0.04
431.1 - 437.1	6.0	NO RECOVERY 437.1 - 437.3	0.0 0.2	0.00
437.1 - 443.1	A /	437.1 - 437.3	0.2	0.03
443.1 - 447.7 447.7 - 455.5	7.0	NO RECOVERY NO RECOVERY	0.0	0.00
447.7 - 400.0	/.0	455.5 - 455.7 460.6 - 461.2 466.5 - 466.5	Ø.Ø Ø.2	0.00 0.04
460 6 - 466 0	2.1	433.3 - 433.7	Ø. 2	Ø. 64 Ø. 11
464 0 - 471 0	J. T	100.0 - 401.2	W.C	0.09
471.2 - 476.9	5.7	471.2 - 471.6	Ø. 4	0.07
476.9 - 481.0	4.1	476.9 - 477.2	0.3	
481.0 - 486.0	5.0	NO RECOVERY	Ø. Ø	0.07 0.00
486.0 - 493.7	6.7	NO RECOVERY	Ø. Ø	0.00
493.7 - 502.5	8.8	493.7 - 494.7	1.0	
502.5 - 505.0	2.5		1.5	0.11 0.60
505.0 - 508.3	2.3 3.3	502.5 - 504.0 505.0 - 504.7		
508.3 - 513.2		505.0 - 506.7	1.7	0.51
	4.9	NO RECOVERY	0.0	0.00
513.2 - 517.9	4.7	513.2 - 514.3	1.1	0.23
517.9 - 518.9	1.0	NO RECOVERY	0.0	0.00
518.9 - 523.5	4.6	518.9 - 523.5	4.6	1.0

OBZ-4 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
523.5 - 528.5	5.0	NO RECOVERY	0.0	0.00
523.5 - 528.5 528.5 - 531.3	2-8	NO RECOVERY NO RECOVERY	0.0	0.00
531.3 - 538.3	7 0	NO RECOVERY NO RECOVERY NO RECOVERY NO RECOVERY 543.1 - 543.6 NO RECOVERY 548.4 - 548.6 552.8 - 553.4 560.1 - 562.4 566.4 - 573.1	Ø. Ø Ø. Ø	0.00
538.3 - 540.3	2.0	NO RECOVERY	0.0	0.00
540.3 - 543.1	2.8	NO RECOVERY	0.0	0.00
543.1 - 545.0	1.9	543.1 - 543.4	0.5	Ø.26
545.0 - 548.4	3.4	NO RECOVERY	P 0	0.00
548.4 - 552.8	4.4	548-4 - 548-4	0.2	0.04
552.8 - 560.1	7.3	552.8 - 553.4	0.6	0.08
560.1 - 566.4	6.3	560.1 - 562.4	2.3	0.36
566.4 - 576.1	9.7	566.4 - 573.1	6.7	0.69
576.1 - 584.1	8.0	576.1 - 578.9	2.8	0.35
576.1 - 584.1 584.1 - 593.1	9.0	576.1 - 578.9 584.1 - 586.6	2.5	0.27
593.1 - 599.0	5.9	593.1 - 596.1	3.0	0.51
593.1 - 599.0 599.0 - 609.3	10.3	593.1 - 596.1 599.0 - 603.8	4.8	0.46
609.3 - 619.7	10.4	609.3 - 611.8	2.5	0.24
619.7 - 630.3	10.6	609.3 - 611.8 619.7 - 619.9	0.2	0.02
630.3 - 636.2	5.9	630.3 - 631.0	0.7	Ø. 11
636.2 - 641.6	5.4	630.3 - 631.0 636.2 - 638.2	2.0	Ø.37
641.6 - 646.9	5.3	NO RECOVERY	0.0	0.00
646.9 - 653.1	6.2	646-9 - 647-6	0.7	Ø. 11
653.1 - 657.4	4.3	636.2 - 638.2 NO RECOVERY 646.9 - 647.6 653.1 - 655.5	2.4	055
MATERIAL PRO	PERTIES	653.1 - 653.7 657.4 - 658.1	MATERIAL PROPE	RTIES
57.4 - 662.0	4.6	657.4 - 658.1	Ø 7	0.15
62.0 - 671.7	9.7	662-0 - 663-9	1.9	Ø. 19
571.7 - 681.0	9.3	662.0 - 663.9 671.7 - 672.0	0.3	0.03
581.0 - 691.6	10.4	681 - Ø - 681 - 6	0.6	0.05
491.4 - 495.4	3.8	681.0 - 681.6 691.6 - 693.0	1.4	0.36
595.4 - 698.1	2.7	691.6 - 693.0 695.4 - 698.1	2.7	1.00
698.1 - 704.1	4.0	695.4 - 698.1 698.1 - 703.0 700.1 - 701.1	4.9	Ø.81
MATERIAL PRO	PERTIES	700.1 - 701.1	MATERIAL PROPE	RTIFS
704.1 - 711.8	7.7	704.1 - 708.9	4.8	0.62
711.8 - 717.0	5.2	704.1 - 708.9 711.8 - 713.4	4.8 1.6	0.30
717.0 - 722.0	5.0	NO RECOVERY	(7) _ (7)	0.00
717.0 - 722.0 722.0 - 724.7	2.7	NO RECOVERY 722.0 - 724.7	2.7	1.00
724.7 - 729.9	5.2	NO RECOVERY	0.0	0.00
724.7 - 729.9 729.9 - 735.1	5.2 5.2	NO RECOVERY 729.9 - 733.9	4.0	0.76
735.1 - 740.5	5.4	735.1 - 739.4	4.3	0.79
740.5 - 745.8	5.3	735.1 - 739.4 740.5 - 745.4	4.9	01.92
745.8 - 754.4	8.6	745.8 - 752.4 754.4 - 763.4	4-6	0.76
754.4 - 763.5	9.1	754.4 - 763.4	9.0	0.79
MATERIAL PRO	PERTIES	756.4 - 757.4 763.5 - 772.1 772.9 - 782.3	MATERIAL PROPE	RTIES
743.5 - 772.9	9.4	763.5 - 772.1	9.1	0.91
772.9 - 782.3	9.4	772 9 - 792 3	9 4	1.00
782.3 - 791.3	9.0	782.3 - 790.1	7.8	
MATERIAL PRO		784.3 - 785.2	MATERIAL PROPE	Ø.86
791.3 - 801.7	10.4	791.3 - 801.6	10.3	0.99
901.7 - 811.7	10.0	901.7 - 811.7	10.0	1.00
311.7 - 821.0	7.3	811.7 - 821.0	9.3	1.00
321.0 - 830.4	7.3 9.4	821.0 - 829.6	9.3 8.6	
MATERIAL PRO				0.91
330.4 - 838.4	8.0	828.1 - 829.1	MATERIAL PROPE	
338.4 - 849.8	11.4	83 <b>0.4</b> - 838.4	8.0	1.00
349.8 - 859.4	9.6	838.4 - 848.7 849.8 - 859.4	10.3	0.90
			9.6	1.00
359.4 - 867.4	8.0	859.4 - 867.4	8.0	1.00

OBZ-4 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE	MARKED	RECOVERED	RECOVERY
	i erri erri erri erri erri erri erri er	ng hills with him own own hill have also seen own own	· · · · · · · · · · · · · · · · · · ·		
867.4 - 876.5	9.1	867.4 -	876.5	9.1	1.00
876.5 - 887.3	10.8	876.5 -	885.9	9.4 MATERIAL PRO	0.87
MATERIAL PRO	PERTIES	882.5 -	883.5	MATERIAL PRO	PERTIES
887.3 - 898.5 898.5 - 904.6	11.2	887.3 -	897.6	10.3	0.92
898.5 - 904.6	6.1	898.5 -	904.6	6.1 9.7 3.5	1.00
904.6 - 914.3 914.3 - 920.4	9.7	904.6 - 914.3 -	914.3	9.7	1.00
914.3 - 920.4	6.1	914.3 -	917.8	3.5	0.57
920.4 - 928.7	8.3	920.4 -	928.7	8.3 MATERIAL PRO	1.00
MATERIAL PRO	PERTIES	925.3 -	926.2	MATERIAL PRO	PERTIES
928.7 - 939.7	11.0	928.7 <del>-</del>	936.2	7.5 10.0 MATERIAL PRO 9.4	0.48
939.7 - 949.9	10.2	939.7 -	949.7	10.0	0.98
MATERIAL PRO	PERTIES	939.7 -	940.7	MATERIAL PRO	PERTIES
949.9 - 959.5	9.6	949.9 -	959.3	9.4	0.98
MATERIAL PRO	PERTIES			MATERIAL PRO	
959.5 - 962.2 969.2 - 967.9	2.7	959.5 -	961.5	2.0	0.74
969.2 - 967.5	5.7	962.2 -	964.9	2.7	0.47
967.9 - 975.3 975.3 - 979.2	7.4	967.9 - 975.3 -	972.9	5.0 3.0	0.67
975.3 - 979.2	3.9	975.3 -	978.3	3.0	0.77
979.2 - 990.0	10.8	979.2 -	989.5	10.3	0.95
MATERIAL PRO	PERTIES	987.0 -	988.0	MATERIAL PRO	PERTIES
990.0 - 995.8	5.8	990.0 -	995.4	5.4	0.93
995.8 - 1008.8	13.0	995.8 -	1004.8	10.3 MATERIAL PRO 5.4 9.0 MATERIAL PROPE	<b>0.</b> 69
MATERIAL PRO	PERTIES	1004.8 -	1007.8	MATERIAL PROPE	RTIES
1008.8 - 1016.3 1016.3 - 1020.7	7.5	1008.8 -	1013.9	5.1	v. 00
1016.3 - 1020.7	4.4	1016 - 1	020.7	4.4	
1020.7 - 1029.2 1029.2 - 1036.8	8.5	1020.7 -	1029.2	8.5 7.6	1.00
1029.2 - 1036.8	7.6	1029.2 -	1036.8	7.6	1.00
1036.8 - 1044.2 1044.2 - 1056.1	. /.4	1036.8 -	1044.2	7.4 10.2	1.00
1044.2 - 1036.1	11.7	1044.2 -	1034.4	10.2	0.85
MATERIAL PRO				MATERIAL PROPE	Ø.82
1056.1 - 1064.8 1064.8 - 1077.9	3 6./	1056.1 -	1003.3	7.2	Ø.47
1004.8 - 10//.7	13.1	1004.8 -	1071.0	6.2	1.00
1077.9 - 1079.1 1079.1 - 1085.2	1.2	1077.7 -	10/7.1	7.0	0.62
10/7.1 - 1085.2	6,1	10/7.1 -	1082.7	3.8	0.21
1085.2 - 1090.4 1090.4 - 1096.0	. 5.2	1000.2 -	1000.3	1.1 5.6	1.00
1070.4 - 1070.0	. 25	1070.4	1070.0	Ø 0	0.32
1096.0 - 1098.5 1098.5 - 1101.8	) <u>2.</u>	1070.0 -	1100 1	0.8 1.5	0.45
1101 9 - 1112 2	1014	1101 8 -	1100.1	2.0	0.19
1101.8 - 1112.2 1112.2 - 1125.1	12.9	1112 2 -	1114 1	1.9	0.14
1175 1 - 1176 3	1 2	1125 1 -	1175 8	Ø. 7	
1125.1 - 1126.3 1126.3 - 1129.6	3.3	1124-3 -	1129-6	3.3	1.00
1126.3 - 1129.6 1129.6 - 1133.3	37	1129.6 -	1130.9	1.3	0.35
1133.3 - 1138.9	5.6	1133.3 -	1135.9	2.6	0.46
1138.9 - 1143.1		1138.9 -		1.0	0.23
1143.1 - 1144.1		1143.1 -		0.4	0.40
1144.1 - 1148.7		1144.1 -		1.7	0.37
1148.7 - 1159.4		1148.7 -		3.2	0.30
1159.4 - 1168.7		1159.4 -		9.3	1.00
MATERIAL PRO	-	1162.4 -		MATERIAL PROPE	
1168.7 - 1173.4		1168.7 -		4.6	0.98
1173.4 - 1177.5		1173.4 -		1.6	0.39
1177.5 - 1186.5		1175.0 -		5.2	0.57
MATERIAL PRO		1178.6 -		MATERIAL PROPE	
1186.5 - 1196.5		1186.5 -		10.0	1.00

OBZ-4 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
MATERIAL PROF	FRTIES	1192.5 - 1193.5	MATERIAL PROPE	RTIES
1196.5 - 1206.2	9.7	1192.5 - 1193.5 1196.5 - 1201.3 1206.2 - 1215.4 1215.9 - 1224.8 1225.4 - 1232.9	4.8	0.49
1204 2 - 1215 9	9.7	1204.2 - 1215.4	9.2	20.95
1215 9 - 1225 A	9.5	1215.9 - 1224.8	8.9	0.93
1225.4 - 1235.1	9.7	1225.4 - 1232.9	7.5	0.77
1245 1 - 1252.2	7.1	1235.1 - 1238.4 1245.1 - 1252.2 1252.2 - 1262.3 1262.3 - 1269.1 1272.5 - 1278.0 1281.5 - 1284.8 1286.8 - 1295.6 1292.3 - 1293.3	5.6	Ø.78
1252 2 - 1242 3	101	1252.2 - 1262.3	10.1	1.00
1262.3 - 1272.5	10.7	1262.3 - 1269.1	6.8	0.66
1272 5 - 1281 5	9 0	1272 5 - 1278 0	5.5	0.61
1281 5 - 1284 6	7. W	1281 5 - 1284 8	7 7	0.62
1284 B - 1297 A	10.6	1284.8 - 1285.4	8.8	0.83
MATERIAL DROE	PERTIES	1200.0 - 1270.0	MATERIAL PROPE	OTTEC
1707 4 - 1707 7	0.0	1207 4 - 1305 0	O 5	0.86
MATERIAL BROS	7.0 EDTIEC	1297.4 - 1305.9 1300.4 - 1301.4	MATERIAL BROBE	PTIEC
1707 0 1717 E	10 7	1300.4 - 1301.4	MHIERIHL PROPER	1.00
1307.2 - 1317.3	10.3	1307.2 - 1317.5 1317.5 - 1325.7 1325.7 - 1331.4 1328.7 - 1329.7	10.3	1.00
1317.3 - 1323.7	0.2	1317.3 - 1323.7	0. £	0.85
1323.7 - 1332.4 MATERIAL BROS	O./ COTICO	1323.7 - 1331.4	MATERIAL PROPE	W.GJ
1370 A 1747 E	CRITES	1320./ - 1327./	PHIERIAL PROPER	71153
1332.4 - 1343.3	11.1	1332.4 - 1341.7	7.3	w.as
1343.3 - 1333.6	10.1	1343.3 - 1333.6	76.1	7.00
1333.6 - 1364.6	11.0	1328.7 - 1329.7 1332.4 - 1341.7 1343.5 - 1353.6 1353.6 - 1361.1 1364.6 - 1374.1 1365.8 - 1366.6	7.5	0.00
1364.6 - 13/4.8	IV.Z	1364.6 - 13/4.1	ATEDIA DOGGE	W.73
MATERIAL PROF	EKITES	1365.8 - 1366.6	MATERIAL PROPER	4 1 1 E 2
13/4.8 - 1383.4	a.o	1374.8 - 1383.4 1383.4 - 1392.9	ö.c	1.00
1383.4 - 1372.7	7.0	1383.4 - 1372.7	7.0	1.00
MATERIAL PROF	EKITES	1386.4 - 1387.4 1392.9 - 1402.4	MATERIAL PROPER	411ES
1392.9 - 1402.7	9.8	1392.9 - 1402.4 1395.9 - 1396.9 NO RECOVERY NO RECOVERY 1411.0 - 1413.4	9.0	0.97
MATERIAL PROF	ERIJES	1375.7 - 1376.7	MATERIAL PRUPER	111ES
1402.7 - 1407.3	J. 4	NO RECOVERY	0.0	0.00
140/.3 - 1411.0	3./	NO RECOVERY	Ø. Ø	0.00
1411.0 - 1414.2 1414.2 - 1424.8	3.2	1411.0 - 1413.4	2.4	0.75
1414.2 - 1424.8	10.6	1414.2 - 1424.2	16.6	W.74
MATERIAL PRUF	ERTIES	1417.8 - 1418.8	MATERIAL PROPER	KILES
1424.8 - 1434.6	9.8	1424.8 - 1434.5	9./	0.99
MATERIAL PROF	ERITES	1427.8 - 1428.8	MATERIAL PROPER	KITES
1434.6 - 1444.3	9.7	1434.6 - 1443.6	9.0	0.92
1444.3 - 1448.8	4.5	1417.8 - 1418.8 1424.8 - 1434.5 1427.8 - 1428.8 1434.6 - 1443.6 1444.3 - 1448.1 1448.8 - 1451.6 1453.0 - 1453.8 1458.4 - 1469.0 1469.0 - 1473.6 1479.5 - 1489.8 1489.8 - 1499.1 1499.5 - 1504.9	3.8	0.84
1448.8 - 1458.4	9.6	1448.8 - 1451.6	2.8	0.29
MATERIAL PROF	PERTIES	1453.0 - 1453.8	MATERIAL PROPER	RTIES
1458.4 - 1469.0	10.6	1458.4 - 1469.0	10.6	1.00
1469.0 - 1479.5	10.5	1469.0 - 1473.6	4.6	0.43
1479.5 - 1489.8	10.3	1479.5 - 1489.8	10.3	1.00
1489.8 - 1499.5	9.7	1489.8 - 1499.1	9.3	0.95
			5.4	
1505.6 - 1512.1	6.5	1505.6 - 1511.6	6.0	0.92
MATERIAL PROF		1509.2 - 1510.2	MATERIAL PROPER	
1512.1 - 1519.7	7.4	1512.1 - 1517.9	5.8	0.78
1519.7 - 1527.7	8.0	1519.7 - 1527.7	8.0	1.00
MATERIAL PROF		1520.2 - 1521.2	MATERIAL PROPER	
1527.7 - 1537.7	10.0	1527.7 - 1537.7	10.0	1.00
MATERIAL PROF	PERTIES	1528.2 - 1529.2	MATERIAL PROPER	
1537.7 - 1546.6	8.9	1537.7 - 1546.6	8.9	1.00
			MATTER VALUE OF COMME	
MATERIAL PROF 1546.6 - 1554.1	ERTIES	1538.5 - 1539.5 1546.6 - 1552.6	MATERIAL PROPER	RTIES 0.80

OBZ-4 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
		This same fills the same same tast same that same same same same same same same same	. Care that man the land the that the land the l	- Apr an 140 an an an qui an qui an 140 an
1554.1 - 1562.7	8.6	1554.1 - 1562.7	8.6	1.00
1562.7 - 1572.5	9.8	1562.7 - 1572.0	9.3	0.95
MATERIAL PROF	PERTIES	1568.1 - 1569.1	MATERIAL PROPE	RTIES
1572.5 - 1578.0	5.5	1572.5 - 1578.0	5.5	1.00
MATERIAL PROF	PERTIES	1573.2 - 1574.2	MATERIAL PROPE	RTIES
1578.0 - 1587.7	9.7	1578.0 - 1587.0	9.0	0.92
MATERIAL PROP	PERTIES	1584.0 - 1585.0	MATERIAL PROPE	RTIES
1587.7 - 1591.9	4.2	1587.7 - 1589.2	1.5	0.35
1591.9 - 1595.2	3.3	1591.9 - 1593.6	1.7	0.51
595.2 - 1601.1	5.9	1595.2 - 1601.1	5.9	1.00
1601.1 - 1603.9	2.8	1601.1 - 1603.9	2.8	1.00

OCT-5 CORE LOG

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
Ø. Ø - 2.7	2.7	0.0 - 0.9	<b>0.</b> 9	0.33
0.0 - 2.7 2.7 - 5.5	2.8	0.0 - 0.9 2.7 - 4.5	1.8	0.64
5.5 - 8.4	2.9	5.5 - 7.3	1.8	0.62
8.4 - 11.2	2.8	5.5 - 7.3 8.4 - 10.2	1.8	0.64
11.2 - 14.0		11.2 - 13.0	1.8	0.64
14.0 - 16.9	2.9	14.0 - 15.6	1.6	0.55
16.9 - 19.8	2.9	16.9 - 18.0	1.1	0.38
19.8 - 22.9		19.8 - 20.2	0.4	0.13
22.9 - 25.0		22.9 - 23.3	0.4	0.19
25.0 - 27.8	2.8	25.0 - 25.3	0.3	0.10
27.8 - 32.2		27.8 - 28.2	0.4	0.09
32.2 - 35.0	2.0	72 2 - 72 A	0.2	0.07
35.0 - 36.7	2.0 1.7	35.0 - 35.7	0.7	0.41
36.7 - 39.2	2.5	36.7 - 37.9	1.2	0.48
39.2 - 41.8		36.7 - 37.9 39.2 - 40.0	Ø. 8	0.30
41.8 - 44.6	2.8	41.8 - 43.2	1.4	0.50
44.6 - 47.4	2.8 2.8	41.8 - 43.2 44.6 - 45.9	1.3	0.46
47.4 - 50.4	3.0	47.4 - 48.8	1.4	0.46
50.4 - 53.4		47.4 - 48.8 50.4 - 51.9	1.5	0.50
53.4 - 56.6		53.4 - 54.8	1.4	0.43
56.6 - 59.8	3.2		1.7	0.53
59.8 - 63.4	3.2 3.6	56.6 - 58.3 59.8 - 61.2	1.4	Ø.38
63.4 - 66.5	3.1	63.4 - 64.4	1.0	0.32
66.5 69.7	3.1 3.2	63.4 - 64.4 66.5 - 67.6	1.1	0.34
69.7 - 73.0	₹.₹	49.7 - 70.6	0.9	0.27
73.0 - 76.1	3.3 3.1	69.7 - 70.6 73.0 - 74.3	1.3	0.42
76.1 - 79.2	3.1	76-1 - 77-4	1,3	0.42
79.2 - 82.3	3.1	76.1 - 77.4 79.2 - 80.4	1.2	0.38
82.3 - 85.4	3.1	82.3 - 83.3	1.0	0.32
85.4 - 88.5	3.1	82.3 - 83.3 85.4 - 86.8	1.4	0.45
88.5 - 91.6		88.5 - 89.6	1.1	0.35
91.4 - 94.7	3.1	91.6 - 93.0	1.4	0.45
94.7 - 97.8	3.1 3.1	94.7 - 96.0	1.3	0.42
97.8 - 100.9	3.1	~~ ~~	0.9	0.29
100.9 - 104.0	3.1 3.1	100.9 - 101.6	0.7	0.22
104.0 - 106.6	3.1 2.6 2.8	104.0 - 104.7	0.7	0.27
106.6 - 109.4	2.8	104.0 - 104.7 106.6 - 107.7	1.1	0.39
109.4 - 112.3	2.9	109.4 - 111.0	1.6	0.55
112.3 - 115.2		112.3 - 114.0	1.7	0.58
115.2 - 118.0		115.2 - 116.5	1.3	0.46
118.0 - 120.8		118.0 - 119.1	1.1	Ø.39
120.8 - 123.4	2.6	120.8 - 121.9		0.42
		123.4 - 124.4	1.0	0.34
123.4 - 126.3 126.3 - 129.1	2.8	126.3 - 127.6	1.3	0.46
129.1 - 131.9	2.8	129.1 - 130.4	1.3	0.46
131.9 - 134.8	2.9	131.9 - 133.1	1.2	0.41
134.8 - 137.7	2.9	134.8 - 135.6	Ø.8	0.27
137.7 - 140.6	2.9	137.7 - 138.5	Ø.8	0.27
140.6 - 143.4	2.8	140.6 - 141.6	1.0	0.35
143.4 - 146.2	2.8	143.4 - 144.1	0.7	Ø.25
146.2 - 149.0	2.8	146.2 - 147.0	0.8	0.28
149.0 - 151.9	2.9	149.0 - 150.0	1.0	0.34
11/14 IGI1/	~ · · /	17/10 1001U	_ • ~	

OCT-5 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
51.9 - 154.7	2.8	151.9 - 152.6	Ø. 7	0.25
54.7 - 157.5	2.8 2.8	151.9 - 152.6 154.7 - 155.6	Ø.7 Ø.9	0.32
57.5 - 160.3	2.8	157.5 - 158.5	1.0	0.35
60.3 - 163.2	2.9	157.5 - 158.5 160.3 - 161.0	1.0 0.7	0.24
63.2 - 166.3	3.1	163.2 - 164.1	0.9	0.29
66.3 - 169.4	3.1	163.2 - 164.1 166.3 - 167.0	Ø.9 Ø.7	
69.4 - 173.0	3.6	166.3 - 167.0 169.4 - 170.5 173.0 - 174.2 176.2 - 177.1 179.3 - 180.1 182.5 - 183.1 185.6 - 186.5 188.7 - 189.5 192.1 - 193.1 195.3 - 196.8	1.1	0.30
73.0 - 176.2	3.2	173.0 - 174.2	1.2	0.37
76.2 - 179.3	3.1	176.2 - 177.1	0.9	0.29
79.3 - 182.5	3.2	179.3 - 180.1	0.8	Ø. 25
82.5 - 185.6	3.1	182.5 - 183.1	0.6	0.19
85.6 - 188.7	3.1	185.6 - 186.5	0.9	0.29
88.7 - 192.1	3.4	188.7 - 189.5	0.8	0.23
92.1 - 195.3	3.2	192.1 - 193.1	1.0	0.31
95.3 - 198.5	3.2	195.3 - 196.8	1.5	0.46
98.5 - 201.6	3.1	198.5 - 199.9	1 - 4	0.45
01.6 - 204.7	3.1	198.5 - 199.9 201.6 - 203.1	1.4 1.5	0.48
04.7 - 207.8	3.1	204.7 - 206.0	1.3	
04.7 - 207.8 07.8 - 211.0	7.2	204.7 - 206.0 207.8 - 209.4	1.3 1.6	0.50
11.0 - 214.2	7 7	207.8 - 209.4 211.0 - 212.2 214.2 - 215.3 217.3 - 218.1 220.4 - 221.5 223.3 - 224.1 226.2 - 226.9 229.1 - 230.1	1.2	0.37
14 0 - 217 T	7 1	211.0 - 212.2	1 1	Ø.35
17 T - 270 A	77 1	217.2 - 213.3	Ø e	Ø.25
20 A - 227 T	2.5	270 4 - 271 5	1 1	0.38
20.7 - 223.3	2.7	220.7 - 221.3	0 8	0.27
24 2 - 220 1	2.7	224.3 - 224.1	0.7	0.24
20.2 - 227.1	2.7	220.2 - 220.7	1 0	0.34
77 N - 232.0	4.7	227.1 - 230.1	1.0	Ø. 47
32.0 - 236.0 36.0 - 240.6	4.Ø 4.6	232.0 - 233.9 236.0 - 237.2	1.9	0.26
40 4 - 24T 7	7.0	240 4 - 241 7	1 1	Ø.35
43.0 243.7 43.7 - 244.0	7 1	240.6 - 241.7 243.7 - 243.8	1.1 0.1	Ø.03
74. Q = 250 Q	4.0	246.7 243.0	0.9	0.22
40.0 - 250.0 50 0 - 251 2	ማ•ወ ኛ ለ	246.8 - 247.7 250.8 - 251.5 254.2 - 254.6 257.4 - 258.5	Ø.5	0.20
JU:0 - 2J7.2 E/ 3 - 357/	7.7	250.0 - 251.5	Ø.4	0.12
57 A - 740 S	7.1	234.2 - 234.0	1.1	Ø.12 Ø.35
3/.4 - 200.3 40 E - 247 7	3.1	257.4 - 258.5 260.5 - 260.7	0.2	Ø.07
63.3 - 266.2	2.0	260.3 - 260.7	0.2	0.31
66.2 - 269.0	2.9 2.8	263.3 - 264.2	Ø.9 1.0	0.35
00.2 - 207.0 40 0 - 271 0	2.0	263.3 - 264.2 266.2 - 267.2 269.0 - 269.6 271.8 - 272.8	7. W	0.21
69.0 - 271.8 71.8 - 274.7	2.0	207.0 - 207.0	0.6 1.0	0.34
74.7 - 277.5	2.7	271.0 - 272.0	1.0	Ø.34 Ø.32
77.5 - 280.4		274.7 - 275.6 277.5 - 278.6	2.7	Ø.32
//.3 ~ ZDU.4	2.7	2//.3 - 2/0.0	0.4	
50.4 ~ Z63.0	∡.o	280.4 - 281.0 283.0 - 283.9	0.6 0.9	0.23
83.0 - 283.8	2.8	265.60 - 265.7	0.7	0.32
85.8 - 288.7	2.9	285.8 - 286.4	W.6	0.20
88.7 - 291.5		288.7 - 289.5	Ø.8	0.28
91.5 - 294.4	2.9	291.5 - 292.4	0.9	0.31
94.4 - 297.3	2.9	294.4 - 295.5	1.1	Ø.38
97.3 - 300.1	2.8	297.3 - 298.2	0.9	0.32
00.1 - 302.9	2.8	300.1 - 301.0	0.9	0.32
02.9 - 305.8	2.9	302.9 - 304.0	1.1	0.38
05.8 - 308.6	2.8	305.8 - 306.8	1.0	0.35
08.6 - 312.2	3.6	308.6 - 309.6	1.0	0.27
12.2 - 315.3	3.1	312.2 - 313.2	1.0	0.32
15.3 - 318.4	3.1	315.3 - 315.9	0.6	0.19
18.4 - 321.6	3.2	318.4 - 319.2	Ø.8	0.25

OCT-5 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
321.6 - 324.7	3.1	321.6 - 322.6 324.7 - 325.7 327.9 - 328.9 330.0 - 331.1	1.0 1.0 1.0	0.32
324.7 - 327.9	3.2	324.7 - 325.7	1.0	0.31
327.9 - 330.0	2.1	327.9 - 328.9 330.0 - 331.1	1.0	0.47
330.0 - 334.1	4.1	330.0 - 331.1	1.1	<b>0.</b> 26
334.1 - 337.3 337.3 - 340.3	3.2	334.1 - 335.1 337.3 - 338.2	1.0	0.31
337.3 - 340.3	3.0	337.3 - 338.2	Ø. 9	0.30
340.3 - 343.5	3.2	340.3 - 341.0 343.5 - 344.2	Ø.7 Ø.7	0.21
343.5 - 347.2	2.7	343.5 - 344.2	0.7	0.26
347.2 - 350.4	3.2	34/.2 - 34/.9	Ø. 7	0.21
350.4 - 353.2 353.2 - 356.1	2.8	343.5 - 344.2 347.2 - 347.9 350.4 - 351.5 353.2 - 354.4	1.1	0.39 0.41
333.2 - 330.1 754 1 - 750 0	2.7	754 1 - 757 7	1.2	0.41
356.1 - 359.0 359.0 - 361.8	2.7	356.1 - 357.3 359.0 - 360.4	1.4	0.50
361.8 - 364.7	2.9	361.8 - 362.9	1.1	0.38
364.7 - 367.6	2.9	361.8 - 362.9 364.7 - 365.7	1.1 1.0	0.34
367.6 - 370.3	2.7	367.6 - 368.9	1.3	0.48
367.6 - 370.3 370.3 - 373.5	3.2	367.6 - 368.9 370.3 - 371.4	1.3 1.1	0.34
373.5 - 376.4	2.9	373.5 - 374.8 376.4 - <b>3</b> 77.7	1.3	0.44
376.4 - 379.4	3.0	376.4 - 377.7	1.3	0.43
379.4 - 382.6	3.2	379.4 - 380.3	0.9	Ø.28
382.6 - 385.6	3.0	382.6 - 383.8	1.2	0.40
3 <b>85.6 - 388.</b> 7	3.1	379.4 - 380.3 382.6 - 383.8 385.6 - 386.7 388.7 - 389.7 391.9 - 392.6	1.1	0.35
388.7 - 391.9	3.2	388.7 - <b>3</b> 89.7	1.0	0.31
391.9 - <b>395.0</b>	3.1	391.9 - 392.6	0.7	0.22
395.0 - 398.1	3.1	395.0 - 396.0 398.1 - 398.6	1.0	0.32
98.1 - 401.2	3.1	398.1 - 398.6	0.5	0.16
101.2 - 405.4	3.2	398.1 - 398.6 401.2 - 402.1 405.4 - 406.0 408.5 - 409.4 411.6 - 412.7 414.7 - 415.6 417.8 - 418.6	Ø.9 Ø.6	0.28
105.4 - 408.5	3.1	405.4 - 406.0	W.6	0.19
111 4 - 411.6	3.1	408.3 - 409.4	Ø.9 i.i	0.29 0.35
111.0 - 717.7	3.1	411.0 - 412.7 414 7 - 415 A	0.9 0.8 1.0	Ø. 29
117.9 - 420.7	2.9	417.8 - 418.6	Ø., A	0.27
120.7 - 424.0	3.3	420.7 - 421.7	1.0	0.30
24.0 - 427.0	3.0	420.7 - 421.7 424.0 - 424.8	2.8	0.26
124.0 - 427.0 127.0 - 429.9	2.9	424.0 - 424.8 427.0 - 427.8	0.8	0.27
29.9 - 432.8	2.9	429.9 - 430.7	0.8	0.27
32.8 - 435.7	2.9	429.9 - 430.7 432.8 - 433.5	Ø.8 Ø.7	0.24
35.7 - 438.1	2.4	435.7 - 436.5 438.1 - 439.0	2.8	0.33
35.7 - 438.1 38.1 - 440.8	2.7	438.1 - 439.0	Ø.8 Ø.9	0.33
40.8 - 443.7	2.9 2.9	440.8 - 441.1 443.7 - 444.4	Ø.6 Ø.7	0.20
143.7 - 446.6	2.9	443.7 - 444.4	0.7	
46.6 - 449.5	2.9	446.6 - 447.6 449.5 - 450.4	1.0 0.9	0.34
149.5 - 452.4	2.9	449.5 - 450.4		
152.4 - 455.2	2.8	452.4 - 453.2	0.8	0.28
155.2 - 458.0		455.2 - 455.8	0.6	0.21
158.0 - 460.9	2.9	458.0 - 458.8	0.8	0.27
160.9 - 463.8	2.9	460.9 - 461.8	<b>0.</b> 9	Ø.31
163.8 - 466.7	2.9	463.8 - 464.4	<b>0.</b> 6	0.20
466.7 - 469.3	2.6	466.7 - 467.4	0.7 0.6	0.27 0.21
469.3 - 472.1 472.1 - 474.8	2.8 2.7	469.3 - 469.9 472.1 - 472.9	Ø.8	0.21
174.8 - 477.7	2.9	474.8 - 475.4	0.6	0.20
177.7 - 480.9	3.2	477.7 - 478.4	0.7	0.21
180.9 - 483.9	3.0	480.9 - 481.7	0.8	0.26

OCT-5 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
				Ø. 25
490.1 - 493.3	3.2	487.0 - 487.8 490.1 - 491.1 493.3 - 494.3 496.5 - 497.4	1.0	0.31
493.3 - 496.5	3.2	493.3 - 494.3	1.0	0.31
496.5 - 499.7	3.2	496.5 - 497.4	1.0 0.9	0.28
499.7 - 502.8	3.1	499.7 - 500.9	1.2	0.38
499.7 - 502.8 502.8 - 505.9	3.1	499.7 - 500.9 502.8 - 503.5	0.7	0.22
<b>505.9 - 509.</b> 3	3.4	505.9 - 506.4 <b>5</b> 09.3 - <b>5</b> 09.9	0.5	0.14
509.3 - 512.4	3.1	<b>50</b> 9.3 - <b>50</b> 9.9	Ø. 6	0.19
512.4 - 515.6	3.2	512.4 - 513.0	Ø.6	0.20
515.6 - 518.7	3.1	512.4 - 513.0 515.6 - 516.5 518.7 - 519.4 522.0 - 522.8	Ø. 9	0.29
518.7 - 522.0	3.3	518.7 - 519.4	0.7	0.21
522.0 - 525.2	3.2	522.0 - 522.8 525.2 - 526.1 528.4 - 529.4 531.5 - 532.3	0.8	0.25
525.2 - 528.4	3.2	525.2 - 526.1	0.9	0.28
528.4 - 531.5 574 5 574.4	3.1	528.4 - 529.4	1.0	0.32
001.0 ~ 004.4 E7/ / - E77 7	2.9	031.0 ~ 032.3	Ø.8	0.27
US4.4 - US7.3 E37 3 - EAD 1	2.7	534.4 - 535.1 537.3 - 538.3	Ø.7 1.0	0.24 0.35
540.1 - 543.1	2.0 7 A	540 1 - 540 0	0.7	Ø.23
543.1 - 546.0	2.0	540.1 - 540.8 543.1 - 544.0	Ø.7 Ø.9	Ø.31
546.0 - 549.0	3.0	546.0 - 546.8	Ø. 8	0.26
549.0 - 551.9	2.9	546.0 - 546.8 549.0 - 549.7	Ø. 7	0.24
551.9 - 554.7	2.8	551.9 - 552.4 554.7 - 555.0 557.5 - 557.9	0.5	0.17
554.7 - 557.5	2.8	554.7 - 555.0	0.3	0.10
557.5 - 560.0	2.5	557.5 - 557.9	0.4	0.16
560.0 - 563.4	3.4	560.0 - 560.7 563.4 - 564.6	0.5	0.20
563.4 - 566.5	3.1	563.4 - 564.6	Ø.5 1.2	0.38
566.5 - 569.6 569.6 - 572.7	3.1	566.5 - 566.7 NO RECOVERY	0.2	0.06
569.6 - 572.7	3.1	NO RECOVERY	0.0	0.00
572.7 - 575.6	2.9	572.7 - 573.7 575.6 - 576.7 578.8 - 579.4 582.0 - 582.3	1.0	0.34
575.6 - 578.8	3.2	575.6 - 576.7	1.1	0.34
578.8 - 582.0	3.2	578.8 - 579.4	0.6	0.18
582.0 - 584.1	2.1	582.0 - 582.3	0.3	0.14
584.1 - 587.5	3.4	584.1 - 584.2 587.5 - 588.1 590.6 - 591.1 593.5 - 594.1	Ø. 1	Ø. Ø3
38/.3 - 370.6 EDG / ED7 E	3.1	587.5 - 588.1	Ø.6	0.19
370.6 - 373.3 507 5 - 504 7	2.7	570.6 - 571.1	W. 5	0.17 0.21
593.5 - 596.3 596.3 - 599.1	2.0	593.5 - 594.1 596.3 - 597.2	v. 6 0. 9	Ø.32
570.3 - 577.1 590 1 - 607 0	2.0	500 1 - 400 0	Ø. 9	Ø.32 Ø.31
407.0 - 404.9	2.7	500.1 - 600.0 602.0 - 602.5	Ø.5	0.17
604.9 - 607.7	2.8	604.9 - 605.7	Ø. 8	0.28
AU/./ - AIU.A	2.9	604.9 - 605.7 607.7 - 608.5	Ø. 8	0.27
610.6 - 613.6	3.0	610.6 - 611.2 613.6 - 614.3 616.5 - 617.2	0.6	0.20
613.6 - 616.5	2.9	613.6 - 614.3	0.7	0.24
616.5 - 619.4	2.9	616.5 - 617.2	<b>0.</b> 7	0.24
619.4 - 622.3	2.9	619.4 - 620.3	0.9	0.31
622.3 - 624.9	2.6	622.3 - 62 <b>3.0</b>	0.7	0.27
624.9 - 627.8	2.9	624.9 - 625.6	0.7	0.24
627.8 - 630.4	2.6	627.8 - 628.6	0.8	0.30
630.4 - 633.3	2.9	630.4 - 631.1	Ø. 7	0.24
633.3 - 636.2	2.9	NO RECOVERY	0.0	0.00
636.2 - 639.2	3.0	636.2 - 636.6	0.4	0.13
639.2 - 642.3	3.1	639.2 - 639.6	Ø. 4 1 ==	Ø.13
642.3 - 645.4 645.4 - 640.5	3.1 3.1	642.3 - 643.8	1.5	Ø.48
645.4 - 648.5 648.5 - 651.6	3.1 3.1	645.4 - 647.0 648.5 - 649.8	1.6 1.3	0.51 0.42
0-44.0 = 001.0	3.1	040.U - 047.G	1.3	₩• 4፫

OCT-5 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
651.6 - 654. <b>3</b>	2.7	651.6 - 652.9 654.3 - 655.9 657.5 - 658.4 660.6 - 661.6 663.7 - 664.4	1.3	0.48
654.3 - 657.5	3.2	654.3 - 655.9	1.6	0.50
57.5 - 660.6	3.1	657.5 ~ 658.4	<b>0.</b> 9	0.29
60.6 - 663.7	3.1	660.6 - 661.6 663.7 - 664.4 666.8 - 667.8 669.9 - 671.1	1.0	0.32
663.7 - 666.8	3.1	663.7 - 664.4	0.7	0.22
566.8 - 669.9	3.1	666-B - 667-B	1.0	0.32
669.9 - 673.2	3.3	669.9 - 671.1	1.2	0.36
573.2 - 676.3	3.1	673.2 - 674.3	1.1	0.35
676.3 - 679.4	3.1 3.1	673.2 - 674.3 676.3 - 677.6	1.1 1.3	0.42
679.4 - 682.5	3.1	679.4 - 680.5	1.1	0.35
679.4 - 682.5 682.5 - 685.6	3.1	679.4 - 680.5 682.5 - 683.4	0.9	0.29
685.6 - 688.8 688.8 - 692.0	3.2	685.6 - 686.9	1.3	0.40
488.8 - <b>492.</b> 0	3.2	685.6 - 686.9 688.8 - 690.0	1.3 1.2	0.37
692.0 - 694.9	2.9	692.0 - 692.8	0.8	0.27
692.0 - 694.9 694.9 - 697.8	2.9 2.9	692.0 - 692.8 694.9 - 696.2	1.3	0.44
697.8 - 700.7	2.9	697.8 ~ 699.3	1.5	0.51
700.7 - 703.7	3.0	697.8 - 699.3 700.7 - 701.7	1.0	0.33
703.7 - 703.7 703.7 - 706.7 706.7 - 709.5	3.0	703.7 - 704.4 704.7 - 707.5	Ø.7	0.23
706.7 - 709.5	2.8	706.7 - 707.5	0.8	<b>0.</b> 28
709.5 - 712.5	3.0	709.5 - 709.9	0.4	0.13
712.5 - 715.4	2.9	709.5 - 709.9 712.5 - 713.2 715.4 - 716.0	0.7	0.24
715.4 - 717.5	2.1	715.4 - 716.0	0.6	0.28
717.5 - 720.5	3.∅	717.5 - 718.4 720.5 - 721.8	0.9	0.30
720.5 - 723.4	2.9	720.5 - 721.8	1.3	0.44
723.4 - 726.2 726.2 - 729.3	2.8	723.4 - 724.5 726.2 - 727.1	1.1	0.39
	3.1	726.2 - 727.1	0.9	0.29
729.3 - 732.2		729.3 - 73 <b>0.0</b> 732.2 - 732.9	0.7	0.24
732.2 - 735.4	3.2	732.2 - 732.9	0.7	0.21
735.4 - 738.4	3.0	735.4 - 735.6 738.4 - 739.1 741.5 - 742.2	0.2	0.06
738.4 - 741.5	3.1	738.4 - 739.1	0.7	0/22
741.5 - 744.6	3.1	741.5 - 742.2	0.7	0.22
744.6 - 747.6	3.0	744.6 - 745.4	0.9	0.26
747.6 - 750.6	3.0	747.6 - 748.5	0.9	0.30
750.6 - 753.7	3.1 3.0	750.6 - 751.8 753.7 - 754.7	1.2	0.38
753.7 - 756.7	3.0	753.7 - 754.7	1.0	0.33
756.7 - 759.8		756.7 - 757.7 759.8 - 761.2	1.0 1.4	0.32
759.8 - 762.8	3.0	759.8 - 761.2	1.4	0.46
762.8 - 765.9	3.1	762.8 - 763.8 765.9 - 766.9 768.8 - 770.0	1.0	0.32
765.9 - 768.8	2.9	765.9 - 766.9	1.0	0.34
768.8 - 771.7	2.9	768.8 - 770.0	1.2	0.41
771.7 - 774.7	3.0	771.7 - 772.8 774.7 - 775.7	1.1	0.36
774.7 - 777.5	2.8	774.7 - 775.7	1.0	0.35
777.5 - 780.2	2.7	777.5 - 778.5 780.2 - 781.2	1.0	Ø.37
780.2 - 783.0	2.8	780.2 - 781.2	1.0	0.35
MATERIAL PRO		780.3 - 781.0	MATERIAL PROP	
783.0 - 785.9	2.9	NO RECOVERY	0.0	0.00
785.9 - 788.6	2.7	785.9 - 787.3	1.4	0.51
788.6 - 791.5	2.9	788.6 - 789.2	0.6	0.20
791.5 - 794.4	2.9	791.5 - 791.9	0.4	0.13
794.4 - 797.3	2.9	797.3 - 798.0	0.8	0.27
797.3 - 800.2	2.9	797.3 - 798.0	0.7	0.24
300.2 - 803.2	3.0	800.2 - 801.2	1.0	0.33
803.2 - 806.1	2.9	803.2 - 804.0	0.8	0.27
306.1 - 809.1 309.1 - 812.2	3.0	806.1 - 806.9	0.8	0.26
	3.1	809.1 - 810.3	1.2	0.38

OCT-5 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
812.2 - 815.4	3,2	812.2 - 813.0	Ø <b>.</b> 8	Ø. 25
815.4 - 818.5	3.1	815.4 - 816.4	1.0	0.32
818.5 - 821.6	3.1	818.5 ~ 819.1	0.6	0.19
B21.6 - B24.7	3.1	821.6 - 822.3	0.7	0.22
324.7 - 827.8	3.1	824.7 - 825.5	0.8	0.25
827.8 - 831.0	3.2	827.8 - 828.6	0.8	0.25
831.0 - 834.1	3.1	831.0 - 831.6	0.6	0.19
334.1 - 837.3	3.2	834.1 - 835.0	0.9	0.28
337.3 - 840.6	3.3	877.3 - 838.1	0.8	0.24
340.6 - 843.6	3.0	840.6 ~ 841.4	0.8	0.26
843.6 - 846.8	3.2	843.6 - 844.6	1.0	0.31
846.8 - 849.9	3.1	846.8 - 847.4	0.6	0.19
849.9 - 851.1	1.2	849.9 - 851.1	1.2	1.00

ODT-6 CORE LOG

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
0.0 - 1.8	1.8	0.0 - 0.9	Ø. 9	0.50
	4	1.8 - 2.2	0.4	0.21
3.7 - 5.6	1.9	3.7 - 5.0	1.3	0.68
5.6 - 7.5	1.9	5.6 - 6.9	1.3	0.48
7.5 - 9.7	2.2	7.5 - 9.0	1.5	0.68
9.7 - 11.7	2.0	9.7 - 11.4	1.7	0.85
11.7 - 13.6	1.9	11.7 - 13.2	1.5	0.79
13.6 - 15.4	1.8	13.6 - 15.3	1.7	0.94
15.4 - 17.4	2.0	15.4 - 17.3	1.9	0.95
1.8 - 3.7 3.7 - 5.6 5.6 - 7.5 7.5 - 9.7 9.7 - 11.7 11.7 - 13.6 13.6 - 15.4 15.4 - 17.4 17.4 - 19.3 19.3 - 21.3	1.9	17.4 - 18.9	1.4	0.74
19.3 - 21.3 21.3 - 23.2	2.0 1.9 2.0	19.3 - 20.6	1.3	0.65
	1.9	21.3 - 23.1	1.8	0.95
23.2 - 25.2	2.0	21.3 - 23.1 23.2 - 25.2	2.0	1.00
25.2 - 27.2	2.0 1.9 1.5	25.2 - 27.2 27.2 - 29.1	2.0	1.00
27.2 - 29.1	1.9	27.2 - 29.1	1.9	1.00
29.1 - 30.6 30.6 - 32.7 32.7 - 34.8	1.5	NO RECOVERY	0.0	0.00
30.6 - 32.7	2.1	30.6 - 31.3	0.7	<b>0.</b> 33
32.7 - 34.8	2.1 2.1 2.2 2.1 2.1 2.0	32.7 - 34.4	1.7	0.81
34.8 - 37.0	2.2	34.8 - 35.3	0.5	0.23
37.0 - 39.1	2.1	37.0 - 39.0	2.0	Ø.95
39.1 - 41.2	2.1	39.1 - 40.8	1.7	0.81
41.2 - 43.2	2.0	41.2 - 42.5	1.3	0.65
41.2 - 43.2 43.2 - 45.2 45.2 - 47.3	2.0 2.1 2.0	43.2 - 45.2	2.0	1.00
45.2 - 47.3	2.1	45.2 - 46.5	1.3	0.62
47.3 - 49.3 49.3 - 51.0	2.0	47.3 - 48.7	1.4	0.70
49.3 - 51.0 51.0 - 53.1	1.7 2.1	49.3 - 50.9	1.6	0.94
	2.1	51.0 - 52.3	1.3	0.62
53.1 - 55.2 55.2 - 57.2	2.1 2.0 2.1 3.0	53.1 - 54.6	1.5	0.71 0.85
57.2 - 59.3	2.0	55.2 - 56.9 57.2 - 58.8	1.7 1.6	0.55 0.76
50 7 - 13 7	Z.1	59.3 - 60.9	1.6	0.75 0.53
17.3 - 62.3 40 7 - 4E 1	ນ.ຍ ກ່ວ	17.0 - 00.7	0.8	Ø. 29
59.3 - 62.3 62.3 - 65.1 65.1 - 67.9	2.8	62.3 - 63.1 65.1 - 66.5	1.4	0.50
67.9 - 70.8	2.9	67.9 - 68.8	Ø.9	0.31
70.0 - 73.0	2. / 3. /A	70.8 - 72.0	1.2	0.40
70.8 - 73.8 73.8 - 76.7	2.9	73.8 - 74.8	1.0	0.34
76.7 - 79.6	2.9	76.7 - 78.0	1.3	0.45
79.6 - 82.0*	2.4	79.6 - 80.5	0.9	Ø.38
82.0 - 84.9		82.0 - 82.9	0.9	0.31
84.9 - 87.9	3.0	84.9 - 85.8	0.9	0.30
87.9 - 90.8	2.9	87.9 - 88.9	1.0	0.34
90.8 - 93.7	2.9	90.8 - 92.2	1.4	0.48
93.7 - 96.6	2.9	93.7 - 94.7	1.0	0.34
93.7 - 96.6 96.6 - 99.6	3.0	96.6 - 98.2	1.6	0.53
99.6 - 102.5	2.9	99.6 - 100.9	1.3	0.45
102.5 - 105.4	2.9 2.9 2.9	102.5 - 103.5	1.0	0.34
105.4 - 108.3	2.9	105.4 - 106.0	0.6	0.21
100 7 - 111 7	2.9	NO RECOVERY	0.0	0.00
111.2 - 113.9	2.7	111.2 - 112.4	1.2	0.44
113.9 - 116.9	3.0	113.9 - 114.9	1.0	0.33
111.2 - 113.9 113.9 - 116.9 116.9 - 119.8	2.9	116.9 - 117.9	1.0	Ø.34

(THIS SAMPLE MAY HAVE BEEN MISMARKED 79.7 - 80.6)

ODT-6 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
119.8 - 122.9	3.1	119.8 - 121.0	1.2	0.39
122.9 - 126.0	3.1	122.9 - 124.0	1.1	0.35
126.0 - 129.0	3.0	126.0 - 127.1	1.1	0.37
129.0 - 132.1	3.1	129.0 - 130.7	1.7	0.55
132.1 - 135.1	3.0	132.1 - 133.2	1.1	0.37
135.1 - 138.2	3.1	135.1 - 136.8	1.7	<b>0.5</b> 5
138.2 - 141.3	3.1	138.2 - 139.8	1.6	<b>0.</b> 52
141.3 - 144.2	2.9	141.3 - 142.7	1.4	0.48
144.2 - 147.3	3.1	144.2 - 145.4	1.2	0.39
147.3 - 150.4	3.1	147.3 - 148.7	1.4	0.45
150.4 - 153.5	3.1	150.4 - 152.1	1.7	<b>0.</b> 55
153.5 - 156.6	3.i	153.5 - 155.1	1.6	0.52
156.6 - 159.6	3.0	156.6 - 157.9	1.3	0.43
159.6 - 162.7	3.1	159.6 - 160.9	1.3	0.42
162.7 - 164.2	1.5	162.7 - 164.2	1.5	1.00

OET-7 CORE LOG

8.0 - 1.9 1.9 1.9 0.0 - 0.6 0.6 0.6 0.32 1.9 - 3.8 1.9 1.9 1.9 - 3.3 1.6 0.84 3.8 - 5.7 1.9 3.8 - 5.5 1.7 0.89 5.7 - 7.6 1.9 5.7 - 6.5 0.8 0.42 7.6 - 9.6 2.0 7.6 - 9.6 2.0 1.00 9.6 - 11.5 1.9 7.6 - 10.9 1.3 0.68 11.5 - 17.3 5.8 11.5 - 12.6 1.1 0.19 17.3 - 18.7 1.4 0.74 19.2 - 21.2 2.0 19.2 - 21.2 2.0 1.00 1.00 1.2 2.1 2.2 2.0 19.2 - 21.2 2.0 1.00 1.00 1.2 2.1 2.2 2.0 19.2 - 21.2 2.0 1.00 1.00 1.00 1.00 1.00 1.00	INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
1.9 - 3.8 1.9 1.9 - 3.3 1.6 0.84 3.8 - 5.7 1.9 3.8 - 5.5 1.7 0.89 5.7 - 7.6 1.9 5.7 - 6.5 0.8 0.42 7.6 - 9.6 2.0 7.6 - 9.6 2.0 1.00 9.6 - 11.5 1.9 9.6 - 10.9 1.3 0.68 11.5 - 17.3 5.8 11.5 - 12.6 1.1 0.19 17.3 - 19.2 1.9 17.3 - 18.7 1.4 0.74 19.2 - 21.2 2.0 19.2 - 21.2 2.0 1.00 21.2 - 25.4 4.2 21.2 - 23.0 1.8 0.43 25.4 - 27.3 1.9 25.4 - 27.2 1.8 0.43 25.4 - 27.3 1.9 25.4 - 27.2 1.8 0.45 27.3 - 29.7 2.4 27.3 - 27.9 0.6 0.25 31.6 - 33.7 2.1 31.6 - 33.0 1.4 0.67 33.7 - 35.8 3.1 6.3 33.7 3.1 1.6 0.53 31.6 - 33.7 2.1 31.6 - 33.0 1.4 0.67 35.7 - 37.8 2.1 35.7 - 37.4 1.7 0.81 35.8 - 39.9 2.1 35.7 - 37.4 1.7 0.81 37.8 - 39.9 2.1 35.7 - 37.4 1.7 0.81 42.2 - 44.3 2.1 42.2 - 43.5 1.6 0.70 42.2 - 44.3 2.1 42.2 - 43.5 1.6 0.70 42.2 - 44.5 2.1 44.3 - 45.7 1.4 0.67 44.4 - 48.4 2.0 46.4 - 48.3 1.9 0.95 44.4 - 50.5 2.1 48.4 - 50.1 1.7 0.85 54.7 - 56.8 2.1 54.7 - 56.1 1.7 0.85 54.7 - 56.8 2.1 54.7 - 56.1 1.7 0.85 54.7 - 56.8 2.1 54.7 - 56.1 1.7 0.85 54.7 - 56.8 2.1 54.7 - 56.1 1.4 0.67 65.7 - 67.9 2.2 65.7 - 67.3 1.6 0.50 69.9 - 72.0 2.1 67.9 - 71.3 1.4 0.67 72.0 - 74.1 2.1 72.0 73.9 1.0 0.50 69.9 - 72.0 2.1 67.9 - 71.3 1.4 0.67 72.0 - 74.1 2.1 72.0 72.9 1.2 0.60 65.7 - 67.9 2.2 65.7 - 67.3 1.6 0.50 69.9 - 72.0 2.1 67.9 - 71.3 1.4 0.67 72.0 - 74.1 2.1 72.0 72.9 1.2 0.60 69.6 - 91.5 1.9 97.9 1.3 0.68 99.6 - 91.5 1.9 97.9 91.3 0.68 99.6 - 91.5 1.9 97.9 91.3 0.68 99.6 - 91.5 1.9 97.9 91.3 0.68 99.6 - 91.5 1.9 97.9 91.3 0.68 99.6 - 91.5 1.9 97.9 91.3 0.68 99.6 - 91.5 1.9 97.6 - 98.4 0.8 0.57 99.0 - 102.0 97.6 - 98.4 0.8 0.57 99.0 - 102.0 97.6 - 98.4 0.8 0.57 99.0 - 102.0 97.6 - 99.8 0.8 0.57 99.0 - 102.0 97.6 99.8 0.8 0.57 99.0 - 102.0 97.0 99.8 0.8 0.57 90.20 97.6 99.0 0.8 0.8 0.57 90.40 97.0 97.0 99.8 0.8 0.57 90.20 97.6 99.0 0.9 0.9 0.8 0.8 0.57 90.20 97.6 99.0 0.9 0.9 0.9 0.8 0.9 0.9 0.9 0.9 0.9 0.9 0.9 0.9 0.9 0.9		1.9		Ø.6	Ø.32
11.5 - 17.3		1.9			
11.5 - 17.3	3.8 - 5.7	1.9	3.8 - 5.5	1.7	Ø.89
11.5 - 17.3	5.7 - 7.6	1.9	5.7 - 6.5	Ø.8	0.42
11.5 - 17.3	7.6 - 9.6	2.0	7, 6,	2.0	1.00
11.5 - 17.3	9.6 - 11.5	1.9	9.6 - 10.9	1.3	0.68
17.3 - 19.2 1.9 17.3 - 18.7 1.4 0.74 19.2 - 21.2 2.0 19.2 - 21.2 2.0 1.00 21.2 - 25.4 4.2 21.2 - 23.0 1.8 0.43 25.4 - 27.3 1.9 25.4 - 27.2 1.8 0.95 27.3 - 29.7 2.4 27.3 - 27.9 0.6 0.25 29.7 - 31.6 1.9 29.7 - 30.7 1.0 0.53 31.6 - 33.7 2.1 31.6 - 33.7 1.0 0.53 31.6 - 33.7 2.0 33.7 - 35.3 1.6 0.80 35.7 - 37.8 2.1 35.6 - 37.4 1.7 0.81 37.8 - 39.9 2.1 35.8 - 39.7 1.9 0.90 39.9 - 42.2 2.3 39.9 - 41.5 1.6 0.70 42.2 - 44.3 2.1 44.3 - 45.7 1.4 0.67 46.4 - 48.4 2.0 46.4 - 48.3 1.9 0.95 48.4 - 50.5 2.1 48.4 - 50.1 1.7 0.81 50.5 - 52.5 2.0 50.5 - 52.2 1.7 0.85 52.5 - 54.7 2.2 52.5 5.3 7 1.2 0.55 54.7 - 56.8 2.1 54.7 - 56.1 1.4 0.67 56.8 - 58.8 2.0 56.8 - 57.4 0.6 0.30 61.6 - 63.7 2.1 61.6 - 62.0 0.4 0.19 65.7 - 67.9 2.2 65.7 - 67.3 1.6 0.50 61.6 - 63.7 2.1 61.6 - 62.0 0.4 0.19 65.7 - 67.9 2.2 65.7 - 67.3 1.6 0.50 61.6 - 63.7 2.1 61.6 - 62.0 0.4 0.73 67.9 - 77.0 2.1 77.9 77.9 77.1 1.0 0.67 72.0 - 77.1 2.1 77.0 - 77.5 1.4 0.67 72.0 - 77.1 2.1 77.0 - 77.5 1.4 0.67 72.0 - 77.9 1.7 76.2 - 77.3 1.1 0.65 77.9 - 89.9 2.0 65.7 - 67.3 1.6 0.73 67.9 - 79.9 1.9 77.9 - 79.1 1.2 0.63 85.6 - 87.6 8.0 79.8 - 81.0 1.2 0.60 85.6 - 87.6 2.0 85.6 - 86.8 1.2 0.60 87.6 - 89.6 2.0 85.6 - 86.8 1.2 0.60 87.6 - 89.6 2.0 85.6 - 86.8 1.2 0.60 87.6 - 89.6 2.0 85.6 - 86.8 1.2 0.60 87.6 - 89.6 2.0 85.6 - 86.8 1.2 0.60 87.6 - 89.6 2.0 85.6 - 86.8 1.2 0.60 87.6 - 89.6 2.0 85.6 - 86.8 1.2 0.60 87.6 - 89.6 2.0 85.6 - 86.8 1.2 0.60 87.6 - 89.6 2.0 85.6 - 86.8 1.2 0.60 87.6 - 89.6 2.0 85.6 - 86.8 1.2 0.60 87.6 - 89.6 2.0 85.6 - 86.8 1.2 0.60 87.6 - 89.6 2.0 85.6 - 86.8 1.2 0.60 87.6 - 99.0 1.4 97.6 - 99.8 0.8 0.6 97.5 - 97.6 2.4 95.2 - 95.8 0.6 0.25 97.6 - 99.0 1.4 97.6 - 99.8 0.8 0.27 97.2 - 97.6 2.4 95.2 - 95.8 0.6 0.25 97.6 - 99.0 1.4 97.6 - 99.8 0.8 0.27 97.2 - 97.6 2.4 95.2 - 95.8 0.6 0.27 97.6 - 99.0 1.4 97.6 - 99.8 0.8 0.60 97.6 - 99.0 1.4 97.6 - 99.8 0.8 0.8 0.40	11.5 - 17.3	5.8	11.5 - 12.6	1.1	0.19
25.4 - 27.3	17.3 - 19.2	1.9	17.3 - 18.7	1.4	0.74
25.4 - 27.3		2.0	19.2 - 21.2	2.0	1.00
25.4 - 27.3	21.2 - 25.4	4.2	21.2 - 23.0		0.43
31.6       - 33.7       2.1       31.6       - 33.0       1.4       0.67         33.7       - 35.7       2.0       33.7       - 35.3       1.6       0.80         35.7       - 37.8       2.1       35.7       - 37.4       1.7       0.81         37.8       - 39.9       2.1       37.8       - 39.7       1.9       0.90         39.9       - 42.2       2.3       39.9       - 41.5       1.6       0.70         42.2       - 44.3       2.1       42.2       - 43.5       1.3       0.62         44.3       - 46.4       2.1       44.3       - 45.7       1.4       0.67         46.4       - 48.4       2.0       46.4       - 48.3       1.9       0.95         48.4       - 50.5       2.1       48.4       - 50.1       1.7       0.81         50.5       - 52.5       2.0       50.5       - 52.2       1.7       0.85         52.5       - 54.7       2.2       52.5       - 53.7       1.2       0.55         54.7       - 56.8       2.0       56.8       - 57.4       0.6       0.30         58.8       - 61.6       62.8       58.8       -	25.4 - 27.3	1.9	25.4 - 27.2	1.8	0.95
31.6       - 33.7       2.1       31.6       - 33.0       1.4       0.67         33.7       - 35.7       2.0       33.7       - 35.3       1.6       0.80         35.7       - 37.8       2.1       35.7       - 37.4       1.7       0.81         37.8       - 39.9       2.1       37.8       - 39.7       1.9       0.90         39.9       - 42.2       2.3       39.9       - 41.5       1.6       0.70         42.2       - 44.3       2.1       42.2       - 43.5       1.3       0.62         44.3       - 46.4       2.1       44.3       - 45.7       1.4       0.67         46.4       - 48.4       2.0       46.4       - 48.3       1.9       0.95         48.4       - 50.5       2.1       48.4       - 50.1       1.7       0.81         50.5       - 52.5       2.0       50.5       - 52.2       1.7       0.85         52.5       - 54.7       2.2       52.5       - 53.7       1.2       0.55         54.7       - 56.8       2.0       56.8       - 57.4       0.6       0.30         58.8       - 61.6       62.8       58.8       -	27.3 - 29.7	2.4	27.3 - 27.9	0.6	0.25
35.7 - 37.8   2.1   35.7 - 37.4   1.7   0.81   37.8 - 39.9   2.1   37.8 - 39.7   1.9   0.90   39.9 - 42.2   2.3   39.9 - 41.5   1.6   0.70   42.2 - 44.3   2.1   42.2 - 43.5   1.3   0.62   44.3 - 46.4   2.1   44.3 - 45.7   1.4   0.67   46.4 - 48.4   2.0   46.4 - 48.3   1.9   0.95   48.4 - 50.5   2.1   48.4 - 50.1   1.7   0.81   50.5 - 52.5   2.0   50.5 - 52.2   1.7   0.85   52.5 - 54.7   2.2   52.5 - 53.7   1.2   0.55   54.7   56.8   2.1   54.7 - 56.1   1.4   0.67   56.8 - 58.8   2.0   56.8 - 57.4   0.6   0.30   58.8 - 61.6   2.8   58.8 - 60.2   1.4   0.50   61.6 - 63.7   2.1   61.6 - 62.0   0.4   0.19   63.7 - 65.7   2.0   63.7 - 64.9   1.2   0.60   65.7 - 67.9   2.2   65.7 - 67.3   1.6   0.73   67.9 - 69.9   2.0   67.9 - 68.9   1.0   0.50   69.9   72.0   72.0   74.1   72.0 - 72.8   0.8   0.8   0.38   74.1 - 76.2   2.1   74.1 - 75.5   1.4   0.67   77.9 - 79.8   1.9   77.9 - 79.1   1.2   0.63   83.7 - 85.6   87.6 - 89.6   2.0   87.6 - 88.9   1.2   0.60   81.8 - 83.7   1.9   81.8 - 83.0   1.2   0.60   81.8 - 83.7   1.9   81.8 - 83.0   1.2   0.60   87.6 - 89.6   87.6 - 89.6   2.0   87.6 - 86.9   1.3   0.68   85.6 - 87.6   89.6   2.0   87.6 - 86.9   1.3   0.68   87.6 - 89.6   87.6 - 89.6   2.0   87.6 - 88.9   1.3   0.68   87.6 - 89.6   97.6 - 99.0   1.3   0.68   0.57   97.0 - 97.0   1.7   97.5 - 97.6   97.6 - 98.7   1.3   0.68   97.6 - 99.0   1.4   97.6 - 98.9   1.3   0.68   0.57   97.0 - 102.0   3.0   99.0 - 99.8   0.8   0.27   102.0 - 104.9   102.0 - 103.3   1.3   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45	27.7	1.9	29.7 - 30.7	1.0	0.53
35.7 - 37.8   2.1   35.7 - 37.4   1.7   0.81   37.8 - 39.9   2.1   37.8 - 39.7   1.9   0.90   39.9 - 42.2   2.3   39.9 - 41.5   1.6   0.70   42.2 - 44.3   2.1   42.2 - 43.5   1.3   0.62   44.3 - 46.4   2.1   44.3 - 45.7   1.4   0.67   46.4 - 48.4   2.0   46.4 - 48.3   1.9   0.95   48.4 - 50.5   2.1   48.4 - 50.1   1.7   0.81   50.5 - 52.5   2.0   50.5 - 52.2   1.7   0.85   52.5 - 54.7   2.2   52.5 - 53.7   1.2   0.55   54.7   56.8   2.1   54.7 - 56.1   1.4   0.67   56.8 - 58.8   2.0   56.8 - 57.4   0.6   0.30   58.8 - 61.6   2.8   58.8 - 60.2   1.4   0.50   61.6 - 63.7   2.1   61.6 - 62.0   0.4   0.19   63.7 - 65.7   2.0   63.7 - 64.9   1.2   0.60   65.7 - 67.9   2.2   65.7 - 67.3   1.6   0.73   67.9 - 69.9   2.0   67.9 - 68.9   1.0   0.50   69.9   72.0   72.0   74.1   72.0 - 72.8   0.8   0.8   0.38   74.1 - 76.2   2.1   74.1 - 75.5   1.4   0.67   77.9 - 79.8   1.9   77.9 - 79.1   1.2   0.63   83.7 - 85.6   87.6 - 89.6   2.0   87.6 - 88.9   1.2   0.60   81.8 - 83.7   1.9   81.8 - 83.0   1.2   0.60   81.8 - 83.7   1.9   81.8 - 83.0   1.2   0.60   87.6 - 89.6   87.6 - 89.6   2.0   87.6 - 86.9   1.3   0.68   85.6 - 87.6   89.6   2.0   87.6 - 86.9   1.3   0.68   87.6 - 89.6   87.6 - 89.6   2.0   87.6 - 88.9   1.3   0.68   87.6 - 89.6   97.6 - 99.0   1.3   0.68   0.57   97.0 - 97.0   1.7   97.5 - 97.6   97.6 - 98.7   1.3   0.68   97.6 - 99.0   1.4   97.6 - 98.9   1.3   0.68   0.57   97.0 - 102.0   3.0   99.0 - 99.8   0.8   0.27   102.0 - 104.9   102.0 - 103.3   1.3   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45	31.6 - 33.7	2.1		1.4	
35.7 - 37.8   2.1   35.7 - 37.4   1.7   0.81   37.8 - 39.9   2.1   37.8 - 39.7   1.9   0.90   39.9 - 42.2   2.3   39.9 - 41.5   1.6   0.70   42.2 - 44.3   2.1   42.2 - 43.5   1.3   0.62   44.3 - 46.4   2.1   44.3 - 45.7   1.4   0.67   46.4 - 48.4   2.0   46.4 - 48.3   1.9   0.95   48.4 - 50.5   2.1   48.4 - 50.1   1.7   0.81   50.5 - 52.5   2.0   50.5 - 52.2   1.7   0.85   52.5 - 54.7   2.2   52.5 - 53.7   1.2   0.55   54.7   56.8   2.1   54.7 - 56.1   1.4   0.67   56.8 - 58.8   2.0   56.8 - 57.4   0.6   0.30   58.8 - 61.6   2.8   58.8 - 60.2   1.4   0.50   61.6 - 63.7   2.1   61.6 - 62.0   0.4   0.19   63.7 - 65.7   2.0   63.7 - 64.9   1.2   0.60   65.7 - 67.9   2.2   65.7 - 67.3   1.6   0.73   67.9 - 69.9   2.0   67.9 - 68.9   1.0   0.50   69.9   72.0   72.0   74.1   72.0 - 72.8   0.8   0.8   0.38   74.1 - 76.2   2.1   74.1 - 75.5   1.4   0.67   77.9 - 79.8   1.9   77.9 - 79.1   1.2   0.63   83.7 - 85.6   87.6 - 89.6   2.0   87.6 - 88.9   1.2   0.60   81.8 - 83.7   1.9   81.8 - 83.0   1.2   0.60   81.8 - 83.7   1.9   81.8 - 83.0   1.2   0.60   87.6 - 89.6   87.6 - 89.6   2.0   87.6 - 86.9   1.3   0.68   85.6 - 87.6   89.6   2.0   87.6 - 86.9   1.3   0.68   87.6 - 89.6   87.6 - 89.6   2.0   87.6 - 88.9   1.3   0.68   87.6 - 89.6   97.6 - 99.0   1.3   0.68   0.57   97.0 - 97.0   1.7   97.5 - 97.6   97.6 - 98.7   1.3   0.68   97.6 - 99.0   1.4   97.6 - 98.9   1.3   0.68   0.57   97.0 - 102.0   3.0   99.0 - 99.8   0.8   0.27   102.0 - 104.9   102.0 - 103.3   1.3   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45   0.45	33.7 - 35.7	2.0	33./ - 35.3	1.6	0.80
39.9 - 42.2       2.3       39.9 - 41.5       1.6       0.70         42.2 - 44.3       2.1       42.2 - 43.5       1.3       0.62         44.3 - 46.4       2.1       44.3 - 45.7       1.4       0.67         46.4 - 48.4       2.0       46.4 - 48.3       1.9       0.95         48.4 - 50.5       2.1       48.4 - 50.1       1.7       0.81         50.5 - 52.5       2.0       50.5 - 52.2       1.7       0.85         52.5 - 54.7       2.2       52.5 - 53.7       1.2       0.55         54.7 - 56.8       2.0       56.8 - 57.4       0.6       0.30         58.8 - 61.6       2.8       58.8 - 60.2       1.4       0.67         61.6 - 63.7       2.1       61.6 - 62.0       0.4       0.19         63.7 - 65.7       2.0       63.7 - 64.9       1.2       0.60         65.7 - 67.9       2.2       65.7 - 67.3       1.6       0.19         67.9 - 69.9       2.0       67.9 - 68.9       1.0       0.50         69.9 - 72.0       2.1       69.9 - 71.3       1.4       0.67         72.0 - 74.1       2.1       72.0 - 77.8       1.4       0.67         76.2 - 77.9       1.7       76.2	35.7 - 37.8	2.1	35.7 - 37.4	1.7	0.81
39.9 - 42.2       2.3       39.9 - 41.5       1.6       0.70         42.2 - 44.3       2.1       42.2 - 43.5       1.3       0.62         44.3 - 46.4       2.1       44.3 - 45.7       1.4       0.67         46.4 - 48.4       2.0       46.4 - 48.3       1.9       0.95         48.4 - 50.5       2.1       48.4 - 50.1       1.7       0.81         50.5 - 52.5       2.0       50.5 - 52.2       1.7       0.85         52.5 - 54.7       2.2       52.5 - 53.7       1.2       0.55         54.7 - 56.8       2.0       56.8 - 57.4       0.6       0.30         58.8 - 61.6       2.8       58.8 - 60.2       1.4       0.67         61.6 - 63.7       2.1       61.6 - 62.0       0.4       0.19         63.7 - 65.7       2.0       63.7 - 64.9       1.2       0.60         65.7 - 67.9       2.2       65.7 - 67.3       1.6       0.19         67.9 - 69.9       2.0       67.9 - 68.9       1.0       0.50         69.9 - 72.0       2.1       69.9 - 71.3       1.4       0.67         72.0 - 74.1       2.1       72.0 - 77.8       1.4       0.67         76.2 - 77.9       1.7       76.2	37.8 - 39.9	2.1		1.9	0.90
42.2 - 44.3	39.9 - 42.2	/m) ~*	39.9 - 41.5	1.6	0.70
56.8       - 58.8       2.0       56.8       - 57.4       0.6       0.30         58.8       - 61.6       2.8       58.8       - 60.2       1.4       0.50         61.6       - 63.7       2.1       61.6       - 62.0       0.4       0.19         63.7       - 65.7       2.0       63.7       - 64.9       1.2       0.60         65.7       - 67.9       2.2       65.7       - 67.3       1.6       0.73         67.9       - 69.9       2.0       67.9       - 68.9       1.0       0.50         69.9       - 72.0       2.1       69.9       - 71.3       1.4       0.67         72.0       - 74.1       2.1       72.0       72.8       0.8       0.38         74.1       - 76.2       2.1       74.1       - 75.5       1.4       0.67         76.2       - 77.9       1.7       76.2       - 77.3       1.1       0.65         77.9       - 79.8       1.9       77.9       - 79.1       1.2       0.63         79.8       - 81.8       2.0       79.8       81.0       1.2       0.60         81.8       - 83.7       1.9       81.8       83.0 </td <td>42.2 - 44.3</td> <td>2.1</td> <td>42.2 - 43.5</td> <td>1.3</td> <td>0.62</td>	42.2 - 44.3	2.1	42.2 - 43.5	1.3	0.62
56.8       - 58.8       2.0       56.8       - 57.4       0.6       0.30         58.8       - 61.6       2.8       58.8       - 60.2       1.4       0.50         61.6       - 63.7       2.1       61.6       - 62.0       0.4       0.19         63.7       - 65.7       2.0       63.7       - 64.9       1.2       0.60         65.7       - 67.9       2.2       65.7       - 67.3       1.6       0.73         67.9       - 69.9       2.0       67.9       - 68.9       1.0       0.50         69.9       - 72.0       2.1       69.9       - 71.3       1.4       0.67         72.0       - 74.1       2.1       72.0       72.8       0.8       0.38         74.1       - 76.2       2.1       74.1       - 75.5       1.4       0.67         76.2       - 77.9       1.7       76.2       - 77.3       1.1       0.65         77.9       - 79.8       1.9       77.9       - 79.1       1.2       0.63         79.8       - 81.8       2.0       79.8       81.0       1.2       0.60         81.8       - 83.7       1.9       81.8       83.0 </td <td>44.3 - 46.4</td> <td>2.1</td> <td>44.3 - 45.7</td> <td>1.4</td> <td></td>	44.3 - 46.4	2.1	44.3 - 45.7	1.4	
56.8       - 58.8       2.0       56.8       - 57.4       0.6       0.30         58.8       - 61.6       2.8       58.8       - 60.2       1.4       0.50         61.6       - 63.7       2.1       61.6       - 62.0       0.4       0.19         63.7       - 65.7       2.0       63.7       - 64.9       1.2       0.60         65.7       - 67.9       2.2       65.7       - 67.3       1.6       0.73         67.9       - 69.9       2.0       67.9       - 68.9       1.0       0.50         69.9       - 72.0       2.1       69.9       - 71.3       1.4       0.67         72.0       - 74.1       2.1       72.0       72.8       0.8       0.38         74.1       - 76.2       2.1       74.1       - 75.5       1.4       0.67         76.2       - 77.9       1.7       76.2       - 77.3       1.1       0.65         77.9       - 79.8       1.9       77.9       - 79.1       1.2       0.63         79.8       - 81.8       2.0       79.8       81.0       1.2       0.60         81.8       - 83.7       1.9       81.8       83.0 </td <td>46.4 - 48.4</td> <td>2.0</td> <td>46.4 - 48.3</td> <td>1.9</td> <td>0.95</td>	46.4 - 48.4	2.0	46.4 - 48.3	1.9	0.95
56.8       - 58.8       2.0       56.8       - 57.4       0.6       0.30         58.8       - 61.6       2.8       58.8       - 60.2       1.4       0.50         61.6       - 63.7       2.1       61.6       - 62.0       0.4       0.19         63.7       - 65.7       2.0       63.7       - 64.9       1.2       0.60         65.7       - 67.9       2.2       65.7       - 67.3       1.6       0.73         67.9       - 69.9       2.0       67.9       - 68.9       1.0       0.50         69.9       - 72.0       2.1       69.9       - 71.3       1.4       0.67         72.0       - 74.1       2.1       72.0       72.8       0.8       0.38         74.1       - 76.2       2.1       74.1       - 75.5       1.4       0.67         76.2       - 77.9       1.7       76.2       - 77.3       1.1       0.65         77.9       - 79.8       1.9       77.9       - 79.1       1.2       0.63         79.8       - 81.8       2.0       79.8       81.0       1.2       0.60         81.8       - 83.7       1.9       81.8       83.0 </td <td>48.4 - 50.5</td> <td>2.1</td> <td>48.4 - 50.1</td> <td>1.7</td> <td>0.81</td>	48.4 - 50.5	2.1	48.4 - 50.1	1.7	0.81
56.8       - 58.8       2.0       56.8       - 57.4       0.6       0.30         58.8       - 61.6       2.8       58.8       - 60.2       1.4       0.50         61.6       - 63.7       2.1       61.6       - 62.0       0.4       0.19         63.7       - 65.7       2.0       63.7       - 64.9       1.2       0.60         65.7       - 67.9       2.2       65.7       - 67.3       1.6       0.73         67.9       - 69.9       2.0       67.9       - 68.9       1.0       0.50         69.9       - 72.0       2.1       69.9       - 71.3       1.4       0.67         72.0       - 74.1       2.1       72.0       72.8       0.8       0.38         74.1       - 76.2       2.1       74.1       - 75.5       1.4       0.67         76.2       - 77.9       1.7       76.2       - 77.3       1.1       0.65         77.9       - 79.8       1.9       77.9       - 79.1       1.2       0.63         79.8       - 81.8       2.0       79.8       81.0       1.2       0.60         81.8       - 83.7       1.9       81.8       83.0 </td <td>50.5 - 52.5</td> <td>2.0</td> <td>50.5 - 52.2</td> <td>1.7</td> <td>0.85</td>	50.5 - 52.5	2.0	50.5 - 52.2	1.7	0.85
56.8       - 58.8       2.0       56.8       - 57.4       0.6       0.30         58.8       - 61.6       2.8       58.8       - 60.2       1.4       0.50         61.6       - 63.7       2.1       61.6       - 62.0       0.4       0.19         63.7       - 65.7       2.0       63.7       - 64.9       1.2       0.60         65.7       - 67.9       2.2       65.7       - 67.3       1.6       0.73         67.9       - 69.9       2.0       67.9       - 68.9       1.0       0.50         69.9       - 72.0       2.1       69.9       - 71.3       1.4       0.67         72.0       - 74.1       2.1       72.0       72.8       0.8       0.38         74.1       - 76.2       2.1       74.1       - 75.5       1.4       0.67         76.2       - 77.9       1.7       76.2       - 77.3       1.1       0.65         77.9       - 79.8       1.9       77.9       - 79.1       1.2       0.63         79.8       - 81.8       2.0       79.8       81.0       1.2       0.60         81.8       - 83.7       1.9       81.8       83.0 </td <td>52.5 - 54.7</td> <td>2.2</td> <td>52.5 - <b>5</b>3.7</td> <td>1.2</td> <td>0.55</td>	52.5 - 54.7	2.2	52.5 - <b>5</b> 3.7	1.2	0.55
63.7       65.7       2.0       63.7       64.9       1.2       0.60         65.7       67.9       2.2       65.7       67.3       1.6       0.73         67.9       69.9       2.0       67.9       68.9       1.0       0.50         69.9       72.0       2.1       69.9       71.3       1.4       0.67         72.0       74.1       2.1       72.0       72.8       0.8       0.38         74.1       76.2       2.1       74.1       75.5       1.4       0.67         76.2       77.9       1.7       76.2       77.3       1.1       0.65         77.9       79.8       1.9       77.9       79.1       1.2       0.63         79.8       81.8       2.0       79.8       81.0       1.2       0.63         79.8       81.8       2.0       79.8       81.0       1.2       0.63         81.8       83.7       1.9       81.8       83.0       1.2       0.63         83.7       85.6       1.9       83.7       85.0       1.3       0.68         85.6       87.6       89.6       89.6       1.3       0.65	54.7 - 56.8	2.1	54.7 - 56.1		
63.7       65.7       2.0       63.7       64.9       1.2       0.60         65.7       67.9       2.2       65.7       67.3       1.6       0.73         67.9       69.9       2.0       67.9       68.9       1.0       0.50         69.9       72.0       2.1       69.9       71.3       1.4       0.67         72.0       74.1       2.1       72.0       72.8       0.8       0.38         74.1       76.2       2.1       74.1       75.5       1.4       0.67         76.2       77.9       1.7       76.2       77.3       1.1       0.65         77.9       79.8       1.9       77.9       79.1       1.2       0.63         79.8       81.8       2.0       79.8       81.0       1.2       0.63         79.8       81.8       2.0       79.8       81.0       1.2       0.63         81.8       83.7       1.9       81.8       83.0       1.2       0.63         83.7       85.6       1.9       83.7       85.0       1.3       0.68         85.6       87.6       89.6       89.6       1.3       0.65	56.8 - 58.8	2.0	56.8 - 57.4	0.6	0.30
63.7       65.7       2.0       63.7       64.9       1.2       0.60         65.7       67.9       2.2       65.7       67.3       1.6       0.73         67.9       69.9       2.0       67.9       68.9       1.0       0.50         69.9       72.0       2.1       69.9       71.3       1.4       0.67         72.0       74.1       2.1       72.0       72.8       0.8       0.38         74.1       76.2       2.1       74.1       75.5       1.4       0.67         76.2       77.9       1.7       76.2       77.3       1.1       0.65         77.9       79.8       1.9       77.9       79.1       1.2       0.63         79.8       81.8       2.0       79.8       81.0       1.2       0.63         79.8       81.8       2.0       79.8       81.0       1.2       0.63         81.8       83.7       1.9       81.8       83.0       1.2       0.63         83.7       85.6       1.9       83.7       85.0       1.3       0.68         85.6       87.6       89.6       89.6       1.3       0.65		2.8	58.8 - 60.2	1.4	0.50
63.7       65.7       2.0       63.7       64.9       1.2       0.60         65.7       67.9       2.2       65.7       67.3       1.6       0.73         67.9       69.9       2.0       67.9       68.9       1.0       0.50         69.9       72.0       2.1       69.9       71.3       1.4       0.67         72.0       74.1       2.1       72.0       72.8       0.8       0.38         74.1       76.2       2.1       74.1       75.5       1.4       0.67         76.2       77.9       1.7       76.2       77.3       1.1       0.65         77.9       79.8       1.9       77.9       79.1       1.2       0.63         79.8       81.8       2.0       79.8       81.0       1.2       0.63         79.8       81.8       2.0       79.8       81.0       1.2       0.63         81.8       83.7       1.9       81.8       83.0       1.2       0.63         83.7       85.6       1.9       83.7       85.0       1.3       0.68         85.6       87.6       89.6       89.6       1.3       0.65	/ 4 / / 7 7	2.1	61.6 - 62.0	0.4	
67.9 - 72.0       2.1       69.9 - 71.3       1.4       0.67         72.0 - 74.1       2.1       72.0 - 72.8       0.8       0.38         74.1 - 76.2       2.1       74.1 - 75.5       1.4       0.67         76.2 - 77.9       1.7       76.2 - 77.3       1.1       0.65         77.9 - 79.8       1.9       77.9 - 79.1       1.2       0.63         79.8 - 81.8       2.0       79.8 - 81.0       1.2       0.63         81.8 - 83.7       1.9       81.8 - 83.0       1.2       0.63         83.7 - 85.6       1.9       83.7 - 85.0       1.3       0.68         85.6 - 87.6       2.0       85.6 - 86.8       1.2       0.60         87.6 - 89.6       2.0       87.6 - 88.9       1.3       0.65         89.6 - 91.5       1.9       89.6 - 90.9       1.3       0.65         89.6 - 91.5       1.9       89.6 - 90.9       1.3       0.65         89.6 - 91.5       1.9       89.6 - 90.9       1.3       0.68         91.5 - 93.2       1.7       91.5 - 92.7       1.2       0.71         93.2 - 95.2       2.0       93.2 - 94.0       0.8       0.40         95.2 - 97.6       2.4       95.2	63.7 - 65.7	2.0	63.7 - 64.9	1.2	0.60
67.9 - 72.0       2.1       69.9 - 71.3       1.4       0.67         72.0 - 74.1       2.1       72.0 - 72.8       0.8       0.38         74.1 - 76.2       2.1       74.1 - 75.5       1.4       0.67         76.2 - 77.9       1.7       76.2 - 77.3       1.1       0.65         77.9 - 79.8       1.9       77.9 - 79.1       1.2       0.63         79.8 - 81.8       2.0       79.8 - 81.0       1.2       0.63         81.8 - 83.7       1.9       81.8 - 83.0       1.2       0.63         83.7 - 85.6       1.9       83.7 - 85.0       1.3       0.68         85.6 - 87.6       2.0       85.6 - 86.8       1.2       0.60         87.6 - 89.6       2.0       87.6 - 88.9       1.3       0.65         89.6 - 91.5       1.9       89.6 - 90.9       1.3       0.65         89.6 - 91.5       1.9       89.6 - 90.9       1.3       0.65         89.6 - 91.5       1.9       89.6 - 90.9       1.3       0.68         91.5 - 93.2       1.7       91.5 - 92.7       1.2       0.71         93.2 - 95.2       2.0       93.2 - 94.0       0.8       0.40         95.2 - 97.6       2.4       95.2	65.7 - 67.9	2.2	65.7 - 67.3	1.6	0.73
76.2 - 77.9	67.9 - 69.9	2.0	67.9 - 68.9	1.0	0.50
76.2 - 77.9	69.9 - 72.0	2.1	69.9 - 71.3	1.4	0.67
76.2 - 77.9	72.0 - 74.1	2.1	72.0 - 72.8	0.8	Ø.38
76.2 - 77.9	74.1 - 76.2	2.1		1.4	0.67
79.8 - 81.8       2.0       79.8 - 81.0       1.2       0.60         81.8 - 83.7       1.9       81.8 - 83.0       1.2       0.63         83.7 - 85.6       1.9       83.7 - 85.0       1.3       0.68         85.6 - 87.6       2.0       85.6 - 86.8       1.2       0.60         87.6 - 89.6       2.0       87.6 - 88.9       1.3       0.65         89.6 - 91.5       1.9       89.6 - 90.9       1.3       0.68         91.5 - 93.2       1.7       91.5 - 92.7       1.2       0.71         93.2 - 95.2       2.0       93.2 - 94.0       0.8       0.40         95.2 - 97.6       2.4       95.2 - 95.8       0.6       0.25         97.6 - 99.0       1.4       97.6 - 98.4       0.8       0.57         99.0 - 102.0       3.0       99.0 - 99.8       0.8       0.27         102.0 - 104.9       2.9       102.0 - 103.3       1.3       0.45         104.9 - 107.9       3.0       104.9 - 106.1       1.2       0.40	76.2 - 77.9	1.7	76.2 - 77.3		0.65
79.8 - 81.8       2.0       79.8 - 81.0       1.2       0.60         81.8 - 83.7       1.9       81.8 - 83.0       1.2       0.63         83.7 - 85.6       1.9       83.7 - 85.0       1.3       0.68         85.6 - 87.6       2.0       85.6 - 86.8       1.2       0.60         87.6 - 89.6       2.0       87.6 - 88.9       1.3       0.65         89.6 - 91.5       1.9       89.6 - 90.9       1.3       0.68         91.5 - 93.2       1.7       91.5 - 92.7       1.2       0.71         93.2 - 95.2       2.0       93.2 - 94.0       0.8       0.40         95.2 - 97.6       2.4       95.2 - 95.8       0.6       0.25         97.6 - 99.0       1.4       97.6 - 98.4       0.8       0.57         99.0 - 102.0       3.0       99.0 - 99.8       0.8       0.27         102.0 - 104.9       2.9       102.0 - 103.3       1.3       0.45         104.9 - 107.9       3.0       104.9 - 106.1       1.2       0.40	77.9 - 79.8	1.9	77.9 - 79.1	1.2	0.63
83.7 - 85.6       1.9       83.7 - 85.0       1.3       0.68         85.6 - 87.6       2.0       85.6 - 86.8       1.2       0.60         87.6 - 89.6       2.0       87.6 - 88.9       1.3       0.65         89.6 - 91.5       1.9       89.6 - 90.9       1.3       0.68         91.5 - 93.2       1.7       91.5 - 92.7       1.2       0.71         93.2 - 95.2       2.0       93.2 - 94.0       0.8       0.40         95.2 - 97.6       2.4       95.2 - 95.8       0.6       0.25         97.6 - 99.0       1.4       97.6 - 98.4       0.8       0.57         99.0 - 102.0       3.0       99.0 - 99.8       0.8       0.27         102.0 - 104.9       2.9       102.0 - 103.3       1.3       0.45         104.9 - 107.9       3.0       104.9 - 106.1       1.2       0.40	79.8 - 81.8	2.0	79.8 - 81.0	1.2	0.60
85.6 - 87.6	81.8 - 83.7	1.9	81.8 - 83.0	1.2	0.63
85.6 - 87.6	83.7 - 85.6	1.9	83.7 - 85.Ø	1.3	0.68
89.6 - 91.5       1.9       89.6 - 90.9       1.3       0.68         91.5 - 93.2       1.7       91.5 - 92.7       1.2       0.71         93.2 - 95.2       2.0       93.2 - 94.0       0.8       0.40         95.2 - 97.6       2.4       95.2 - 95.8       0.6       0.25         97.6 - 99.0       1.4       97.6 - 98.4       0.8       0.57         99.0 - 102.0       3.0       99.0 - 99.8       0.8       0.27         102.0 - 104.9       2.9       102.0 - 103.3       1.3       0.45         104.9 - 107.9       3.0       104.9 - 106.1       1.2       0.40	85.6 - 87.6	2.0	85.6 - 86.8	1.2	0.60
93.2 - 95.2     2.0     93.2 - 94.0     0.8     0.40       95.2 - 97.6     2.4     95.2 - 95.8     0.6     0.25       97.6 - 99.0     1.4     97.6 - 98.4     0.8     0.57       99.0 - 102.0     3.0     99.0 - 99.8     0.8     0.27       102.0 - 104.9     2.9     102.0 - 103.3     1.3     0.45       104.9 - 107.9     3.0     104.9 - 106.1     1.2     0.40	87.6 - 89.6	2.0	87.6 - 88.9	1.3	0.65
93.2 - 95.2     2.0     93.2 - 94.0     0.8     0.40       95.2 - 97.6     2.4     95.2 - 95.8     0.6     0.25       97.6 - 99.0     1.4     97.6 - 98.4     0.8     0.57       99.0 - 102.0     3.0     99.0 - 99.8     0.8     0.27       102.0 - 104.9     2.9     102.0 - 103.3     1.3     0.45       104.9 - 107.9     3.0     104.9 - 106.1     1.2     0.40	89.6 - 91.5	1.9	89.6 - 90.9	1.3	0.68
93.2 - 95.2     2.0     93.2 - 94.0     0.8     0.40       95.2 - 97.6     2.4     95.2 - 95.8     0.6     0.25       97.6 - 99.0     1.4     97.6 - 98.4     0.8     0.57       99.0 - 102.0     3.0     99.0 - 99.8     0.8     0.27       102.0 - 104.9     2.9     102.0 - 103.3     1.3     0.45       104.9 - 107.9     3.0     104.9 - 106.1     1.2     0.40	91.5 - 93.2	1.7	91.5 - 92.7	1.2	0.71
99.0 - 102.0 3.0 99.0 - 99.8 0.8 0.27 102.0 - 104.9 2.9 102.0 - 103.3 1.3 0.45 104.9 - 107.9 3.0 104.9 - 106.1 1.2 0.40	93.2 - 95.2	2.0		0.8	0.40
99.0 - 102.0 3.0 99.0 - 99.8 0.8 0.27 102.0 - 104.9 2.9 102.0 - 103.3 1.3 0.45 104.9 - 107.9 3.0 104.9 - 106.1 1.2 0.40	95.2 - 97.6	2.4		0.6	0.25
99.0 - 102.0 3.0 99.0 - 99.8 0.8 0.27 102.0 - 104.9 2.9 102.0 - 103.3 1.3 0.45 104.9 - 107.9 3.0 104.9 - 106.1 1.2 0.40	97.6 - 99.0	1.4		0.8	0.57
102.0 - 104.9     2.9     102.0 - 103.3     1.3     0.45       104.9 - 107.9     3.0     104.9 - 106.1     1.2     0.40       107.9 - 110.8     2.9     107.9 - 109.2     1.3     0.45       110.8 - 113.7     2.9     110.8 - 111.6     0.8     0.28       113.7 - 116.7     3.0     113.7 - 114.5     0.8     0.27	99.0 - 102.0	3.0	99.0 - 99.8		0.27
104.9 - 107.9     3.0     104.9 - 106.1     1.2     0.40       107.9 - 110.8     2.9     107.9 - 109.2     1.3     0.45       110.8 - 113.7     2.9     110.8 - 111.6     0.8     0.28       113.7 - 116.7     3.0     113.7 - 114.5     0.8     0.27	102.0 - 104.9	2.9	102.0 - 103.3		
107.9 - 110.8     2.9     107.9 - 109.2     1.3     0.45       110.8 - 113.7     2.9     110.8 - 111.6     0.8     0.28       113.7 - 116.7     3.0     113.7 - 114.5     0.8     0.27	104.9 - 107.9	3.0	104.9 - 106.1	1.2	
110.8 - 113.7     2.9     110.8 - 111.6     0.8     0.28       113.7 - 116.7     3.0     113.7 - 114.5     0.8     0.27	107.9 - 110.8	2.9	107.9 - 109.2	1.3	
113.7 - 116.7 3.0 113.7 - 114.5 0.8 0.27	110.8 - 113.7	2.9	110.8 - 111.6	Ø.8	
	113.7 - 116.7	3.0	113.7 - 114.5	0.8	0.27

OET-7 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
116.7 - 119.6	2.9	116.7 - 117.8	1.1	0.38
19.6 - 122.6		119.6 - 120.9	1.3	0.43
22.6 - 125.1	2.5	119.6 - 120.9 122.6 - 124.1	1.5	0.60
25.1 - 128.0		125.1 - 126.6	1.6	0.55
28.0 - 131.0		128.0 - 129.5	1.5	0.50
131.0 - 133.9	20	131.0 - 132.4	1.4	0.48
33.9 - 136.8	2.9	133.9 - 135.5	1.6	0.55
36.8 - 139.8	3.0	136.8 - 138.0	1.2	0.40
39.8 - 142.7	2.9 2.9	139.8 - 140.5 142.7 - 143.8	0.7	0.24
142.7 - 145.6				0.38
45.6 - 148.6	3.0	145.6 - 146.7		0.37
148.6 - 151.5		148.6 - 149.8	1.2	0.41
151.5 - 154.3	2.0	151.5 - 152.6	1.1	0.39
154.3 - 157.2	2.9	154.3 - 155.4	1.1	0.38
57.2 - 160.2		157.2 - 160.2	1.5	0.50
.60.2 - 163.3	3.1	160.2 - 161.4	1.2	0.39
.63.3 - 166.4	3.1	163.3 - 164.4	1.1	<b>0.</b> 35
166.4 - 169.5	3.1			0.58
169.5 - 172.5		169.5 - 171.1	1.6	<b>0.5</b> 3
172.5 - 175.6	3.1	169.5 - 1/1.1 172.5 - 174.1	1.6	0.52
175.6 - 178.7	3.1	1/3.0 - 1//.0	1.4	0.45
178.7 - 181.8	3.1	178.7 - 180.2 181.8 - 183.0 184.8 - 186.1	1.5	Ø.48
181.8 - 184.8	3.0	181.8 - 183.0	1.2	0.40
	3.0	184.8 - 186.1	1.3	0.43
87.8 - 190.9	3.1	187.8 - 189.6	1.8	0.58
190.9 - 194.1	3.2	190.9 - 192.6	1.7	<b>0.5</b> 3
94.1 - 197.3		194.1 - 195.2	1.1	0.34
197.3 - 201.6	4.3			0.21
201.6 - 204.7	3.1	201.6 - 202.6	1.0	0.33
204.7 - 207.7	3.0	204.7 - 205.8	1.1	0.37
207.7 - 210.7	3.0		0.9	0.30
210.7 - 213.6			1.3	0.45
213.6 - 216.3	2.7	213.6 - 214.3	0.7	0.26
216.3 - 219.2		216.3 - 217.2	0.9	0.31
219.2 - 222.1	2.9	219.2 - 220.4	1.2	0.41
222.1 - 225.0	2.9	217.2 - 220.4 222.1 - 223.2 225.0 - 225.4 227.9 - 228.5	1.1	0.38
225.0 - 227.9	2.9	225.0 - 225.4		0.14
				0.21
230.7 - 231.7	1.0	230.7 - 231.7	1.0	1.00

OFT-8 CORE LOG

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
<b>0.0 -</b> 2.2	2.2	Ø.Ø - 1.Ø	1.0	Ø.45
2.2 - 4.2	2.0	00 70	0.8	0.40
4.2 - 6.3	2.0	4.2 - 5.1 6.3 - 7.1	Ø ♥	0.43
4.2 - 6.3 6.3 - 8.6 8.6 - 10.8 10.8 - 12.7 12.7 - 14.6 14.6 - 16.4 16.4 - 18.3 18.3 - 20.2 20.2 - 22.1 22.1 - 24.0 24.0 - 25.9 25.9 - 27.5 27.5 - 29.4 29.4 - 31.3 31.3 - 33.2 33.2 - 34.9 34.9 - 37.1 37.1 - 39.0	2.3	6.3 - 7.1 8.6 - 9.1 10.8 - 12.7 12.7 - 13.3 14.6 - 15.5 16.4 - 17.2 18.3 - 19.3 20.2 - 20.5 22.1 - 23.3 24.0 - 25.0 25.9 - 26.7 27.5 - 28.5 29.4 - 30.6 31.3 - 32.1 33.2 - 34.0 34.9 - 35.6 37.1 - 38.3	0.8	0.35
8.6 - 10.8	2.2	8.4 - 9.1	0.5 1.2 0.6 0.9	0.23
10.8 - 12.7	1.9	10.8 - 12.7	1.2	0.63
12.7 - 14.6	1.9	12.7 - 13.3	0.6	0.32
14-6 - 16-4	1.8	14.6 - 15.5	0.9	0.50
16.4 18.3	1.9	16.4 - 17.2	0.8	0.42
18.3 - 20.2	1.9	18.3 - 19.3	1.0	0.53
20.2 - 22.1	1.9	20.2 - 20.5	0.6 0.9 0.8 1.0 0.3	0.16
22.1 - 24.0	1.9	22.1 - 23.3	1.2	0.63
24.0 - 25.9	1.9	24.0 - 25.0	1.0	0.53
25.9 - 27.5	1.6	25.9 - 26.7	0.8	0.50
27.5 - 29.4	1.9	27.5 - 28.5	1.0	0.53
29.4 - 31.3	1.9	29.4 - 30.6	1.2	0.63
31.3 - 33.2	1.9	31.3 - 32.1	0.8	0.42
33.2 - 34.9	1.7	33.2 - 34.0	0.8	0.47
34.9 - 37.1	2.2	34.9 - 35.4	0.7	0.32
34.9 - 37.1 37.1 - 39.0	1 0	371 - 393	1.2	0.63
30 D - 40 0	1 0	3/.1 - 30.3	1.3	0.68
40.9 - 42.9	1 0	40 0 - 42 1	1.2	0.63
42 8 - 44 6	1 😡	42 9 - 44 2	1.4	0.78
44.6 - 46.4	20	44 4 4 45 0	1.3	0.65
46 A - 48 3	1 9	46 4 - 47 7	Ø. 8	0.42
34.9 - 37.1 37.1 - 39.0 39.0 - 40.9 40.9 - 42.8 42.8 - 44.6 44.6 - 46.4 46.4 - 48.3 48.3 - 49.9 49.9 - 52.0 52.0 - 54.2 54.2 - 56.4 56.4 - 58.5 58.5 - 60.6	1 6	37.1 - 38.3 37.0 - 40.3 40.9 - 42.1 42.8 - 44.2 44.6 - 45.9 46.4 - 47.2 48.3 - 49.1 49.9 - 50.1 52.0 - 52.7 54.2 - 55.2 56.4 - 57.0 58.5 - 59.2 60.6 - 61.1 63.0 - 68.2 70.2 - 71.8	<b>0.</b> 8	0.50
49.9 - 52.0	2 1	49 9 - 50 1	Ø.2	0.10
52.0 - 54.2	2 2	52 0 - 52 7	0.7	0.32
54.2 - 54.4	2.2	54 2 - 55 2	1.0	0.45
56.4 - 58.5	2.1	54.4 - 57.0	0.6	0.29
58.5 - 60.6	2.1	59.5 - 59.2	0.7	0.33
58.5 - 60.6 60.6 - 63.8 63.8 - 67.0	3.2	60.6 - 61.1	0.5	0.16
43 A - 47 B	7 7	47 9 - 45 1	1.3	0.41
67.0 - 70.2	3.2	67.0 - 68.2		0.38
70.2 - 73.3	3.1	70.2 - 71.9	1.6	Ø.52
73.3 - 76.0	2.7	73.3 - 74.4	1.1	0.41
76.0 - 80.1	4.1	76.0 - 77.5	1.5	0.37
80.1 - 83.2	3-1	80.1 - 81.4	1.3	0.42
83.2 - 86.4	3.2	83.2 - 84.2	1.0	0.31
86.4 - 89.4	3.0	86.4 - 87.7	1.3	Ø. 43
89.4 - 92.5	3.1	89.4 - 90.2	0.8	0.26
92.5 - 95.8	3.3	92.5 - 93.4	0.9	0.27
95.8 - 98.9	3.1	95.8 - 96.9	1.1	Ø.35
98.9 - 102.A	3.7	98.9 - 100.1	1.2	<b>0.</b> 32
56.4 - 58.5 58.5 - 60.6 60.6 - 63.8 67.0 - 70.2 70.2 - 73.3 73.3 - 76.0 76.0 - 80.1 80.1 - 83.2 83.2 - 86.4 89.4 - 92.5 92.5 - 95.8 98.9 - 102.6 105.7 - 108.6 108.6 - 111.4 111.4 - 114.3 117.3 - 127.1	3.1	67.0 - 68.2 70.2 - 71.8 73.3 - 74.4 76.0 - 77.5 80.1 - 81.4 83.2 - 84.2 86.4 - 87.7 89.4 - 90.2 92.5 - 93.4 95.8 - 96.9 98.9 - 100.1 102.6 - 103.5 105.7 - 107.1	0.9	0.29
105.7 - 109.4	2 0	105.7 - 107 1	1.4	0.48
108.6 - 111 4	2.8	105.7 - 107.1 108.6 - 109.7 111.4 - 112.6 114.3 - 115.8	1.1	0.39
111 A - 114 T	2.0	111.4 - 117.4	1.2	0.41
114.3 - 117 3	7. O	114 3 - 115 0	1.5	0.50
114.3 - 117.3 117.3 - 120.1	2.0	117 7 - 110 5	1.2	Ø. 43
120.1 - 123.0	2.9	117.3 - 118.5 120.1 - 121.3 123.0 - 124.1	1.2	0.41
123.0 - 125.0	20	123.0 - 124.1	1.1	Ø.38
123.0 - 123.9	2.7	123.0 - 124.1	1.1	M. 20

OFT-8 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
125.9 - 128.7	2.0	105 0 10/ 4	<b>7.</b> 5	<b>9.10</b>
128.7 - 131.6			<b>4.</b> 5	0.18 0.45
131.6 - 134.5		131.6 - 133.0	1.4	Ø.43 Ø.48
MATERIAL PRO		15110 15510	MATERIAL PROPE	e. TO
134.5 - 137.4		134 5 - 134 3	1.8	0.62
137.4 - 140.3		134.5 - 136.3 137.4 - 138.9	1.5	Ø.52
140.3 - 143.2	2.9	140.3 - 141.4	1.3	0.45
143.2 - 146.1	2.9 2.9	140.3 - 141.6 143.2 - 144.3	1.3 1.1	Ø.38
146.1 - 148.9	2.8	146.1 - 147.4	1.3	0.46
148.9 - 151.8	2.8 2.9	148.9 - 150.1	1.2	0.41
151.8 - 154.6	2.8	151.8 - 152.9	1.1	0.39
154.6 - 157.4	2.8 2.8	154.6 - 155.7	1.1	0.39
157.4 - 160.3	2.9	157.4 - 158.7	1.3	Ø.45
160.3 - 162.9	2.6	160.3 - 161.3	1.0	0.38
162.9 - 165.7	2.8	162.9 - 164.3	1.4	Ø.50
165.7 - 168.7	3.0	165.7 - 166.3	0.6	0.20
168.7 - 171.6	2.9	168.7 - 169.4	0.7	0.24
171.6 - 174.4		171.6 - 171.9	0,3	0.11
174.4 - 177.3	2.9	174.4 - 174.7	0.3	0.10
177.3 - 180.1	2.8	177.3 - 178.1	0.8	Ø. 29
180.1 - 183.0	2.9	180.1 - 181.0	0.9	0.31
183.0 - 185.9		183.0 - 183.9	0.9	0.31
185.9 - 188.8		193.7 - 186.8	W. 7	0.31
188.8 - 191.8	3.0	188.8 - 189.7	0.9	0.30
191.8 - 195.1	3.3	191.8 - 192.9	1.1	<b>0.3</b> 3
195.1 - 198.2		195.1 - 196.2		Ø.35
198.2 - 201.3		198.2 - 199.7	1.5	0.48
201.3 - 204.4	3.1	201.3 - 202.4		0.35
204.4 - 207.6 207.6 - 210.7		204.4 - 205.3 207.6 - 208.7	0.9	Ø.28
210.7 - 213.8		207.6 - 208.7	1.1 0.6	0.35 0.19
213.8 - 216.9		210.7 - 211.3 213.8 - 215.1	1.3	Ø. 17 Ø. 42
216.9 - 220.1	3.2	216.9 - 217.8	0.9	0.28
220.1 - 223.4	3.3	220.1 - 220.6	Ø.5	0.15
223.4 - 226.6	3.2	223.4 - 224.4	1.0	Ø.31
226.6 - 230.4		226.6 - 228.2	1.6	0.42
230.4 - 233.5	3.1	230.4 - 231.3	0.9	0.29
233.5 - 236.7		233.5 - 234.3	0.8	Ø. 25
236.7 - 239.8	3.1	236.7 - 237.3	0.6	0.19
239.8 - 243.3	3.5	239.8 - 240.8	1.0	0.29
243.3 - 246.5	3.2	243.3 - 244.2	Ø. 9	Ø.28
246.5 - 249.6	3.1	246.5 - 247.4	0.9	0.29
249.6 - 252.8	3.2	249.6 - 249.9	<b>0.</b> 3	0.09
252.8 - 255.8	3.0	252.8 - 253.4	0.6	0.20
255.8 - 258.5	2.7	255.8 - 256.5	0.7	Ø.26
258.5 - 261.4	2.9	258.5 - 259.4	0.9	0.31
261.4 - 264.2	2.8	261.4 - 262.3	0.9	<b>0.</b> 32
264.2 - 267.1	2.9	264.2 - 265.1	0.9	0.31
267.1 - 270.0	2.9	267.1 - 268.0	0.9	0.31
270.0 - 272.9	2.9	270.0 - 270.9	0.9	0.31
272.9 - 275.7	2.8	272.9 - 274.2	1.3	Ø. 46
275.7 - 282.0	6.3	275.7 - 276.7	1.0	0.16
282.0 - 283.5	1.5	282.0 - 283.5	1.5	1.00
	AUTD OK	SOFT LAYER FROM 278	.7 - 282.4	

OGT-9 CORE LOG

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
	• •	0.0 - 0.5	0.5	0.31
0.0 - 1.6 1.6 - 3.5		1.6 - 2.4	Ø. S	0.31
	1.7	3.5 - 4.2	Ø. 5 Ø. 7	0.37
		5.4 - 6.2	2.7 2.5	Ø.25
		7.4 - 7.9	2.5 2.5	0.31
7.3 - 9.0?	1.7	7.3 - 8.0	<b>0.</b> 7	0.41
9.0 - 10.9	1.9	7.3 - 6.6 9.0 - 9.9	0.9	0.47
	1.9	10.9 - 11.5	Ø. 5	0.32
12.8 - 12.8	1.5	12.8 - 13.4	Ø.6	0.40
14.3 - 14.3	2.1	14.3 - 14.6	0.3	0.14
14.3 - 18.4 16.4 - 18.5	2.1	16.4 - 16.6	0.2	0.10
18.5 - 21.5	3.0	18.5 - 18.9	0.4	0.13
21.5 - 23.6	2.1	21.5 - 22.3	Ø. 8	0.38
23.6 - 26.0	2.1	23.6 - 24.9	1.3	Ø.56 Ø.54
26.0 - 28.1	2.1	26.0 - 27.4	1.4	Ø. 67
28.1 - 3 <b>0</b> .2	2.1	28.1 - 29.5	1.4	0.67
20.2 - 32.3	2.1	30.2 - 31.7	1.5	0.71
50.2 - 32.3 52.3 - 34.5	2.2	32.3 - 33.6	1.3	Ø.59
52.3 - 34.5 54.5 - 36.6	2.1	34.5 - 35.9	1.4	Ø. 57
	2.0	36.6 - 37.5	0.9	2.45
36.6 - 38.6	2.0 3.2		0.7 0.7	Ø.45 Ø.28
88.6 - 41.8		38.6 - 39.5		ø.∠6 Ø.75
11.8 - 43.0	1.2 3.0	41.8 - 42.7 43.0 - 43.8	Ø.9 Ø.8	Ø.75 Ø.27
13.0 - 46.0	_	43.0 - 43.8 46.0 - 46.5	0.5	Ø. 27
16.0 - 49.2	3.2		w. 5 Ø. 9	Ø.18 Ø.29
19.2 - 52.3	3.1	49.2 - 50.1		Ø. 29 Ø. 19
52.3 - 55.4	3.1	52.3 - 52.9	Ø. 6	Ø.17 Ø.26
55.4 - 58.5	3.1	55.4 - 56.2	0.8	
58.5 - 61.7	3.2	58.5 - 59.2	0.7	0.22
61.7 - 64.8	3.1	61.7 - 62.6	Ø. 9	0.29
4.8 - 67.9	3.1	64.8 - 65.5	0.7	Ø.23
57.9 - 71.1	3.2	67.9 - 69.2	1.3	0.41
71.1 - 74.2	3.1	71.1 - 72.2	1.1	0.35
74.2 - 75.0	Ø.8	74.2 - 75.0	Ø.8	1.00

OHT-10 CORE LOG

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INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
0.0 - 2.0	2.0		0.8	0.40
2.0 - 3.6	1.6	2.0 - 3.1 3.6 - 4.1	1.1	0.48
3.6 - 5.5	1.9	3.0 - 4.1	0.5	0.26
5.5 - 7.4	1.9	5.5 - 5.8 7.4 - 7.9	0.3	0.15
7.4 - 9.2	1.8		Ø <b>.</b> 5	Ø.27
9.2 - 11.1	1.9	9.2 - 10.1	0.9	0.47
11.1 - 12.9	1.8	11.1 - 11.6	0.5	0.27
12.9 - 14.8	1.9	12.9 - 13.6	0.7	0.36
14.8 - 16.4	1.6	14.8 - 15.1	0.3	0.18
16.4 - 18.3	1.9	16.4 - 17.1	0.7	0.36
18.3 - 20.1		18.3 - 18.8	0.5	0.27
20.1 - 21.9	1.8	20.1 - 20.5	0.4	0.22
21.9 - 23.8	1.9 1.9	21.9 - 21.5	0.6	0.31
23.8 - 25.7	1.9	23.8 - 24.5	Ø.7	Ø.36
25.7 - 27.6	1.9	25.7 - 26.4	0.7	0.36
27.6 - 29.5	1.9	27.6 - 28.6	1.0	0.52
29.5 - 31.5	1.8	29.5 - 30.5	1.0	<b>0.5</b> 5
31.3 - 33.2	1.9	31.3 - 32.3	1.0	0.52 0.26
33.2 - 35.5	2.3 2.1	33.2 - 33.8 35.5 - 36.4	Ø. 6	
35.5 - 37.6	2.1	37.6 - 38.4	0.9 0.8	0.42 0.36
37.6 - 39.8 39.8 - 42.0	2.4	39.8 - 40.7	Ø. 9	Ø.41
42.0 - 45.0		42.0 - 43.0	1.0	Ø. 50
45.0 - 47.2	2.0	45.0 - 46.3	1.3	Ø.59
47.2 - 50.4	2.2 2.2	47.2 - 48.3	1.1	Ø.50
50.4 - 52.4		NO BECOUSEV	0.0	0.00
52.4 - 53.5	1.1	NO RECOVERY NO RECOVERY	0.0	0.00
53.5 - 55.9	2.4	53.5 - 53.9	Ø. 4	0.16
55.9 - 58.1	2.2	55.9 - 57.6	1.7	0.77
58.1 - 60.2	2.1	58.1 - 59.4	1.3	0.61
60.2 - 62.4	2.2	60.2 - 61.2	1.0	0.45
62.4 - 64.5	2.1	62.4 - 63.1	0.7	0.33
64.5 - 66.9	2.4	44.5 - 45.4	0.9	0.37
66.9 - 69.1	2.2	66.9 - 68.1	1.2	0.54
69.1 - 70.8		69.1 - 70.5	1.4	0.82
70.8 - 72.9	2.1	70.8 - 72.2	1.4	0.66
72.9 - 75.1	2.2	72.9 - 73.9	1.0	0.45
75.1 - 77.3	2.2	75.1 - 76.3	1.2	0.54
77.3 - 79.2	1.9	77.3 - 78.5	1.2	0.63
79.2 - 81.2	2.0	79.2 - 79.8	0.6	0.30
81.2 - 82.9		81.2 - 82.2	1.0	0.58
82.9 - 84.8	1.9	82.9 - 83.8	0.9	0.47
84.8 - 86.6		84.8 - 85.9	1.1	0.61
86.6 - 88.5	1.9	86.6 - 87.5	Ø. 9	0.47
88.5 - 90.4	1.9	88.5 - 90.1	0.6	0.31
90.4 - 92.4	2.0	90.4 - 91.8	1.4	0.70
92.4 - 94.2	1.8	92.4 - 93.4	1.0	<b>0.5</b> 5
94.2 - 97.0	2.8	94.2 - 95.5	1.3	0.46
97.0 - 98.7	1.7	97.0 - 98.6	1.6	Ø.94
98.7 - 101.6	2.9	98.7 - 99.8	1.1	Ø.38
101.6 - 104.5 104.5 - 107.4	2.9	101.6 - 102.9	1.3	Ø.44 Ø.44
104.3 - 10/.4	2.9	104.5 - 105.8	1.3	w. ~~

OHT-10 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
107.4 - 110.2	2.8	107.4 - 108.6	1.2	0.42
110.2 - 113.1	2.9	110.2 - 111.3	1.1	0.38
113.1 - 116.0	2.9	113.1 - 114.5	1.4	0.48
116.0 - 119.0	3.0	116.0 - 117.3	1.3	0.43
119.0 - 121.8	2.8	119.0 - 120.5	1.5	0.53
121.8 - 124.7	2.9	121.8 - 123.0	1.2	0.41
124.7 - 129.5	4.8	124.7 - 125.8	1.1	0.23
129.5 - 134.3	4.8	129.5 - 131.1	1.6	0.33
134.3 - 139.3	5.0	134.3 - 135.9	1.6	0.32
139.3 - 144.3	5.0	139.3 - 140.6	1.3	0.26
144.3 - 149.5	5.2	144.3 - 145.3	1.0	0.19
149.5 - 155.0	5.3	149.5 - 150.3	0.8	0.14
155.0 - 158.1	3.1	155.0 - 156.1	1.1	0.35
158.1 - 161.3	3.2	158.1 - 159.0	0.9	0.28
161.3 - 162.5	1.2	161.3 - 162.5	1.2	1.00

OIT-11 CORE LOG

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INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
0.0 - 1.8	1.8	0.0 - 0.3	0.3	0.17
1.8 - 3.7	1.9	1.8 ~ 2.0	0.2	Ø.11
3.7 - 5.6 5.6 - 7.5	1.9	3.7 - 4.3	0.6	0.32
5.6 - 7.5	1.9	5.6 ~ 5.9	0.3	0.16
7.5 - 9.4	1.9	7.5 - 7.7	0.2	0.11
9.4 - 11.3		9.4 - 9.8	Ø.4	0.21
11.3 - 13.0	1.7	11.3 - 11.6	0.3	0.18
13.0 - 14.9		13.0 - 14.2	1.2	0.63
14.9 - 16.5	1.6	14.9 ~ 15.8	0.9	0.56
16.5 - 18.4	1.9	16.5 - 17.7	1.2	0.63
18.4 - 20.1		18.4 - 19.1 NO RECOVERY 22.0 - 23.0	0.7	0.41
20.1 - 22.0	1.9	NO RECOVERY	0.0	0.00
22.0 - 23.8	1.8	22.0 - 23.0	1.0	0.56
23.8 - 25.6		23.8 - 24.7 25.6 - 26.6	0.9	0.50
25.6 - 27.4	1.8		1.0	0.56
27.4 - 29.4	2.0	27.4 - 28.3	0.9	Ø.45
29.4 - 31.6	2.2	29.4 - 30.4	1.0	0.45
31.6 - 34.2	2.2 2.6 2.3	31.6 - 33.1	. 1.5	Ø.58
34.2 - 36.5	2.3	34.2 - 35.5	1.3	0.57
36.5 - 38.6	Z. L	36.5 - 37.6	1.1	Ø.52
38.6 - 40.7	2.1	38.6 - 39.8	1.2	0.57
40.7 - 42.8 42.8 - 45.0	2.1 2.2 2.1	70./ - 71.0	1.1	Ø.52
	2.2	42.8 - 44.1	1.3	0.59
45.0 - 47.1	2.1	45.0 - 46.2	1.2	0.57
47.1 - 49.3		47.1 - 48.1	1.0	0.45
49.3 - 51.4 51.4 - 53.5	2.1	49.3 - 50.2 51.4 - 52.7	0.9	0.43 0.62
	2.1		1.3 1.3	0.57
53.5 - 55.8 55.8 - 57.8	2.3	53.5 - 54.8 55.8 - 57.0	1.2	0.60
57.8 - 60.0	2.0 2.2		1.4	0.64
60.0 - 62.1	2.1	57.8 - 59.2 60.0 - 61.6	1.6	0.76
62.1 - 64.3			1.2	0.55
64.3 - 66.5	2.2 2.2	62.1 - 63.3 64.3 - 65.7	1.4	0.64
66.5 - 68.7		66.5 - 67.9	1.4	0.64
68.7 - 70.9		68.7 - 70.2	1.5	0.68
70.9 - 73.0	2.1	70.9 - 72.2	1.3	0.62
73.0 - 75.2	2.2		0.9	0.41
75.2 - 76.2		75 0 - 74 0	1.0	1.00
76.2 - 79.0*		76.2 - 76.7	0.5	0.18
79.0 - 82.0		79.0 - 79.7	0.7	0.23
82.0 - 85.4	3.4	82.0 - 83.1	1.1	0.32
85.4 - 88.5	3.4 3.1	85.4 - 86.8	1.4	0.45
88.5 - 91.5	3.0	88.5 - 89.8	1.3	0.43
91.5 - 94.7		91.5 - 92.8	1.3	0.41
94.7 - 97.8	3.1	94.7 - 95.4	0.7	0.23
97.8 - 100.9	3.1 3.1	97.8 - 98.9	1.1	0.35
100.9 - 104.0	3.1 3.1	100.9 - 102.0	1.1	0.35
104.0 - 107.2	3.2	104.0 - 105.6	1.6	0.50
107.2 - 110.3	3.1	107.2 - 108.5	1.3	0.42
110.3 - 113.4	3.1 3.1	110.3 - 111.5	1.2	0.39
113.4 - 116.4	3.0	113.4 - 114.7	1.3	0.43

* SAMPLE PROBABLY MISMARKED 76.1 - 76.6

OIT-11 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
116.4 - 119.5	3.1	116-4 - 118-0	1.6	<b>0.</b> 52
119.5 - 122.6	3.1	119.5 - 120.4 122.6 - 123.7	0.9	0.29
119.5 - 122.6 122.6 - 125.7	3.1 3.1	122.6 - 123.7	0.9 1.1	0.35
125.7 - 128.9	3.2	125.7 - 127.2 128.9 - 130.2	1.5	0.47
128.9 - 132.2	3.2 3.3	128.9 - 130.2	1.5 1.3	0.39
170 0 - 175 7	₹.1	132.2 - 133.4	1 2	0.39
135.3 - 138.4	3.1	132.2 - 133.4 135.3 - 136.2 138.4 - 139.4 141.5 - 142.2 144.5 - 144.7 147.4 - 148.1	1.2 Ø.9	0.29
138.4 - 141.5	3.1	138.4 - 139.4	1.0	0.32
141.5 - 144.5	3.0	141.5 - 142.2	0.7	Ø.23
144.5 - 147.4	2.9	144.5 - 144.7	0.2	0.07
147.4 - 150.2	2.8	144.5 - 144.7 147.4 - 148.1 150.2 - 151.1 153.0 - 153.9	0.7	0.25
150.2 - 153.0	2.8	150.2 - 151.1	0.9	0.32
153.0 - 155.8	2.8	153.0 - 153.9 155.8 - 156.9	0.9	0.32
155.8 - 158.7	2.9	155.8 - 156.9	Ø.9 1.1	0.38
158.7 - 161.6	2.9	150 7 _ 150 S	Ø.8	Ø.28
161.6 - 164.5	2.9 2.9	161.6 - 162.2	0.6	0.21
164.5 - 167.3	2.8	164.5 - 165.3	0.8	0.29
164.5 - 167.3 167.3 - 170.2	2.9	164.5 - 165.3 167.3 - 167.9	0.8 0.6	0.21
170.2 - 173.1	2.9	170.2 - 171.4	1.2	0.41
173.1 - 176.0	2.9	170.2 - 171.4 173.1 - 174.0	1.2 0.9	0.31
176.0 - 178.7	2.7	176.0 - 177.2	1.2	
178.7 - 181.6	2.9	176.0 - 177.2 178.7 - 179.6	0.9	0.31
181.6 - 184.5	2.9	181.6 - 183.0	1.4	0.48
184.5 - 187.4	2.9	184.5 - 185.7	1.2	0.41
184.5 - 187.4 187.4 - 190.2	2.8	184,5 - 185.7 187.4 - 188.4	1 - 10	0.36
190.2 - 192.9	2.7	190.2 - 191.6	1.4	0.52
192.9 - 195.7	2.7 2.8	190.2 - 191.6 192.9 - 194.1 195.7 - 196.7 198.6 - 200.0	1.4 1.2	0.43
195.7 - 198.6	2.9	195.7 - 196.7	1.0	0.34
198.6 - 201.5	2.9 2.9	198.6 - 200.0	1.4	Ø. 48
	2.8	201.5 - 202.9	1.4	0.50
201.5 - 204.3 204.3 - 207.2	2.9	201.5 - 202.9 204.3 - 205.6	1.3	0.45
207.2 - 210.1	2.9	207.2 - 208.6	1.4	0.48
210.1 - 213.0	2.9	207.2 - 208.6 210.1 - 211.3	1.2	Ø. 41
213.0 - 216.5	3.5	213.0 - 214.0	1.0	0.29
216.5 - 219.5	3.0	216.5 - 217.7	1.2	0.40
219.5 - 222.8	3.Ø 3.3	216.5 - 217.7 219.5 - 22 <b>0.</b> 3	0.8	0.24
222.8 - 225.9	3.1	222.8 - 223.8	1.0	0.32
225.9 - 229.1	3.1 3.2	222.8 - 223.8 225.9 - 226.9	1.0 1.0	0.31
229.1 - 232.2	3.1	229.1 - 230.5	1.4	
229.1 - 232.2 232.2 - 235.3	3.1	229.1 - 230.5 232.2 - 233.6	1.4 1.4	0.45
235.3 - 238.4	3.1	235.3 - 236.5	1.2	0.39
238.4 - 241.6	3.2	235.3 - 236.5 238.4 - 239.7 241.6 - 242.1 244.7 - 245.9	1.3	0.41
241.6 - 244.7	3.1	241.6 - 242.1	0.5	0.16
244.7 - 247.9	3.2	244.7 - 245.9	1.2	0.38
247.9 - 251.0	3.1	247.9 - 249.1	1.2	0.39
251.0 - 254.2	3.2	251.0 - 252.0	1.0	0.31
254.2 - 257.6	3.4	254.2 - 255.8	1.6	0.47
257.6 - 260.7	3.1	257.6 - 258.4	0.8	0.26
260.7 - 263.9	3.2	260.7 - 261.7	1.0	0.31
263.9 - 267.1	3.2	263.9 - 264.7	0.8	Ø. 25
267.1 - 270.2	3.1	267.1 - 268.0	0.9	0.29
270.2 - 273.4	3.2	270.2 - 271.2	1.0	0.31
273.4 - 276.5	3.1	273.4 - 274.4	1.0	0.32
276.5 - 279.8	3.3	276.5 - 277.7	1.2	0.36
	~			

OIT-11 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
282.8 - 285.5	2.7	282.8 - 283.7	Ø.9	0.33
285.5 - 286.5	1.0	285.5 - 286.5	1.0	1.00

OJT-12 CORE LOG

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
0.0 - 2.2	2.2	0.0 - 0.7 2.2 - 3.6 4.3 - 5.6	<b>0.</b> 7	0.32
2.2 - 4.3	2.1	2.2 - 3.6 4.3 - 5.6	1.4	0.67
4.3 - 6.3	2.0	4.3 - 5.6	1.4 1.3	0.45
6.3 - 8.6	2.3	6.3 - 7.7	1.4	0.61
8.6 - 10.5	1.9	8.6 - 9.7	1.1	0.58
0.5 - 12.4	1.9	10.5 - 11.2	0.7	0.37
2.4 - 14.3	1.9 1.9 1.9 1.8 1.9 2.0 1.9 1.9	12.4 - 13.2	1.0	0.53
4.3 - 16.2	1.9	14.3 - 14.9 16.2 - 17.1	0.6	0.32
6.2 - 18.0	1.8	16.2 - 17.1	0.9	0.50
8.0 - 19.8	1.8	18.0 - 18.9	0.9	0.50
9.8 - 21.7	1.9	19.8 - 20.9	1.1	0.58
1.7 - 23.7	2.0	21.7 - 22.5	0.8	0.40
3.7 - 25.6	1.9	23.7 - 24.8 25.6 - 27.0	1.1 1.4	0.58
5.6 - 27.5	1.9	23.7 - 24.8 25.6 - 27.0 26.3 - 27.0	1.4	0.74
MATERIAL	PROPERTIES	26.3 - 27.0	MATERIAL PROPE	RTIES
7.5 - 29.4	1.9	27.5 - 28.9 29.4 - 29.7	1.4	
9.4 - 31.2	1.9 1.8 1.9 1.9	29.4 - 29.7	0.3	0.17
1.2 - 33.1	1.9	31.2 - 32.4	1.2	0.63
3.1 - 35.0	1.9	33.1 - 34.7	1.6	0.84
5.0 - 36.9	1.9	35.0 - 36.5	1.3	0.79
6.9 - 38.8	1.9	36.9 - 38.1	1.2	0.63
8.8 - 40.7	1.9	38.8 - 39.8 40.7 - 41.6	1.0	0.53
0.7 - 42.6	1.9	40.7 - 41.6	0.9	0.47
2.6 - 44.4	1.9 1.9 1.9 1.8 1.9 1.4 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.1	42.6 - 43.3	Ø. 7	0.39
4.4 - 46.3	1.9	44.4 - 45.3	0.9	0.47
6.3 - 47.7	1.4	46.3 - 46.8	0.5	0.36
7.7 - 49.8	2.1	47.7 - 49.2	1.5	0.71
9.8 - 51.9	2.1	49.8 - 51.5	1.7	0.81
1.9 - 54.0	2.1	51.9 - 53.0	1.1 0.9	0.52
4.6 - 56.1	2.1	54.0 - 54.9 56.1 - 57.1		Ø.43
6.1 - 58.2	2.1	56.1 - 5/.1	1.0	0.48
8.2 - 60.3	2.1	58.2 - 59.2	1.0	Ø.48
0.3 - 62.3	2.0	60.3 - 61.1 62.3 - 63.4	Ø.8	0.40
2.3 - 64.4	2.1	62.3 - 63.4	1.1	0.52 0.38
4.4 - 00.0	2.1	64.4 - 65.2 66.5 - 67.6	Ø.8 1.1	Ø.58 Ø.52
4.4 - 66.3 6.5 - 68.6	2.1	40.3 - 6/.6	1.1	Ø.52 Ø.57
8.6 - 70.7 0.7 - 72.8	2.1 2.1 2.1	68.6 - 69.8 70.7 - 71.6	0.9	Ø. 43
2.8 - 74.9	2.1	72.8 - 73.8	1.0	Ø. 48
	2.1	74.9 - 75.9	1.0	Ø. 48
70 - 77.0	2.1	74.7 - 73.7	1.4	0.61
7.10 - 77.3	2.1 2.3 2.1	77.0 - 78.4 79.3 - 80.5	1.2	0.57
7.0 - B1.4	~ · i	79.3 - 80.3 81.4 - 82.9	1.5	Ø.48
1.7 - 00.0 7 4 - 05 7	2.1 2.2 2.1 2.1 2.1 2.0		1.2	0.57
5.0 - 65./	2.1	83.6 - 84.8 85.7 - 87. <b>0</b>	1.3	0.62
J. / - 0/.0	2.1	MT M MM 4	1.3	0.62
/ . G - 70 . U	2 M	90.0 - 91.4	1.4	0.70
0.0 - 72.0 2.0 - 64.2	2.0	90.0 - 91.4 92.0 - 93.2	1.2	0.76 0.56
2.0 - 74.2	2.2	94.2 - 94.7 94.3 - 97.3	0.5	Ø. 24

OKT-13 CORE LOG

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
		0.0 - 3.74		
0.0 - 1.9	1.9	0.0 - 0.6	0.6	0.31
1.9 - 3.9	2.0	1.9 - 3.7	1.8	Ø.9
3.9 - 6.1	2.2	3.9 - 5.4	1.5	Ø. 68
6.1 - 8.1	2.0	6.1 - 7.2	1.1	0.55
8.1 - 10.2	2.1	8.1 - 9.1	1.0	Ø.47
10.2 - 12.3	2.1	10.2 - 11.1	0.9	0.42
12.3 - 14.4	2.1	12.3 - 12.9	0.6	Ø.28
14.4 - 16.5	2.1	14.4 - 15.1	0.7	<b>0.</b> 33
16.5 - 18.8	2.3	16.5 - 17.4	0.9	0.39
18.8 - 20.9	2.1	18.8 - 20.1	1.3	0.61
20.9 - 23.0	2.1	20.9 - 22.3	1.4	0.66
23.0 - 25.0	2.0	23.0 - 24.7	1.7	0.85
25.0 - 27.2	2.2	25. <b>0</b> - 26.9	1.9	0.86
27.2 - 29.3	2.1	27.2 - 29.2	2.0	0.95
29.3 - 31.6	2.3	29.3 - 29.9	0.6	0.26
31.6 - 33.6	2.0	NO RECOVERY	0.0	0.00
33.6 - 35.6	2.0	33.6 - 34.8	1.2	0.60
35.6 - 37.8	2.2	35.6 - 37.1	1.5	Ø. 68
37.8 - 39.9	2.1	37.8 - 39.0	1.2	0.57
39.9 - 42.0	2.1	39.9 - 41.5	1.6	0.76
42.0 - 43.7	1.7	42.0 - 42.9	0.9	0.52
43.7 ~ 45.5	1.8	43.7 - 44.6	Ø.9	0.50
45.5 - 47.4	1.9	45.5 - 46.1	0.6	0.31
47.4 - 49.3	1.9	47.4 - 48.1	0.7	Ø.36
49.3 - 51.2	1.9	49.3 - 50.0	Ø. /	0.36
51.2 - 53.1	1.9	51.2 - 51.8	Ø.6	0.31
55.1 ~ 55.6	1.9	53.1 - 53.7	W.B	0.42
55.87 - 56.7 E/ 0 - E0 7	1.7	55.6 - 56.1	1.1	0.57 0.66
50.7 - 20.7	7.0	50.7 - 40.0	1.2	0.44
41 4 - 44 5	2.7	41 4 - 47 0	1.3	0.44
44 5 - 47 4	2.7	44 5 - 45 0	1.3	0.48
67 A - 70 T	2.17	47 A 40 Q	1 4	Ø. 48
70.3 - 73.3	Ξ. Ø	70.3 - 71.8	1.5	0.50
73.3 ~ 76.1	2.8	73-3 - 74-6	1.3	0.46
76.1 - 78.9	2.8	76.1 - 77.4	1.3	0.46
78.9 ~ 81.7	2.8	78.9 - 90.0	1.1	0.39
81.7 - 84.7	3.0	81.7 - 83.0	1.3	0.43
84.7 ~ 87.5	2.8	84.7 - 85.7	1.0	0.35
87.5 - 90.4	2.9	87.5 - 88.7	1.2	0.41
90.4 - 93.4	3.0	90.4 - 91.7	1.3	0.14
93.4 - 96.0	2.6	93.4 - 94.7	1.3	0.50
96.0 - 98.9	2.9	96.0 - 97.1	1.1	0.37
98.9 - 102.2	3.3	98.9 - 1 <b>00.</b> 2	1.3	0.39
102.2 - 105.3	3.1	102.2 - 103.6	1.4	<b>0.</b> 45
105.3 - 108.4	3.i	105.3 - 106.2	0.9	0.29
108.4 - 111.6	3.2	108.4 - 109.9	1.5	0.46
111.6 - 114.6	3.0	111.6 - 113.0	1.4	0.46
114.6 - 117.7	3.1	114.6 - 115.6	1.0	0.32
117.7 - 120.8	3.1	117.7 - 118.2	0.5	0.16
120.8 - 123.9	3.1	120.8 - 122.1	1.3	0.41
123.9 - 127.0	3.1	123.9 - 125.5	1.6	0.51

OKT-13 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
				0.70
127.0 - 130.1	3.1	127.0 - 128.2 130.1 - 131.5	1.2	Ø.38
130.1 - 133.2	3.1	130.1 - 131.5 133.2 - 134.5 136.1 - 137.2 139.3 - 140.6 142.4 - 143.6 145.5 - 146.6 148.6 - 149.6 151.7 - 153.0 154.8 - 156.1 157.9 - 159.2	1.4	0.45
133.2 - 136.1	2.9	133.2 - 134.5	1.3	0.44
136.1 - 139.3	3.2	136.1 - 137.2	1.1	0.34
139.3 - 142.4	3.1	139.3 - 140.6	1.3	0.41
142.4 - 145.5	3.1	142.4 - 143.6	1.2	0.38
145.5 - 148.6	3.1	145.5 - 146.6	1.1	0.35
148.6 - 151.7	3.1	148.6 - 149.6	1.0	0.32
151.7 - 154.8	3.1	151.7 - 153.0	1.3	Ø.41
154.8 - 157.9	3.1	154.8 - 156.1	1.3	0.41
157.9 - 161.1	3.2	157.9 - 159.2	1.3	0.40
161.1 - 164.2	3.1	161.1 - 162.5 164.2 - 165.4	1.4	Ø.45
164.2 - 167.4	3.2	164.2 - 165.4	1.2	0.37
167.4 - 170.6	3.2	167.4 - 168.4	1.0	0.31
170.6 - 173.8	3.2	170.6 - 171.2	Ø. 6	Ø. 18
173.8 - 176.9	3.1	NO RECOVERY	0.0	0.00
176.9 - 180.0	3.1	176.9 - 178.4	1.5	0.48
180.0 - 182.9	2.9	180.0 - 181.3	1.3	0.44
182.9 - 185.8	2.9	182.9 - 184.3	1.4	0.48
185.8 - 188.8	3.0	185.8 - 186.9	1.1	0.36
188.8 - 191.7	2.9	188.8 - 190.3	1.5	0.51
191.7 - 194.6	2.9	164.2 - 165.4 167.4 - 168.4 170.6 - 171.2 NO RECOVERY 176.9 - 178.4 180.0 - 181.3 182.9 - 184.3 185.8 - 186.9 188.8 - 190.3 191.7 - 193.0 194.6 - 195.7 197.6 - 200.5 200.5 - 201.7	1.3	0.44
194.6 - 197.6	3.0	194.6 - 195.7	1.1	0.36
197.6 - 200.5	2.9	197.6 - 200.5	2.9	1.00
200 5 - 203.4	2.9	200 5 - 201 7	1 2	0.41
DOT 4 DO/ 7	~ ~	007 4 004 0		a a=
200.7 200.0	20	203.4 - 204.2 206.3 - 207.7 209.2 - 210.4 212.2 - 213.5 215.2 - 216.3 218.1 - 219.3 221.0 - 222.2 223.9 - 225.4	1 4	0.48
200.3 - 207.2	-≛-7 7₹ (7)	200.3 - 207.7	1 2	0.40
207.2 - 212.2	3.0	207.2 - 210.7	1 7	0.43
212.2 - 213.2	2.0	212.2 - 213.3	1.3	Ø.37
210.2 - 210.1	2.7	210.2 - 210.3	1 7	Ø.41
210.1 - 221.0	2.7	270.1 - 217.3	1.2	0.41
221.0 - 223.7	2.7	221.0 - 222.2	1.2	0.51
226.8 - 229.7	2.7	223.7 - 223.4	1.5	Ø.31
220.0 - 227./	2.7	226.8 - 227.9 229.7 - 230.8	1.1	0.37 0.37
227.7 - 232.6	2.9	227.7 - 230.6	1.1	
232.6 - 235.3 235.3 - 238.2	2.7 2.9	232.6 - 233.4 235.3 - 236.6	0.8	0.29
235.3 - 238.2	2.9	235.3 - 236.6	1.3	0.44
238.2 - 241.1	2.9	238.2 - 239.5 241.1 - 242.5 244.1 - 245.0 247.2 - 248.7 250.2 - 251.8	1.3	0.44
241.1 - 244.1	3.0	241.1 - 242.5	1.4	0.46
244.1 - 247.2	3.1	244.1 - 245.0	0.9	0.29
247.2 - 250.2	3.0	247.2 - 248.7	1.5	0.50
250.2 - 253.4	3.2	250.2 - 251.8	1.6	0.50
253.4 - 256.4	3.0	253.4 - 255.0 256.4 - 258.0	1.6	w. 33
256.4 - 259.5	3.1	256.4 - 258.0	1.6	0.51
259.5 - 262.6	3.1	259.5 - 2 <b>60</b> .6	1.1	0.35
262.6 - 265.7	3.1	262.6 - 264.0	1.4	0.45
265.7 - 268.8	3.1	265.7 - 267.2	1.5	0.48
268.8 - 271.8	3.0	268.8 - 270.0	1.2	0.40
271.8 - 274.9	3.1	271.8 - 273.0	1.2	0.38
274.9 - 277.9	3.0	274.9 - 275.8	0.9	0.30
277.9 - 281.0	3.1	277.9 - 279.1	1.2	0.38
281.0 - 284.1	3.1	281.0 - 281.8	0.8	0.25
284.1 - 287.2	3.1	284.1 - 285.1	1.0	Ø.32
287.2 - 290.4	3.2	287.2 - 288.1	0.9	0.28
290.4 - 293.5	3.1	290.4 - 291.2	0.8	0.25
			<del></del>	

OKT-13 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
293.5 - 296.6	3.1	293.5 - 294.4 296.6 - 297.4 299.6 - 300.6 302.7 - 303.5 305.7 - 306.7 308.6 - 309.5 311.5 - 312.5	0.9	0.29
96.6 - 299.6	3.0	296.6 - 297.4	0.8	0.26
99.6 - 302.7	3.1	299.4 - 300.4	1.0	0.32
02.7 - 305.7	3.0	302.7 - 303.5	0.8	0.26
05.7 - 308.6	3.1	305.7 - 306.7	1.0	0.32
08.6 - 311.5	2.9	308.4 - 309.5	0.9	0.31
11.5 - 314.4	2.9	311.5 - 312.5	1.0	0.34
14.4 - 317.3	2.9	314.4 - 315.0	0.6	0.20
17.3 - 320.3	3.0	317.3 - 317.7	0.4	0.13
20.3 - 323.2	2.9	320.3 - 321.3	1.0	0.34
23.2 - 326.0	2.8	323.2 - 324.0	Ø. 8	0.28
26.0 - 328.9	2.9	326.0 - 327.0	1.0	0.34
28.0 - 331.8	2.9	328.9 - 329.7	0.8	0.27
31.8 - 334.7	2.9	331.8 - 332.9	1.1	0.37
34.7 - 337.6	2.9	334.7 - 335.7	1.0	0.34
37. A - 340. 4	2.8	337.4 - 338.7	1 - 1	0.39
40.4 - 343.3	2.9	340.4 - 341.2	Ø. 8	0.27
43.3 - 345.8	2.5	343.3 - 343.7	0.4	0.16
45.8 - 348.6	2.8	345.8 - 346.8	1.0	0.35
48.6 - 351.4	2.8	34B.4 - 349.4	0.8	0.28
51.4 - 354.9	3.5	351.4 - 351.9	0.5	0.14
54.9 - 358.A	3.1	354.9 - 355.7	Ø. B	0.25
58.0 - 361.2	3.2	358.0 - 359.0	1.0	0.31
61.2 - 364.3	3.1	361.2 - 361.9	2.7	0.22
64.3 - 367.6	3.3	364.3 - 365.3	1.0	0.30
67.6 - 370.8	3.2	367-6 - 367-9	Ø. 3	0.09
70.8 - 374.0	3.2	370.8 - 371.4	0.8	0.25
74.0 - 377.2	3.2	374-0 - 374-7	Ø. 7	0.21
77.2 - 380.3	3.1	377.2 - 378.2	1.0	0.32
80.3 - 383.4	3.1	380.3 - 381.4	1.3	0.41
83.4 - 386.5	3.1	383.4 - 384.6	1.2	0.38
86.5 - 389.6	3.1	308.6 - 309.5 311.5 - 312.5 314.4 - 315.0 317.3 - 317.7 320.3 - 321.3 323.2 - 324.0 326.0 - 327.0 328.9 - 329.7 331.8 - 332.7 334.7 - 335.7 337.6 - 338.7 340.4 - 341.2 343.3 - 346.8 348.6 - 349.4 351.4 - 351.9 354.9 - 355.7 358.0 - 355.7 358.0 - 355.7 358.0 - 367.9 370.8 - 371.6 374.0 - 374.7 377.2 - 378.2 380.3 - 381.6 384.5 - 387.0 389.6 - 390.7 392.8 - 393.8 395.9 - 390.7 398.8 - 399.9 401.8 - 402.6 407.5 - 410.6 413.4 - 414.3 416.4 - 417.7 421.3 - 422.5 423.3 - 424.5	0.5	0.16
89.6 - 392.8	3.2	389.6 - 390.7	1.1	0.34
92.8 - 395.9	3.1	392.8 - 393.8	1.0	0.37
95.9 - 398.8	2.9	395.9 - 394.7	a. 8	0.27
98.8 - 401.8	3.0	398.8 - 399.9	1.1	0.34
01.8 - 404.6	2.8	401.8 - 402.6	Ø. 8	0.28
04.4 - 407.5	2.9	404 4 - 405 4	1.0	0.34
07.5 - 410.5	3.0	407.5 - 408.6	1.1	0.36
10.5 - 413.4	2.9	410.5 - 410.4	Ø . 1	0.03
13.4 - 416.4	3.0	413.4 - 414.3	0.9	0.30
16.4 - 421.3	4.9	416.4 - 417.7	1.3	0.26
21.3 - 423.3	2.0	421.3 - 422.5	1.2	0.60
23.3 - 426.1	2.8	421.3 - 422.5 423.3 - 424.5	1.2	0.41
26.1 - 429.1	3.0	426.1 - 427.3	1.2	0.40
29.1 - 431.9	2.8	429.1 - 430.3	1.2	0.42
31.9 - 434.8	2.9	431.9 - 432.9	1.0	0.34
34.8 - 437.7	2.9	434.8 - 435.5	0.7	0.24
37.7 - 440.7	3.0	437.7 - 438.6	0.9	0.30
40.7 - 443.6	2.9	440.7 - 441.4	0.7	0.24
43.6 - 446.6	3.0	443.6 - 444.3	0.7	0.23
46.6 - 449.6	3.0	446.6 - 447.5	0.9	0.30
49.6 - 452.7	3.1	449.6 - 450.5	0.9	Ø.29
	3.1		0.9 0.9	0.29 0.29
152.7 - 455.8		452.7 - 453.6		

OKT-13 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
		450.0		
458.8 - 461.9	3.1	458.8 - 459.7	<b>4</b> 0.9	0.29
461.9 - 465.1 465.1 - 468.1	3.2 3.0	461.9 - 462.8 465.1 - 466.0	0.9	0.28
465.1 - 468.1	3.0	465.1 - 466.0	0.9	0.30
468.1 - 471.2	3.1	468.1 - 469.3 471.2 - 472.3 474.2 - 475.3 477.2 - 478.2	1.2	0.38
471.2 - 474.2	3.0	471.2 - 472.3	1.1	0.36
474.2 - 477.2	3.0	474.2 - 475.3	1.1	0.36
477.2 - 480.3	3.1	477.2 - 478.2	1.0	0.32
480.3 - 483.4	3.1	477.2 - 478.2 480.3 - 481.2 483.4 - 484.4 486.4 - 487.5 489.5 - 490.0 492.5 - 493.6 495.5 - 496.7 498.4 - 499.0	0.9	0.29
483.4 - 486.4	3.0	483.4 - 484.4	1.0	0.33
486.4 - 489.5	3.1	486.4 - 487.5	1.1	0.35
489.5 ~ 492.5	3.0	489.5 - 490.0	1.2	0.40
492.5 - 495.5	3.0	492.5 - 493.6	1.1	0.36
495.5 - 498.4	2.9	495.5 - 496.7	1.2	0.41
498.4 - 501.3	2.9	498.4 - 499.0	0.6	0.20
501 3 - 504 2	2 9	501 T - 502 2	0.0	0.31
501.3 - 504.2 504.2 - 507.1	2 0	501.3 - 502.2 504.2 - 505.2	1 0	0.34
507 1 SID 1	Z.7	507 1 500 A	W 5	0.30
507.1 - 510.1 510.1 - 513.0	3.0	507.1 - 508.0 510.1 - 511.0	0.7	0.31
517.0 515.0	2.7	517.0 517.0	0.7	
212.0 - 212.9	2.7	513.0 - 513.8 515.9 - 516.8	Ø. 8	0.27
212.9 - 218.8	2.9	515.7 - 516.8	<b>0.</b> 9	0.31
518.8 - 521.6	2.8	518.8 - 519.7 521.6 - 522.5 524.5 - 525.3 527.4 - 528.4 530.3 - 531.4	Ø. 9	0.32
521.6 - 524.5	2.9	521.6 - 522.5	0.9	0.31
524.5 - 527.4	2.9	524.5 - 525.3	Ø.8	0.27
<b>527.4 - 530.3</b>	2.9	527.4 - 528.4	1.0	0.34
530.3 - 533. <b>3</b>	3.0	530.3 - 531.4	1.1	Ø.36
533.3 - 536.2	2.9	<b>5</b> 33.3 - 533.9	0.6	0.20
536.2 - 539.1	2.9	<b>5</b> 33.3 - 533.9 <b>5</b> 36.2 - <b>5</b> 37.1	0.9	0.31
539.1 - 542.2	3.1	539.1 - 540.1 542.2 - 543.1 545.3 - 546.2 548.4 - 549.2 551.4 - 552.2 554.5 - 555.3 557.6 - 558.5	1.0	0.32
542.2 - 545.3	3.1	542.2 - 543.1	0.9	0.29
545.3 - 548.4	3.1	545.3 - 546.2	0.9	0.29
548.4 - 551.4	3.0	548.4 - 549.2	0.8	0.26
551.4 - 554.5	3.1	551.4 - 552.2	0.8	0.25
554.5 - 557.6	3.1	554.5 - 555.3	0.8	0.25
557.6 - 560.7	3.1	557.6 - 558.5	21.9	0.29
540 7 - 543 8	₹ 1	560 7 - 561 7	1 0	0.32
547 8 - 544 0	Z 1	560.7 - 561.7 563.8 - 564.7	Ø 9	0.29
566.9 - 570.0	7 1	544 0 - 547 0	0.0	0.29
570.0 - 573.0	J. I	566.9 - 567.8 570.0 - 570.9	Ø. 7	0.30
570.0 - 576.0 577 0 - 576.1	J. W	577 0 577 5	0.7	0.30
3/3.W - 3/0.I	3.1	573.0 - 573.8 576.1 - 577.0 579.2 - 580.1 582.2 - 583.3 585.4 - 586.4 588.3 - 589.3	0.0	0.25
5/6.1 - 5/9.2	3.1	5/6.1 - 5//.0	W. 7	0.29
579.2 - 582.2	3.0	5/9.2 - 580.1	4.9	0.30
582.2 - 585.4	3.2	582.2 - 583.3	1.1	0.34
585.4 - 588.3	2.9	585.4 - 586.4	1.0	0.34
588.3 - 591.4	3.1	588.3 - 589.3	1.0	0.32
371.4 - 374.3	3.1	591.4 - 592.4	1.0	0.32
594.5 - 597.5	3.0	594.5 - 595.4	0.9	0.30
597.5 - 600.6	3.1	597.5 - 598.5	1.0	<b>0.</b> 32
600.6 - 603.5	2.9	600.6 - 601.4	0.8	0.27
603.5 - 606.5	3.0	603.5 - 604.3	0.8	0.26
606.5 - 611.4	3.9	606.5 - 607.4	0.9	0.23
611.4 - 616.1	4.7	611.4 - 612.4	1.0	0.21
616.1 - 620.9	4.8	616.1 - 617.1	1.0	0.20
620.9 - 626.0	5.1	620.9 - 621.8	0.9	0.17
626.0 - 630.8	4.8	626.0 - 626.8	0.8	0.16
630.8 - 635.7	4.9	630.8 - 631.7	0.9	0.18
	7 # 7	00010 - 0011/	<b>U.</b> 7	0.10

OKT-13 CORE LOG (cont.)

		SAMPLE MARKED		
		635.7 - 636.6		
40.6 - 645.5	4.9	640.6 - 641.5	0.9	0.18
45.5 - 650.8	5.3	645.5 - 646.5	1.0	0.18
		65 <b>0.</b> 8 - 651.6		0.16
55.8 - 660.7	4.9	<b>655.8 - 656.6</b>	0.8	0.16
60.7 - 665.6	4.9	660.7 - 661.5	Ø.8	0.16
65.6 - 670.7	5.1	665.6 - 666.6	1.0	0.19
		670.7 - 671.6		0.18
75.7 - 680.8	5.1	675.7 - 676.6	0.9	0.17
80.8 - 685.9	5.1	480.8 - 481.4	0.8	0.15
85.9 - 691.0	5.1	685.9 - 686.7	0.8	
91.0 - 696.0	. 5.0	691.0 - 691.8	Ø.8	0.16
96.0 - 701.1	5.1	696 <b>.0</b> - 696.7	0.7	0.13
01.1 - 706.4	5.3	701.1 - 702.0	Ø.9	0.16
06.4 - 711.6	5.2	706.4 - 707.4	1.0	.19
11.6 - 716.6	5.0	711.6 - 712.1	0.5	0.10
116.6 - 721.7	5.1	716.6 - 717.7	1.1	0.21
21.7 - 726.7	5.0	721.7 - 722.5	Ø.8	0.16
		726.7 - 727.7		
31.6 - 736.7	5.1	731.6 - 732.7	1.1	0.21
36.7 - 741.5				0.22
41.5 - 746.4	4.9	741.5 - 742.5	1.0	0.20
		746.4 - 747.2		0.16
		751.3 - 752.2		
756.2 - 760.1	3.9	756.2 - 757.3	1.1	0.28
		760.1 - 760.8		
		765.1 - 765.8		

OLT-14 CORE LOG

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
0.0 - 2.2	2.2	0.0 - 0.9	0.9	0.41
2.2 - 4.2	2.0	2.2 - 3.0	0.8	0.40
4.2 - 6.4	2.2	4.2 - 4.8	0.6	Ø. 27
6.4 - 8.5	2.1	6.4 - 7.9	1.5	0.71
8.5 - 10.8	2.3	8.5 - 9.9	1.4	0.61
10.8 - 12.9	2.1	10.8 - 12.2	1.4	0.67
12.9 - 15.0	2.1	12.9 - 14.1	1.2	0.57
15.0 - 17.0	2.0	NO RECOVERY	0.0	0.00
17.0 - 19.1	2.1	17.0 - 18.4	1.4	Ø.67
19.1 - 21.0	1.9	19.1 - 20.6	1.5	0.79
21.0 - 22.9	1.9	21.0 - 22.4	1.4	0.74
22.9 - 24.8	1.9	22.9 - 24.2	1.3	<b>0.</b> 68
24.8 - 26.7	1.9	24.8 - 26.2	1.4	0.74
26.7 - 28.7	2.0	26.7 - 27.8	1.1	0.55
28.7 - 30.6	1.9	28.7 - 30.1	1.4	0.74
30.6 - 32.5	1.9	30.6 - 32.0	1.4	0.74
32.5 - 34.5	2.0	32 <b>.5 - 34.0</b>	1.5	0.75
34.5 - 37.0	2.5	34.5 - 36.0	1.5	Ø. 6Ø
37.0 - 38.9	1.9	37 <b>.0</b> - 37.5	0.5	0.26
38.9 - 40.8	1.9	38.9 - 40.3	1.4	Ø.74
40.8 ~ 42.7	1.9	40.8 - 41.1	0.3	0.16
42.7 - 44.6	1.9	42.7 - 43.6	0.9	0.47
44.6 - 46.6	2.0	44.6 - 45.4	Ø.8	0.40
46.6 - 48.5	1.9	46.6 - 47.4	0.8	0.42
48.5 - 49.2	0.7	48.5 - 49.2	Ø.7	1.00

OMT-15 CORE LOG

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INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
0.0 - 2.2	2.2	<b>0.0</b> - <b>0.</b> 5	Ø.5	0.23
2.2 - 4.3	2.1	2.2 - 2.5	Ø.3	Ø.14
4.3 - 6.6	2.3	4.3 - 5.1	0.8	0.35
5.6 - 8.6	2.0	6.6 - 6.7	Ø. 1	0.05
3.6 - 10.6	2.0	8.6 - 8.9	0.3	0.15
0.6 - 12.7	2.1	10.6 - 11.2	0.6	0.29
2.7 - 14.7	2.0	12.7 - 13.6	0.9	0.45
1.7 - 16.9	2.2	14.7 - 15.5	0.8	0.36
5.9 - 18.9	2.0	16.9 - 17.9	1.0	0.50
3.9 - 21.0	2.1	18.9 - 19.8	0.9	0.43
.0 - 23.2	2.2	21.0 - 21.6	0.6	0.27
3.2 - 25.3	2.1	23.2 - 23.8	0.6	0.29
5.3 - 27.4	2.1	25.3 - 26.1	0.8	0.38
7.4 - 29.4	2.0	27.4 - 28.5	1.1	0.55
7.4 - 31.5	2.1	29.4 - 30.6	1.2	0.57
1.5 - 33.7	2.2	31.5 - 33.3	1.8	0.82
3.7 - 35.6	1.9	NO RECOVERY	0.0	0.00
5.6 - 37.5	1.9	35.6 - 36.0	0.4	0.21
7.5 - 39.5	2.0	37.5 - 39.3	1.8	0.90
7.5 - 41.4	1.9	39.5 - 40.9	1.4	0.74
.4 - 43.3	1.9	41.4 - 42.6	1.2	0.63
3.3 - 45.3	2.0	43.3 - 45.1	1.8	0.90
5.3 - 47.3	2.0	45.3 - 46.7	1.4	0.70
7.3 - 49.2	1.9	47.3 - 48.6	1.3	0.68
7.2 - 51.2	2.0	49.2 - 50.5	1.3	0.65
2 - 53.1	1.9	51.2 - 51.9	0.7	0.37
5.1 - 55.0	1.9	53.1 - 54.7	1.6	0.84
5.0 - 57.0	2.0	55.0 - 56.3	1.3	0.65
7.0 - 58.9	1.9	57 <b>.0</b> - 58.3	1.3	0.68
3.9 - 60.9	2.0	58.9 - 60.2	1.3	0.45
1.9 - 63.8	2.9	60.9 - 62.0	1.1	0.38
3.8 <b>- 6</b> 6.7	2.9	63.8 - 64.8	1.0	0.34
6.7 - 69.7	3.0	6 <b>6.</b> 7 - <b>6</b> 8.5	1.8	0.60
7.7 - 72.6	2.9	69.7 - 71.0	1.3	0.45
2.6 - 75.5		72.6 - 73.9	1.3	0.45
5.5 - 76.6	1.1	75.5 - 76.6	1.1	1.00

ONT-16 CORE LOG

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
0.0 - 2.0	2.0	0.0 - 0.6	Ø <b>.</b> 6	0.30
2.0 - 4.1	2.1	2.0 - 3.3	1.3	0.62
4.1 - 6.1	2.0	4.1 - 4.5	0.4	0.20
6.1 - 8.2	2.1	6-1 - 6-6	0.5	0.24
8.2 - 10.2		8.2 - 9.0	0.5 0.8	0.40
10.2 - 12.3	2.1	6.1 - 6.6 8.2 - 9.0 10.2 - 10.7	0.5	0.24
12.3 - 14.3	2.0	12.3 - 13.2	0.9	0.45
10.2 - 12.3 12.3 - 14.3 14.3 - 16.4	2.0	12.3 - 13.2 14.3 - 14.9	0.6	0.29
	2.0	16.4 - 17.5 18.4 - 19.8 20.3 - 20.9 22.2 - 23.2 24.1 - 24.9 26.0 - 26.8	0.5 0.9 0.6 1.1 1.4	0.55
18.4 - 18.4 18.4 - 20.3 20.3 - 22.2	1.9	18.4 - 19.8	1.4	0.74
20.3 - 22.2	1.9	20.3 - 20.9	0.6	0.32
22.2 - 24.1 24.1 - 26.0 26.0 - 28.1	1.7 1.9 2.1 1.8 1.9 1.9	22.2 - 23.2	1.0	0.53
24.1 - 26.0	1.9	24.1 - 24.9	0.8	0.42
26.0 - 28.1	2.1	26.0 - 26.8	0.8	0.38
28.1 - 29.9	1.8	28.1 - 28.8	0.7	0.39
28.1 - 29.9 29.9 - 31.8 31.8 - 33.7	1.9	28.1 - 28.8 29.9 - 30.7	0.8	0.42
31.8 - 33.7	1.9	31.8 - 32.2	0.4	0.21
33.7 - 35.6	1.9	33.7 - 34.8	1.1	0.58
35.6 - 37.5	1.9 1.9 1.9	35.6 - 36.5 37.5 - 38.4 39.4 - 40.7	0.6 1.0 0.8 0.7 0.9 0.4 1.1 0.9 1.4 1.5	0.47
37.5 - 39.4	1.9	37.5 - 38.4	0.9	0.47
39.4 - 41.3	1.9	39.4 - 40.7	1.3	0.68
41.3 - 43.2	1.9	41.3 - 42.7 43.2 - 44.7	1.4	0.74
43.2 - 45.1	1.9	43.2 - 44.7	1.5	0.79
45.1 - 46.9	1.8	45.1 - 46.7	1.6	0.89
46.9 - 48.9	2.0	46.9 - 48.2	1.3	0.65
46.9 - 48.9 48.9 - 51.8	1.9 1.9 1.8 2.0 2.9	46.9 - 48.2 48.9 - 50.4	1.6 1.3 1.5	0.52
	2.9	51.8 - 52.8	1.0 0.7 1.2 0.9	0.34
54.7 - 57.6	2.9	54.7 - 55.5	0.7	0.24
57.6 - 60.4	2.8	57.6 - 58.8	1.2	0.43
60.4 - 63.2	2.8	60.4 - 61.3	0.9	0.32
51.8 - 54.7 54.7 - 57.6 57.6 - 60.4 60.4 - 63.2 63.2 - 66.3 66.3 - 69.4 69.4 - 72.4 72.4 - 75.5 75.5 - 78.7 78.7 - 81.8	3.1	57.6 - 58.8 60.4 - 61.3 63.2 - 63.7 66.3 - 67.4 69.4 - 70.4	0.5 1.1	0.16
66.3 - 69.4	3.1	66.3 - 67.4	1.1	0.35
69.4 - 72.4	3.0	69.4 - 70.4	1.0	0.33
72.4 - 75.5	· 3.1	72.4 - 73.7	1.3	0.42
75.5 - 78.7	3.2	75.5 - 76.5	1.0	0.31
78.7 - 81.8	3.1	72.4 - 70.4 72.4 - 73.7 75.5 - 76.5 78.7 - 80.0 81.8 - 83.2 84.8 - 86.1 87.9 - 89.1	1.3	0.42
81.8 - 84.8	3.0	81.8 - 83.2	1.4	0.47
84.8 - 87.9	3.1	84.8 - 86.1	1.3	0.42
87.9 - 91.2	3.3	87.9 - 89.1	1.2	0.36
91.2 - 94.3	3.1	91.2 - 92.7	1.5	0.48
94.3 - 97.4	3.1	94.3 - 95.3	1.0	0.32
97.4 - 100.4	3.0	97.4 - 98.6	1.2	0.40
75.5 - 78.7 78.7 - 81.8 81.8 - 84.8 84.8 - 87.9 87.9 - 91.2 91.2 - 94.3 94.3 - 97.4 97.4 - 100.4 100.4 - 103.5 103.5 - 106.5 106.5 - 109.6 109.6 - 112.9 112.9 - 116.0 116.0 - 119.1 119.1 - 122.1 122.1 - 125.2 125.2 - 128.3 128.3 - 131.4	3.1	97.4 - 98.6 100.4 - 101.9 103.5 - 104.8 106.5 - 108.0 109.6 - 110.5 112.9 - 113.9 116.0 - 117.2	1.1 1.0 1.3 1.0 1.3 1.4 1.3 1.2 1.5 1.0 1.5	0.48
103.5 - 106.5	3.0	103.5 - 104.8	1.3	0.43
106.5 - 109.6	3.1	106.5 - 108.0	1.5	0.48
109.6 - 112.9	3.3	109.6 - 110.5	0.9 1.0 1.2	0.27
112.9 - 116.0	3.1	112.9 - 113.9	1.0	0.32
116.0 - 119.1	3.1	116.0 - 117.2	1.2	0.39
119.1 - 122.1	3.0	119.1 - 120.3	1.2	0.40
122.1 - 125.2	3.1	122.1 - 123.0	0.9	0.29
125.2 - 128.3	3.1	125.2 - 126.4 128.3 - 129.3	1.2	0.39
128.3 - 131.4	3.1	128.3 - 129.3	1.0	0.32

ONT-16 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
131.4 - 134.5	3.1	131.4 - 132.5	1.1	<b>0.</b> 35
134.5 - 137.5	3.0	134.5 - 135.4	0.9	0.30
137.5 - 140.2	2.7	137.5 - 138.4	0.9	<b>0.3</b> 3
140.2 - 143.2	3.0	140.2 - 141.4	1.2	0.40
143.2 - 146.1	2.9	143.2 - 144.3	1.1	0.40
146.1 - 149.0	2.9	146.1 - 146.4	0.3	0.10
149.0 - 151.8	2.8	149.0 - 150.2	1.2	0.43
151.8 - 152.3	0.5	151.8 - 152.3	Ø.5	1.00

OOR-17 CORE LOG

INTERVAL	LENGTH	SAMPLE	MARKED	RECOVERED	RECOVERY
0.0 - 2.0	2.0	0.0 -	1.7	1.7 Ø.9	0.85
2.0 - 3.9	7 1.9	2.0 -		Ø. 9	0.47
3.9 - 5.8	1.9	3.9 -	4.5	0.6 0.8	0.31
5.8 - 7.7	7 1.9	5.8 - 7.7 - 9.6 -	6.6	0.8	0.42
7.7 - 9.6	1.9	7.7 -	8.2	0.5	0.26
9.6 - 11.5	1.9	9.6 -	10.8	1.2	<b>0.6</b> 3
11.5 - 13.4	1.9	11.5 - 13.4 -	12.1	0.6 1.0	0.31
13.4 - 15.3	1.9	13.4 -	14.4	1.0	0.52
15.3 - 17.2	1.9	15.3 - 17.2 -	16.3	1.0 1.3	0.52
17.2 - 19.1	1.9	17.2 -	18.5	1.3	0.48
19.1 - 21.1	2.0	19.1 -	19.8	0.7	Ø.35
21.1 - 23.6	1.9	21.1 -	22.2	1.1 0.2	Ø.57
23.10 - 24.6	1.8	23.6 -	23.2	1.2	0.11
24.8 - 26.6	1.8	24.8 -	26.0	1.2	0.66
20.6 - 20.6	2.0	17.2 - 19.1 - 21.1 - 23.0 - 24.8 - 26.6 - 28.6 -	27.1	0.5 0.9	0.25
28.6 - 30.5	1.9	28.6 -	29.5	0.9	0.47
30.5 - 32.4	1.7	30.5 - 32.4 -	31./	1.2	Ø. 63
32.4 - 34.3	1.7	32.4 -	33.5	1.1	Ø.57
34.3 - 36.2	2 1.7	34.3 - 36.2 - 38.2 -	35.1	0.8	0.42
36.2 - 38.2	2.0	36.2 -	3/.1	0.9	0.45
38.2 - 40.1	1.9	38.2 -	39.3	1.1	0.57
40.1 - 42.6	0 1.9	40.1 -	41.3	1.2	0.63
42.0 - 43.9	1.9	42.0 - 43.9 -	43.3	1.3	0.48
43.9 - 45.8	1.9	43.9 -	44.7	Ø.8	0.42
45.8 - 47.7	1.9	45.8 -	46.7	0.9	0.47
4/./ - 49./	2.0	47.7 - 49.7 -	48./	1.0	0.50
49./ - 51./	2.0	49.7 -	52.7	0.9	0.45
51./ - 54.4	2.3	51.7 -	52.7	1.0	0.43 0.47
54.6 - 56.1	7.1	54.0 - 56.1 - 58.2 -	55.0	1.0	
56.1 - 58.4	2.1	20.1 -	3/.1	1.0	Ø.47
38.2 - 60.2	2.0	58.2 -	57.2	1.0	0.50
60.2 - 62.3	2.1	60.2 - 62.3 -	61.2	1.0	0.47
62.3 - 64.4	+ 2.1 • 5.7	62.3 -	65.2	0.9	0.42
64.4 - 66.4	+ 2.0	64.4 -	65.4	1.0	0.50
66.4 - 68.5	2.1	66.4 - 68.5 -	6/./	1.3	0.61
68.5 - 70.7	2.2	70.7 -	71.3	1.0 0.6	Ø.45 Ø.28
70.7 - 72.6	2.1				
74.8 - 74.5	7 2.1	72.8 - 74.9 -	76.1		0.85 0.54
77 1 70 5	. 2.2		78.2		Ø. 34 Ø. 45
70 5 01 4	2.4	7/:1 -	/O.Z	1.5	Ø. 43 Ø. 71
77.0 - 01.0	7 7 1	79.5 - 81.6 -	01.0	1.2	0.71 0.57
01.0 - 03.7	7 20	01.0 -	85.5	1.8	0.90
DS 7 - D7 -	7 2.W		86.9		0.50
03.7 - 07.7	2.6	87.7 -	00.7		
0.0       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -       -	9 4. L 9 9 1	0/./ -	07.U	1.8	0.61 0.85
07.0 - 71.5	7 46.1 H 70.1	89.8 -	92.9	1.0	Ø. 47
71.7 - 74.6	1 2 4	91.9 - 94.0 -	94.9	<b>0.</b> 9	Ø.42
74.0 - 70.7	1	94.0 - 96.1 -			0.42 0.42
70.1 70.4	 7 7 1	70.1 -	7/•W	₩.7 1 ₹	Ø.42 Ø.61
100 7 - 100 A	- 4.1 1 7 1	100 3	1011 4	1.3 1.3 MATERIAL (	0.61
MATERIAL PRO	TPERTIES	100.3	101.0	MATERIAL I	PROPERTIES
HELEVINE EK	J. 16(1) 1650	166.	7.07.4	THE PARTY OF	THE STATE OF THE S

OOR-17 CORE LOG (cont.)

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INTERVAL	LENGTH	SAMPLE M	ARKED	RECOVERED	RECOVERY
102.4 - 104.5	5 2.1	102.4 -	1013. A	1.2	0.57
104.5 - 106.6	5 2.1	104.5 -	105.4	1.2 0.9	0.42
MATERIAL PRO	PERTIES	104.5 -	105.2	MATERIAL PROF	PERTIES
106.6 - 108.	5 1.9	106.6 -	108.1	MATERIAL PROF	0.78
108.5 - 110.5	5 2.0	108.5 -	109.6	1.1	0.55
108.5 - 110.5 110.5 - 112.6	4 1.9	110.5 -	111.1	1.1 Ø.6	0.31
112.4 - 114.3	3 1.9	112.4 -	112.9	Ø.5 Ø.6	0.26
114.3 - 116.5	2 1.9	114.3 -	114.9	0.6	0.31
114.3 - 116.1 116.2 - 119.1 119.1 - 122.0	1 2.9	116.2 - 119.1 -	116.6	0.4 0.4	0.13
119.1 - 122.0	<b>2.</b> 9	119.1 -	117.5		0.13
122.0 - 124.9	7 2.9	122.0 - 124.9 -	122.8	0.8	0.27
119.1 - 122.0 122.0 - 124.9 124.9 - 127.0	3 2.9	124.9 -	125.5	0.6	0.20
127.8 - 130.3	7 2.9	127.8 -	129.3	1.5	0.51
130.7 - 133.	5 2.8	130.7 -	132.2	1.5	<b>0.5</b> 3
133.5 - 136.4	4 2.9	NO RECOVE	RY	0.0	0.00
136.4 - 139.	1 2.7	136.4 -	137.4	1.5 1.5 0.0 1.0 1.3 MATERIAL PROF	Ø.37
139.1 - 142.6	2.9	139.1 -	140.4	1.3	0.44
MATERIAL PR	OPERTIES	139.5 -	140.2	MATERIAL PROF	PERTIES
142.0 - 144.9	7 2.9	142.0 -	143.2	1.2	0.41
144.9 - 147.8	3 2.9	144.9 -	146.3	1.4 MATERIAL PROF	0.48
MATERIAL PR	OPERTIES	145.4 -	146.1	MATERIAL PROF	PERTIES
147.8 - 150.	7 2.9	147.8 -	148.8	1.Ø 1.6	0.34
150.7 - 153.6	5 2.9	150.7 -	152.3	1.6 1.0	0.55
153.6 - 156.6	5 3.0	153.6 -	154.6	1.0	0.33
156.6 - 159.	5 2.9	154.6 -	158.0	1.4	0.48
159.5 - 162.	3.0	159.5 -	159.7	1.6 1.0 1.4 0.2 0.2	0.06
162.5 - 165.6	5 3.1	162.5 -	162.7	0.2	0.06
165.6 - 168.	7 3.1	165.5 -	166.4	0.8	0.25
168.7 - 171.8 171.8 - 174.6	3.1	168.7 -	169.9	1.2 1.5	<b>0.</b> 30
1/1.8 - 1/4.0	3 3.0	171.8 -	173.3	1.5	0.50
174.8 - 178.6 178.0 - 181.6	0 3.2	1/4.8 ~	1/6.1	1.3	0.40
	a 3.W	178.2 -	1/9.1	1.1	0.36
181.0 - 184.	l 3.1	181.0 - 181.4 -	182.5	1.5 MATERIAL PROF	0.48
MATERIAL PRI	JPEKI1E5	181.4 ~	182.1	MATERIAL PROF	Ø.12
107 7 - 107	2 J.I	104.1	100.1	Ø.4 Ø.9 Ø.4	0.12
107.2 - 170.		107.2 -	100.1	0.7	0.12
190.3 - 193.6	3 3.3 4 70	170.3 -	170.7	0.7	0.12
193.6 - 196.6 196.6 - 199.8	3 3. <b>6</b> 3 7 7	170.0 -	100 1	0.7 1.5	0.46
MATERIAL DE	DEDTIES	170.0 -	107 4	MATERIAL PROF	EDTIES
100 8 - 201	1 77	190 9	201 2	MATERIAL PROF 1.4 1.0	0.42
203.1 - 206.3	2 3.1	203.1 -	201.1	1 . Ø	0.32
MATERIAL PRO	PERTIES	203.3 -	203.9	1.0 MATERIAL PROF	PERTIES
206.2 - 209.	3 3.1	206.2 -	207.3	1.1	0.35
207.3 - 212.4			210.2	0.9	Ø.29
212.4 - 215.			213.3	0.9	0.29
215.5 - 218.6			216.0	0.5	0.16
218.6 - 221.			219.7	1.1	0.36
MATERIAL PRO			219.4	MATERIAL PROF	
221.6 - 224.			223.3	1.7	0.54
224.7 - 227.6			226.3	1.6	0.55
227.6 - 230.4			229.2	1.6	0.57
MATERIAL PRI			228.7	MATERIAL PROF	
230.4 - 233.3			231.4	1.0	0.35
233.2 - 236.			234.3	1.1	0.38
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OOR-17 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE	MARKED	RECOVERED	RECOVERY
				, and that has not not the see our till see the see of the see the see on t	
236.1 - 239.0	2.9	236.1 -	237.4	1.3	0.44
			237.0	MATERIAL PROF	PERTIES
239.0 - 241.7 241.7 - 244.5 244.5 - 247.4 247.4 - 250.3 250.3 - 253.3	2.7	239.0 -	239.7	0.7	0.25
241.7 - 244.5	2.8	241.7 -	242.6	0.9	0.32
244.5 - 247.4	2.9	244.5 -	245.0	Ø.5	0.17
247.4 - 250.3	2.9	247.4 -	247.8	Ø. 4	W . I .
250.3 - 253.3	3.0	250.3 -	250.9	0.6 0.7 1.0 MATERIAL PROF 0.4 1.3	0.20
253.3 - 255.9 255.9 - 258.7	2.6	253.3 -	254.0	0.7	0.26
255.9 - 258.7	2.8	255.9 -	256.9	1.0	0.35
MATERIAL PRO	PERTIES	256.1 -	256.8	MATERIAL PROF	'ERTIES
MATERIAL PRO 258.7 - 261.5 261.5 - 264.4 264.4 - 267.3	2.8	258.7 -	259.1	0.4	0.14
261.5 - 264.4	2.9	261.5 -	262.8	1.3 0.9 MATERIAL PROF 1.0 1.4 MATERIAL PROF	0.44
264.4 - 267.3	2.9	264.4 -	265.3	0.9	0.31
MATERIAL PRO	PERTIES	264.5 -	265.2	MATERIAL PROF	ERTIES
267.3 - 270.1	2.8	267.3 -	268.3	1.0	0.35
270.1 - 273.0	2.9	270.1 -	271.5	1.4	0.48
MATERIAL PRO	PERTIES	270.6 -	271.3	MATERIAL PROF 1.1 1.0 MATERIAL PROF	ERTIES
273.0 - 275.9	2.9	273.0 -	274.1	1.1	0.37
275.9 - 278.9	3.0	275.9 -	276.9	1.0	<b>0.3</b> 3
MATERIAL PRO	PERTIES	276.1 -	276.8	MATERIAL PROF	ERTIES
278.9 - 282.1 282.1 - 285.2	3.2	278.9 -	279.9	1.0 0.6	0.31
282.1 - 285.2	3.1	282.1 -	282.7	Ø.6	0.19
285.2 - 288.4 288.4 - 291.5	3.2	285.2 -	285.9	Ø.7 1.3	0.21
288.4 - 291.5	3.1	285.2 - 288,4 -	289.7	1.3	0.41
291.5 - 294.7	3.2	291.5 -	292.8	1.3	0.40
294.7 - 297.9	3.2	294.7 -	296.2	1.5	0.46
MATERIAL PRO	PERTIES	295.0 -	295.7	1.3 1.5 MATERIAL PROF 1.5 1.9 MATERIAL PROF 1.4	ERTIES
297.9 - 300.9	3.0	297.9 -	299.4	1.5	0.50
300.9 - 304.4	3.5	300.9 -	302.8	1.9	0.54
MATERIAL PRO	PERTIES	300.9 -	302.8	MATERIAL PROF	ERTIES
304.4 - 307.5	3.1	304.4 -	305.8	1.4	0.45
307.5 - 310.7 310.7 - 313.8	3.2	307.5 -	308.4	0.9	
310.7 - 313.8	3.1	310.7 -	311.3	0.6	0.19
313.8 - 317.0	3.2	313.8 -	314.2	0.4 0.2	0.12
313.8 - 317.0 317.0 - 320.2	3.2	317.0 -	317.2	0.2	0.06
320.2 - 323.4 323.4 - 326.7	3.2	320.2 -	321.1	1.0	0.31
323.4 - 326.7	3.3	323.4 -	324.0	0.6	0.18
326.7 - 329.8	3.1	326.7 -	327.2	Ø <b>.</b> 5	0.16
329.8 - 333.0	3.2	329.8 -	331.5	0.5 1.7 MATERIAL PROF	0.53
MATERIAL PRO	PERTIES	<b>3</b> 3 <b>0.5</b> -	331.2	MATERIAL PROF	PERTIES
330.0 - 336.1 336.1 - 339.0	3.1	330.0 -	334.0	1.0	w. J2
336.1 - 339.0	2.9	336.1 -	337.4	1.3	0.44
339.0 - 341.9 341.9 - 344.8	2.9	339.0 -	340.2	1.2	0.41
341.9 - 344.8	2.9	341.9 -	343.0	1.1	0.37
344.8 - 347.7		344.8 -	346.2		0.48
347.7 - 350.5	2.8	347.7 -	348.2	Ø <b>.</b> 5	0.17
350.5 - 353.4	2.9	350.5 -	351.2	0.7	0.24
353.4 - 356.3		353.4 -	354.0	0.6	0.20
356.3 - 359.3		356.3 -		0.7	0.23
359.3 - 362.1		359.3 -	359.7	0.4	0.14
362.1 - 365.0		362.1 -		1.0	0.34
365.0 - 367.9		365.0 -	366.6	1.6	0.55
367.9 - 370.7		367.9 -		1.2	0.42
370.7 - 373.6		370.7 -		1.0	0.34
373.6 - 376.4		373.6 -		0.8	0.28

OOR-17 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE	MARKED	RECOVERED	RECOVERY
376.4 - 379.3		376.4 -		Ø.3	0.10
379.3 - 382.1 382.1 - 385.0	2.8	379.3 -	380.6	1.3 0.7	0.46
382.1 - 385.0	2.9	382.1 -	382.8	Ø.7	0.24
385.0 - 388.1 388.1 - 391.0	3.1	385.0 -	386.1	1.1	0.35
388.1 - 391.0	2.9	200.1 -	207.10	<b>0.</b> 7	0.31
391.0 - 394.1	3.1	391.0 -	391.6	0.6	0.19
394.1 - 397.3 397.3 - 400.4	3.2	394.1 -		Ø.6	0.18
397.3 - 400.4	3.1	397.3 -	398.2	0.9	0.29
400.4 - 403.7 403.7 - 406.8	3.3	400.4 - 403.7 -	401.1	1.7	0.51
403.7 - 406.8	3.1	403.7 -	404.0	0.3	0.09
406.8 - 410.1 410.1 - 413.3	3.3	406.8 - 410.1 -	408.0	1.2	0.36
410.1 - 413.3	3.2	410.1 -	410.7	0.6	Ø.18
413.3 - 416.4	3.1	413.3 -	414.1	Ø.8	0.25
413.3 - 416.4 416.4 - 419.7	3.3	413.3 - 415.4 -	417.6	1.2	0.36
419.7 - 422.8	3.1	419.7 -	420.3	0.6	0.19
422.8 - 425.9	3.1	419.7 - 422.8 -	423.7	0.9	0.29
425.9 - 429.1 429.1 - 432.3 432.3 - 435.5	3.2	425.9 -	426.6	0.7	0.21
429.1 - 432.3	3.2	425.9 - 429.1 -	429.7	Ø. 6	0.18
432.3 - 435.5	3.2	429.1 - 432.3 - 435.5 -	433.0	0.7	0.21
435.5 - 438.5	3.0	435.5 -	436.5	1.0	0.33
435.5 - 438.5 438.5 - 441.3	2.8	438.5 -	439.2	0.7	0.25
441.3 - 444.1	2.8	441.3 -	442.3	1.0	0.35
441.3 - 444.1 444.1 - 446.8	2.7	441.3 - 444.1 -	444.9	Ø.8	0.29
446.8 - 449.B	3.0	446.8 -	447.8	1.0	0.33
446.8 - 449.8 449.8 - 452.6	2.8	446.8 - 449.8 -	450.7	Ø. 9	0.32
452.6 - 460.7	8.1	452.6 -	453.4	0.8	0.09
452.6 - 460.7 460.7 - 464.1	3.1	452.6 - 460.7 -	461.1	0.4	0.11
464.1 - 467.3	7 7	464.1 -	464 5	Ø. 4	Ø. 12
467 3 - 470 5	3.2	467.3 -	467.6	0.3	0.09
467.3 - 470.5 470.5 - 474.4 474.4 - 477.3 477.3 - 480.0	3.2	470 5 -	471 0	Ø.5	0.12
A74 A - A77 3	2.0	474.4 -	475 5	1 1	0.37
477 3 - 400 0	9 7	477 T -	470.0	Ø.5 1.1 1.3	Ø.48
480.0 - 482.9	2.9	490 0 -	481.6	1.6	
MATERIAL PROF		400.6	401.0	1.6 MATERIAL PROF	DEDITE
		400.0 -	401.3	1.5	
482.9 - 485.8 485.8 - 488.6	2.1	482.9 - 485.8 -	404·4	1.1	0.39
400.6 - 401.6	2.0	400.6 -	400.7	1.1 Ø.5 1.0	Ø. 17
400.0 - 471.4	2.0	488.6 - 491.4 -	407.1	1.0	0.34
488.6 - 491.4 491.4 - 494.3 494.3 - 497.2 497.2 - 500.0 500.0 - 502.7	2.7	471.4 -	47214 405 3		Ø.34
474.3 - 47/.2	2.7	494.3 - 497.2 -	473.3	1.0	Ø.25
497.2 - 500.0	2.8	47/.2 -	47/.7	Ø.7 Ø.6	Ø. 23
502.7 - 505.5	2.7	500.0 -	500.6	v.0	
505.5 - 508.3	2.8	502.7 - 505.5 -	503./	1.Ø 1.1	0.35 0.39
	2.8 	505.J -	504.6	MATERIAL BRODE	
MATERIAL PROF			506.4		
508.3 - 511.2	2.9	508.3 -	509.5	1.2	Ø.41
511.2 - 514.2	3.0	511.2 -		1.2	0.40
MATERIAL PROF		511.5 -	512.2	MATERIAL PROF	
514.2 - 522.8	8.6	NO RECO		0.0	0.00
522.8 - 525.5	2.7	522.8 -	523.7	0.9	0.33
525.5 - 528.1	2.6	525.5 -	526.4	0.9	0.34
528.1 - 530.8	2.7	528.1 -	529.1	1.0	0.37
530.8 - 533.9	3.1	530.8 -	531.6	0.8	0.25
533.9 - 537.6	3.7	533.9 -	535.3	1.4	0.37
MATERIAL PRO		534.2 -		MATERIAL PROF	
537.6 - 540.7	3.1	337.6 -	538.6	1.0	0.32

OOR-17 CORE LOG (cont.)

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INTERVAL	LENGTH	SAMPLE	MARKED	RECOVERED	RECOVERY
540.7 - 543.9	3.2	540.7 -	541.5	0.8	0.25
543.9 - 547.2	3.3	543.9 -	544.6	0.7	0.21
543.9 - 547.2 547.2 - 550.3	3.1	547.2 -	547.9	0.7 0.7	0.22
550.3 - 553.5	3.2	550.3 -	551.1	0.7 0.8 0.7	Ø.22 Ø.25
550.3 ~ 553.5 553.5 ~ 556.8	3.3	553.5 -	554.2	Ø.7	0.21
556.8 - 560.0	3.2	556.8 -	557.5	Ø. 7	0.21
553.5 - 556.8 556.8 - 560.0 560.0 - 563.2 563.2 - 566.3 566.3 - 569.6 569.6 - 572.9 MATERIAL PROF	3.2	560.0 -	560.8	Ø.8	W.25
563.2 - 566.3	3.1	563.2 -	564.1	0.9	0.29
566.3 - 569.6	3.3	566.3 -	567.3	1.0	Ø 70
569.6 - 572.9	3.3	569.6 -	571.0	1.4	0.42
MATERIAL PROF	PERTIES	569.9 -	570.6	MATERIAL PRO	PERTIES
572.9 - 576.0	3.1	572.9 -	574.2	1.3	0.41
576.0 - 579.3	3.3	576. <b>0</b> -	577.0	1.0 MATERIAL PRO 0.8 0.9	0.30
MATERIAL PROF	PERTIES	576.2 -	576.9	MATERIAL PRO	PERTIES
579.3 ~ 582.4	3.1	579.3 -	580.1	0.8	0.25
582.4 - 585.3	2.9	582.4 -	583.3	0.9	0.31
585.3 - 588.1 588.1 - 591.0	2.8	585.3 -	586.3	1.0	0.35
588.1 - 591.0	2.9	588.1 -	589.1	1.0	
591.0 - 593.8	2.8	591.0 -	592.3	1.3 MATERIAL PRO	0.46
MATERIAL PROF	PERTIES	591.3 -	592.0	MATERIAL PRO	PERTIES
593.8 - 596.6	2.8	593.8 -	595.0	1.2 1.5 1.4 1.0	0.42
596.6 - 599.5	2.9	596.6 -	598.1	1.5	0.51
599.5 - 602.1	2.6	599 <b>-</b> 5 -	600.9	1.4	0.53
602.1 - 605.0	2.9	602.1 -	603.1	1.0	0.34
605.0 - 607.8	2.8	605.0 -	605.9	0.9	0.32
607.8 - 610.7	2.9	607.8 -	609.0	1.2 1.3	0.41
607.8 - 610.7 610.7 - 613.6	2.9	610.7 -	612.0	1.3	0.44
613.6 - 616.5	2.9	613.6 -	614.6	1.0	0.34
616.5 - 619.3	2.8	616.5 -	617.6	1.0	0.39
MATERIAL PROP	PERTIES	616.8 -	A17.5	MATERIAL PRO	PERTIES
619.3 - 622.2	2.9	619.3 -	619.9	0.6 0.9 0.8 1.2 0.7	0.20
622.2 - 625.4	3.2	622.2 -	623.1	0.9	0.28
625.4 - 628.6	3.2	625.4 -	626.2	0.8	0.25
628.6 - 631.7	3.1	628.6 -	629.8	1.2	0.38
631.7 - 635.1	3.4	631.7 -	632.4	Ø.7	0.20
635.1 - 638.3	3.2	635.1 -	636.1	1.0	0.31
638.3 - 641.5 641.5 - 644.8 644.8 - 648.0 648.0 - 650.8 650.8 - 653.7 653.7 - 656.5 656.5 - 659.2 659.2 - 662.0	3.2	638.3 -	639.3	1.0	0.31
641.5 - 644.8	3.3	641.5 -	642.4	0.9	0.27
644.8 - 648.0	3.2	644.8 -	645.8	1.0	0.31
648.0 - 650.8	2.8	648.0 -	649.1	1.1	0.39
650.8 - 653.7	2.9	65 <b>0.</b> 8 -	651.7	0.9	0.31
653.7 - 656.5	2.8	<b>653.</b> 7 -	654.6	0.9	0.32
656.5 - 659.2	2.7	65 <b>6.</b> 5 -	657 <b>.</b> 0	0.5	0.18
659.2 - 662.0	2.8	659.2 -	660.1	0.9	0.32
662.0 - 664.8	2.8	662.0 -	662.8	w.c	0.28
664.8 - 667.6	2.8	664.8 -	665.9	1.1	0.39
667.6 - 670.5	2.9	667.6 -	668.8	1.2	0.41
670.5 - 673.1	2.6	670.5 -	671.4	0.9	0.34
673.1 - 676.1	3.0	673.1 -	674.3	1.2	0.40
676.1 - 678.9	2.8	676.1 -	677.1	1.0	0.35
678.9 - 681.8	2.9	678.9 -	680.2	1.3	0.44
681.1 - 684.6	2.8	681.8 -	682.9	1.1	0.39
684.6 - 687.4	2.8	684.6 -	685.5	0.9	0.32
687.4 - 690.2	2.8	687.4 -	688.2	0.8	0.28
690.2 - 692.9	2.7	690.2 -	691.1	0.9	0.33

OOR-17 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
692.9 - 695.8	20	692.9 - 693.8	0.9	0.31
695.8 - 700.8	5.0	405 0 - 404 0	1.1	0.22
695.8 - 700.8 700.8 - 706.4	5.6	NO RECOVERY	0.0	0.00
706.4 - 711.4	5.0	706.4 - 707.3	0.9	0.18
706.4 - 711.4 711.4 - 716.7	5.3	706.4 - 707.3 711.4 - 712.1	0.7	0.13
716.7 - 721.9	5.2	716.7 - 717.7	1.0	0.19
716.7 - 721.9 721.9 - 724.1	2.2	721.9 - 723.1	1.2	0.54
724.1 - 729.3	5.2	NO RECOVERY	0.0	0.00
724.1 - 729.3 729.3 - 734.4	5.i	716.7 - 717.7 721.9 - 723.1 NO RECOVERY 729.3 - 730.3	1.0	0.19
734.4 - 736.7 736.7 - 737.9	2.3	734.4 - 735.4	1.0	0.43
736.7 - 737.9	1.2	734.4 - 735.4 736.7 - 737.4 737.9 - 742.9 745.8 - 747.9	0.7	0.58
737.9 - 745.8 745.8 - 752.4	7.9	737.9 - 742.9	5.0	0.63
745.8 - 752.4	6.6	745.8 - 747.9	2.1	0.31
752.4 - 755.1	2.7	752.4 - 754.4 755.1 - 764.2	2.0	0.74
755.1 - 766.3	11.2	755.1 - 764.2	9.1	Ø.81
752.4 - 755.1 755.1 - 766.3 766.3 - 768.3 768.3 - 771.3	2.0	733.1 - 764.2 766.3 - 768.2 768.3 - 771.3 771.3 - 776.8	1.9	0.95
768.3 - 771.3	3.0	768.3 - 771.3	3.0	1.00
771.3 - 780.0	8.7	771.3 - 776.8	5.5	<b>0.</b> 63
780.0 - 783.6 783.6 - 793.1	3.6	780.0 - 782.4 783.6 - 793.1	2.4 9.5	0.66
				1.00
MATERIAL PRO	PERTIES	787.6 - 788.6 793.1 - 803.8 803.8 - 808.6	MATERIAL PRO	PERTIES
793.1 - 803.8	10.7	793.1 - 803.8	10.7	
803.8 - 808.6 808.6 - 818.5	4.8	803.8 - 808.6 809,6 - 815.4	4.8	1.00
808.6 - 818.5	9.9	808,6 - 815.4	6.8	0.68
818.5 - 827.0	8.5	818.5 - 825.2 820.3 - 821.1	6.7 MATERIAL PRO	Ø.78
MATERIAL PRO	PERTIES	820.3 - 821.1	MATERIAL PRO	
827.0 - 838.5	11.5	827.0 - 836.3 838.5 - 842.6 842.6 - 846.8 843.5 - 844.4 850.2 - 852.6	9.3	0.80
838.5 - 842.6	4.1	838.5 - 842.6	4.1 4.2	1.00
842.6 - 850.2	/.6 DEDITO	842.6 - 846.8	4.2 MATERIAL PRO	0.55
MAIEKIAL FKU	7 7	843.5 - 844.4	MATERIAL PRO	PERILES 0 7E
057 4 - 040 1	ა.∠ 4.7	850.2 - 852.6	2.4	0.75 0.58
853.4 - 860.1 860.1 - 864.1	4.0	853.4 - 857.3 860.1 - 862.4	3.9 2.3	Ø.57
864.1 - 870.0	T. W	044 1 - 040 0		0.96
MATERIAL PR		864.1 - 869.8 866.8 - 867.7	MATERIAL PRO	
070 0 074 7	~	~~~ ~~	A ***	
874.3 - 885.8	11.5	870.0 - 874.3 874.5 - 884.2	9.9	0.86
MATERIAL PR	OPERTIES	880.1 - 881.1	MATERIAL PRO	PERTIES
885.8 - 896.1	10.3	885.8 - 894.1	10.3	1.00
896.1 - 904.3	8.2	896.1 - 903.6	7.5	0.91
MATERIAL PR	OPERTIES	870.0 - 874.3 874.5 - 884.2 880.1 - 896.1 895.8 - 896.1 896.1 - 903.6 897.9 - 898.9 904.3 - 907.4 907.4 - 916.7	MATERIAL PRO	PERTIES
904.3 - 907.4	3.1	904.3 - 907.4	3.1	1.00
907.4 - 918.7	11.3	907.4 916.7	0.82	
MATERIAL PR	OPERTIES	907.4 916.7 914.4 - 915.4	MATERIAL PRO	PERTIES
918.7 - 928.1		918.7 - 928.1	9.4	1.00
MATERIAL PR	OPERTIES	921.7 - 922.7	MATERIAL PRO	PERTIES
928.1 - 938.4	10.3	928.1 - 938.4	10.3	1.00
MATERIAL PR	OPERTIES	933.4 - 934.4	MATERIAL PRO	PERTIES
938.4 - 947.8		938.4 - 947.8	9.4	1.00
947.8 - 956.3		947.8 - 953.1	5.3	0.62
956.3 - 961.0		956.3 - 960.2	3.9	0.82
961.0 - 956.6		961.0 - 963.3	2.3	0.50
965.6 - 968.3		965.6 - 967.6	2.0	0.74
968.3 - 972.1		968.3 - 970.6	2.3	0.60
972.1 - 979.8	7.7	972.1 - 979.8	7.7	1.00
		•		

_OOR-17 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE	MARKED	RECOVERED	RECOVERY
979.8 - 986.7	6.9	979.8 -	984.6	4.8	0.69
986.7 - 994.0	7.3	986.7 -	992.1	5.4	Ø.73
MATERIAL PROF	PERTIES	990.7 -	991.5	MATERIAL PRO	PERTIES
994.0 - 997.2	3.2	994.0 -	994.9	0.9	0.28
997.2 - 1003.9	6.7	997.2 -	999.2	2.0	0.29
1003.9 - 1013.4	9.5	1003.9 -	1011.6	7.7	0.81
1013.4 - 1023.8	10.4	1013.4 -	1023.7	10.3	0.99
MATERIAL PROF	PERTIES	1023.8 -	1024.8	MATERIAL PROPE	RTIES
1023.8 - 1030.3	6.5	1023.8 -	1030.3	6.5	1.00
1030.3 - 1038.2	7.9	1030.3 -	1038.2	7.9	1.00
1038.2 - 1047.5	9.3	1038.2 -	1047.5	9.3	1.00
MATERIAL PROF	PERTIES	1043.2 -	1044.2	MATERIAL PROPE	RTIES
1047.5 - 1058.1	10.6	1047.5 -	1056.8	9.3	0.87
1058.1 - 1065.0	6.9	1058.1 -	1064.6	6.5	0.94
1065.0 - 1067.3	2.3	1065.0 -	1067.3	2.3	1.00
1067.3 - 1073.8	6.5	1067.3 -		4.9	Ø.75
1073.8 - 1079.3	5.5	1073.8 -	1078.7	4.9	0.89
1079.3 - 1085.6			1084.8	0.5	0.07
1085.6 - 1091.1	5.5	1085.6 -		5.5	1.00
	<b>-</b>			~ <del></del>	

OPZ-18 CORE LOG

8.0 - 1.9	INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
1.9 - 3.8 1.9 1.9 - 3.6 1.7 0.89   3.8 - 6.3 2.5 3.8 - 5.5 1.7 0.68   8.3 - 10.2 1.9 8.3 - 10.0 1.7 0.89   10.2 - 12.1 1.9 10.2 - 11.9 1.7 0.89   12.1 - 14.0 1.9 12.1 - 13.8 1.7 0.89   14.0 - 16.0 2.0 14.0 - 15.7 1.7 0.89   14.0 - 16.0 2.0 14.0 - 15.7 1.7 0.89   14.0 - 17.8 1.8 16.0 - 17.7 1.7 0.99   16.0 - 17.8 1.8 16.0 - 17.7 1.7 0.94   17.8 - 19.7 1.9 17.8 - 18.7 0.9 0.9 0.47   19.7 - 21.6 1.9 17.8 - 18.7 0.9 0.9 0.47   19.7 - 22.6 1.9 21.6 - 23.3 1.7 0.89   23.5 - 25.5 1.9 21.6 - 23.3 1.7 0.89   23.5 - 25.5 2.0 23.5 - 24.5 0.8 0.8 0.40   25.5 - 27.3 1.8 25.5 - 26.8 1.3 0.72   27.3 - 29.2 1.9 27.3 - 27.9 0.6 0.31   29.2 - 31.1 1.9 29.2 - 29.7 0.5 0.26   31.1 - 33.0 1.9 31.1 - 32.0 0.9 0.47   33.0 - 35.0 2.0 33.0 - 34.2 1.2 0.9   35.0 - 36.9 1.9 35.0 - 34.2 1.2 0.9   36.9 - 35.8 0.8 0.8 0.42   26.9 - 38.8 1.9 35.0 - 34.2 1.2 0.00   38.8 - 40.8 2.0 38.8 - 40.3 0.5 0.8 0.8 0.42   36.9 - 38.8 1.9 36.9 37.1 0.2 0.10   38.8 - 40.8 1.9 36.9 37.1 0.2 0.10   38.8 - 40.8 1.9 44.6 - 46.3 1.7 0.99   44.6 - 46.5 1.9 44.6 - 46.3 1.7 0.99   44.6 - 46.5 1.9 44.6 - 46.3 1.7 0.99   44.6 - 46.5 1.9 44.6 - 46.3 1.7 0.99   44.6 - 46.5 1.9 44.6 - 46.3 1.7 0.99   44.6 - 46.5 1.9 44.6 - 46.3 1.7 0.99   44.6 - 46.5 1.9 52.6 - 54.5 1.2 0.8 0.3 0.15   40.8 - 40.8 1.9 52.6 - 54.5 1.7 0.99   44.6 - 46.5 1.9 52.6 - 56.0 1.5 0.78   57.4 - 58.7 1.9 52.6 - 54.5 1.7 0.99   54.5 - 57.4 1.9 52.6 - 54.5 1.7 0.99   54.5 - 77.5 7.5 2.2 50.4 - 51.2 0.8 0.5 0.71   58.7 - 60.8 2.1 58.7 - 60.2 1.5 0.71   60.8 - 62.9 2.1 60.8 - 62.3 1.5 0.71   60.8 - 62.9 2.1 60.8 - 62.3 1.5 0.71   60.8 - 62.9 2.1 60.8 - 62.3 1.5 0.71   60.8 - 62.9 2.1 60.8 - 62.3 1.5 0.71   60.8 - 62.9 2.1 60.8 - 62.3 1.5 0.71   60.8 - 62.9 2.1 60.8 - 62.3 1.5 0.71   60.8 - 62.9 2.1 60.8 - 62.3 1.5 0.71   60.8 - 62.9 2.1 60.8 - 62.3 1.5 0.71   60.8 - 62.9 2.1 60.8 - 62.3 1.5 0.71   60.8 - 62.9 2.1 60.8 - 62.3 1.5 0.71   60.8 - 62.9 2.1 60.8 - 62.3 1.5 0.71   60.8 - 62.9 2.1 60.8 - 62.3 1.5 0.71   60.8 - 62.9 2.1 60.8 - 62.3 1.5 0.71   60.8 - 62.9 2.1 60.8 - 62.3 1.5 0.71   60.8 - 62.	0.0 1.0	1 0	0.0 - 0.4	Ø 4	Ø 71
3.8 - 6.3					
6.3 - 8.3					
8.3 - 10.2 1.9 8.3 - 10.0 1.7 0.89 10.2 - 11.9 10.2 - 11.9 1.7 0.89 12.1 - 14.0 1.9 12.1 - 13.8 1.7 0.89 14.0 - 16.0 2.0 14.0 - 15.7 1.7 0.89 14.0 - 16.0 2.0 14.0 - 15.7 1.7 0.85 16.0 - 17.8 1.8 1.6 0 - 17.7 1.7 0.94 17.8 - 19.7 1.9 17.8 - 18.7 0.9 0.47 17.8 - 19.7 1.9 17.8 - 18.7 0.9 0.47 17.8 - 19.7 1.9 17.8 - 18.7 0.9 0.47 17.4 0 - 23.5 1.9 21.6 - 23.3 1.7 0.89 21.6 - 23.5 22.5 2.0 23.5 - 24.5 0.8 0.8 0.40 25.5 - 27.3 1.8 25.5 - 26.8 1.3 0.72 27.3 - 29.2 1.9 27.3 - 27.9 0.6 0.31 29.2 1.9 27.3 - 27.9 0.6 0.31 29.2 27.3 - 29.2 1.9 27.3 - 27.9 0.6 0.31 29.2 21.1 1.9 29.2 - 29.7 0.5 0.26 31.1 - 32.0 0.9 0.47 33.0 - 35.0 2.0 33.0 - 35.0 2.0 33.0 - 35.0 2.0 33.0 - 35.0 2.0 33.0 - 35.0 2.0 33.0 - 35.0 2.0 33.0 - 35.0 2.0 33.0 - 35.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.0 33.0 2.					
10.2 - 12.1					
12.1 - 14.0					
14.0 - 16.0 2.0 14.0 - 15.7 1.7 0.85 16.0 - 17.8 1.8 16.0 - 17.7 1.7 0.94 17.8 - 19.7 1.9 17.8 - 18.7 0.9 0.47 19.7 - 21.6 1.9 19.7 - 21.4 1.7 0.89 23.5 - 25.5 2.0 23.5 - 24.5 0.8 0.40 25.5 - 27.3 1.8 25.5 - 26.8 1.3 0.72 27.3 - 29.2 1.9 27.3 - 27.9 0.6 0.31 27.2 - 31.1 1.9 29.2 - 29.7 0.5 0.26 31.1 - 33.0 1.9 33.0 - 34.2 1.2 0.60 35.0 - 35.0 2.0 33.0 - 34.2 1.2 0.60 35.0 - 36.9 1.9 35.0 - 35.8 0.8 0.42 36.9 - 39.8 1.9 36.9 - 37.1 0.2 0.60 36.8 - 40.8 2.0 38.8 - 40.3 0.5 0.25 42.7 - 44.6 1.9 42.7 - 43.0 0.3 0.5 0.25 44.6 - 46.5 1.9 44.6 - 46.3 1.7 0.89 48.4 - 46.5 1.9 44.6 - 46.3 1.7 0.89 48.4 - 50.4 2.0 48.4 - 49.8 1.4 0.70 48.6 - 52.6 2.2 50.4 - 51.2 0.8 0.8 50.4 - 52.6 57.4 1.9 52.6 - 54.3 1.7 0.89 48.4 - 50.4 2.0 48.4 - 49.8 1.4 0.70 50.4 - 52.6 6.9 1.1 1.9 52.6 - 54.3 1.7 0.89 48.7 - 60.8 2.1 58.7 - 60.2 1.5 0.71 60.8 62.9 2.1 69.4 - 51.2 0.8 0.8 0.36 67.1 - 71.2 2.1 69.1 - 70.3 1.5 0.71 60.8 62.9 - 64.9 2.0 66.9 1.5 0.71 60.8 62.9 2.1 69.1 - 70.3 1.5 0.71 60.8 62.9 2.1 69.1 - 70.3 1.5 0.71 60.8 62.9 2.1 69.1 - 70.3 1.5 0.71 60.8 62.9 - 64.9 2.0 65.7 - 70.9 1.5 0.70 64.9 - 67.1 2.2 64.9 - 64.4 1.5 0.70 69.1 - 71.2 2.1 69.1 - 70.3 1.2 0.57 77.3 - 77.5 2.2 75.3 - 76.8 1.5 0.71 64.9 - 67.1 2.9 64.9 - 66.4 1.5 0.70 69.1 - 71.2 2.1 69.1 - 70.3 1.2 0.57 77.5 - 79.6 2.1 77.5 - 78.9 1.4 0.66 77.6 - 82.8 8.2 79.6 81.1 1.5 0.68 85.7 - 90.3 3.4 94.9 - 66.5 1.4 0.55 88.7 - 90.3 3.4 94.9 - 66.5 1.4 0.55 88.7 - 90.3 3.4 94.9 - 66.4 1.5 0.68 89.7 - 90.3 3.4 94.9 - 66.4 1.5 0.68 89.7 - 90.3 3.4 94.9 - 66.4 1.5 0.68 89.7 - 90.3 3.4 94.9 - 66.4 1.5 0.68 89.7 - 90.3 3.4 94.9 - 90.5 1.6 0.55 88.7 - 90.3 3.4 94.9 - 90.5 1.6 0.55 88.7 - 90.3 3.4 94.9 - 90.5 1.6 0.55 88.7 - 90.3 3.4 94.9 - 90.5 1.6 0.55 88.7 - 90.3 3.4 94.9 - 90.5 1.6 0.55 88.7 - 90.3 3.4 94.9 - 90.5 1.6 0.55 88.7 - 90.3 3.4 94.9 - 90.5 1.6 0.55 88.7 - 90.3 3.4 94.9 - 90.5 1.6 0.55 89.7 - 90.3 3.4 94.9 - 90.5 1.6 0.55 89.7 - 90.3 3.4 94.9 - 90.5 1.6 0.55 89.7 - 90.3 3.4 94.9 - 90.5 1.6 0.55 89.7 - 90.3 3.4 94.9 - 90.5 1.6 0.55 89.7 - 90.3 3.4 94.9 - 90.5 1.6 0.5					
16.0 - 17.8					
17.8       -       19.7       1.9       17.8       -       18.7       0.9       0.47         19.7       -       21.6       1.9       19.7       -       21.4       1.7       0.89         21.6       -       23.5       -       25.5       0.8       0.40         25.5       -       25.5       2.0       23.5       -       24.5       0.8       0.40         25.5       -       27.3       -       27.3       -       27.9       0.6       0.31         27.3       -       29.2       1.9       27.3       -       27.9       0.6       0.31         27.3       -       29.2       1.9       27.3       -       27.9       0.6       0.31         27.3       -       29.2       1.9       35.0       0.25       0.26       0.31         27.3       -       35.0       1.9       35.0       34.2       1.2       0.60         35.0       35.0       2.0       35.0       0.25       0.26       0.20         36.8       1.9       35.0       35.0       0.35       0.25       0.25         40.8       40.8       2.0	-				
19.7 - 21.6		1.8			
21.6 - 23.5		1.9	17.8 - 18.7		
23.5 - 25.5 2.0 23.5 - 24.5 0.8 0.40 25.5 - 27.3 1.8 25.5 - 26.8 1.3 0.72 27.3 - 29.2 1.9 27.3 - 27.9 0.6 0.31 29.2 - 31.1 1.9 29.2 - 29.7 0.5 0.26 31.1 - 33.0 1.9 31.1 - 32.0 0.9 0.47 33.0 - 35.0 2.0 33.0 - 34.2 1.2 0.60 35.0 - 36.9 1.9 35.0 - 35.8 0.8 0.8 0.42 36.9 - 38.8 1.9 36.9 - 37.1 0.2 0.10 38.8 - 40.8 2.0 38.8 - 40.3 0.5 0.25 40.8 - 42.7 1.9 NO RECOVERY 0.0 0.3 0.15 44.6 - 46.5 1.9 44.6 - 46.3 1.7 0.89 46.5 - 48.4 1.9 46.5 - 48.2 1.7 0.89 46.5 - 48.4 1.9 46.5 - 48.2 1.7 0.89 46.4 - 50.4 2.0 48.4 - 49.8 1.4 0.70 50.4 - 52.6 2.2 50.4 - 51.2 0.8 0.36 52.6 - 54.5 1.9 52.6 - 54.3 1.7 0.89 54.5 - 57.4 1.9 52.6 - 54.3 1.7 0.89 54.5 - 57.4 1.9 52.6 - 54.3 1.7 0.89 54.5 - 57.4 1.9 54.5 - 56.0 1.5 0.78 57.4 - 58.7 1.3 57.4 - 58.1 1.7 0.53 58.7 - 60.8 2.1 58.7 - 60.2 1.5 0.71 60.8 - 62.9 2.1 60.8 - 62.3 1.5 0.71 62.9 - 64.9 2.0 62.9 - 64.6 1.7 0.85 64.9 - 64.1 2.0 67.1 - 68.5 1.4 0.70 69.1 - 71.2 2.1 69.1 - 70.3 1.2 0.57 71.2 - 73.3 2.1 71.2 - 72.9 1.7 0.80 73.3 - 75.5 2.0 75.3 - 76.8 1.5 0.70 75.3 - 77.5 2.2 75.3 - 76.8 1.5 0.70 75.4 - 82.8 3.2 79.6 - 81.1 1.5 0.68 67.1 - 69.1 2.0 67.1 - 68.5 1.4 0.70 75.3 - 77.5 7.6 2.1 77.5 - 78.9 1.4 0.66 77.6 - 82.8 3.2 79.6 - 81.1 1.5 0.46 82.8 - 85.7 - 98.3 3.4 94.9 - 96.5 1.6 0.51 60.47 98.3 - 101.4 3.1 98.3 - 99.9 1.6 0.51 60.47 98.3 - 101.4 3.1 98.3 - 99.9 1.6 0.51 60.55 60.50		1.9		1.7	Ø.89
25.5 - 27.3	21.6 - 23.5	1.9	21.6 - 23.3		0.89
25.5 - 27.3	23.5 - 25.5	2.0	23.5 - 24.5	0.8	0.40
27.3 - 29.2	25.5 - 27.3	1.8	25.5 - 26.8		0.72
29.2 - 31.1       1.9       29.2 - 29.7       0.5       0.26         31.1 - 33.0       1.9       31.1 - 32.0       0.9       0.47         33.0 - 35.0       2.0       33.0 - 35.8       0.8       0.42         35.0 - 36.9       1.9       35.0 - 35.8       0.8       0.42         36.9 - 38.8       1.9       36.9 - 37.1       0.2       0.10         38.8 - 40.8       2.0       38.8 - 40.3       0.5       0.25         40.8 - 42.7       1.9       NO RECOVERY       0.0       0.00         42.7 - 44.6       1.9       42.7 - 43.0       0.3       0.15         44.6 - 46.5       1.9       44.4 - 46.3       1.7       0.89         46.5 - 48.4       1.9       46.5 - 48.2       1.7       0.89         48.4 - 50.4       2.0       48.4 - 49.8       1.4       0.70         50.4 - 52.6       2.2       50.4 - 51.2       0.8       0.36         52.6 - 54.5       1.9       52.6 - 54.3       1.7       0.89         54.5 - 57.4       1.9       54.5 - 56.0       1.5       0.78         57.4 - 58.7       1.3       57.4 - 58.1       1.7       0.89         54.9 - 64.5       1.9       54.5		1.9	27.3 - 27.9		0.31
31.1 - 33.0					
33.0 - 35.0 2.0 33.0 - 34.2 1.2 0.60 35.0 - 36.9 1.9 35.0 - 35.8 0.8 0.42 36.9 - 38.8 1.9 36.9 - 37.1 0.2 0.10 38.8 - 40.8 2.0 38.8 - 40.3 0.5 0.25 40.8 - 42.7 1.9 NO RECOVERY 0.0 0.3 0.15 44.6 - 44.5 1.9 44.7 - 45.0 0.3 0.5 44.6 - 46.5 1.9 44.6 - 46.3 1.7 0.89 46.5 - 48.4 1.9 46.5 - 48.2 1.7 0.89 46.5 - 48.4 1.9 46.5 - 48.2 1.7 0.89 50.4 - 50.4 2.0 48.4 - 51.2 0.8 0.36 52.6 - 54.5 1.9 52.6 - 54.3 1.7 0.89 54.5 - 57.4 1.9 52.6 - 54.3 1.7 0.89 57.4 - 58.7 1.3 57.4 - 58.1 1.7 0.89 57.4 - 58.7 1.3 57.4 - 58.1 1.7 0.53 58.7 - 60.8 2.1 58.7 - 60.2 1.5 0.71 60.8 - 62.9 2.1 60.8 - 62.3 1.5 0.71 62.9 - 64.9 2.0 62.9 - 64.6 1.7 0.85 64.9 - 67.1 2.2 64.9 - 64.6 1.7 0.85 64.9 - 67.1 2.2 64.9 - 64.6 1.7 0.85 64.1 - 71.2 2.1 69.1 - 70.3 1.2 0.57 71.2 - 73.3 2.1 71.2 - 72.9 1.7 0.80 69.1 - 71.2 2.1 69.1 - 70.3 1.2 0.57 71.2 - 73.3 - 75.5 2.2 75.3 - 74.7 1.4 0.70 75.3 - 77.5 2.2 75.3 - 74.7 1.4 0.70 75.3 - 77.5 2.2 75.3 - 74.7 1.4 0.70 75.3 - 77.5 2.2 75.3 - 74.7 1.4 0.70 75.3 - 77.5 2.2 75.3 - 74.7 1.4 0.70 75.3 - 77.5 2.2 75.3 - 74.7 1.4 0.66 88.7 - 91.8 3.1 88.7 - 89.7 1.0 0.32 91.8 - 94.9 3.1 91.8 - 94.9 1.6 0.51 101.4 - 104.5 3.1 101.4 - 103.0 1.6 0.51 101.5 - 107.5 1.0 10.7 3.0 107.5 - 109.0 1.5 0.50					
35.0 - 36.9					
36.9 - 38.8 1.9 36.9 - 37.1 0.2 0.10 38.8 - 40.8 2.0 38.8 - 40.3 0.5 0.25 40.8 - 42.7 1.9 NO RECOVERY 0.0 0.3 0.15 44.6 - 44.5 1.9 42.7 - 43.0 0.3 0.15 44.6 - 46.5 1.9 44.6 - 46.3 1.7 0.89 46.5 - 48.4 1.9 46.5 - 48.2 1.7 0.89 48.4 - 50.4 2.0 48.4 - 49.8 1.4 0.70 50.4 - 52.6 2.2 50.4 - 51.2 0.8 0.36 52.6 - 54.5 1.9 52.6 - 54.3 1.7 0.89 54.5 - 57.4 1.9 52.6 - 54.3 1.7 0.89 57.4 - 58.7 1.3 57.4 - 56.0 1.5 0.78 57.4 - 58.7 1.3 57.4 - 56.1 1.7 0.53 58.7 - 60.8 2.1 58.7 - 60.2 1.5 0.71 60.8 - 62.9 2.1 60.8 - 62.3 1.5 0.71 62.9 - 64.9 2.0 67.1 62.9 64.6 1.7 0.85 64.9 - 67.1 2.2 64.9 - 66.4 1.5 0.68 67.1 - 69.1 2.0 67.1 - 68.5 1.4 0.70 69.1 - 71.2 2.1 69.1 - 70.3 1.2 0.57 71.2 - 73.3 2.1 71.2 - 72.9 1.7 0.80 73.3 - 75.3 2.0 73.3 - 74.7 1.4 0.70 75.3 - 77.5 79.6 2.1 77.5 - 76.8 1.5 0.68 67.9 - 82.8 3.2 79.6 - 81.1 1.5 0.68 88.7 - 91.8 3.1 88.7 - 89.7 1.0 0.32 91.8 - 94.9 3.1 91.8 - 94.9 1.6 0.51 101.4 - 104.5 3.1 101.4 - 103.0 1.6 0.51 101.4 - 104.5 3.1 101.4 - 103.0 1.6 0.51 110.7 - 113.7 3.0 110.7 - 112.2 1.5		_			
38.8 - 40.8         2.0         38.8 - 40.3         0.5         0.25           40.8 - 42.7         1.9         NO RECOVERY         0.0         0.00           42.7 - 44.6         1.9         42.7 - 43.0         0.3         0.15           44.6 - 46.5         1.9         44.6 - 46.3         1.7         0.89           46.5 - 48.4         1.9         46.5 - 48.2         1.7         0.89           48.4 - 50.4         2.0         48.4 - 49.8         1.4         0.70           50.4 - 52.6         2.2         50.4 - 51.2         0.8         0.36           52.6 - 54.5         1.9         52.6 - 54.3         1.7         0.89           54.5 - 57.4         1.9         54.5 - 56.0         1.5         0.78           57.4 - 58.7         1.3         57.4 - 58.1         1.7         0.53           58.7 - 60.8         2.1         58.7 - 60.2         1.5         0.71           60.8 - 62.9         2.1         60.8 - 62.3         1.5         0.71           62.9 - 64.9         2.1         60.8 - 62.3         1.5         0.71           62.9 - 64.9         2.1         60.9 - 62.3         1.5         0.71           64.9 - 67.1         2.0 <td< td=""><td></td><td></td><td></td><td></td><td></td></td<>					
40.8 - 42.7       1.9       NO RECOVERY       0.0       0.00         42.7 - 44.6       1.9       42.7 - 43.0       0.3       0.15         44.6 - 46.5       1.9       44.6 - 46.3       1.7       0.89         46.5 - 48.4       1.9       46.5 - 48.2       1.7       0.89         48.4 - 50.4       2.0       48.4 - 49.8       1.4       0.70         50.4 - 52.6       2.2       50.4 - 51.2       0.8       0.36         52.6 - 54.5       1.9       52.6 - 54.3       1.7       0.89         54.5 - 57.4       1.9       54.5 - 56.0       1.5       0.78         57.4 - 58.7       1.3       57.4 - 58.1       1.7       0.53         58.7 - 60.8       2.1       58.7 - 60.2       1.5       0.71         60.8 - 62.9       2.1       60.8 - 62.3       1.5       0.71         62.9 - 64.9       2.0       62.9 - 64.6       1.7       0.85         64.9 - 67.1       2.2       64.9 - 66.4       1.5       0.68         67.1 - 69.1       2.0       67.1 - 68.5       1.4       0.70         71.2 - 73.3       2.1       71.2 - 72.9       1.7       0.80         75.3 - 75.3       2.0       73.3					
42.7 - 44.6       1.9       42.7 - 43.0       0.3       0.15         44.6 - 46.5       1.9       44.6 - 46.3       1.7       0.89         46.5 - 48.4       1.9       46.5 - 48.2       1.7       0.89         48.4 - 50.4       2.0       48.4 - 49.8       1.4       0.70         50.4 - 52.6       2.2       50.4 - 51.2       0.8       0.36         52.6 - 54.5       1.9       52.6 - 54.3       1.7       0.89         57.4 - 58.7       1.9       52.6 - 56.0       1.5       0.78         57.4 - 58.7       1.3       57.4 - 58.1       1.7       0.53         58.7 - 60.8       2.1       58.7 - 60.2       1.5       0.71         60.8 - 62.9       2.1       60.8 - 62.3       1.5       0.71         60.8 - 62.9       2.1       60.8 - 62.3       1.5       0.71         62.9 - 64.9       2.0       62.9 - 64.6       1.7       0.85         64.9 - 67.1       2.2       64.9 - 66.4       1.5       0.68         67.1 - 69.1       2.0       67.1 - 68.5       1.4       0.70         73.3 - 75.3       2.1       71.2 - 72.9       1.7       0.80         75.3 - 77.5       2.2       75.3					
44.6 - 46.5       1.9       44.6 - 46.3       1.7       0.89         46.5 - 48.4       1.9       46.5 - 48.2       1.7       0.89         48.4 - 50.4       2.0       48.4 - 49.8       1.4       0.70         50.4 - 52.6       2.2       50.4 - 51.2       0.8       0.36         52.6 - 54.5       1.9       52.6 - 54.3       1.7       0.89         54.5 - 57.4       1.9       54.5 - 56.0       1.5       0.78         57.4 - 58.7       1.3       57.4 - 58.1       1.7       0.53         58.7 - 60.8       2.1       58.7 - 60.2       1.5       0.71         60.8 - 62.9       2.1       60.8 - 62.3       1.5       0.71         62.9 - 64.9       2.0       62.9 - 64.6       1.7       0.85         64.9 - 67.1       2.0       62.9 - 64.6       1.7       0.85         64.9 - 67.1       2.0       67.1 - 68.5       1.4       0.70         69.1 - 71.2       2.0       67.1 - 70.3       1.2       0.57         71.2 - 73.3       2.1       71.2 - 72.9       1.7       0.80         77.3 - 75.3       2.1       71.2 - 72.9       1.7       0.68         77.5 - 79.6       2.1       77.5					
46.5 - 48.4       1.9       46.5 - 48.2       1.7       0.89         48.4 - 50.4       2.0       48.4 - 49.8       1.4       0.70         50.4 - 52.6       2.2       50.4 - 51.2       0.8       0.36         52.6 - 54.5       1.9       52.6 - 54.3       1.7       0.89         54.5 - 57.4       1.9       54.5 - 56.0       1.5       0.78         57.4 - 58.7       1.3       57.4 - 58.1       1.7       0.53         58.7 - 60.8       2.1       58.7 - 60.2       1.5       0.71         60.8 - 62.9       2.1       60.8 - 62.3       1.5       0.71         62.9 - 64.9       2.0       62.9 - 64.6       1.7       0.85         64.9 - 67.1       2.2       64.9 - 66.4       1.5       0.68         67.1 - 69.1       2.0       67.1 - 68.5       1.4       0.70         69.1 - 71.2       2.1       69.1 - 70.3       1.2       0.57         71.2 - 73.3       2.1       71.2 - 72.9       1.7       0.80         73.3 - 75.3       2.0       73.3 - 74.7       1.4       0.70         75.3 - 77.5       2.2       75.3 - 76.8       1.5       0.68         779.6 - 82.8       3.2       77.					
48.4 - 50.4       2.0       48.4 - 49.8       1.4       0.70         50.4 - 52.6       2.2       50.4 - 51.2       0.8       0.36         52.6 - 54.5       1.9       52.6 - 54.3       1.7       0.89         54.5 - 57.4       1.9       54.5 - 56.0       1.5       0.78         57.4 - 58.7       1.3       57.4 - 58.1       1.7       0.53         58.7 - 60.8       2.1       58.7 - 60.2       1.5       0.71         60.8 - 62.9       2.1       60.8 - 62.3       1.5       0.71         62.9 - 64.9       2.0       62.9 - 64.6       1.7       0.85         64.9 - 67.1       2.2       64.9 - 66.4       1.5       0.68         67.1 - 69.1       2.0       67.1 - 68.5       1.4       0.70         69.1 - 71.2       2.1       69.1 - 70.3       1.2       0.57         71.2 - 73.3       2.1       71.2 - 72.9       1.7       0.80         73.3 - 75.3       2.0       73.3 - 74.7       1.4       0.70         73.3 - 77.5       2.2       75.3 - 76.8       1.5       0.68         77.5 - 79.6       2.1       77.5 - 78.9       1.4       0.64         79.6 - 82.8       3.2       79.6					
50.4 - 52.6       2.2       50.4 - 51.2       0.8       0.36         52.6 - 54.5       1.9       52.6 - 54.3       1.7       0.89         54.5 - 57.4 - 1.9       54.5 - 56.0       1.5       0.78         57.4 - 58.7       1.3       57.4 - 58.1       1.7       0.53         58.7 - 60.8       2.1       58.7 - 60.2       1.5       0.71         60.8 - 62.9       2.1       60.8 - 62.3       1.5       0.71         62.9 - 64.9       2.0       62.9 - 64.6       1.7       0.85         64.9 - 67.1       2.2       64.9 - 66.4       1.7       0.85         64.9 - 67.1       2.0       67.1 - 68.5       1.4       0.70         69.1 - 71.2       2.1       69.1 - 70.3       1.2       0.57         71.2 - 73.3       2.1       71.2 - 72.9       1.7       0.80         73.3 - 75.3       2.0       73.3 - 74.7       1.4       0.70         75.3 - 77.5       2.2       75.3 - 76.8       1.5       0.68         77.5 - 79.6       2.1       77.5 - 78.9       1.4       0.66         77.5 - 79.6       2.1       77.5 - 78.9       1.4       0.64         79.6 - 82.8       3.2       79.6 - 81.1					
52.6 - 54.5       1.9       52.6 - 54.3       1.7       0.89         54.5 - 57.4       1.9       54.5 - 56.0       1.5       0.78         57.4 - 58.7       1.3       57.4 - 58.1       1.7       0.53         58.7 - 60.8       2.1       58.7 - 60.2       1.5       0.71         60.8 - 62.9       2.1       60.8 - 62.3       1.5       0.71         62.9 - 64.9       2.0       62.9 - 64.6       1.7       0.85         64.9 - 67.1       2.2       64.9 - 66.4       1.5       0.68         67.1 - 69.1       2.0       67.1 - 68.5       1.4       0.70         69.1 - 71.2       2.1       69.1 - 70.3       1.2       0.57         71.2 - 73.3       2.1       71.2 - 72.9       1.7       0.80         73.3 - 75.3       2.0       73.3 - 74.7       1.4       0.70         75.3 - 77.5       2.2       75.3 - 74.7       1.4       0.66         77.5 - 79.6       2.1       77.5 - 78.9       1.4       0.66         79.6 - 82.8       3.2       79.6 - 81.1       1.5       0.46         82.7 - 88.7       2.9       82.8 - 83.5       0.7       0.24         85.7 - 88.7       3.0       85.7					
54.5 - 57.4       1.9       54.5 - 56.0       1.5       0.78         57.4 - 58.7       1.3       57.4 - 58.1       1.7       0.53         58.7 - 60.8       2.1       58.7 - 60.2       1.5       0.71         60.8 - 62.9       2.1       60.8 - 62.3       1.5       0.71         62.9 - 64.9       2.0       62.9 - 64.6       1.7       0.85         64.9 - 67.1       2.2       64.9 - 66.4       1.5       0.68         67.1 - 69.1       2.0       67.1 - 68.5       1.4       0.70         69.1 - 71.2       2.1       69.1 - 70.3       1.2       0.57         71.2 - 73.3       2.1       71.2 - 72.9       1.7       0.80         75.3 - 75.3       2.0       73.3 - 74.7       1.4       0.70         75.3 - 77.5       2.2       75.3 - 76.8       1.5       0.68         77.5 - 79.6       2.1       77.5 - 78.9       1.4       0.66         79.6 - 82.8       3.2       79.6 - 81.1       1.5       0.46         82.7 - 88.7       3.0       85.7 - 87.3       1.6       0.53         88.7 - 91.8       3.1       88.7 - 89.7       1.0       0.53         91.8 - 94.9       3.1       91.8					
57.4 - 58.7       1.3       57.4 - 58.1       1.7       0.53         58.7 - 60.8       2.1       58.7 - 60.2       1.5       0.71         60.8 - 62.9       2.1       60.8 - 62.3       1.5       0.71         62.9 - 64.9       2.0       62.9 - 64.6       1.7       0.85         64.9 - 67.1       2.2       64.9 - 66.4       1.5       0.68         67.1 - 69.1       2.0       67.1 - 68.5       1.4       0.70         69.1 - 71.2       2.1       69.1 - 70.3       1.2       0.57         71.2 - 73.3       2.1       71.2 - 72.9       1.7       0.80         73.3 - 75.3       2.0       73.3 - 74.7       1.4       0.70         75.3 - 77.5       2.2       75.3 - 76.8       1.5       0.68         77.5 - 79.6       2.1       77.5 - 78.9       1.4       0.66         79.6 - 82.8       3.2       79.6 - 81.1       1.5       0.66         79.6 - 89.7       3.0       85.7 - 87.3       1.6       0.53         88.7 - 91.8       3.1       88.7 - 89.7       1.0       0.32         91.8 - 94.9       3.1       91.8 - 94.9       1.6       0.51         104.5 - 107.5       3.0       10					
58.7 - 60.8       2.1       58.7 - 60.2       1.5       0.71         60.8 - 62.9       2.1       60.8 - 62.3       1.5       0.71         62.9 - 64.9       2.0       62.9 - 64.6       1.7       0.85         64.9 - 67.1       2.2       64.9 - 66.4       1.5       0.68         67.1 - 69.1       2.0       67.1 - 68.5       1.4       0.70         69.1 - 71.2       2.1       69.1 - 70.3       1.2       0.57         71.2 - 73.3       2.1       71.2 - 72.9       1.7       0.80         73.3 - 75.3       2.0       73.3 - 74.7       1.4       0.70         75.3 - 77.5       2.2       75.3 - 74.7       1.4       0.70         75.3 - 77.5       2.2       75.3 - 76.8       1.5       0.68         77.5 - 79.6       2.1       77.5 - 78.9       1.4       0.66         79.6 - 82.8       3.2       79.6 - 81.1       1.5       0.46         82.8 - 85.7       2.9       82.8 - 83.5       0.7       0.24         85.7 - 88.7       3.0       85.7 - 87.3       1.6       0.53         88.7 - 91.8       3.1       98.7 - 89.7       1.0       0.32         91.8 - 94.9       3.1       91.8					
60.8 - 62.9       2.1       60.8 - 62.3       1.5       0.71         62.9 - 64.9       2.0       62.9 - 64.6       1.7       0.85         64.9 - 67.1       2.2       64.9 - 66.4       1.5       0.68         67.1 - 69.1       2.0       67.1 - 68.5       1.4       0.70         69.1 - 71.2       2.1       69.1 - 70.3       1.2       0.57         71.2 - 73.3       2.1       71.2 - 72.9       1.7       0.80         73.3 - 75.3       2.0       73.3 - 74.7       1.4       0.70         75.3 - 77.5       2.2       75.3 - 74.7       1.4       0.70         75.3 - 79.6       2.1       77.5 - 78.9       1.4       0.68         77.5 - 79.6       2.1       77.5 - 78.9       1.4       0.66         79.6 - 82.8       3.2       79.6 - 81.1       1.5       0.46         82.8 - 85.7       2.9       82.8 - 83.5       0.7       0.24         85.7 - 88.7       3.0       85.7 - 87.3       1.6       0.53         88.7 - 91.8       3.1       88.7 - 89.7       1.0       0.32         91.8 - 94.9       3.1       91.8 - 94.9       1.6       0.51         94.9 - 98.3       3.4       94.9					
62.9 - 64.9       2.0       62.9 - 64.6       1.7       0.85         64.9 - 67.1       2.2       64.9 - 66.4       1.5       0.68         67.1 - 69.1       2.0       67.1 - 68.5       1.4       0.70         69.1 - 71.2       2.1       69.1 - 70.3       1.2       0.57         71.2 - 73.3       2.1       71.2 - 72.9       1.7       0.80         73.3 - 75.3       2.0       73.3 - 74.7       1.4       0.70         75.3 - 77.5       2.2       75.3 - 76.8       1.5       0.68         77.5 - 79.6       2.1       77.5 - 78.9       1.4       0.66         79.6 - 82.8       3.2       79.6 - 81.1       1.5       0.46         82.8 - 85.7       2.9       82.8 - 83.5       0.7       0.24         85.7 - 88.7       3.0       85.7 - 87.3       1.6       0.53         88.7 - 91.8       3.1       88.7 - 89.7       1.0       0.32         91.8 - 94.9       3.1       91.8 - 94.9       1.6       0.51         101.4 - 104.5       3.1       98.3 - 99.9       1.6       0.51         104.5 - 107.5       3.0       104.5 - 106.1       1.6       0.51         107.5 - 110.7       3.0	58.7 - 60.8	2.1	58.7 - 60.2	1.5	0.71
64.9 - 67.1       2.2       64.9 - 66.4       1.5       0.68         67.1 - 69.1       2.0       67.1 - 68.5       1.4       0.70         69.1 - 71.2       2.1       69.1 - 70.3       1.2       0.57         71.2 - 73.3       2.1       71.2 - 72.9       1.7       0.80         73.3 - 75.3       2.0       73.3 - 74.7       1.4       0.70         75.3 - 77.5       2.2       75.3 - 76.8       1.5       0.68         77.5 - 79.6       2.1       77.5 - 78.9       1.4       0.66         79.6 - 82.8       3.2       79.6 - 81.1       1.5       0.46         82.8 - 85.7       2.9       82.8 - 83.5       0.7       0.24         85.7 - 88.7       3.0       85.7 - 87.3       1.6       0.53         88.7 - 91.8       3.1       88.7 - 89.7       1.0       0.32         91.8 - 94.9       3.1       91.8 - 94.9       1.6       0.51         101.4 - 104.5       3.1       98.3 - 99.9       1.6       0.51         104.5 - 107.5       3.0       104.5 - 106.1       1.6       0.53         107.5 - 110.7       3.0       107.5 - 109.0       1.5       0.50	60.8 - 62.9	2.1		1.5	0.71
67.1 - 69.1       2.0       67.1 - 68.5       1.4       0.70         69.1 - 71.2       2.1       69.1 - 70.3       1.2       0.57         71.2 - 73.3       2.1       71.2 - 72.9       1.7       0.80         73.3 - 75.3       2.0       73.3 - 74.7       1.4       0.70         75.3 - 77.5       2.2       75.3 - 76.8       1.5       0.68         77.5 - 79.6       2.1       77.5 - 78.9       1.4       0.66         79.6 - 82.8       3.2       79.6 - 81.1       1.5       0.46         82.8 - 85.7       2.9       82.8 - 83.5       0.7       0.24         85.7 - 88.7       3.0       85.7 - 87.3       1.6       0.53         88.7 - 91.8       3.1       88.7 - 89.7       1.0       0.32         91.8 - 94.9       3.1       91.8 - 94.9       1.6       0.51         194.9 - 98.3       3.4       94.9 - 96.5       1.6       0.51         101.4 - 104.5       3.1       101.4 - 103.0       1.6       0.51         104.5 - 107.5       3.0       104.5 - 106.1       1.6       0.53         107.5 - 110.7       3.0       107.5 - 109.0       1.5       0.50	62.9 - 64.9	2.0	62.9 - 64.6	1.7	Ø.85
69.1 - 71.2       2.1       69.1 - 70.3       1.2       0.57         71.2 - 73.3       2.1       71.2 - 72.9       1.7       0.80         73.3 - 75.3       2.0       73.3 - 74.7       1.4       0.70         75.3 - 77.5       2.2       75.3 - 76.8       1.5       0.68         77.5 - 79.6       2.1       77.5 - 78.9       1.4       0.66         79.6 - 82.8       3.2       79.6 - 81.1       1.5       0.46         82.8 - 85.7       2.9       82.8 - 83.5       0.7       0.24         85.7 - 88.7       3.0       85.7 - 87.3       1.6       0.53         88.7 - 91.8       3.1       88.7 - 89.7       1.0       0.32         91.8 - 94.9       3.1       91.8 - 94.9       1.6       0.51         94.9 - 98.3       3.4       94.9 - 96.5       1.6       0.47         98.3 - 101.4       3.1       98.3 - 99.9       1.6       0.51         101.4 - 104.5       3.1       101.4 - 103.0       1.6       0.51         104.5 - 107.5       3.0       104.5 - 106.1       1.6       0.53         107.5 - 110.7       3.0       107.5 - 109.0       1.5       0.50	64.9 - 67.1	2.2	64.9 - 66.4	1.5	Ø. 68
71.2 - 73.3	67.1 - 69.1	2.0	67.1 - 68.5	1.4	0.70
73.3 - 75.3       2.0       73.3 - 74.7       1.4       0.70         75.3 - 77.5       2.2       75.3 - 76.8       1.5       0.68         77.5 - 79.6       2.1       77.5 - 78.9       1.4       0.66         79.6 - 82.8       3.2       79.6 - 81.1       1.5       0.46         82.8 - 85.7       2.9       82.8 - 83.5       0.7       0.24         85.7 - 88.7       3.0       85.7 - 87.3       1.6       0.53         88.7 - 91.8       3.1       88.7 - 89.7       1.0       0.32         91.8 - 94.9       3.1       91.8 - 94.9       1.6       0.51         94.9 - 98.3       3.4       94.9 - 96.5       1.6       0.47         98.3 - 101.4       3.1       98.3 - 99.9       1.6       0.51         101.4 - 104.5       3.1       101.4 - 103.0       1.6       0.51         104.5 - 107.5       3.0       104.5 - 106.1       1.6       0.53         107.5 - 110.7       3.0       107.5 - 109.0       1.5       0.50	69.1 - 71.2	2.1	69.1 - 70.3	1.2	0.57
75.3 - 77.5	71.2 - 73.3	2.1	71.2 - 72.9	1.7	0.80
75.3 - 77.5	73.3 - 75.3	2.0	73.3 - 74.7	1.4	0.70
77.5 - 79.6       2.1       77.5 - 78.9       1.4       0.66         79.6 - 82.8       3.2       79.6 - 81.1       1.5       0.46         82.8 - 85.7       2.9       82.8 - 83.5       0.7       0.24         85.7 - 88.7       3.0       85.7 - 87.3       1.6       0.53         88.7 - 91.8       3.1       88.7 - 89.7       1.0       0.32         91.8 - 94.9       3.1       91.8 - 94.9       1.6       0.51         94.9 - 98.3       3.4       94.9 - 96.5       1.6       0.47         98.3 - 101.4       3.1       98.3 - 99.9       1.6       0.51         101.4 - 104.5       3.1       101.4 - 103.0       1.6       0.51         104.5 - 107.5       3.0       104.5 - 106.1       1.6       0.53         107.5 - 110.7       3.0       107.5 - 109.0       1.5       0.50          110.7 - 113.7       3.0       110.7 - 112.2       1.5       0.50				1.5	0.68
79.6 - 82.8       3.2       79.6 - 81.1       1.5       0.46         82.8 - 85.7       2.9       82.8 - 83.5       0.7       0.24         85.7 - 88.7       3.0       85.7 - 87.3       1.6       0.53         88.7 - 91.8       3.1       88.7 - 89.7       1.0       0.32         91.8 - 94.9       3.1       91.8 - 94.9       1.6       0.51         94.9 - 98.3       3.4       94.9 - 96.5       1.6       0.47         98.3 - 101.4       3.1       98.3 - 99.9       1.6       0.51         101.4 - 104.5       3.1       101.4 - 103.0       1.6       0.51         104.5 - 107.5       3.0       104.5 - 106.1       1.6       0.53         107.5 - 110.7       3.0       107.5 - 109.0       1.5       0.50         110.7 - 113.7       3.0       110.7 - 112.2       1.5       0.50					
82.8 - 85.7       2.9       82.8 - 83.5       0.7       0.24         85.7 - 88.7       3.0       85.7 - 87.3       1.6       0.53         88.7 - 91.8       3.1       88.7 - 89.7       1.0       0.32         91.8 - 94.9       3.1       91.8 - 94.9       1.6       0.51         94.9 - 98.3       3.4       94.9 - 96.5       1.6       0.47         98.3 - 101.4       3.1       98.3 - 99.9       1.6       0.51         101.4 - 104.5       3.1       101.4 - 103.0       1.6       0.51         104.5 - 107.5       3.0       104.5 - 106.1       1.6       0.53         107.5 - 110.7       3.0       107.5 - 109.0       1.5       0.50         110.7 - 113.7       3.0       110.7 - 112.2       1.5       0.50					
85.7 - 88.7       3.0       85.7 - 87.3       1.6       0.53         88.7 - 91.8       3.1       88.7 - 89.7       1.0       0.32         91.8 - 94.9       3.1       91.8 - 94.9       1.6       0.51         94.9 - 98.3       3.4       94.9 - 96.5       1.6       0.47         98.3 - 101.4       3.1       98.3 - 99.9       1.6       0.51         101.4 - 104.5       3.1       101.4 - 103.0       1.6       0.51         104.5 - 107.5       3.0       104.5 - 106.1       1.6       0.53         107.5 - 110.7       3.0       107.5 - 109.0       1.5       0.50         110.7 - 113.7       3.0       110.7 - 112.2       1.5       0.50					
88.7 - 91.8       3.1       88.7 - 89.7       1.0       0.32         91.8 - 94.9       3.1       91.8 - 94.9       1.6       0.51         94.9 - 98.3       3.4       94.9 - 96.5       1.6       0.47         98.3 - 101.4       3.1       98.3 - 99.9       1.6       0.51         101.4 - 104.5       3.1       101.4 - 103.0       1.6       0.51         104.5 - 107.5       3.0       104.5 - 106.1       1.6       0.53         107.5 - 110.7       3.0       107.5 - 109.0       1.5       0.50         110.7 - 113.7       3.0       110.7 - 112.2       1.5       0.50					
91.8 - 94.9       3.1       91.8 - 94.9       1.6       0.51         94.9 - 98.3       3.4       94.9 - 96.5       1.6       0.47         98.3 - 101.4       3.1       98.3 - 99.9       1.6       0.51         101.4 - 104.5       3.1       101.4 - 103.0       1.6       0.51         104.5 - 107.5       3.0       104.5 - 106.1       1.6       0.53         107.5 - 110.7       3.0       107.5 - 109.0       1.5       0.50         110.7 - 113.7       3.0       110.7 - 112.2       1.5       0.50					
94.9 - 98.3     3.4     94.9 - 96.5     1.6     0.47       98.3 - 101.4     3.1     98.3 - 99.9     1.6     0.51       101.4 - 104.5     3.1     101.4 - 103.0     1.6     0.51       104.5 - 107.5     3.0     104.5 - 106.1     1.6     0.53       107.5 - 110.7     3.0     107.5 - 109.0     1.5     0.50       110.7 - 113.7     3.0     110.7 - 112.2     1.5     0.50					
98.3 - 101.4     3.1     98.3 - 99.9     1.6     0.51       101.4 - 104.5     3.1     101.4 - 103.0     1.6     0.51       104.5 - 107.5     3.0     104.5 - 106.1     1.6     0.53       107.5 - 110.7     3.0     107.5 - 109.0     1.5     0.50       110.7 - 113.7     3.0     110.7 - 112.2     1.5     0.50					
101.4 - 104.5     3.1     101.4 - 103.0     1.6     0.51       104.5 - 107.5     3.0     104.5 - 106.1     1.6     0.53       107.5 - 110.7     3.0     107.5 - 109.0     1.5     0.50       110.7 - 113.7     3.0     110.7 - 112.2     1.5     0.50					
104.5 - 107.5     3.0     104.5 - 106.1     1.6     0.53       107.5 - 110.7     3.0     107.5 - 109.0     1.5     0.50       110.7 - 113.7     3.0     110.7 - 112.2     1.5     0.50					
107.5 - 110.7 3.0 107.5 - 109.0 1.5 0.50 110.7 - 113.7 3.0 110.7 - 112.2 1.5 0.50					
110.7 - 113.7 3.0 110.7 - 112.2 1.5 0.50					
113.7 - 116.4 2.7 113.7 - 115.3 1.6 0.59					
	113.7 - 116.4	2.7	113.7 - 115.3	1.6	0.59

OPZ-18 CORE LOG(cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
مين وينان الحد الحد الحد الحد الحد الحد الحد الحد		***** 'Tour This This this this this thir 'Tour SHP This SHE and this this this thir SHP SHP THE T	يين احمد احمد دوين ميم هنده کپښه نومې احمد حاص ويين احمد احمد نوين نومې احمد حم	, 400 (00 (00 100 100 60 60 60 60 60 60 60 60 60 60 60 60 6
116.4 - 119.3 119.3 - 122.2	2.9	116.4 - 117.8 119.3 - 120.9	1.4 1.6	Ø.48
119.3 - 122.2	2.9	119.3 - 120.9	1.6	0.55
122.2 - 125.2 125.2 - 128.1	3.0 2.9	122.2 - 122.9 125.2 - 125.8	0.7 0.6	0.23
	2.9	125.2 - 125.8	0.6	
128.1 - 131.0		128.1 - 129.5 131.0 - 132.6	1.4	Ø.48
131.0 - 133.9	2.9	131.0 - 132.6 133.9 - 135.3 136.8 - 138.1 139.7 - 140.8 142.6 - 143.8 145.5 - 146.9 148.4 - 148.8 151.3 - 152.1 154.2 - 155.3 157.1 - 158.3	1.6	0.55
133.7 ~ 136.8	2.9	133.7 - 135.3	1 • 4	0.48
130.0 ~ 137./	2.7	130.8 - 138.1	1.3 1.1	0.44 0.37
142.6 - 145.5	2.9	142.4 - 143.8	1.2	Ø.41
145.5 - 148.4	2.9	145.5 - 146.9	1.2 1.4	0.48
148.4 - 151.3	2.9	148.4 - 148.8	0.4	0.13
151.3 - 154.2	2.9	151.3 - 152.1	Ø.4 Ø.8	0.27
154.2 - 157.1	2.9	154.2 - 155.3	1.1 1.2	0.37
157.1 - 160.0	2.9	157.1 - 158.3	1.2	0.41
160.0 - 162.9 162.9 - 165.8	2.9 2.9	160.0 - 161.5 162.9 - 164.2	1.5	0.51
162.9 - 165.8	2.9	162.9 - 164.2	1.3	0.44
165.8 - 168.7	2.9 2.9	165.8 - 166.6 168.7 - 169.9	ø. 8	0.27
168.7 - 1/1.6	2.9	168.7 - 169.9	1.2	W. 41
171.6 - 174.5	2.9	171.6 - 172.6 174.5 - 175.4	1.0	0.34
174.5 - 179.5	5.0	174.5 - 175.4	0.9	0.18
179.5 - 182.3	2.8	179.5 - 180.2	0.7	
182.3 - 185.2	2.9	182.3 - 183.0	0.7	0.24
185.2 - 188.6	J.4	185.2 - 186.0	Ø.8	0.23
100.0 - 171.0	ა.∠ ₹ 1	188.6 - 187.5	0.7	0.28 0.19
191.0 - 194.7	3.1	174.5 - 175.4 179.5 - 180.2 182.3 - 183.0 185.2 - 186.0 188.6 - 189.5 191.8 - 192.4	0.7	0.22
194.9 - 198.0 198.0 - 201.1	3.1 3.1	194.9 - 195.6 198.0 - 198.7	0.7	0.22
201.1 - 204.2	3.1	201.1 - 202.1	1.0	0.32
204.2 - 207.3	3.1	201.1 - 202.1 204.2 - 204.9	Ø.7	Ø.22
207.3 - 210.4	3.1	207.3 - 208.3	1.0	0.32
210.4 - 213.6	3.2	207.3 - 208.3 210.4 - 211.4 213.6 - 214.5	1.0	0.31
213.6 - 217.0	3.4	213.6 - 214.5	0.9	0.26
217.0 - 220.2	3.2	217.0 - 217.8	0.8	0.25
220.2 - 223.3	3.1	217.0 - 217.8 220.2 - 220.9 223.3 - 224.2 226.4 - 227.3	0.7	0.22
223.3 - 226.4	3.1	223.3 - 224.2	0.9	0.29
226.4 - 229.5	3.1	226.4 - 227.3	0.9	
229.5 - 232.6 232.6 - 235.8	3.1	229.5 - 232. <b>0</b> 232.6 - 233.6	0.7 1.0	0.22
232.6 - 235.8	3.2	232.6 - 233.6	1.0	0.31
235.8 - 238.9 238.9 - 242.1	3.1 3.2	235.8 - 236.4 238.9 - 239.4	Ø.6 Ø.5	0.19
238.9 - 242.1	3.2	238.9 - 239.4	0.5	
242.1 - 245.2	3.1	242.1 - 242.9 245.2 - 245.9 248.1 - 248.9	Ø.8	0.25
245.2 - 248.1	2.7	245.2 - 245.9	0.7 0.8	0.24
251.0 - 253.9	2.9	251.0 - 251.9	ø. 8	Ø.27 Ø.31
253.9 - 256.7	2.8	251.0 - 251.9 253.9 - 254.8	0.9 0.9	Ø.31 Ø.32
256.7 - 259.6	2.9	256.7 - 257.4	0.7 0.7	0.24 ·
259.6 - 262.5	2.9	259.6 - 260.5	Ø. 9	0.31
262.5 - 265.3	2.8	262.5 - 263.3	0.8	0.28
265.3 - 268.2	2.9	265.3 - 266.3	1.0	0.34
268.2 - 271.0	2.8	268.2 - 269.0	0.8	0.28
271.0 - 273.7	2.7	271.0 - 272.0	1.0	0.37
273.7 - 276.6	2.9	273.7 - 274.6	0.9	0.31
276.6 - 279.5	2.9	276.6 - 277.6	1.0	0.34
279.5 - 282.3	2.8	279.5 - 280.1	0.6	0.21

OPZ-18 CORE LOG(cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
			•	
282.3 - 285.1	2.8	282.3 - 283.0 285.1 - 286.1 289.9 - 290.7 294.8 - 296.0	0.7	0.25
285.1 - 289.9	4.8	285.1 - 286.1	1.0	0.20
289.9 - 294.8	4.9	289.9 - 290.7	Ø.8 1.2	0.16
294.8 - 299.8	5.0	294.8 - 296.0	1.2	0.24
299.8 - 305.1	5.3	299.8 - 300.7	0.9	0.16
305.1 - 310.2	5.1	305.1 - 306.3	1.2	0.23
310.2 - 315.4	5.2	299.8 - 300.7 305.1 - 306.3 310.2 - 311.0 315.4 - 316.5	Ø.8	0.15
315.4 - 320.5	5.1	315.4 - 316.5	1.1	0.21
320.5 - 325.8	5.3	320.5 - 321.6	1.1	0.20
325.8 - 330.9	5.1	315.4 - 316.5 320.5 - 321.6 325.8 - 326.7 330.9 - 331.9 335.9 - 337.2 341.2 - 342.2 346.3 - 347.3 351.5 - 352.6 356.7 - 357.6 361.9 - 362.6	0.9	0.17
330.9 - 335.9	5.0	330.9 - 331.9	1.0	0.20
335.9 - 341.2	5.3	335.9 - 337.2	1.3	0.24
341.2 - 346.3	5.1	341.2 - 342.2	1.0	0.19
346.3 - 351.5	5.2	346.3 - 347.3	1.0	0.19
351.5 - 356.7	5.2	351.5 - 352.6	1.1	0.21
356.7 - 361.9	5.2	356.7 - 357.6	20.9	0.17
361.9 - 367.0	5.1	361.9 - 362.6	0.7	0.13
367.0 - 371.9	4.9	367.00 - 368.00 371.9 - 372.6	1.0 0.7	0120
371.9 - 376.7	4.8	371.9 - 372.6	0.7	0.14
376.7 - 381.4	4.7	376.7 - 377.2 381.4 - <b>3</b> 81.9	0.5	0.10
381.4 - 386.2	4.8	381.4 - 381.9	0.5	0.10
386.2 - 391.1	4.9	381.4 - 381.9 386.2 - 387.0 391.1 - 391.8 395.8 - 396.6 400.6 - 401.1 405.0 - 405.4 409.7 - 409.9 414.3 - 414.7	0.8	0.16
391.1 - 395.8	4.7	391.1 - 391.8	0.7	0.14
395.8 - 400.6	4.8	395.8 - 396.6	0.8	0.16
400.6 - 405.0	4.4	400.6 - 401.1	0.5	0.11
405.0 - 409.7	4.7	405.0 - 405.4	Ø. 4	0.08
409.7 - 414.3	4.6	409.7 - 409.9	0.2	0.04
414.3 - 418.9	4.6	414.3 - 414.7	0.4	0.08
418.9 - 423.7	4.8	418.9 - 419.5 423.7 - 424.4	Ø.6 Ø.7	0.12
423.7 - 428.8	5.1	423.7 - 424.4	4.7	0.13
428.8 - 434.1	5.3	423.7 - 424.4 428.8 - 429.6 434.1 - 434.6 439.3 - 440.1 444.6 - 445.3 449.8 - 450.5 455.0 - 455.6 460.6 - 461.4	0.8	0.15
434.1 - 439.3	5.2	434.1 - 434.6	0.5	0.09
439.3 - 444.6	5.3	439.3 - 440.1	0.8	0.15
444.6 - 449.8	5.2	444.6 - 445.5	0.7	0.13
449.8 - 455.0	5.2	449.8 - 450.5	4.7	0.13
400.0 - 460.6	5.6	455.0 - 455.6	0.6	0.10
400.0 - 400.7	5.3	460.6 - 461.4	Ø. 8	0.15
455.7 - 471.1	5.2	465.9 - 466.7 471.1 - 471.6	0.8	0.10
471.1 - 470.3	J. 4	4/1.1 - 4/1.6	0.5	0.09
4/6.3 - 481.4	5.1	4/6.3 - 4//.0	Ø.7 1.0	0.13
481.4 - 486.7	D.D	476.3 - 477.0 481.4 - 482.4 486.9 - 487.6 492.2 - 493.1	1.0	0.18 0.13
486.7 - 472.2	5.3	486.9 - 487.6	0.7	
472.2 - 477.0	5.3	492.2 - 493.1	0.9	0.16
47/.3 - 302.4	4.7	497.5 - 498.3	0.8	0.16
		502.4 - 503.2	Ø.8	0.16
507.3 - 512.0	4.7 4.9	507.3 - 508.1 512.0 - 512.7	0.8	0.17
512.0 - 516.9 516.9 - 521.6	4.7 4.7		Ø.7 1.3	0.14 0.27
521.6 - 526.3	4.7	516.9 - 518.2 521.6 - 522.1	0.5	0.10
526.3 - 531.1	4.8	526.3 - 526.9	0.6	0.12
531.1 - 535.8	4.7	531.1 - 531.7	0.6	0.12
535.8 - 540.6	4.8	535.8 - 536.4	0.6	0.12
540.6 - 545.4	4.8	540.6 - 541.1	Ø.5	0.10
545.4 - 550.1	4.7	545.4 - 546.0	0.6	0.12
550.1 - 555.0	4.9	550.1 - 550.9	Ø.8	0.16
555.0 - 559.8	4.8	555.0 - 555.6	Ø.6	0.12

OPZ-18 CORE LOG(cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
59.8 - 565.0	5.2	559.8 - 560.4	Ø.6	0.11
65.0 - 570.1	5.1	565.0 ~ 565.7	0.7	0.13
70.1 - 575.4	5.3	570.1 - 570.8	0.7	0.13
75.4 - 580.7		575.4 - 576.1	0.7	0.13
80.7 - 586.9	6.2	580.7 - 581.8	1.1	0.17
86.9 - 592.1	5.2	586.9 ~ 587.6	0.7	Ø.13
92.1 - 597.3	5.2	592.1 ~ 593.0	<b>0.</b> 9	0.17
97.3 - 602.1	4.8	597.3 - 597.9	0.6	0.12
02.1 - 606.9	4.8	602.1 - 602.9	0.8	0.16
06.9 - 611.6	4.7	606.9 - 607.7	Ø.8	0.17
11.6 - 616.4	4.8	611.6 - 612.5	0.9	0.18
16.4 - 621.2	4.8	616.4 - 617.2	Ø.8	0.16
21.2 - 626.1	4.9	621.2 - 622.1	0.9	Ø.18
26.1 - 630.9	4.8	626.1 - 626.9	0.8	0.16
30.9 - 635.6	4.7	630.9 ~ 631.9	1.0	0.21
35.6 - 640.6	5.0	635.6 ~ 636.2	0.6	0.12
40.6 - 645.4	4.8	640.6 - 641.1	0.5	0.10
45.4 - 650.3	4.9	645.4 ~ 646.1	0.7	0.14
50.3 - 655.1	4.8	650.3 - 650.7	0.4	0.08
55.1 - 659.9	4.8	655.1 ~ 655.6	0.5	0.10
59.9 - 664.4	4.5	659.9 ~ 660.5	0.6	0.13
64.4 - 669.3	4.9	664.4 - 665.2	0.8	0.16
69.3 - 674.2	4.9	669.3 - 670.1	0.8	0.16
74.2 - 679.1	4.9	674.2 - 674.7	0.5	0.10
79.1 - 683.9	4.8	679.1 - 679.8	0.7	0.14
83.9 - 688.9	5.0	683.9 - 684.4	0.5	0.10
88.9 - 694.1	5.2	688.9 - 689.4	0.5	0.09
94.1 - 699.5	5.4	694.1 - 694.9	0.8	0.14
99.5 - 704.9	5.4	699.5 - 700.0	0.5	0.09
04.9 - 710.1	5.2	704.9 - 705.4	0.5	0.09
10.1 - 715.8	5.7	710.1 - 710.9	0.8	0.14
15.8 - 720.9		715.8 - 716.3	0.5	0.09
20.9 - 721.6		720.9 - 721.6	0.7	1.00

OQT-19 CORE LOG

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
0.0 - 5.1 5.1 - 10.3	5.1	0.0 - 0.6 5.1 - 6.4 10.3 - 11.7 15.5 - 16.7 20.6 - 20.9 25.7 - 27.0 30.8 - 31.6 36.6 - 37.1 40.9 - 42.1 45.6 - 46.6 50.5 - 51.8 53.4 - 54.4 56.2 - 57.3 59.6 - 60.8 62.7 - 63.9 65.8 - 67.3 72.9 75.4 - 70.2 72.9 75.4 - 79.8 81.8 - 82.9 84.9 - 86.1 87.8 - 99.8 103.3 - 104.4 108.2 - 109.6 112.7 - 114.2 115.3 - 116.7 118.3 - 119.0 121.2 - 122.6 124.1 - 125.1 129.0 - 129.7 133.8 - 134.9 137.7 - 148.5 152.0 - 152.9 156.8 - 158.0 161.8 - 167.9 172.2 - 173.2 178.3 - 197.0 187.8 - 193.9 197.2 - 200.0 201.9 - 202.7 205.1 - 205.7 208.2 - 208.8	Ø. 6	Ø. 11
5.1 - 10.3	5.2	5.1 - 6.4	1.3	0.25
10.3 - 15.5	5.2	10.3 - 11.7	1.4	0.26
15.5 - 20.6	5.1	15.5 - 16.7	1.2	0.23
20.6 - 25.7	5.1	20.6 - 20.9	0.3	0.05
25.7 - 30.8	5.1	25.7 - 27.0	1.3	Ø. 25
30.8 - 36.6	5.8	30.8 - 31.6	Ø.8	0.13
36.6 - 40.9	4.3	36.6 - 37.1	0.5	0.11
40.9 - 45.6	4.7	40.9 - 42.1	1.2	0.25
45.6 - 50.5	4.9	45.6 - 46.6	1.0	0.20
50.5 - 53.4	2.9	50.5 - 51.8	1.3	Ø. 44
53.4 - 56.2	2.8	53.4 - 54.4	1.0	0.35
56.2 - 59.6	3.4	56.2 - 57.3	1.1 1.2	0.32
59.6 - 62.7	3.1	59.6 - 60.8	1.2	0.38
62.7 - 65.8	3.1	62.7 - 63.9	1.2	Ø.38
65.8 - 68.9	3.1	65.8 - 67.3	1.5	Ø.48
68.9 - 72. <b>0</b>	3.1	68.9 - 7 <b>0.</b> 2	1.3	Ø.41
72.0 - 75.4	3.4	72. <b>0</b> - 72.9	0.9	0.26
75.4 - 78.7	3.3	75.4 - 76.3	0.9	0.27
78.7 - 81.8	3.1	78.7 - 79.8	1.1	0.35
81.8 - 84.9	3.1	81.8 - 82.9	1.1	Ø.35
84.9 - 87.8	2.9	84.9 - 86.1	1.2	Ø.41
87.8 - 9 <b>0</b> .7	2.9	87.8 - 88. <b>6</b>	0.8	Ø.27
90.7 - 93.5	2.8	907 - 91.5	Ø.8	0.28
93.5 - 98.4	4.9	93.5 - 95.0	1.5	0.30
98.4 - 103.3	4.9	98.4 - 99.8	1.4	Ø.28
103.3 - 108.2	4.9	103.3 - 104.4	1.1	0.22
108.2 - 112.7	4.5	108.2 - 109.6	1.4	0.31
112.7 - 115.3	2.6	112.7 - 114.2	1.5	0.57
115.3 - 118.3	3.0	115.3 - 116.7	1.4	0.46
118.3 - 121.2	2.9	118.3 - 119.0	0.7	0.24
121.2 - 124.1	2.9	121.2 - 122.6	1.4	Ø.48
124.1 - 129.0	4.9	124.1 - 125.1	1.0	0.20
129.0 - 133.8	4.8	129.0 - 129.7	Ø.7	0.14
133.8 - 137.7	3.9	133.8 - 134.9	1.1	Ø.28
137.7 - 142.5	4.8	137.7 - 138.8	1.1	Ø.22
142.5 - 147.5	5.0	142.5 - 143.5	1.0	0.20
147.5 - 152.0	4.5	147.5 - 148.5	1.0	Ø.22
152.0 - 156.8	4.8	152.0 - 152.9	0.9	0.18
156.8 - 161.8	5.0	156.8 - 158.0	1.2	0.24
161.8 - 167.0	5.2	161.8 - 162.7	0.9	Ø.17
167.0 - 172.2	5.2	167.0 - 167.9	0.9	0.17
172.2 - 178.3	6.1	172.2 - 173.2	1.0	0.16
1/8.3 - 183.1	4.8	178.3 - 179.6	1.3	0.27
183.1 - 187.8	4.7	183.1 - 183.9	0.8	0.17
187.8 - 193.1	5.3	187.8 - 188.8	1.0	0.18
173.1 - 176.3	3.2	193.1 - 193.9	Ø.8	Ø.25
176.3 - 199.2	2.9	196.3 - 197.0	Ø.7	0.24
177.2 - 201.9	2.7	199.2 - 200.0	Ø.8	Ø.29
201.7 - 205.1	3.2	201.9 - 202.7	Ø.8	Ø.25
205.1 - 208.2	3.1	205.1 - 205.7	Ø.6	0.19
208.2 - 211.3	3.1	208.2 - 208.8	0.6	0.19

OQT-19 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
211.3 - 216.4	5.1	211.3 - 212.0	<b>0.</b> 7	0.13
216.4 - 221.6	5.2	216.4 - 217.3	0.9	0.17
221.6 - 226.7		221.6 - 222.4	73 52	0.15
226.7 - 231.6	4.9	226.7 - 227.9	1.2	0.24
231.6 - 236.7	4.9 5.1	226.7 - 227.9 231.6 - 232.7	1.1	0.21
236.7 - 242.0	5.3	236.7 - 238.4	1.7	0.32
242.0 - 247.0		236.7 - 238.4 242.0 - 243.2	1.2	0.24
247.0 - 252.1	5.1	247.0 - 248.5	1.5	0.29
252.1 - 262.1	10.0	247.0 - 248.5 252.1 - 253.6	1.5	0.15
262.1 - 266.4	4.3	262.1 - 263.5	1.4	0.32
266.4 - 271.2	4.3 4.8	262.1 - 263.5 266.4 - 267.7	1.3	0.27
271.2 - 276.1	4.9	271.2 - 272.3 276.1 - 276.8	1.1	0.22
276.1 - 281.0	4.9	276.1 - 276.8	0.7	0.14
281.0 - 285.9		281. <b>0</b> - 282.3	1.3	0.26
2 <b>85.9 - 290.</b> 8	4.9	285.9 - 287. <b>0</b>	1.1	0.22
29 <b>0.</b> 8 - 295.8	5.0	285.9 - 287.0 290.8 - 292.0	1.2	0.24
295.8 - 300.7	4.9 4.8	295.8 - 296.3	1.5	0.30
300.7 - 305.5	4.8	295.8 - 296.3 300.7 - 301.7	1.0	0.20
305.5 - 310.4	4.9	305.5 - 306.3	0.8	0.16
310.4 - 315.3	4.9 4.9	305.5 - 306.3 310.4 - 310.9	0.5	0.10
315.3 - 320.2	4.9	315.3 - 316.0	0.7	0.14
320.2 - 324.9	4.7	315.3 - 316.0 320.2 - 321.0	0.8	0.17
324.9 - 329.7		324.9 - 325.6	0.7	0.14
329.7 - 334.6	4.9	329:7 - 330.7	1.0	0.20
334.6 - 339.7	5.1	334.6 - 335.7	1.1	0.21
339.7 - 344.8	5.1	339.7 - 340.7	1.0	0.19
344.8 - 349.9	5.1 5.1	339.7 - 340.7 344.8 - 345.9	1.1	0.21
349.9 - 355.2	5.3	349.9 - 35 <b>0.</b> 8	0.9	0.16
355.2 - 360.3	5.3 5.1	349.9 - 350.8 355.2 - 355.7	0.5	0.09
360.3 - 365.6	5.3	360.3 - 361.4 365.6 - 366.6	1.1	0.20
365.6 - 370.9	5.3	365.6 - 366.6	1.0	0.18
370.9 - 376.7		370.9 - 371.5	0.6	0.10
376.7 - 381.8	5.1	376.7 - 377.2	. 0.5	0.09
381.8 - 387.4	5.6	381.8 - 382.6	0.8	0.14
387.4 - 392.3	4.9	387.4 - 388.2		0.16
392.3 - 397.2	4.9 4.9	387.4 - 388.2 392.3 - 393.1	0.8	0.16
597.2 - 401.9	A 7	397.2 - 398.4	1.2	0.25
101.9 - 406.8	4.9	401.9 - 403.0	1.1	0.22
106.8 - 411.7	4.9		0.5	0.10
111.7 - 416.3	4.9 4.6	406.8 - 407.3 411.7 - 412.2	0.5	0.10
116.3 - 421.2	4.9	416.3 - 417.3	1.0	0.20
21.2 - 426.0	4.9 4.8	416.3 - 417.3 421.2 - 422.4	1.2	0.25
126.0 - 430.8	4.8	426.0 - 427.4	1.4	0.29
430.8 - 435.7	4.9	426.0 - 427.4 430.8 - 431.8	1.0	0.20
135.7 - 440.6	4.9	435.7 - 436.7	1.0	0.20
140.6 - 445.5	4.9	440.6 - 441.5	0.9	Ø.18
445.5 - 450.2	4.7	445.5 - 446.0	0.5	0.10
450.2 - 455.2	5.0	450.2 - 451.1	0.9	0.18
155.2 - 460.3	5.1	455.2 - 456.1	0.9	0.17
160.3 - 470.4	10.1	460.3 - 461.4	1.1	0.09
70.4 - 480.6	10.2	470.4 - 471.2	0.8	0.07
180.6 - 490.7	10.1	480.6 - 481.5	0.9	0.08
190.7 - 500.8	10.1	490.7 - 491.5	Ø.8	0.07
500.8 - 511.2	10.4	500.8 - 501.8	1.0	0.09
511.2 - 521.3	10.1	511.2 - 512.1	0.9	0.08

OQT-19 CORE LOG (cont.).

		SAMPLE MARKED		
		521.3 ~ 522.3		
532.5 - 541.6	9.1	532.5 - 533.4	Ø.9	0.09
541.6 - 551.8	10.2	541.6 ~ 542.8	1.2	0.11
551.8 - 561.9	10.1	551.8 ~ 552.7	0.9	0.08
561.9 - 572.0	10.1	561.9 - 562.8	0.9	0.08
572.0 ~ 581.9	9.9	572 <b>.0</b> - 572.7	0.7	0.07
581.9 - 591.8	9.9	581.9 - 582.8	0.9	0.09
591.8 - 601.6	9.8	591.8 - 592.8	1.0	0.10
601.6 - 611.6	10.0	601.6 ~ 602.8	1.2	0.12
511.6 - 621.4	9.8	611.6 - 612.4	0.8	0.08
521.4 - 631.2	9.8	621.4 ~ 622.3	0.9	0.09
531.2 - 641.1	9.9	631.2 - 632.4	1.2	0.12
41.1 - 650.6	9.5	641.1 - 642.2	1.1	0.11
50.6 - 655.5	4.9	650.6 - 651.5	0.9	0.18
555.5 - 660.3	4.8	<b>655.5 ~ 656.5</b>	1.0	0.20
660.3 - 665.3	5.0	660.3 - 661.2	0.9	0.18
645.3 - 670.1	4.8	665.3 - 666.1	0.8	0.16
570.1 - 680.2	10.1	670.1 - 671.0	0.9	
80.2 - 690.3	10.1	680.2 - 680.8	0.6	0.05
590.3 - 700.3	10.0	690.3 - 691.4		
700.3 - 701.5		700.3 - 701.5	1.2	1.00

ORT-20 CORE LOG

INTERVAL	LENGTH	SAMPLE MARKED  0.0 - 1.2 5.0 - 5.9 NO RECOVERY 14.9 - 15.1 19.8 - 19.9 24.8 - 25.8 29.7 - 36.1 39.6 - 41.2 44.6 - 46.0 47.7 - 49.0 51.1 - 52.6 54.1 - 55.3 59.2 - 60.4 269.3 - 70.2 72.3 - 76.8 88.5 - 89.7 78.4 - 79.5 83.4 - 84.7 88.5 - 94.3 98.6 - 100.1 111.7 112.7 114.8 - 115.1 111.7 114.8 - 115.9 117.8 - 118.2 120.8 - 122.0 130.9 - 132.2 140.9 - 142.1 151.1 - 152.4 161.0 - 162.4 171.0 - 172.1 181.1 - 182.4 171.0 - 172.1 181.1 - 191.8 201.0 - 201.9 210.9 - 211.9 220.8 - 221.8 230.7 - 231.7 234.6 - 240.6 244.6 - 245.6 249.7 - 255.8 265.0 - 276.1 285.4 - 286.5 300.5 - 301.5 305.6 - 306.5 310.3 - 311.2	RECOVERED	RECOVERY
Ø.Ø - 5.Ø	5.0	0.0 - 1.2	1.2	Ø.24
5.0 - 9.9	4.9	5.0 - 5.9	0.9	0.18
9.9 - 14.9	5.0	NO RECOVERY		
14.9 - 19.8	4.9	14.9 ~ 15.1	0.2	0.04
19.8 - 24.8	5.0	19.8 - 19.9	Ø. 1	0.02
24.8 - 29.7	4.9	24.8 - 25.8	1.0	0.20
29.7 - 34.7	5.0	29.7 - 30.9	1.2	0.24
34.7 - 39.6	4.9	34.7 - 36.1	1.4	0.28
39.6 - 44.6	5.0	39.6 - 41.2	1.6	0.32
44.6 - 47.7	3.1	44.6 - 46.0	1.4	Ø.45
47.7 - 51.1	3.4	47.7 - 49.0	1.3	Ø.38
51.1 - 54.1	3.0	51.1 - 52.6	1.5	0.50
54.1 - 59.2	5.1	54.1 - 55.3	1.2	0.23
59.2 - 64.2	5.0	59.2 - 60.4	1.2	0.24
64.2 - 69.3	5.1	64.2 - 65.2	1.0	0.19
69.3 - 72.3	3.0	69.3 - 70.2	0.9	0.30
72.3 - 75.3	3.0	72.3 - 73.7	1.4	0.46
75.3 - 78.4	3.1	75.3 - 76.8	1.5	Ø. 48
78.4 - 83.4	5.0	78.4 - 79.5	1.1	0.22
83.4 - 88.5	5.1	83.4 - 84.7	1.3	0.25
88.5 - 93.5	5.0	88.5 - 89.7	1.2	0.24
93.5 - 98.6	5.1	93.5 - 94.3	Ø. 8	0.15
98.6 - 103.6	5.0	98.6 - 99.5	0.9	Ø. 18
103.6 - 108.7	5.1	103.6 ~ 105.1	1.5	0.29
108.7 - 111.7	3.0	108.7 - 110.1	1.4	0.46
111./ - 114.8	3.1 7.0	111./ ~ 112./	1.0	0.32
114.8 ~ 117.8	3.0	114.8 - 115.9	1.1	0.36
17.0 - 120.0	3.0	117.0 ~ 110.2	<b>0.</b> 4	Ø.13 Ø.11
120.0 - 130.7	10.1	120.0 - 122.0	1.2	0.13
100.7 - 140.7	10.0	130.7 - 132.2	1.3	Ø. 13 Ø. 11
140.7 - 131.1	10.2	151 1 - 157 4	1.2	0.13
141 0 - 171 0	7 * 7 101 01	141 0 - 142 4	1.0	0.14
171 0 - 101 1	10.40	171 0 - 172 1	1 1	0.10
101 1 - 101 1	10.0	101 1 - 102 4	1 7	0.13
101 1 - 201 0	20.0	101 1 - 101 9	Ø 7	0.13
201.0 - 210.9	9. 9	201.0 - 201.9	0.9	0.09
210.9 - 220.8	9.9	210.9 - 211.9	1.0	0.10
220.8 - 230.7	9.9	220.8 - 221.8	1.0	0.10
230.7 - 234.6	3.9	230.7 - 231.7	1.0	0.25
234.6 - 239.6	5. Ø	234.6 - 235.3	Ø. 7	0.14
239.6 - 244.6	5.0	239.6 - 240.6	1.0	0.20
244.6 - 249.7	5.1	244.6 - 245.6	1.0	0.19
249.7 - 254.8	5.1	249.7 - 250.4	0.7	0.13
254.8 - 265.0	10.2	254.8 - 255.8	1.0	0.09
265.0 - 275.0	10.0	265.0 - 266.1	1.1	0.11
275.0 - 285.4	10.4	275.0 - 276.1	1.1	0.10
285.4 - 295.5	10.1	285.4 - 286.5	1.1	0.10
295.5 - 300.5	5.0	295.5 - 296.5	1.0	0.20
300.5 - 305.6	5.1	300.5 - 301.5	1.0	0.19
305.6 - 310.3	4.7	305.6 - 306.5	0.9	0.19
		745 7 744 6	<b>a</b> a	0.18

ORT-20 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
315.3 - 320.6	5.3	315.3 - 316.2	<b>0.</b> 9	0.16
320.6 - 325.7	5.1	<b>320.6 - 321.5</b>	0.9	0.17
325.7 <b>- 3</b> 30.6	4.9	325.7 - 326.5	0.8	0.16
30.6 - 335.6	5.0	330.6 - 331.7	1.1	0.22
35.6 - 340.5	4.9	335.6 - 335.8	0.2	0.04
40.5 - 350.6	10.1	340.5 - 341.5	1.0	0.09
50.6 - 360.5	9.9	350.6 - 351.9	1.3	Ø.13
860.5 - 363.4	2.9	360.5 - 360.7	0.2	0.06
63.4 - 370.4	8.0	363.4 - 363.9	0.5	0.06
70.4 - 380.2	9.8	370.4 - 370.9	0.5	0.05
80.2 - 390.1	9.9	380.2 - 380.7	0.5	0.05
590.1 - 400.0	9.9	390.1 - 390.5	0.4	0.04
00.0 - 410.2	10.2	400.0 - 400.8	0.8	0.07
10.2 - 420.1	9.9	410.2 - 410.5	0.3	0.03
20.1 - 425.2	5.1	420.1 - 421.3	1.2	0.23
25.2 - 430.3	5. i	425.2 - 426.7	1.5	0.29
30.3 - 435.4	5.1	430.3 - 431.1	0.8	0.15
35.4 - 440.5	5.1	435.4 - 436.4	1.0	0.19
40.5 - 450.6	10.1	440.5 - 441.4	0.9	0.08
50.6 - 460.7	10.1	450.6 - 451.4	0.8	0.07
60.7 - 470.6	9.9	460.7 - 461.6	0.9	0.09
70.6 - 480.7	10.1	470.6 - 472.0	1.4	0.13
80.7 - 490.8	10.1	480.7 - 481.5	0.8	0.07
90.8 - 491.8	1.0	490-8 - 491.8	1.0	1.00

OSR-21 CORE LOG

INTERVAL	LENGTH	SAMPLE	MARKED	RECOVERED	RECOVERY
00 57	F 7		<b>a</b> 0	<b>2</b> S	Ø 15
0.0 - 5.3		U.U ~	0.8	0.8 1.7 1.2 MATERIAL PROPE 1.1 1.6	0.15 0.34
5.3 - 10.3 10.3 - 15.3	5.W	5.5 -	7.4	1.7	0.54
		10.5 -	11.5	L.Z	0.24
MATERIAL PRO		10.5 -	11.1	MATERIAL PROPE	-KIIES
15.3 - 20.8	5.5	15.3 -	16.4	1.1	Ø.20
20.8 - 25.8 MATERIAL PRO	5.0	20.8 -	22.4	1.6 MATERIAL PROPE	0.32
MATERIAL PRO	DPERTIES	21.1 -	22.0	MATERIAL PROPE	ERITES
25.8 - 30.9	5.1	25.8 -	27.1	1.3	0.25
30.9 - 35.9	5.0	30.9 -	32.2	1.3	Ø.26
25.8 ~ 30.9 30.9 ~ 35.9 35.9 ~ 41.0 41.0 ~ 46.9	5.1	35.9 -	37.3	1.4	0.27
41.0 - 46.9	5.9	41.0 -	41.4	Ø. 4	0.07
46.9 - 52.3		46.9 -	47.5	0.6	
52.3 - 57.1	4.8	52.3 -	53.8	1.5 MATERIAL PROPE	0.31
MATERIAL PRO	DPERTIES	52.4 -	53.2	MATERIAL PROPE	ERTIES
57.1 ~ 61.9	4.8	57.1 -	58.2	1.1	0.23
57.1 - 61.9 61.9 - 66.7 66.7 - 71.5	4.8	61.9 -	62.7	Ø. 8	0.17
66.7 - 71.5 71.5 - 76.3	4.8	66.7 - 71.5 -	67.4	<b>0.</b> 7	0.15
71.5 - 76.3	4.8	71.5 -	72.0	0.5	0.10
76.3 - 79.1 MATERIAL PRO	2.8	76.3 -	77.6	1.3 MATERIAL PROPE	0.46
MATERIAL PRO	OPERTIES	76.3 -	77.Ø	MATERIAL PROPE	ERTIES
79.1 - 81.9	2.8	79.1 -	80.6	1.5	0.54
81.9 - 86.8	4.9	81.9 -	83.1	1.2	0.24
86.8 - 91.6	4.8	86.8 -	87.2	0.4	0.08
91.6 - 96.4	4.8	91.6 -	92.0	0.4	0.08
96.4 - 99.4	3.0	96.4 -	97.1	MATERIAL PROPE 1.5 1.2 0.4 0.7 1.0	0.23
99.4 - 102.2	2.8	99.4 -	100.4	1.0 1.4 MATERIAL PROPER 1.0 1.5 MATERIAL PROPER	0.36
102.2 - 105.2	3.0	102.2 -	103.6	1.4	0.47
MATERIAL PRO	OPERTIES	102.5 -	103.3	MATERIAL PROPER	TIES
105.2 - 114.3	9.1	105.2 -	106.2	1.0	Ø. 11
114.3 - 124.0	9.7	114.3 -	115.8	1.5	0.15
MATERIAL PRO	PERTIES	114.7 -	115.5	MATERIAL PROPERT	TIES
124.0 - 134.2	10.2	124.0 -	125.4	1.4	0.14
124.0 - 134.2 134.2 - 144.5	10.3	134.2 -	174 9	0.7	0.07
144.5 - 154.7	10.0	144 5 -	145 4	1.1	0.11
144.5 - 154.7 154.7 - 164.9	10.2	154.7	154 0	1.3	0.13
154.7 - 164.9 164.9 - 175.2	10.2	164.0 -	145 0	1.0	0.10
175 7 - 105 4	10.0	175 7 -	174 5	1.3	0.13
175.2 - 185.4 185.4 - 195.8	10.2	105 4 -	104 0	1.4	0.13
105.4 - 175.6	103 7	105.4 -	100.0	1.2	0.12
195.8 - 206.1 206.1 - 216.3	10.0	704 1	17/.W	1.2	0.12
714 7 - 710 F	1W. Z	214 7 200.1	207.3	1 · ∠	0.12 0.47
216.3 - 219.5 219.5 - 222.6	J.∡	216.3 - 219.5 -	220 G	1.5 1.3	Ø.47 Ø.42
217.3 - 222.6	J. 1	217.0 ~	22W.0	1.3	
222.6 - 225.7 225.7 - 228.8	J. 1	222.0 -	ZZQ.7	1.3	Ø.42
				1.3	Ø.42
228.8 - 231.9	3.1	228.8 -		1.4	0.45
231.9 - 236.6	4.7	231.9 -		1.3	0.28
236.6 - 241.7	5.1	236.6 -		1.3	0.25
241.7 - 246.8	5.1	241.7 -		1.4	0.27
246.8 - 251.6	4.8	246.8 -		1.3	0.27
251.6 - 256.5	4.9	251.6 -		1.3	0.27
256.5 - 259.4	2.9	256.5 -		1.2	0.41
259.4 - 262.3	2.9	259.4 -	260.4	1.0	0.34

OSR-21 CORE LOG

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
262.3 - 265.3	3.0	262.3 - 263.6	1.3	0.43
265.3 - 268.0	2.7	265.3 - 266.5	1.2	Ø.43 Ø.44
268.0 - 277.9	9.9	268.0 - 269.2	1.2	0.12
MATERIAL PRO	PERTIES	268.3 - 269.Ø	MATERIAL PROPE	ERTIES
277.9 - 287.8	9.9	277.9 - 279.2	1.3	0.13
287.8 - 297.8	10.0	287.8 - 289.3	1.5	0.15
297.8 - 307.7	9.9	297.8 - 299.3	1.5	0.15
307.7 - 317.6	9.9	307.7 - 308.0	0.3	0.03
317.6 - 327.4	9.8	317.6 - 318.8	1.2	0.12
327.4 - 337.3	9.9	327.4 - 327.9	Ø <b>.</b> 5	0.05
337.3 - 347.1	9.8	337.3 - <b>3</b> 37.7	Ø. 4	0.04
347.1 - 354.3	7.2	347.1 - 348.0	0.9	0.13

OTG-23 CORE LOG

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
0.0 - 276.2	276.2	NO RECOVERY	Ø. Ø	0.00
276.2 - 308.3	32.1	276.2 - 276.9	0.7	0.02
308.3 - 339.3	31.0	308.3 - 309.2	0.9	0.03
339.3 - 371.1	31.8	339.3 - 339.8	0.5	0.02
371.1 - 402.4	31.3	371.1 - 371.7	0.6	0.02
402.4 - 433.7	31.3	402.4 - 403.2	0.8	0.03
433.7 - 464.5	30.8	433.7 - 434.4	0.7	0.02
464.5 - 495.3	30.8	464.5 - 464.8	0.3	0.01
495.3 - 524.9	29.6	495.3 - 495.9	0.6	0.02
524.9 - 555.6	30.7	524.9 - 525.6	0.7	0.02
555.6 - 586.7	30.7	555.6 - 556.3	0.7	0.02
586.7 - 587.3	0.6	586.7 - 587.3	0.6	1.00

OUT-24 CORE LOG

	·			
INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
		. Wen som som tige som van teen som som som som som tide ster som une som van som van som		
0.0 - 4.2	4 2	0.0 - 0.6	0.6	Ø. 14
4.2 - 7.3		4.2 - 5.0	Ø.8	0.26
7.3 - 10.4	3.1	7.3 - 8.4	1.1	0.35
			1.4	<b>0.</b> 45
10.4 - 13.5	3.1	10.4 - 11.8	0.7	
13.5 - 16.7	3.2	13.5 - 14.2	Ø.7 Ø.7	0.22
16.7 - 19.8	3.2 3.0	16.7 - 17.4		0.22
19.8 - 22.8		19.8 - 20.9	1.1	0.37
22.8 - 25.9		22.8 - 23.7	Ø. 9	0.29
25.9 - 29.4		25.9 - 26.5	Ø. 6	0.17
29.4 - 31.6	2.2	29.4 - 30.0 31.6 - 32.8 · 34.5 - 35.3	0.6	0.27
31.6 - 34.5	2.9	31.6 - 32.8 ·	1.2	0.41
34.5 - 37.4	2.9	34.5 - 35.3 37.4 - 38.1 40.2 - 41.1	0.8	0.28
37.4 - 40.2		37.4 - 38.1	Ø.7	Ø.25
40.2 - 43.1	2.9			0.31
43.1 - 46.0		43.1 - 43.7	0.6	0.21
46.0 - 48.4	2.4	46.0 - 46.6	0.6	0.25
48.4 - 53.3	4.9 5.2	48.4 - 49.0	0.6	0.12
53.3 - 58.5	5.2	53.3 - 54.3	1.0	Ø. 19
58.5 - 63.0		58.5 - 59.4	0.9	0.20
63.0 - 67.7		63.0 - 64.0	1.0	0.21
67.7 - 72.5		67.7 - 68.5	0.8	0.17
72.5 - 77.8		72.5 - 74.0	1.5	0.28
77.8 - 82.7		77.8 - 79.2	1.4	0.29
82.7 - 87.6 87.6 - 92.5		82 <u>.</u> 7 - 84.2 87.6 - 88.6	1.5	0.31 0.20
92.5 - 97.7	4.7	92.5 - 93.4	1.0	
97.7 - 102.7	5.2 5.0	97.7 - 98.2	0.9 0.5	0.17 0.10
102.7 - 105.9	7.0	NO RECOVERY	0.0	0.00
105.9 - 111.6		105.9 - 107.1	1.2	0.21
	5.1	111.6 - 112.9	1.3	0.25
111.6 - 116.7 116.7 - 121.9	5.2	116.7 - 117.8	1.1	0.21
121.9 - 126.7		121.9 - 123.1	1.2	0.25
126.7 - 131.6		126.7 - 127.6	0.9	0.18
131.6 - 141.0		131.6 - 133.0	1.4	0.15
141.0 - 150.8		141.0 - 142.5	1.5	0.15
150.8 - 160.7	9.9	150.8 - 151.7	0.9	0.09
160.7 - 170.5	9.8	160.7 - 162.0	1.3	0.13
170.5 - 180.3				0.16
180.3 - 190.1	9.8	170.5 - 172.1 180.3 - 181.6 190.1 - 191.8	1.3	0.13
190.1 - 199.9	9.8 9.8	190.1 - 191.8	1.7	0.17
199.9 - 209.4	9.5	199.9 - 201.3	1.4	0.15
209.4 - 219.3		209.4 - 210.6	1.2	0.12
	9.8	219.3 - 220.3	1.0	0.10
229.1 - 239.0		229.1 - 230.2	1.1	0.11
239.0 - 249.2	10.2	239.0 - 239.8	Ø.8	0.08
249.2 - 259.4	10.2	249.2 - 250.0	0.8	0.08
259.4 - 269.4	10.0	259.4 - 260.3	0.9	0.09
269.4 - 279.6	10.2	269.4 - 270.3	0.9	0.09
279.6 - 289.8	10.2	279.6 - 280.1	0.5	0.05
289.8 - 300.0	10.2	289.8 - 290.4	0.6	0.06
300.0 - 310.1	10.1	300.0 - 300.6	0.6	0.06
310.1 - 320.3	10.2	310.1 - 311.1	1.2	0.12

OUT-24 CORE LOG (cont.)

INTERVAL	LENGTH	SAMPLE MARKED	RECOVERED	RECOVERY
320.3 - 330.2	5.9	320.3 - 320.9	Ø <b>.</b> 6	0.06
330.2 - 340.3	10.1	330.2 - 331.0	0.8	0.08
340.3 - 342.5	2.2	340.3 - 341.1	Ø.8	0.36
342.5 - 344.6	2.1	342.5 - 343.3	0.8	0.38
344.6 - 346.7	2.1	344.6 - 345.5	0.9	0.43
346.7 - 348.8	2.1	346.7 - 347.5	0.8	0.38
348.8 - 350.6	1.8	348.8 - 349.6	0.8	0.44
350.6 - 351.1	Ø.5	350.6 - 351.1	0.5	1.00

### UNITED STATES DEPARTMENT OF THE INTERIOR

### GEOLOGICAL SURVEY

Pacific Enewetak Atoll Crater Exploration (PEACE) Program Enewetak Atoll, Republic of the Marshall Islands

Part 1: Drilling operations and descriptions of boreholes in vicinity of KOA and OAK craters

Open-File Report 86-419

### APPENDIX II

Geotechnical Investigations,
Phase II of PEACE Program

bу

G. Leon Holloway and Alan G. Young

McClelland Engineers, Inc. Houston, Texas

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26	_	Borehole OLT- 14	93
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28	_	Borehole ONT- 16	95
29	A-F	Borehole OOR- 17	96
30	A-D	Borehole OPZ- 18	102
31	A-D	Borehole OQT- 19	106
32	A-C	Borehole ORT- 20	110
33	A-B	Borehole OSR- 21	113
34	_	Borehole OSM- 22	115
35	-	Borehole OTG- 23	116
36	A-B	Borehole OUT- 24	117

^(*) Page number given for beginning of borehole log only.

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### APPENDIX II:

# GEOTECHNICAL INVESTIGATIONS, PHASE II OF PEACE PROGRAM

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McClelland Engineers, Inc. 1

### INTRODUCTION

This appendix begins with a description of the drilling and coring/sampling program conducted at Enewetak, Republic of the Marshall Islands (figure II-1). Technical information on the drilling system and the specific components also is discussed. This section is followed by an overview of the soils encountered throughout the project with discussions concerning the corehandling procedures. Following the text are the boring logs and test results for all the boreholes drilled from the M/V Knut Constructor during the Peace Program. The project organization chart for McClelland Engineers (MEI), Inc., is shown in Figure II-2.

### DRILLING AND CORING/SAMPLING PROGRAM

McClelland Engineers drilled 32 borings for the Enewetak Drilling Project in the vicinity of the nuclear craters KOA and OAK (figure II-1). These included 27 geologic, 4 materials properties, and 1 cone-penetrometer boring. The boring penetrations ranged from about 40 to 1,600 ft below the seafloor. The field operations are discussed in the following paragraphs.

<u>Drilling/Coring/Sampling Operation</u>. -- The basic drilling, coring, and sampling operation followed for the Enewetak drilling project consisted of the following steps:

- (1) Lower and set reentry frame / reaction mass on seafloor with marine riser extending back to vessel. This step was modified as discussed subsequently in this section.
- (2) Begin drilling / soil sampling with open-hole technique (using drilling mud from the seafloor to refusal depth or until stability problems prevented further advancement using McClelland soil-sampling tools.
- (3) Install 8-5/8-in. casing through zone where soil samples were obtained.

^{1...} 

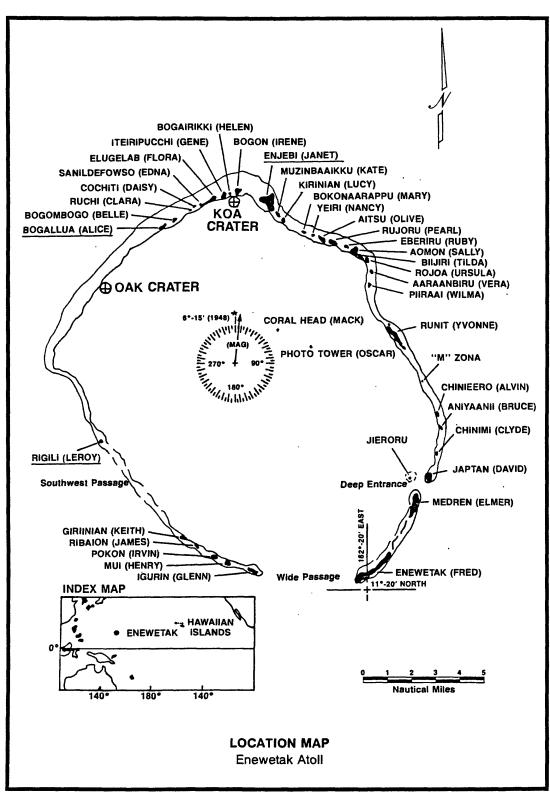


FIGURE II-1. -- Location map (insert) of Enewetak Atoll, Republic of the Marshall Islands; larger map shows principal islands of Enewetak Atoll (including site names, in parentheses) and other features including location of KOA and OAK craters.

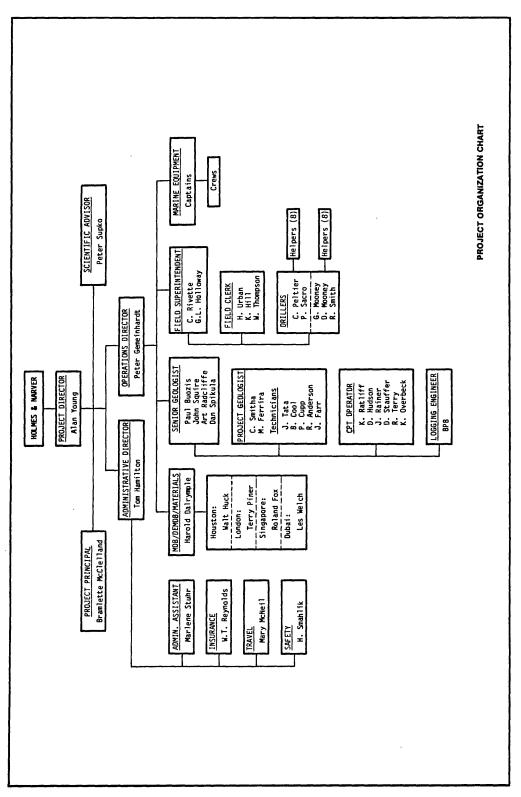


FIGURE II-2. -- Project organization chart for McClelland Engineers, Inc., during PEACE Program on Enewetak Atoll.

- (4) Continue drilling using the circulation drilling technique with either McClelland soil-sampling tools or marine wireline core barrel.
- (5) Install additional casing strings if lost circulation or hole instability was a problem.
- (6) Core/sample to total depth of boring.
- (7) Run logging tool in selected boreholes.
- (8) Pull casing.
- (9) Recover marine riser and reentry frame (if used) from seafloor.

Several key decisions concerning the drilling operation were made during the course of the program which altered the procedures outlined above. One of these was the decision to discontinue the use of the reaction mass. This evolved after no further Dolphin cone-penetrometer tests were planned. A method was devised to disconnect the heavy, cumbersome reaction mass from the marine riser and leave it on the seafloor in a convenient area of the lagoon during the remainder of the drilling program. Aside from the fact that no further Dolphin CPT was to be run, it also eliminated the possibility of losing the reaction mass or damaging the drilling rig during riser-recovery operations. Implementation of this decision permitted increased core/sample production and safer drilling operations.

The marine riser, however, was retained for the drilling operation. Its primary function was to serve as a reentry system when changing from a drilling and sampling mode to the coring operation. A stinger (or an unflanged section of the marine riser) was attached to the bottom portion of the riser pipe. This allowed the pipe to be lowered directly into the soil and "ride" with the ship during tidal fluctuations. The marine riser was held just above the seafloor until a sufficient sampling depth was effected, then it was allowed to penetrate into the seabed. Recovery of the riser system was controlled in the "moonpool" area by the welded padeye stops attached to the riser below each flanged connection.

In many instances, the material was too soft to core or too heavily fractured for standard coring systems to produce satisfactory recovery percentages. Therefore, in an attempt to keep recovery high, coring was replaced with percussion sampling. This option allowed a greater flexibility in the drilling program and also saved valuable time in the overall field investigation. The primary coring system was chosen to be compatible with McClelland's standard percussion samplers. Therefore, percussion samples could be taken through the outer core barrel and diamond bit when the inner barrel was removed. Caution was exercised as the sample tube passed through the bit so as not to damage or chip the diamond matrix on the face of the drill bit.

Soil-Sampling Procedures. -- Soil sampling was carried out primarily using thick-walled tubes driven with a percussion sampler. This type of sampler has been used for over 20 years in many offshore applications. The primary benefit in using this tool is its simple design and robust construction. Two different size percussion hammers were used during the Enewetak field investigation. The majority of the sampling was done with the 300-lb hammer. The smaller 175-lb

hammer was used occasionally at the beginning of the field program. In many instances, typically at the beginning of each boring where the material was extremely soft, no hammer blows were required; the weight of the hammer alone produced enough penetration to obtain a full tube of material. Dimensions and other details for the variety of soil samplers used on the Enewetak coring program are presented in the Table II-1 below.

Description	Outside Diameter, mm	Inside Diameter, mm	Max. Sample Length, mm	Core Catcher
76-mm thin-wall	76.26	72.20	764	no
57-mm thin-wall	57.00	53.70	775	no
76-mm thick-wall	76.60	63.20	764	no
76-mm split-barrel	77.00	64.00	595	yes
53-mm split-barrel		38.50	470	yes

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TABLE II-1. -- Dimensions of sample tubes used in PEACE program.

Rock-Coring Procedures. -- Below the soft and/or fractured material below the crater, the density of the material precluded the use of percussion samplers and thick-wall tubes. At this point, the drilling generally changed to the Longyear core barrel with a surface-set diamond, side-discharge bit. The Longyear wireline coring system was designed for terrestrial, deep-hole mineral exploration, but also performs well in recovering uncemented material or soil samples. The rock coring tool has a non-rotating inner barrel that can cut up to a 10-ft length of 3.346-in.-diameter core. The advantage of the Longyear system is that it can recover material in the zones of uncemented loose materials where other types of core barrels cannot. A schematic of the Longyear CHD-134 wireline coring system is shown on Figure II-3. Along with the Longyear core barrel, the Longyear heavy-duty CHD-127 casing also was used. This casing combines strong-wearing alloy steel box and pin tool joints with a lighter section midbody.

The Christensen marine wireline coring system was designated as the primary coring system at the beginning of the project. However, after a number of attempts with little or no recovery, the Longyear system became the primary. Three types of coring were attempted with the Christensen system prior to using the Longyear system exclusively. These three systems were (1) the non-rotating inner barrel system, (2) the extended coring system, and (3) the punch coring system. An illustration of these coring systems is shown on Figure II-4. Use of a conventional Christensen core barrel capable of cutting a 4-in.-diameter core up to 20 ft long also was attempted. This barrel had a 5-3/4-in.-diameter, face-discharge, diamond drill bit. It also did not prove to be appropriate for soil conditions at Enewetak.

During each core run, the mud-pump output, weight on bit, penetration rate, and rotary speed were controlled closely by the driller to optimize core recovery. This information was documented for each core run and is summarized on the boring logs.

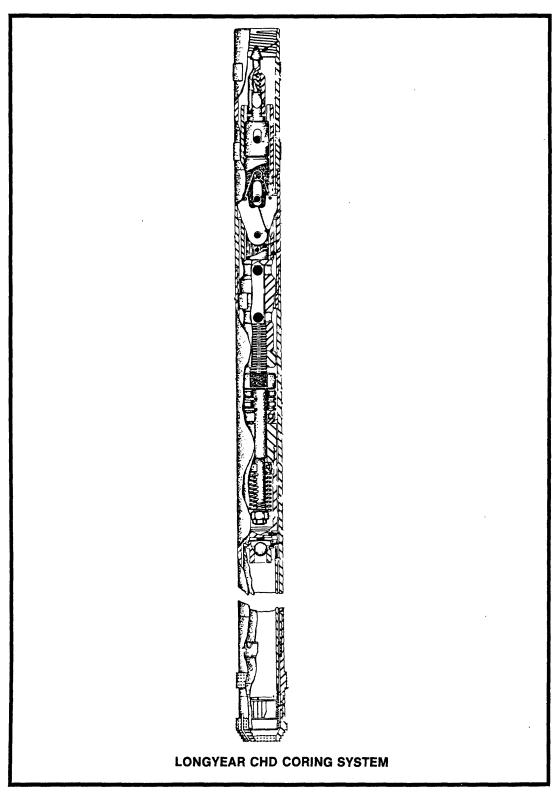


FIGURE II-3. -- Schematic diagram of Longyear CHD-134 wireline coring system.

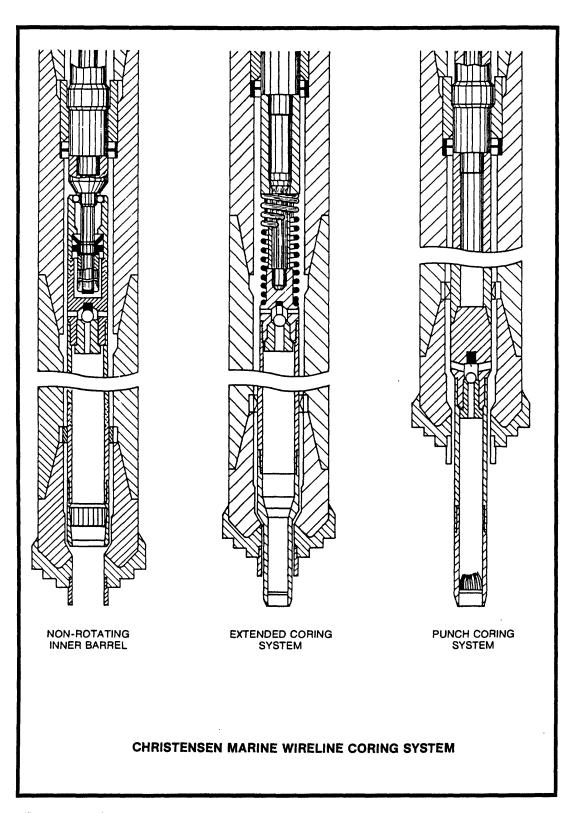


FIGURE II-4. -- Schematic diagram of Christensen marine wireline coring system.

<u>Drill-Bit Selection</u>. -- To cope with the variety of formations that were encountered, the following bits were available:

- o McClelland winged latch-in open-center bits,
- o McClelland Kor-King roller latch-in open-center bit,
- o McClelland KUTRITE saw-tooth bit,
- o Longyear surface-set PQ bits,
- o Christensen marine wireline bits,
- o Christensen diamond bits for 4-in., conventional core barrel,
- o Diamont Boart diamond bits, and
- o Hughes tricone roller bits.

The McClelland winged bits are designed specially for soil sampling and in situ testing tools. These bits are suitable for drilling in soil, but they also can penetrate thin rock layers. McClelland's latch-in roller bits also occasionally were substituted for the winged bits when large gravel or hard layers were encountered. However, the most successful bit used throughout the boring program was an open-hole saw-toothed KUTRITE faced bit which was manufactured onboard the vessel during the course of the work. This bit was manufactured from a piece of Longyear casing and scrap steel. The entire face of the bit and stabilizing wings was covered with KUTRITE tungsten-carbide chips.

The Longyear coring bits were surface-set diamond bits, designated as NWD3. Along with the bits, Longyear reaming shells also were used. These shells were set with diamonds to ensure a constant hole diameter and serve as a stabilizer for the bit. These drill bits featured a tapered pilot design, thin kerf, and also had water courses only along the inside and outside diameters. This combination of bits and reaming shells proved to be superior to the Christensen and Diamont Boart bits.

The diamond bits presented a smoother running characteristic than the carbide bits and thus provided for better core recovery in the formations encountered. The bit wear was minimal in these formations, and only a few were required to accomplish the entire program.

The Christensen coring bit had a saw-tooth, multistep profile with replaceable leading pilot and carbide inserts on the leading edge of each tooth to protect the mixed carborandum and natural diamonds from mechanical damage caused by fractured ground. The pilot bit effectively reduces the bit kerf area and also minimizes the erosion caused by fluid. The removable pilot bits were diamond set. Mud flush is 90 percent discharged with ports above the pilot section and 10 percent annular discharged through the pilot.

Possible explanations why the Longyear system proved to be a superior product in this application over the Christensen system are: (1) the Christensen bit had too many face discharge ports, (2) the kerf size of the Longyear was much smaller, and (3) the tapered pilot design of the Longyear bit worked much better than the 0.D.-step-taper bit system used on the Christensen.

<u>Bit Weight.</u> -- The required bit weight while coring depended primarily on the formation hardness and/or the type of drill bit being used. The Longyear diamond bits are a light-load design. Therefore, 3000- to 7000-lb bit weight typically was used to core the formations. These loads were adjusted with

depth to obtain the optimum results. Drill collars were present but were not required to attain the desired operating range of weights. Stabilizers were also available but were not necessary. The revolutions-per-minute (RPM) which appeared to give the optimum results ranged from 80 to 120.

<u>Drilling-Mud Program.--</u> Drilling mud was used during the entire drilling, sampling, and coring program. Reasons for using drilling mud are:

- o Viscosity was required to suspend and lift larger size cuttings, sand, and shell fragments out of the borehole;
- o Solids were required to stabilize the upper material before casing;
- o Core/sample recovery was improved; and
- o Core/sample quality was better because core erosion was reduced.

The drilling mud program was outlined originally by Fenix and Scisson (F&S), a DOE contractor. This consisted of mixing a salt gel with a modified gar gum and polymer. However, sufficient quantities of this mixture soon were depleted. Because of the many and varied products that had been procured, MEI experimented with the onboard supplies until another shipment of drilling mud that was adequate could be obtained. Some of these mixtures consisted of (1) Baravis, gar gum, and Poly-add, (2) Baravis and Poly-add, (3) Sepiolite, Baravis, and Poly-add, and (4) Sepiolite and Poly-add. The last three mixtures required defoamer. The two most successful products were the Baravis with Poly-add and the Sepiolite with Poly-add.

Some initial problems developed with not being able to shear the sepiolite so that it would yield and stay in suspension. However, after some onsite testing by a mud engineer, it was discovered that the Sepiolite indeed could be used if a better shearing action was produced. Mud guns were installed at this point in the program to be used with the large quantity of Sepiolite which was on hand. This mixture produced an adequate mud. The Sepiolite consumption was much higher than expected to yield the required viscosity, gel strength, and hole-stability qualities. Also, many of the borings at this time were shallow and thus being drilled using the open-hole technique. This increased the mudconsumption rate. In addition, the Sepiolite mixed slowly and required a significant amount of time to thoroughly circulate through the mud-gun system before it would shear sufficiently to attain its specifications.

Because of the large quantity of Sepiolite required, it became more cost-effective to use the Baravis polymer with Poly-add after the supply of Sepiolite was depleted. This mixture (Baravis and Poly-add) appeared to produce the best drilling fluid for this application. Viscosity could be increased quickly with addition of only a partial bag of Baravis. It also produced good suspension characteristics and exhibited superior holestabilization properties. There was no real indication that the addition of the Polyadd contributed any added benefits to the drilling fluids other than helping reduce the foaming.

## DRILLING AND SUPPORT EQUIPMENT

<u>Drilling Vessel.--</u> The M/V <u>Knut Constructor</u> was chosen as the drilling support vessel to perform the drilling and coring operations. This vessel is a

237- x 49- x 15.9-ft converted freighter with a 4- or 6-point mooring system. The M/V Knut Constructor is a completely self-contained vessel, whose principal features are:

- Onboard accommodations for all personnel required for the project, reserve beds for guests, and a three-birth hospital cabin with private facilities.
- (2) Large areas of free deck space and below deck for storage of materials and equipment.
- (3) Two large office areas that were used for onboard core analysis.
- (4) One main propeller, a 760-hp, 375 rpm, CP diesel.
- (5) Two 600-hp Schottel propellers (360-degree revolving) and a 350-hp tunnel bow thruster.
- (6) Two cranes, one of 150-ton lift and one of 15-ton lift, which covered the complete working area.
- (7) High storage capacity for meat, fruit, vegetables, and dry goods, enabling the vessel to remain on location for extended periods.
- (8) Mechanical and electrical work shops for equipment maintenance.
- (9) A self-propelled work boat available for transportation of personnel from ship to shore.

Additional specifications for the <u>Knut</u> Constructor are given in Table II-2. The vessel provided lodging for the entire drilling and scientific team. Most of the spare equipment and drilling supplies, such as casing, riser pipe, and drilling mud were stored onboard quite conveniently for easy access. During work later in the program, the vessel also served as the support vessel for the small submersible Delta and her support crew.

Additional comments concerning the vessel are presented in the main text of the current report.

Drilling Rig. -- McClelland Engineers chose to use a Failing-2000 drilling rig for the Enewetak project. The rig was capable of drilling to a depth of 2,000 ft while taking 3.346-in.-diameter rock cores using a conventional swivel, kelly, and rotary system. The rig is designed for both soil sampling and rock coring from a floating vessel in a harsh marine environment. The main lifting line was equipped with a six-part traveling block so that the additional capacity could be utilized when raising or lowering the marine riser and reaction mass. Technical specifications pertaining to the drilling rig are presented on Table II-3.

Heave Compensation. -- The drill string of the M/V Knut Constructor was compensated for vessel heave during drilling and coring operations. A pneumatic cylinder was incorporated into the drilling system to absorb the vessel heave while keeping a nearly constant weight on the drill bit. A schematic illustration of the tensioner is shown on Figure II-5. Figure II-6

### TECHNICAL SPECIFICATIONS FOR M/V KNUT CONSTRUCTOR

Class: Des norske Veritas + 1A1 Call Sign: HO 5368 Port of Registry: Panama Commissioning Date: August 1974 Manager: Knutsen O.A.S. Shipping A.S., Haugesund, Norway PRINCIPAL DIMENSIONS: TANK CAPACITIES: NAVIGATION AND RADIO Length O.A. Length B.P. 77.25 m. Fresh water Fuel oil 260 cu m. EQUIPMENT: 214 cu m. - 2 X 3-cm radars. 66.05 m. - Satellite. - Radio Direction Finder. Breadth Mid. Breadth Mid. over Blister 9.00 m. 15.00 m. Water ballast 1,050 cu m. Depth to Upper Deck 7.80 m.
Depth to Shelter Deck (2 deck) 5.50 m.
Maximum Draft (summer) abt. 4.35 m.
Corresponding Deadweight Maximum draft (Schottel) 1,080 tons.
Assume draft (Schottel) 1,458.31 tons.
1,458.31 tons. SSB Radio Station, M/F, H/F.
 Telex facilities.
 VHF, stationary and portable. - 1 x 19 cu m per 24 hrs. Reverse-osmosis water maker. - Autopilot. LIFTING EQUIPMENT: - Gyro Compass. - American Hoist Model 9299 w/ 80-ft boom plus - Standard Magnetic Compass. 1,032.94 tons. - Echo Sounder. Net Tonnage 20-ft extension boom; max. lifting capacity 330,000 lbs. l x 15-ton SWL Haglund electric hydraulic crane w/ 65-ft boom. - Echo Magnifier. STABILIZING SYSTEM:
Passive stabilizing system. - Intercommunication System. ACCOMMODATIONS: 76 persons, 19 berths for ship's crew and 57 for charterer's personnel - 6 x 2-berth cabins. PROPULSION: Main Engine:
- 1 x 760-HP, 375-rpm C.P. Propeller. WORKING WELL (MOON POOL): 5 x 6 m (midship). Schottel Propellers:
- 2 x 600-HP, 360-degree revolving. OPEN OECK SPACE (Upper Deck): Working area: 375 sq m. - 5 x 4-berth cabins. - 4 x 6-berth cabins. **BOW THRUSTER:** - in addition, up to 11 occasional - 1 x 350-HP tunnel thruster. MAXIMUM DECK LOAD: bench berths. 5 tons/sq m on Upper Deck. - cafeteria in messroom, 54 seats. AUXILIARIES: 2 tons/sq m on other decks. - 2 x 220/275 kW/kVA. 440 V / 60 Hz. - 1 x 196/245 kW/kVA, 440 V / 60 Hz. WORKSHOPS: - 1 x 15-sq m Rigger Shop on Upper Deck. STORAGE DECK: - 450 sq m on Shelter Deck. - 80 sq m on Main Deck. - 150 sq m on Tank Top. - 1 x 25-sq m General Workshop on Shelter Deck. All generators driven by separate diesel engine. - 1 x 20-sq m Electrical Workshop on Main Deck. - 1 x 30-sq m Mechanical Workshop - 90 sq m on Grating Deck. TRANSFORMERS: RANSFORMERS:
- 2 x 60 kVA, 440/220 v, 100 A, 60 Hz.
Total power available:
- 440 V AC: 440 kW excl. emerg.
- 440 V AC: 636 kW incl. emerg. OFFICES: on Main Deck. 1 x 8 sq m on Upper Deck.
1 x 15 sq m on Shelter Deck. EQUIPMENT IN MECHANICAL WORKSHOP:
- 1 x 1,500-mm effective length lathe MOORING EQUIPMENT / 6-POINT: - 6 x 20/30-tons, H.P. hydr. winches, central and remote controlled w/ 1,400 m x 36-mm dia. wire rope. machine.
- 1 x 32-mm dia. vertical drilling FUEL CONSUMPTION: Marine diesel (per 24 hours).
- Transit, approx. 7.3 cu m. 1 x 300-Amp welding set.1 Oxyacetylene welding set. - Moored, working operation approx. 2.3 cu m. - 4 x 5-tons H.P. hydr. pennant winches. - In Port, approx. 0.8 cu m. - 6 x 4,500-kp net buoyancy SERVICE AIR COMPRESSOR: pennant buoys.
- 6 x 5,000-kp offshore anchors. - 2 x 2-stage, water cooled. Capacity: 23 cu m / mm. Pressure: 3 kp / sq cm. Air Receiver: 2 cu m. SPEED: Average 8 knots.

TABLE II-2. -- Technical specifications for drill ship M/V Knut Constructor.

# FAILING 2000-CF TECHNICAL SPECIFICIATIONS

DATED	2 500 64 (750 0 -)	Designed to headle sender leads up to 54 000 the 100 000 tol. (4th 5 litera
RATED CAPACITY	2,500 ft (762.0 m) with 2-7/8-in (73.0 mm-) drill pipe	Designed to handle casing loads up to 64,000 lbs (29,029 kg) with 6 lines.
MAST Choice of Lengths	Multi-section, hydraulically raised and lowered, with provision for running a 3-sheave drilling block and 3-sheave hoisting block. Channel guide for swivel	Height with optional pulldown: 58 ft (17.7 m); or 54 ft (16.5 m) of clear working space. Height w/o pulldown: 58 ft (17.7 m); 54 ft (16.5 m); 48 ft (14.6 m); 44 ft (13.4 m) of clear working space. Total gross capacity 75,000 lbs (34,019 kg). Maximum hookload capacity 64,000 lbs (29,030 kg) w/ 6 lines. 60,000 lbs (27,216 kg) w/ 4 lines. Crown 8 sheaves (4 per drum) plus sand-line sheave. Racking capacity 2,500 ft of 3-1/2 in.; 4,000 ft of 2-7/8 in.; 5,500 ft of 2-3/8 in. (762 m of 8.9 cm; 1,219 m of 7.3 cm; 1,676 m of 6.0 cm)
(Optional) H.D. MAST		Same choice of above except gross load 90,000 lbs (40,823 kg) capacity. Hookload w/ 4 lines 72,000 lbs (32,659 kg) Hookload w/ 6 lines 77,000 lbs (34,926 kg). Blocks are deadlined at the crownblock.
DRAWWORKS	Two identical drums.	Spool diameter 9 in. (22.9 cm). Spool length 12 in. (30.5 cm). Maximum Single-line pull 15,000 lbs (6,804 kg). Brakes 21 x 5 in. (53.4 x 12.7 cm) double, equalized. Line capacity 5/8 in. x 500 ft w/ 58-ft mast (15.9 mm x 152 m w/ 17.9 m). 5/8 in. x 460 ft w/ 58 ft mast (15.9 mm x 140 m w/ 15.5 m). 5/8 in. x 400 ft w/ 48-ft mast (15.9 mm x 134 m w/ 14.6 m). 5/8 in. x 370 ft w/ 44-ft mast (15.9 mm x 113 m w/ 13.4 m). Clutches 16-ft (14.9 m) Wichita, 2-plate, air.
	Catheads (Optional)	Foster Breakout Type on right side ahd/or Foster Spinning Cathead on left (driller's) side. Foster catheads are no equipped with rope spool and divider; standard FAILING 25202 spool type also available on left end of optional third drum shaft.
	Sand Reel (Optional)	Spool diameter 9 in. (22.9 cm). Spool length 38 in. (96.5 cm). Maximum single-line pull 8,600 lbs (3,901 kg) bare drum. Brake Single 21 x 6 in. (53.3 cm x 15.2 cm). Clutch 16-in. (40.6 cm) Wichita, 1 plate, air.
ROTARY	Standard	18-in. (45.7-cm) opening. Hinged to clear 28-in. (71.1-cm) diameter.
TABLE	Optional	Hydraulically retractable table with 8-1/2-in. (21.6-cm) opening, retracts to clear 18-in. (45.7-cm) diameter.
PULLDOWN {Optional}	30,000 lbs (13.6 kg) pressure on bit	Two chains, 1-3/4-in. (4.4-cm) pitch. Two-speed, hydraulically actuated.
STD. MAIN RANSMISSION	5 speeds forward 1 speed reverse	7.20:1, 3.90:1, 2.12:1, 1.18:1, 1.00:1. 14-in. (35.6-cm) clutch, 2 plate, air controlled. 7.09:1 (This provides rotary speeds of from 23 to 163 rpm.)
	9 speeds forward 3 speeds reverse	20.90:1, 14.63:1, 8.64:1, 5.48:1, 3.55:1, 2.44:1, 1.54:1, 1.00:1, 0.75:1. 3.30:1, 11.70:1, 16.71:1. (This provides rotary speeds of from 8 to 217 rpm.)
OIL PUMP	For pulldown	20 gpm 0 2,000 psi. Pressure compensated. 11 gpm 0 2,000 psi. Fixed displacement.
MUD PUMP (Optional)	Air clutch control	7-1/2 x 8 in. (19.1 x 20.3 cm) FY-FXX. 5 x 8 in. or 5-1/2. x 8 in. or 5 x 6-1/2 in. also available. (12.7 x 20.32 or 14.0 x 20.3 or 12.7 x 16.5 cm).
(opt.) AIR COMPRESSOR	250 psi	Model 256-528 (Other compressors may be installed).
ENGINE	Single or compounded	170 continuous BHP when equipped with FY-FXX Pump. 200 continuous BHP when equipped with Model 256-S2B air compressor.
CONTROLS	Air-aranatad	Grouped in control panel in drill frame at driller's station.
MOUNTING	Tandem axle	Trailer or truck, *

TABLE II-3. Technical specifications for the Failing 2000-CF drill rig. Asterisk (*) calls attention to the fact that the drill rig was mounted directly on the drilling platform located over the moon pool aboard the  $\underline{\text{Knut}}$   $\underline{\text{Constructor}}$ .

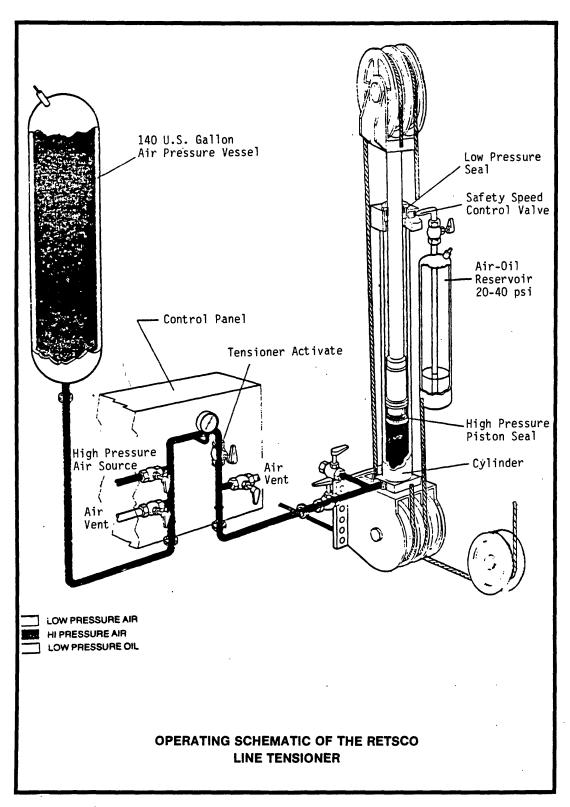


FIGURE II-5. -- Operating schematic of the Retsco line tensioner.

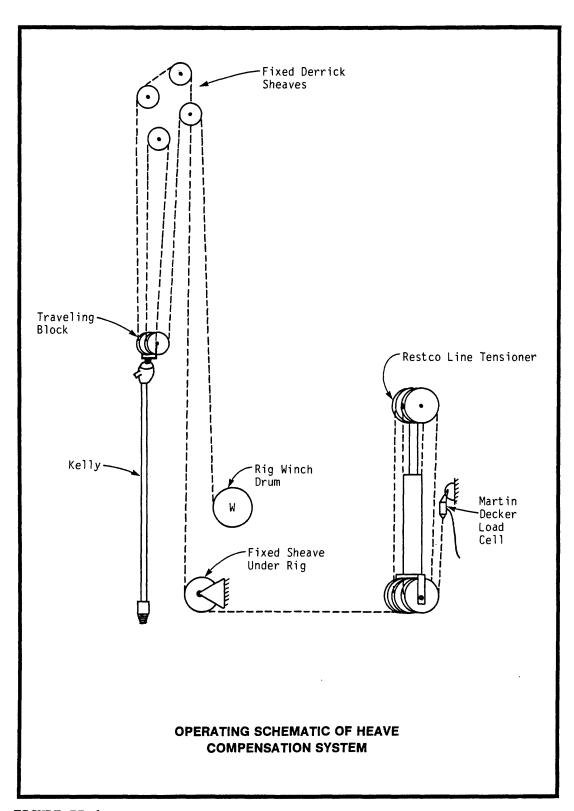


FIGURE II-6. -- Operating schematic of heave-compensating system.

shows the actual hookup of the tensioner on board the M/V Knut Constructor. The M/V Knut Constructor was equipped with a Retsco 16,000-lb, 40-ft-line stroke tensioner. Technical specifications are shown on Table II-4 and a schematic diagram of its operation is shown in Figure II-7.

Mud-Handling System. -- The vessel had two agitated mud pits, each with a capacity of about 1,200 gals. Mud was mixed in the pits using a separate pump that had a manifold permitting pumping of seawater or prepared mud. The pump discharged through a hopper where mud materials were added. Mud was then pumped to a holding tank by a separate pump where it stood by until the driller was ready for its use. Once drilling commenced, mud was pumped down the borehole with the mud pump which is an integral part of the Failing-2000 drill rig.

Fluid returned to the surface through the casing system and was discharged into a two-section settling tank, shown in Figure II-8. After the solids had settled out, the returns were run through a mini-desander and then pumped back to the main mud pits for recirculation.

Marine Riser and Casing Schedule. -- To allow recirculation of drilling fluid and to prevent problems associated with borehole instability, a marine riser and casing system was used. At the start of each borehole, a 12-in. marine riser connected to the top of the seafloor reentry frame was lowered to the seafloor. Sketches showing the marine riser and casing systems for the vessel are presented as Figures II-9 and II-10. The riser facilitated hole reentry but was open at the bottom where clamping units were present to grip the drill pipe for in situ testing. The riser by itself would not permit mud recirculation.

After the upper zone had been sampled using the open-hole drilling technique, an 8-5/8-in. surface casing generally was set to stabilize the formation and seal the hole for recirculation. A larger casing size of 10-5/8-in. also was available and was used in one application. To set the surface casing string, the borehole occasionally had to be reamed out. The casing was connected to a flexible rubber hose in the moonpool area so the mud returns could flow into the settling basin.

Coring was carried out until borehole stabilization became a problem or circulation was lost. When this occurred, a second string of 7-5/8-in. flush-joint casing was run. A third string of 6-5/8-in. flush joint-casing was available if problems occurred farther down the borehole. Generally, reaming was not required to install the 7-5/8-in. or 6-5/8-in. flush-joint casing.

The drilling rig was elevated 15 ft above the deck of the M/V Knut Constructor. The space below the drill floor allowed stripping joints of casing over the drill pipe as drilling proceeded, permitting simultaneous drilling and casing. However, the casing generally was run with the drill string removed from the borehole. This permitted the casing itself to be attached to the kelly and drilled in, forming a good seal into the formation.

# DOLPHIN IN-SITU TESTING EQUIPMENT

McClelland Engineers provided the Dolphin cone-penetrometer testing system (CPT) to perform the in situ testing for the Enewetak project. The Dolphin is

# RETSCO LINE TENSIONER SPECIFICIATIONS

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GUIDE-LINE TENSIONER - 16,000	LBS -	40 FT	TRAVEL
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Length retracted	224 in.
Length extended	344 in.
Weight	3,800 lbs
Cylinder bore	7 in.
Cylinder stroke	120 in.
Maximum Operational Air Pressure	1,900 psi
Maximum Tension (Single Line)	16,000 lbs
Maximum Wire Line Travel	40 ft.
Line Speed	Over 300 fpm
Oil Volume (normal contained in reservoir	·
and cylinder during operation)	11 U.S. gals
Air-Oil Reservoir Pressure (operational)	15 to 70 psi
Relief Valve Setting (Air-Oil Resvoir)	95 psi – normal
-	120 psi - maximum

# **SHE AVES**

OD	28 in.
Tread diameter	25-3/4 in.

Bearing Type	Tapered Roller
Wire Rope Groove	3/4-in. diameter

# OIL TYPE - AIR OIL RESERVOIR

Standard	822-tcf
	Quintolubric

# AIR PRESSURE VESSEL

Maximum Operational Pressure	2,400 psi
Standard Volume (Contained)	140 U.S. gals or
•	•

TABLE II-4. -- Technical specifications for Retsco line tensioner.

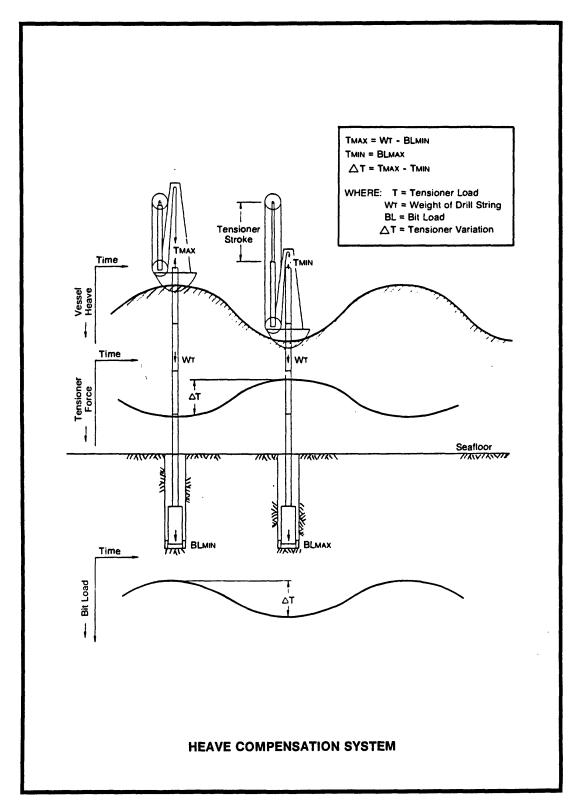
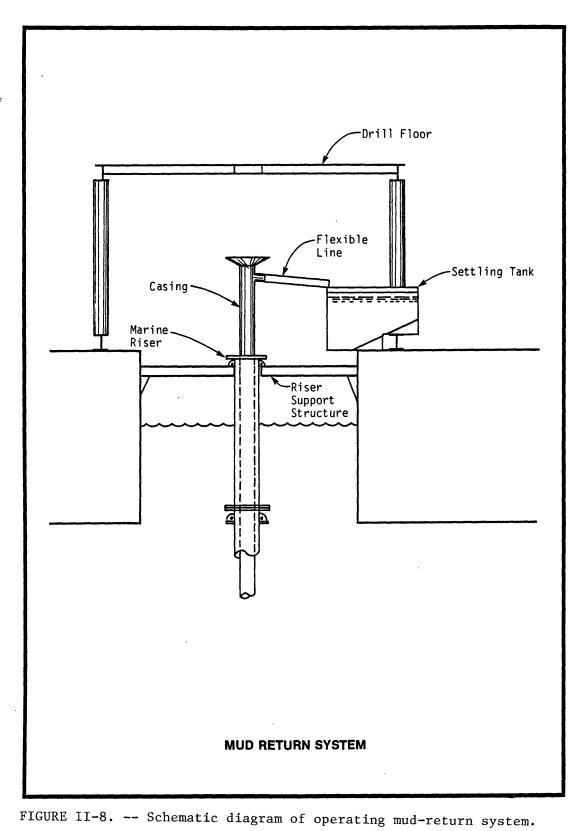


FIGURE II-7. -- Schematic diagram of operating heave-compensation system.



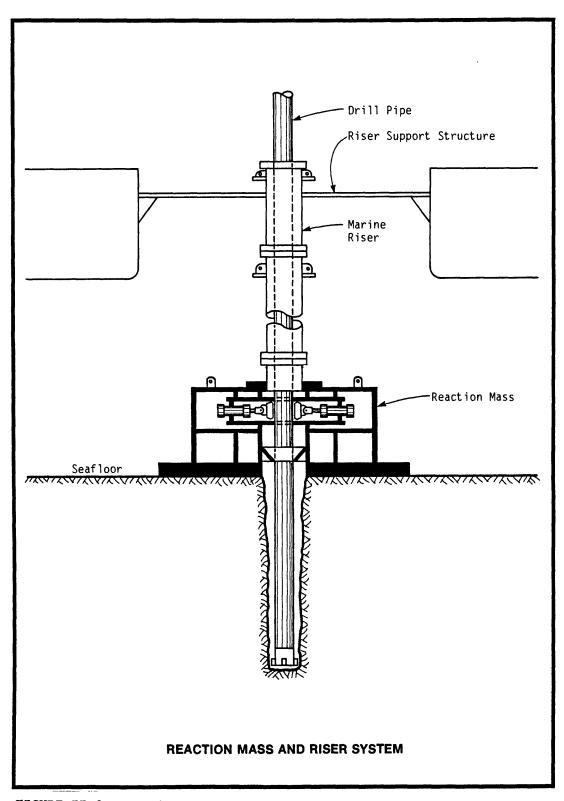


FIGURE II-9. -- Schematic diagram of reaction mass and riser system.

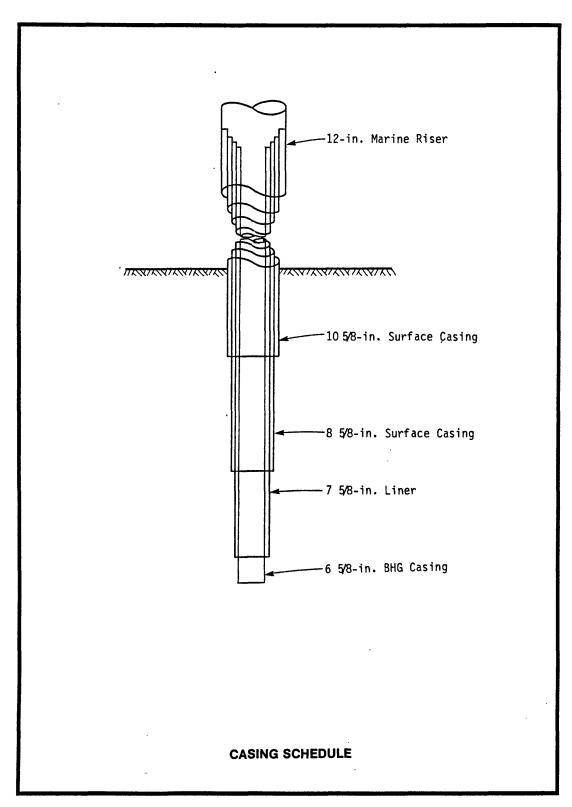


FIGURE II-10. -- Casing schedule used during PEACE Program.

a state-of-the-art system which has many unique features. Information pertaining to the system and how it works will be presented in further detail in this section.

Cone-Penetrometer Tests. -- In all, only one CPT test was performed for the project. This borehole, designated KAP-3, was drilled and tested to 78.0 ft below the seafloor. Eight tests were recorded using the Dolphin CPT in the cone-penetrometer mode only. The results of these tests are shown on Plate 5. The boring was terminated due to loose material falling back into the borehole and the anticipation of encountering an extremely hard layer.

Dolphin System (Background). -- MEI introduced an improved in situ testing and sampling system called Dolphin in early 1984. The main advantage of the Dolphin is the state-of-the-art data acquisition and operational simplicity provided in a single system. The system has the capability to perform piezocone penetrometer, in situ vane testing, and fixed-piston soil sampling with the tools illustrated in Figure II-11.

The Dolphin system requires only a dead-weight reaction mass and a drill rig with a motion compensator. The reaction mass, shown on Figure II-9, was mounted in the moon pool of the M/V Knut Constructor.

Remote-Data Acquisition. -- The Dolphin system uses a remote data acquisition system to sample, digitize, and record data downhole as they are generated. The advantages of this system are that it:

- o eliminates the electrical umbilical and associated electrical noise in the data;
- o eliminates excessive pipe handling and thus increases production;
- o samples, digitizes, and records data at the source, resulting in better quality data; and
- o allows tools to free-fall to the bottom of the hole and be retrieved with a high-speed winch, thus increasing production.

Although the data cannot be observed by the operator in "real time" as they are generated, mud-pressure observations at the surface provide feedback on downhole tool performance. Proper tool latch-in, depth of penetration, thrust, and tool refusal can be monitored.

Cone-Penetrometer Testing. -- The cone penetrometer used with MEI's Dolphin system records three channels of information at a rate of five samples per second. These data include: (1) point resistance, (2) sleeve friction, and (3) rate of penetration. All this information is stored in the remote memory unit. The tool has a 10-ft continuous stroke. The stroke rate is controlled internally and can be varied by changing the control valve within the tool.

The Dolphin system was programmed with a portable computer while on the deck of the M/V Knut Constructor. The tool, shown in figure II-11, is then allowed to free-fall down the pipe without an electrical wireline and to latch into the bit.

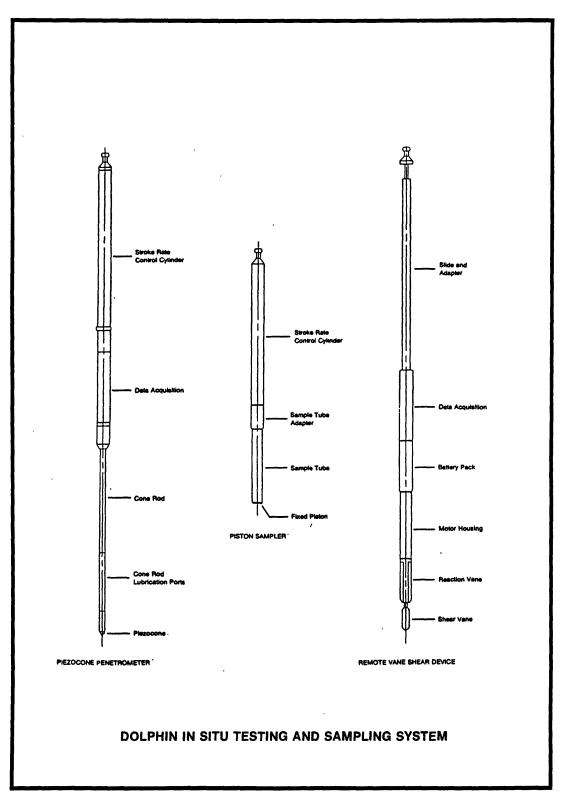


FIGURE II-11. -- Schematic diagram of Dolphin® in situ testing and sampling system used in borehole KAP-3 during PEACE Program.

The test was started by increasing the mud pressure in the drill pipe, causing the cone penetrometer to penetrate the soil. The test was terminated when the mud pressure reached a predetermined level indicating that either full stroke or refusal had been achieved.

When the test was completed, the CPT tool was retrieved by an overshot attached to a sandline on a high-speed winch. Once the tool was back on deck, the remote memory unit within the tool was connected by a service cable to a HP-85 computer. The data were transferred from the remote memory into the computer.

After viewing the test results, the operator stored the data for later conversion into engineering units, and the memory was prepared for the next test. After conversion, the 8.5- by ll-in. plot, shown on Plate II-5, was prepared showing point resistance and sleeve-friction resistance, or various normalized combinations of the data such as the ratio of sleeve friction to point resistance. The sleeve-friction ratio is most useful in identifying changes in the soil stratigraphy.

#### ENGINEERING CHARACTERIZATION OF SOIL CONDITIONS

A total of 32 borings were performed in the field program. Eight of these borings were performed at the KOA crater, and are referenced on Figure II-12. The remaining 24 borings were performed at the OAK crater site. A borehole reference map for the OAK Crater is shown on Figure II-13.

The boring program consisted of boreholes being drilled both across the crater's mouth and outside the immediate crater; the boreholes outside the craters were designated as reference borings. A profile of the KOA crater is shown on Figure II-14. Similar cross sections of the OAK crater are presented as Figure II-15 and II-16.

Core-Handling Procedures. -- The core/sample recovered from the geologic borings were first divided into two separate samples. Cores were split vertically with a rock saw, and tube samples which could not be cut were divided equally into two separate D-tubes. The first half sample was designated as the archive sample. These samples were marked as such and packaged immediately into cardboard containers and plywood crates for shipment. The remaining half was designated as the working half sample. These samples were marked to precisely agree with their borehole. After the core was described by the MEI geologists for engineering classification, these samples were turned over to U.S. Geological Survey (USGS) personel for geologic description and analysis. When the geologic description was completed the cores/samples were packaged the same way as their archive counterparts and made ready for shipment.

<u>Description of Soil Stratigraphy</u>. -- The general soil conditions across the site of KOA and OAK craters typically consisted of carbonate silty sands, carbonate sands, coral, and limestone. Degrees of cementation varied across the crater.

Detailed soil-stratigraphy information is presented on the boring logs. The boring logs for KOA crater are presented on Plates II-3 through II-4 and II-6 through II-11. Those for OAK are given as Plates II-12 through II-36. In

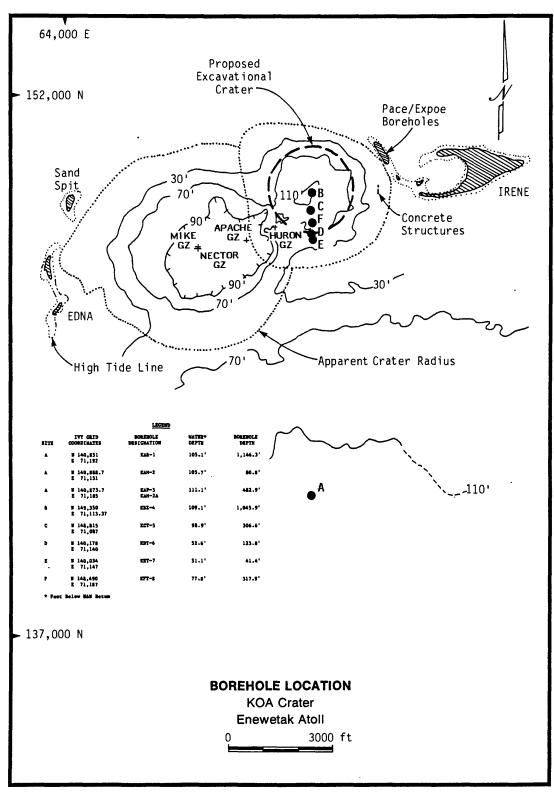


FIGURE II-12. -- Map showing location of borehole sites (A-F) drilled in KOA crater during PEACE Program on Enewetak.

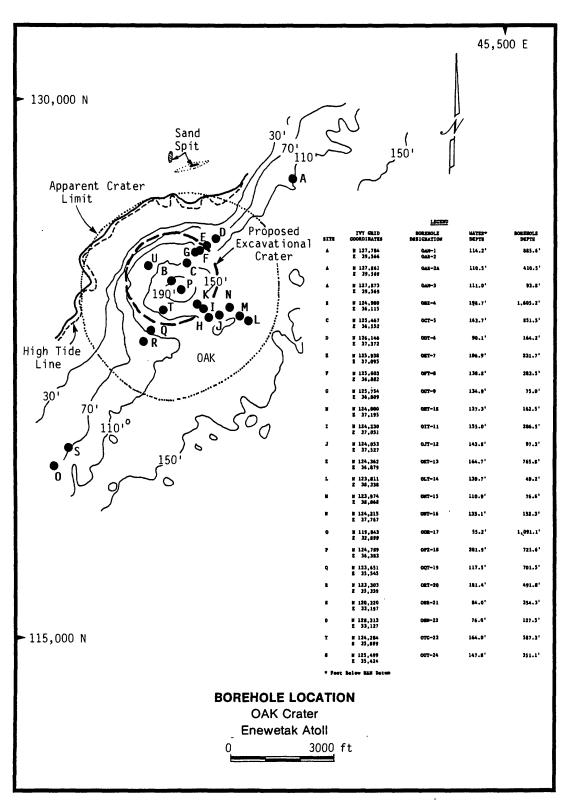


FIGURE II-13. -- Map showing location of borehole sites (A-U) drilled in OAK crater during PEACE Program on Enewetak.

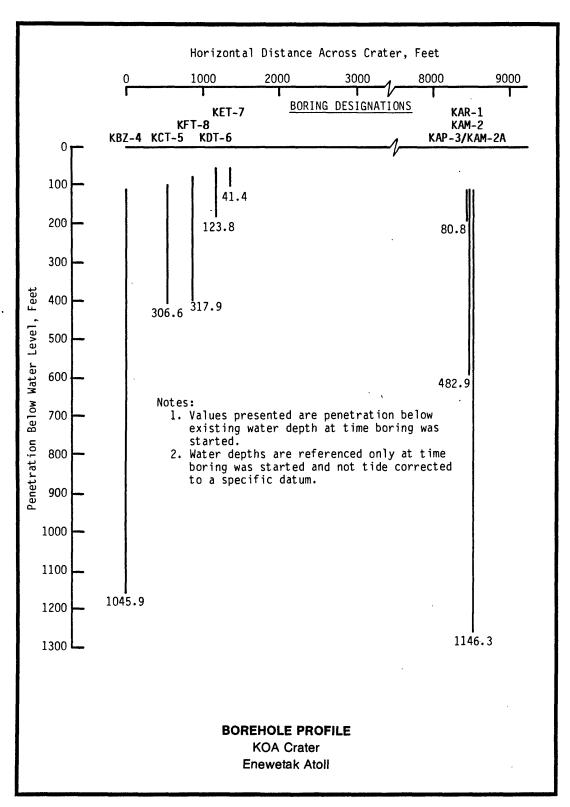


FIGURE II-14. -- Borehole profile for KOA crater. Location of borehole sites is shown on Figure II-12.

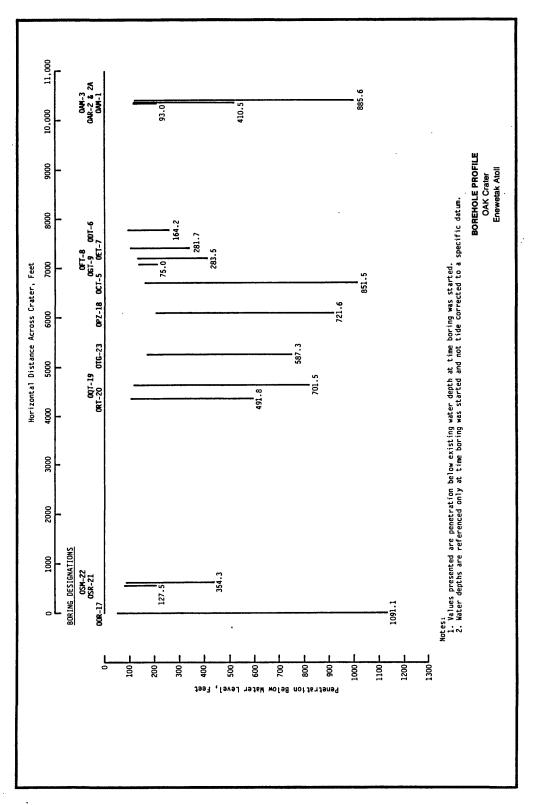


FIGURE II-15. -- Borehole profile for southwest-to-northeast transect of OAK crater. Location of borehole sites is shown on Figure II-13.

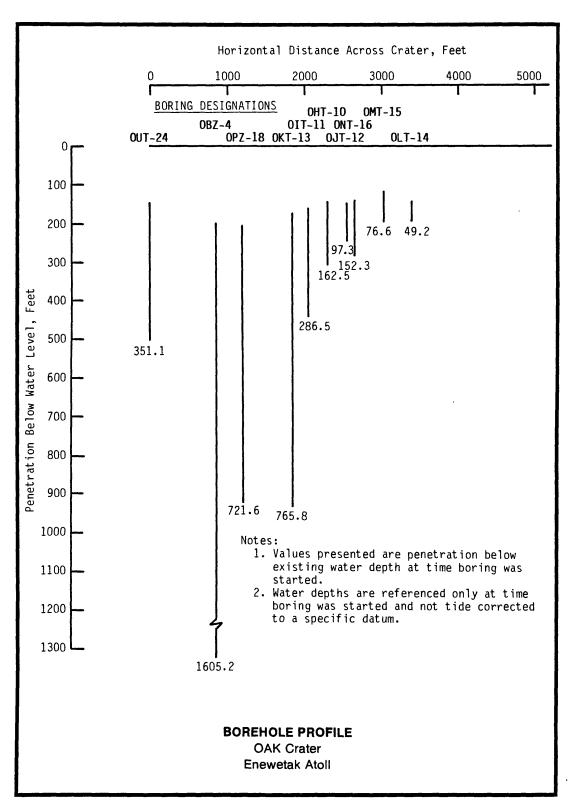


FIGURE II-16. -- Borehole profile for northwest-to-southeast transect of OAK crater. Location of borehole sites is shown on Figure II-13.

addition to the soil stratigraphy, at the scale of 1 in  $\cdot$  = 20 ft, the boring logs show boring coordinates, seafloor elevation, and date completed. The water depth shown is referenced to the Holmes & Narver (H&N) datum.

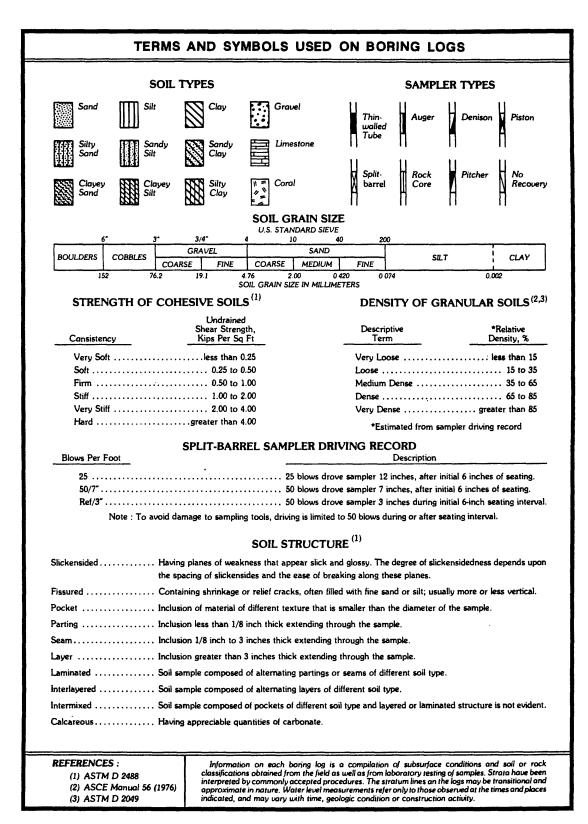
Roman numerals are assigned to identify each stratum and are presented on the left hand column of the boring logs. Detail soil descriptions that include textural variations and inclusions are noted on the boring logs. A key to the terms and symbols used on the boring logs (Plates II-3 through II-36) is presented on Plates II-1 and II-2 It should be noted that the symbols on the logs deviate slightly from those shown on the terms and symbols figures, specifically under sampler type. Since there were numerous types of sampling tools used throughout the boring, each type is designated on the boring log independently. Therefore, only a darkened symbol is used to indicate from what depth the samples actually were recovered and not by the sampler type symbols as indicated in the symbol page.

The only laboratory test that were performed by MEI offshore, aside from engineering visual classification, was the moisture content. These test results are shown on the boring log in the same column as Blow Counts. Blow counts are also plotted and are normalized to a standard 12-in. penetration except where noted on the logs.

Percent recovery is expressed by two means. The first being the total sample recovered divided by the total interval drilled. This is shown as the solid line on the boring log in the column under Percent Recovery. The dotted line represents the total sample recovered divided by the total interval sampled.

The last two columns on the boring logs were used only when rock coring was attempted. Drilling rates were monitered on a foot- by -foot basis and are presented as such. The weight on the bit and revolutions per minute also were recorded on the same basis and are plotted in a similar fashion.

No attempt was made to present a idealized stratigraphy for the borings or groups of borings. The borehole data are plotted based solely on the McClelland geologist's and technician's visual observations and drilling parameters as reported by the drillers.



#### ENGINEERING ROCK MASS CLASSIFICATION TERMS **INTACT ROCK STRENGTH (1)** Unconfined Compressive Strength, Field Estimation (MPa) (ksf) Term of Hardness Extremely Strong >200 > 4200 Several blows of geologic hammer required to break specimen Very Strong 100 - 200 2100 - 4200 More than one blow of geologic hammer required to break specimen Strong 50 - 100 1050 - 2100 Hand held specimen can be broken with single blow of hammer Moderately Strong 12.5 - 50 250 - 1050 Indentation of 5 mm with sharp end of pick Moderately Weak 5 · 12.5 100 - 250 Too hard to cut by hand into a triaxial specimen Weak 30 - 100 Material crumbles under firm blows with the sharp end of a 1.25 - 5geologic pick Very Weak $0.4 \cdot 1.25$ 10 - 30 Brittle or tough, may be broken by hand with difficulty RELATIONSHIP OF RQD AND WEATHERING **ROCK QUALITY (2)** Fresh Rock fresh with few joints and may RQD-Rock Quality show slight staining Term Rock Quality Designation (%) Moderate - Significant portions of rock show discoloration and weathering effects and show significant loss of strength compared with fresh rock Moderately · Rock shows severe loss of strength and Severe can be excavated with geologist's pick Good ...... 75 - 90 Very Severe - Mass effectively reduced to soil with Excellent ..... 90 - 100 only fragments of strong rock remaining DISCONTINUITY SURFACE AND MICROSTRUCTURE SPACING (3) Description for Spacing Description for Joints, Bedding Planes Faults or Other Fractures (mm) Very Thickly Bedded >1000 Very Widely (Fractured or Jointed) Thickly Bedded 300 - 1000 Widely Medium Bedded 100 - 300 Medium Thinly Bedded 30 - 100 Closely Very Thinly Bedded 10 - 30 Very Closely Thickly Laminated 3 - 10 < 3 Thinly Laminated JOINT ROUGHNESS CLASSIFICATION (3) Classification Description ..... Appears smooth and is smooth to the touch. May be slickensided. Slightly Rough ...... Asperities on the fracture surfaces are visible and can be distinctly felt. Medium Rough ...... Asperities are clearly visible and fracture surface feels abrasive. Very Rough ...... Near vertical steps and ridges occur on the fracture surface.

PLATE 2

Core Logging, 1976.

References: (1) Geological Society Engineering Group, 1977; (2) Deere et al, 1967; (3) AEG Committee on

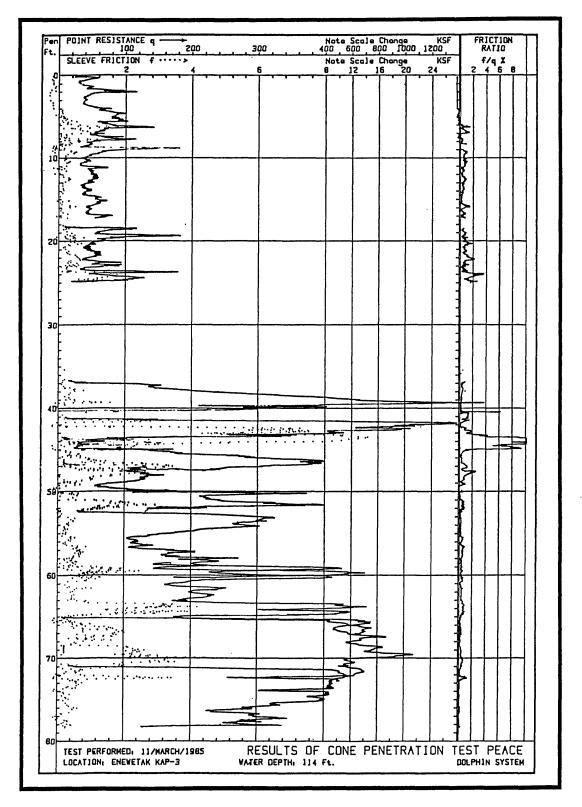


PLATE 5

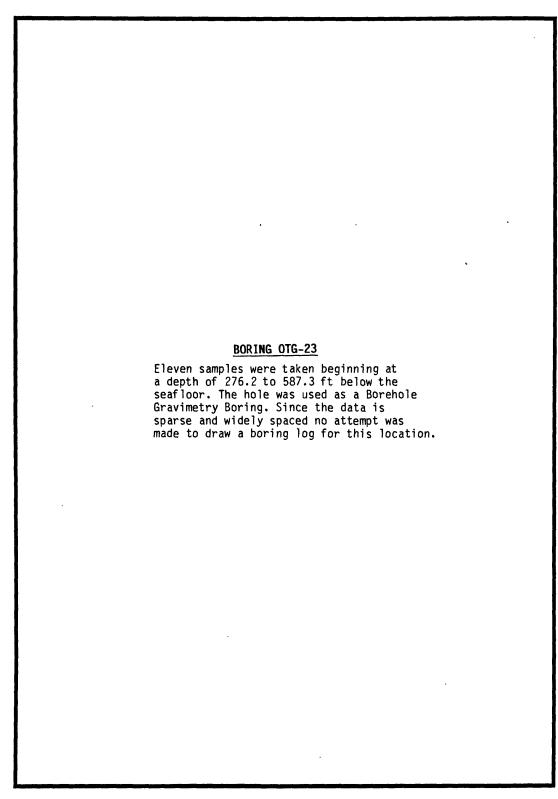


PLATE 35

# UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY

Pacific Enewetak Atoll Crater Exploration (PEACE) Program Enewetak Atoll, Republic of the Marshall Islands

Part 1: Drilling operations and descriptions of boreholes in vicinity of KOA and OAK craters

Open-File Report 86-419

# APPENDIX III

Radiological Monitoring, Phase II of PEACE Program

by

Department of Energy Nevada Operations Office Las Vegas, Nevada

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Monitoring Procedures during Drilling Program	1
Summary	2
Instruments Used	3

#### APPENDIX III:

# RADIOLOGICAL MONITORING, PHASE II OF PEACE PROGRAM

Department of Energy 1

The Department of Energy (DOE), Nevada Operations Office (NVO), contracted EG&G, Inc., Energy Measurements (EM) in December, 1984, to provide radiological support for the PEACE Project. This support consisted of one employee for approximately one week and procurement and installation of specialized radiation-detection equipment at the project site plus support equipment available at EG&G/EM's Atlas facility.

#### INITIAL SURVEY

An initial radiological survey of the drill ship, the M/V Knut Constructor, was conducted to determine the radiation level of the ship and its equipment (some drilling muds contain naturally occurring radioactive elements—thorium, monozonite sands, bentonite, etc.). This survey consisted of a swipe survey, random swipes of work locations and coring tools, plus housing and feeding locations. The radiation survey, utilizing protable alpha, beta, and gamma detectors, found only background levels.

# MONITORING PROCEDURES DURING DRILLING PROGRAM

Thermoluminescence dosimeters (TLD) were placed in various locations around the drilling platform and core-handling area to determine gamma levels encountered during the entire drilling operation.

A drilling-mud-return monitor was installed to record gamma levels on a continuous basis and to signal an alarm (audible and visual) if the background changed significantly.

Core/samples and debris were checked on an individual basis using a "pancake" Geiger-Muller (GM) gamma detector plus an alpha scintillator. Swipes were taken to be counted later with EG&G's automatic gas proportional counter.

The mud monitor was considered to be the most critical radiation-detecting instrument, and an operational check was performed weekly on it. This consisted of battery and alarm checks plus a source check using either "Coleman" gas-lantern mantles or thorium-activated tungsten electrodes. Chart paper was changed on a monthly or as-needed basis.

Appendix III of this report is extracted with minor editorial modifications from the Department of Energy Publication NVO-294, Enewetak Atoll Cratering Exploration Completion Report, September 1985, p. III-1 thru -2.

Portable instruments consisting of Eberline E-520 "pancake" GM detectors and an Eberline PRM-6 with AC-3 (alpha-scintillation) probe were checked operationally using "Coleman" gas-lantern mantles and/or thorium-activated tungsten electrodes.

Swipes were counted at EG&G's Atlas facility on a Canberra, Model-2400 dual-detector, simultaneous alpha/beta proportional, constant-flow, automatic sample counter. This instrument has a daily chi-square check, a monthly alpha/beta-effeciency check, and a quarterly alpha/beta-effeciency check against samples provided by the Environmental Protection Agency (EPA).

Minimum Detectable Activity (MDA) at 95% confidence level is 3.2 disintegrations per minute (dpm) for alpha and 10.4 dpm for beta.

Whole body counts were performed before and after the project on Emmett Herbst (Holmes and Narver) and Robert Clarke (DOE/NVO). These two men accumulated the most time in close, continuous contact with the drilling activities and resulting samples. No significant uptake of activity was indicated for either man.

# SUMMARY

The initial radiological survey; swipes, beta/gamma, and gamma indicated a low background-radiation level of <4 micro-roentgens per hour (uR/h). TLDs were furnished by Reynolds Electircal and Engineering Co., Environmental Sciences, and were exchanged on an approximate monthly basis. The TLD data were consistant with the portable-instrument radiation survey.

Initial and routine radiation surveys indicated no detectable contamination. 2,778 swipes were counted for possible alpha/beta, contamination with no swipe indicating >4.3 pCi or 12.8 dpm beta.

Examination of the mud monitor's strip charts indicated no variation above three (3) times background during normal operation. Normal background aboard ship ranged from 3 to 5 uR/h, which is lower than levels typical for the Continental United States.

# INSTRUMENTS USED

The instruments used during the PEACE Program on Enewetak, and some of their specifications, are listed below.

- Health Physics Instruments (HPI) Pipeline-Monitor Gamma Recorder (2 each): range 0.001 to 10.0 milliroentgens per hour (mR/h); 1-1/2-in. by 1-1/2-in NaI thallium (T1) detector. Average statistical fluctuation at 0.001 mR/h: + 20%. At 0.001 mR/h: for 95% confidence limit, trip-level setting is 30% above 0.001 mR/h.
- Eberline E-520 with "pancake" GM probe (2 each), 8% efficiency for alpha 3 million electron volts (mev), >20% eff. for beta >40 kev.
- Eberline PRM-6 with AC-3 (alpha scintillation) probe (2 each), sensitivity 6 counts per minute per square centimeter (cpm/sqcm) + 12% deviation.

Canberra Model-2400 gas proportional alpha/beta counter (1 each), alpha Bkg. 0.085 cpm 3.2 dpm MDA for alpha; beta Bkg. 1.33 cpm 10.4 dpm MDA for beta.

Micro R meter (1 each).

Ludlum Model-19 Micro R meter, l-in. by l-in. NaI (T1) scintillator, 0 to  $25~\mathrm{uR}$  most sensitive range.

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