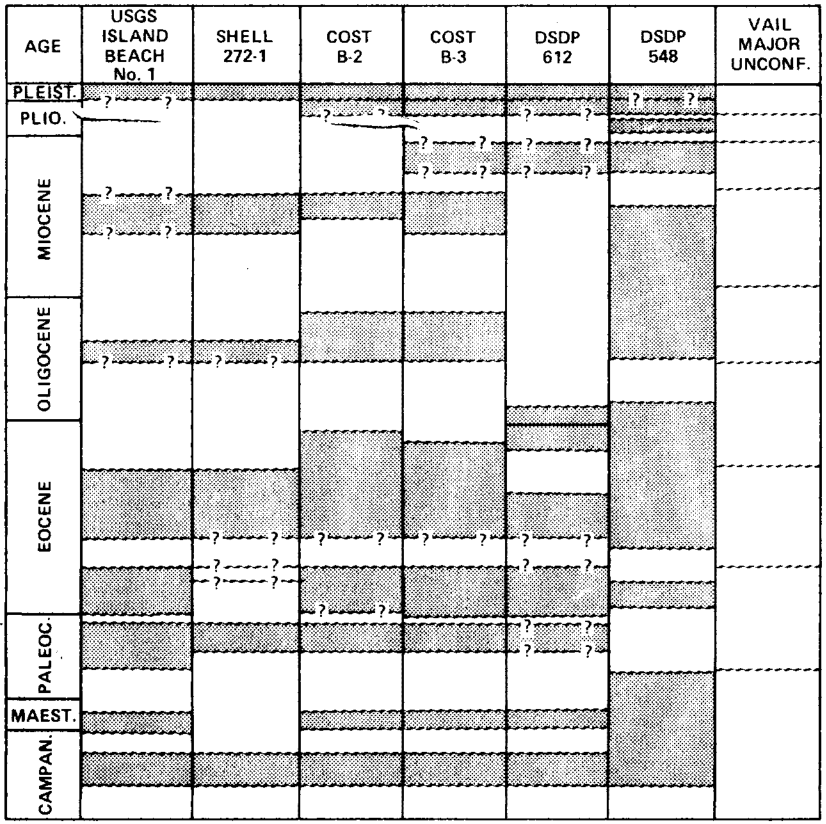
INITIAL CORE DESCRIPTIONS

DEEP SEA DRILLING PROJECT

LEG 95

NEW JERSEY TRANSECT



Prepared for the
NATIONAL SCIENCE FOUNDATION
National Ocean Sediment Coring Program
Under Contract C-482
By the
UNIVERSITY OF CALIFORNIA
Scripps Institution of Oceanography
Prime Contractor for the Project

Cover Caption

Comparison of depositional sequences and unconformities of New Jersey margin and Goban Spur (Site 548, Leg 89) with position of major unconformities in Vail model.

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SCRIPPS INSTITUTION OF OCEANOGRAPHY
Deep Sea Drilling Project, A-031
LA JOLLA, CALIFORNIA 92093

November 1, 1984

Dear Colleague:

This document has been produced and distributed by the Deep Sea Drilling Project for the purpose of sample selection by interested earth scientists. Sample requests are honored two months after publication of the Initial Core Descriptions. It is an interim and informal document consisting of site data and sedimentologic and paleontologic data and interpretations as known six (6) months post-cruise. These data, while adequate for most sample selection needs, are subject to slight revision by the time of issue of the corresponding volume of the *Initial Reports* of the Deep Sea Drilling Project.

The information contained herein is preliminary and privileged, consequently this document is not to be cited or used as the basis of other publications. Data cited or used in a manuscript will be considered a breach of professional ethics.

Thank you for your interest in the Deep Sea Drilling Project.

Sincerely,

Yves Lancelot
Chief Scientist
Deep Sea Drilling Project

YL:eb

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AUGUST 17–SEPTEMBER 26, 1983

A Project Planned by and Carried Out With the Advice of the
JOINT OCEANOGRAPHIC INSTITUTIONS FOR DEEP EARTH SAMPLING (JOIDES)

MEMBER ORGANIZATIONS

Institute of Geophysics, University of Hawaii
Lamont-Doherty Geological Observatory, Columbia University
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Bundesanstalt fur Geowissenschaften und Rohstoffe, Hannover
Ocean Research Institute, University of Tokyo
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EXPLANATORY NOTES

INTRODUCTION

This *Initial Core Description* is presented here to aid investigators in selecting samples for detailed study. Samples from this leg become available to the public about 8 months after the cruise, with the completion of this *Initial Core Description.*

Potential investigators who desire to obtain samples should refer to the DSDP-NSF Sample Distribution Policy. Sample request forms may be obtained from:

The Curator
Deep Sea Drilling Project, A-031
University of California, San Diego
La Jolla, California 92093

Requests must be as specific as possible: include site, core, section, interval within a section, and volume of sample required. The purpose of this publication is to aid interested investigators in understanding the (1) terminology, labeling, and numbering conventions used by the Deep Sea Drilling Project (DSDP); (2) sediment classification and biostratigraphic framework used; and in addition, (3) to present the preliminary lithologic and paleontologic data on core forms, so that sampling can be guided. However, the investigator should be aware that the data is subject to future revision.

NUMBERING OF SITES, HOLES, CORES, SAMPLES

DSDP drill sites are numbered consecutively from the first site drilled by *Glomar Challenger* in 1968. Site numbers are slightly different from hole numbers. A site number refers to one or more holes drilled while the ship was positioned over one acoustic beacon. These holes could be located within a radius as great as 900 meters from the beacon. Several holes may be drilled at a single site by pulling the drill pipe above the sea floor (out of one hole) and moving the ship 100 meters or more from the previous hole, and then begin drilling another hole.

The first (or only) hole drilled at a site takes the site number. A letter suffix distinguishes each additional hole at the same site. For example: the first hole takes only the site number; the second takes the site number with suffix A; the third takes the site number with suffix B, and so forth. It is important, for sampling purposes, to distinguish the holes drilled at a site, since recovered sediments or rocks from different holes usually do not come from equivalent positions in the stratigraphic column.

There are two types of coring systems used on the *Glomar Challenger*: (1) the standard DSDP rotary-coring system, which cuts ~9.5 meter-long cores and has been used since Leg 1; and (2) the Hydraulic Piston Coring (HPC) system, used since Leg 64.

HPC holes are not assigned a special letter designation. The HPC operates on the principle of a core barrel which is lowered inside the drill string, hydraulically ejected into the sediment and retrieved. The pipe is then lowered to the next interval and the procedure repeated. Disturbance can occur in the top 50–100 cm of HPC cores especially near the top of a hole. The standard DSDP rotary coring system typically disturbs the cores in the upper 100 meters of any hole, and generally half or more of each core is quite disturbed.

The cored interval is measured in meters below the sea floor. The depth interval of an individual core is the depth below sea floor that the coring operation began to the depth that the coring operation ended. For example, in the rotary-coring system, each coring interval is generally 9.5 meters long, which is the nominal length of a core barrel; however, the coring interval may be shorter or longer (rare). "Cored intervals" are not necessarily adjacent to each other, but may be separated by "drilled intervals". In soft sediment, the drill string can be "washed ahead" with the core barrel in place, but no recovering sediment, by pumping water down the pipe at high pressure to wash the sediment out of the way of the bit and up the space between the drill pipe and wall of the hole; however, if thin hard rock layers are present, then it is possible to get "spotty" sampling of these resistant layers within the washed interval, and thus have a cored interval greater than 9.5 meters. In drilling hard rock, a center bit may replace the core barrel if it is necessary to drill without core recovery.

Cores taken from a hole are numbered serially from the top of the hole downward. Core numbers and their associated cored interval in meters below the sea floor are normally unique for a hole; however, problems may arise if an interval is cored twice. When this situation occurs, the core number is assigned a suffix, such as "S"* for supplementary.

In the rotary-coring system, full recovery for a single core is normally 9.28 meters of sediment or rock, which is in a plastic liner (6.6 cm I. D.), plus about a 0.2 meter-long sample (without a plastic liner) in the Core-Catcher. The Core-Catcher is a device at the bottom of the core barrel which prevents the cored sample from sliding out when the barrel is being retrieved from the hole. The sediment-core, which is in the plastic liner, is then cut into 1.5 meter-long sections and numbered serially from the top of the sediment-core (Figure 1). When we obtain full recovery, the sections are numbered from 1 through 7 with the last section possibly being shorter than 1.5 meters. The Core-Catcher sample is placed below the last section when the core is described, and labeled Core-Catcher (CC): it is treated as a separate section.

When recovery is less than 100 percent, and if the sediment or rock is contiguous, the recovered sediment is placed in the top of the cored interval, and then 1.5 meter-long sections are numbered serially, starting with Section 1 at the top. There will be as many sections as are needed to accommodate the length of the core recovered (Figure 1); for example, 3 meters of core sample in plastic liners will be divided into two 1.5 meter-long sections. Sections are cut starting at the top of the recovered sediment, and the last section may be shorter than the normal 1.5 meter length.

This technique differs from the labeling systems used on Legs 1 through 45, which had a designation called "zero section". On Legs 1–45 there were seven sections labeled 0, 1, 2, 3, 4, 5, and 6. The new system used from Legs 46 to the present, has seven sections, but they are labeled 1, 2, 3, 4, 5, 6, and 7.

When recovery is less than 100 percent, the sediment's original stratigraphic position in the cored interval is unknown, so we employ the convention assigning the top of the sediment recovered to the top of the cored interval. This is done for convenience in data handling, and consistency. If recovery is less than 100 percent, and core fragments are separated, and if shipboard scientists believe the sediment was not contiguous, then sections are numbered serially and the intervening sections

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* Note that this designation has been used on previous legs as a prefix to the core number for sidewall core samples.

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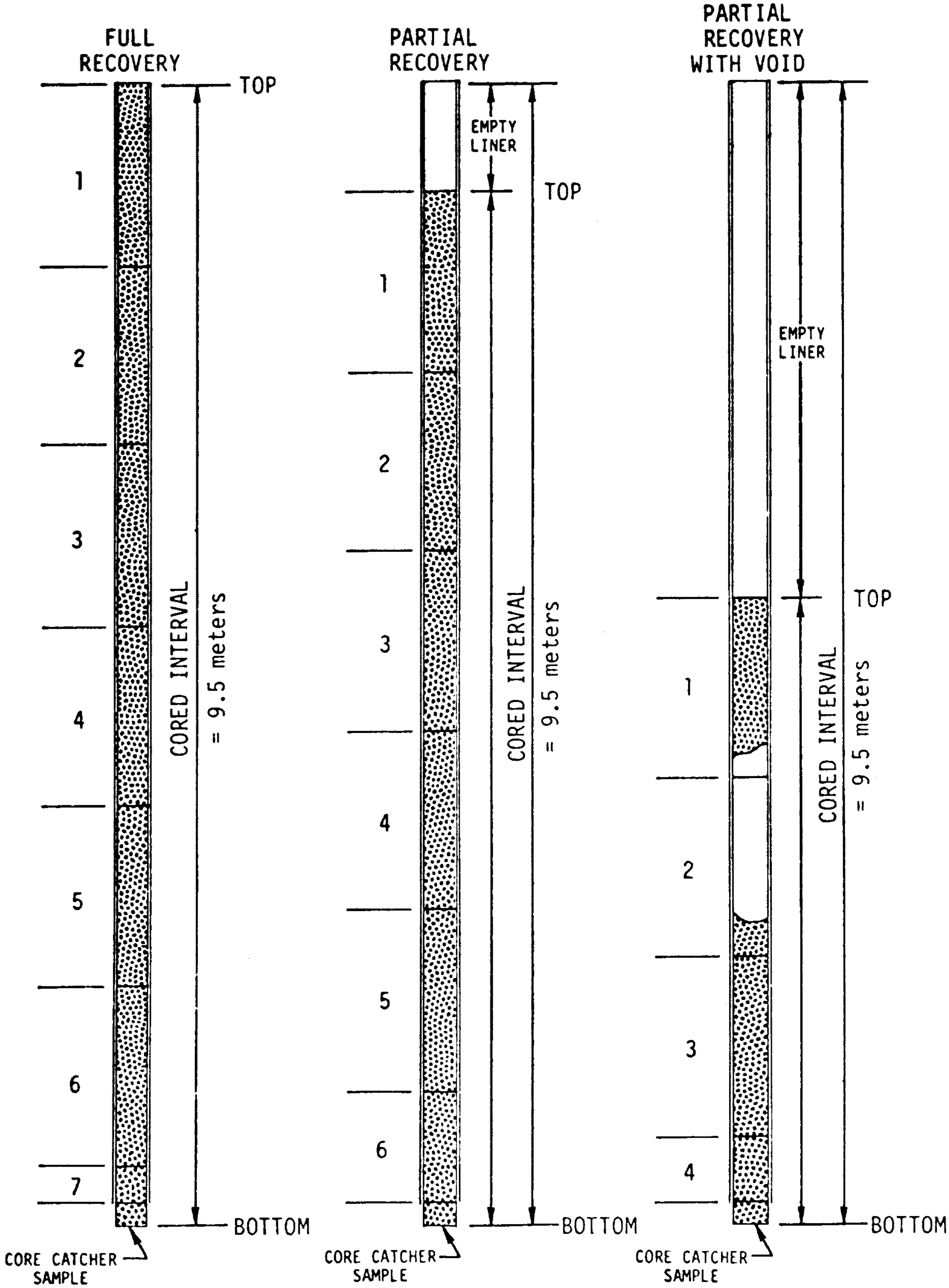

Figure 1. Diagram showing procedure in cutting and labeling of core sections.

are noted as void, whether it is contiguous or not. The Core-Catcher sample is described in the visual core descriptions beneath the lowest section.

Samples are designated by centimeter distances from the top of each section to the top and bottom of the sample in that section. A full identification number for a sample consists of the following information:

Leg
Site
Hole
Core Number
Interval in centimeters from the top of section

For example, a sample identification number of "75-531A-6-3, 12—14 cm" is interpreted as follows: 12—14 cm designates a sample taken at 12 to 14 cm from the top of Section 3 of Core 6, from the second hole drilled at Site 531 during Leg 75. A sample from the Core-Catcher of this core is designated as "75-531A-6, CC, 12—14 cm".

The depth below the seafloor for a sample numbered at "75-531A-6-3, 12—14 cm", is the summation of the following: (1) the depth to the top of the cored interval for Core 6, which is 430 meters; (2) plus 3 meters for Sections 1 and 2 (each 1.5 meters long); and plus the 12 cm depth below the top of Section 3. All of these variables add up to 433.21 meters*, which by convention is the sample depth below the sea floor.

HANDLING OF CORES CONTAINING SEDIMENTS

A core containing sediments is normally cut into 1.5 meter sections, sealed, and labeled; and then the sections are brought into the core laboratory for processing. The following determinations are normally made before the sections are split: gas analysis, and continuous wet-bulk density determinations using the Gamma Ray Attenuation Porosity Evaluation (GRAPE) as described in Boyce (1976).

The cores are then split longitudinally into "work" and "archive" halves**. Samples are extracted from the "work" half, including those for determination of grain-size distribution, mineralogy by x-ray diffraction, sonic velocity by the Hamilton Frame method as described in Boyce (1976), wet-bulk density by a static GRAPE technique (Boyce, 1976), water content by gravimetric analysis, carbon-carbonate analysis, percent calcium carbonate (Carbonate Bomb), geochemical analysis, paleontological studies, and others.

Smear slides or thin sections from each major lithology, and most minor lithologies, are prepared and examined microscopically. The archive half is then described and photographed. Physical disturbance by the drill bit, color, texture (for uncemented lithologies), and sedimentary and igneous structures and composition (±20%) of the various lithologies are noted on standard core description sheets.

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* Sample requests should refer to a specific interval within a core-section, rather than the level below sea floor.

** In the HPC system the cores are oriented relative to each other, thus, for example, all archive halves are on the same side of the hole. We do not know, however, their orientation relative to the Earth's magnetic north.

After the cores are sampled and described, they are maintained in cold storage aboard *Glomar Challenger* until they can be transferred to the DSDP repository. Core sections which are removed for organic geochemistry study are frozen immediately on board ship and kept frozen. Frozen cores are presently stored at the DSDP West Coast Repository (Scripps Institution of Oceanography).

These core descriptions, smear slide descriptions (plus occasional peels and thin sections) and carbonate bomb (% $CaCO_3$) determinations (all of these data are determined aboard ship) serve as the data for the visual core descriptions presented here. These samples, and their location in the core, are coded with a symbol on the core description sheets. The key to these codes, in order to identify the samples, is in Figures 2–6.

SPECIAL CORES AND SAMPLES

Occasionally, special cores or samples are recovered that require specific identification. These are designated as follows:

X = miscellaneous debris or out-of-sequence core material.

C = center bit samples; i. e., samples obtained upon removal of the center bit (a device to prevent core recovery while drilling or washing ahead for some interval).

S = side-wall core; i.e., a core taken in the side of the hole, usually to obtain a sample of material not recovered during previous coring.

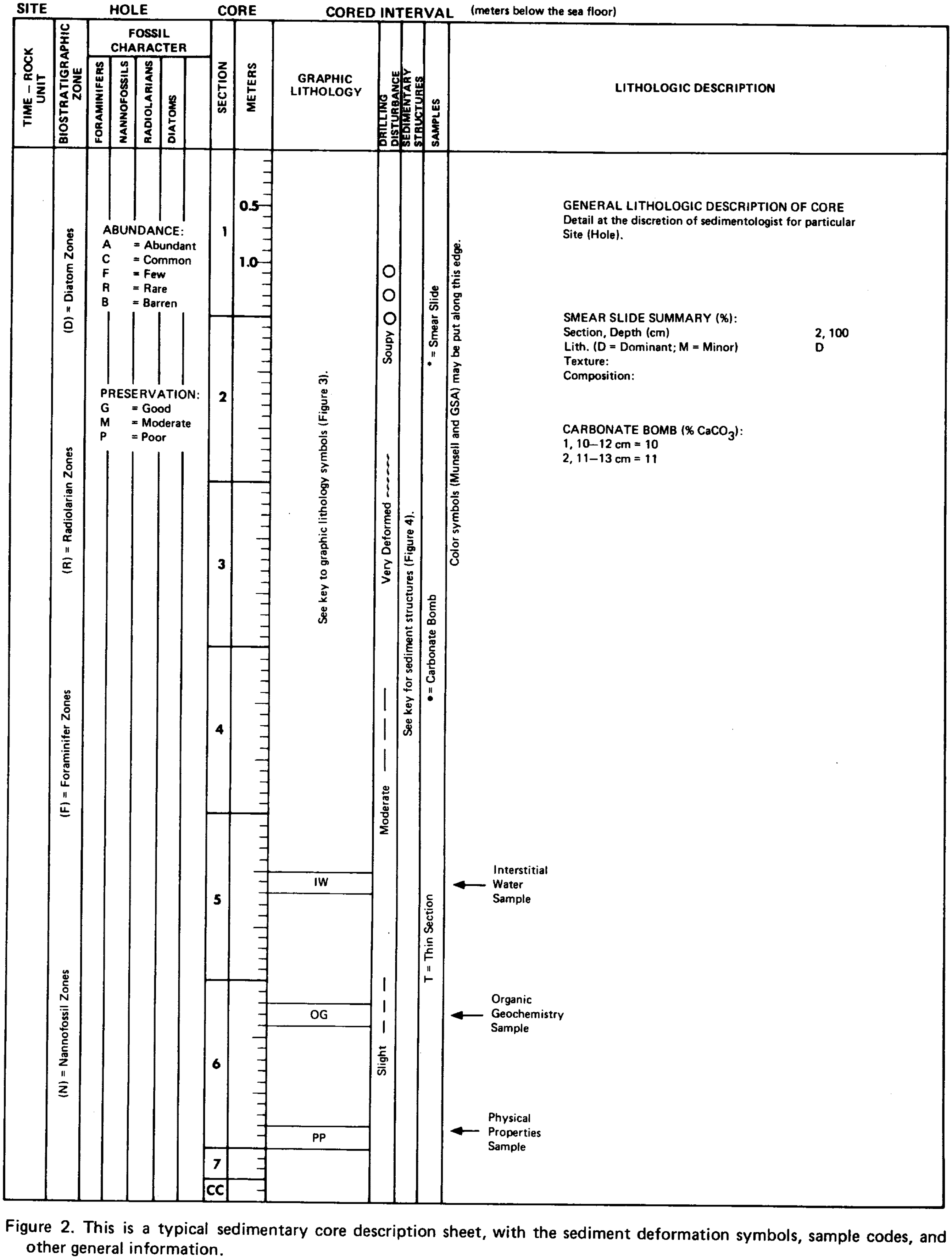
H = a wash core; i. e., a core taken while washing ahead for an interval larger than 9.5 m (say, 50 m), but without the center bit in place. Such a core may sample at several places in the washed interval, but their depths cannot be specified within that interval.

B = bit material; i. e., material removed from core bits upon retrieval of the drill string following completion of a hole, or prior to re-entry with a new core bit.

Cores or samples of these types are designated X1, X2, H1, H2, etc., each type in the sequence they were obtained. Additional types of special samples may be designated by the shipboard party or cruise operations manager. The letter designation for these samples is chosen in consultation with the DSDP curatorial representative and laboratory officer, and is indicated on each core description form.

DESCRIPTION OF SEDIMENTS

The following is the sediment description and classification scheme devised by the JOIDES Sedimentary Petrology and Physical Properties Panel, and approved by the JOIDES Planning Committee in March, 1974. In the past, shipboard parties have, in some instances, found it necessary to modify or amend the classification for their particular situation. Any modifications to the classification for the cores described herein are presented in the section following the JOIDES classification.



SITE HOLE CORE CORED INTERVAL (meters below the sea floor)

TIME – ROCK UNIT

BIOSTRATIGRAPHIC ZONE

FOSSIL CHARACTER: FORAMINIFERS, NANNOFOSSILS, RADIOLARIANS, DIATOMS

SECTION

METERS

GRAPHIC LITHOLOGY

DRILLING DISTURBANCE

SEDIMENTARY STRUCTURES

SAMPLES

LITHOLOGIC DESCRIPTION

(D) = Diatom Zones

(R) = Radiolarian Zones

(F) = Foraminifer Zones

(N) = Nannofossil Zones

ABUNDANCE:
A = Abundant
C = Common
F = Few
R = Rare
B = Barren

PRESERVATION:
G = Good
M = Moderate
P = Poor

Sections: 1, 2, 3, 4, 5, 6, 7, CC

Meters: 0.5, 1.0

See key to graphic lithology symbols (Figure 3).

IW

OG

PP

Soupy ○ ○ ○

Very Deformed

Moderate

Slight

See key for sediment structures (Figure 4).

• = Smear Slide

● = Carbonate Bomb

T = Thin Section

Color symbols (Munsell and GSA) may be put along this edge.

GENERAL LITHOLOGIC DESCRIPTION OF CORE
Detail at the discretion of sedimentologist for particular Site (Hole).

SMEAR SLIDE SUMMARY (%):

Section, Depth (cm)	2, 100
Lith. (D = Dominant; M = Minor)	D
Texture:	
Composition:	

CARBONATE BOMB (% $CaCO_3$):
1, 10–12 cm = 10
2, 11–13 cm = 11

← Interstitial Water Sample

← Organic Geochemistry Sample

← Physical Properties Sample

Figure 2. This is a typical sedimentary core description sheet, with the sediment deformation symbols, sample codes, and other general information.

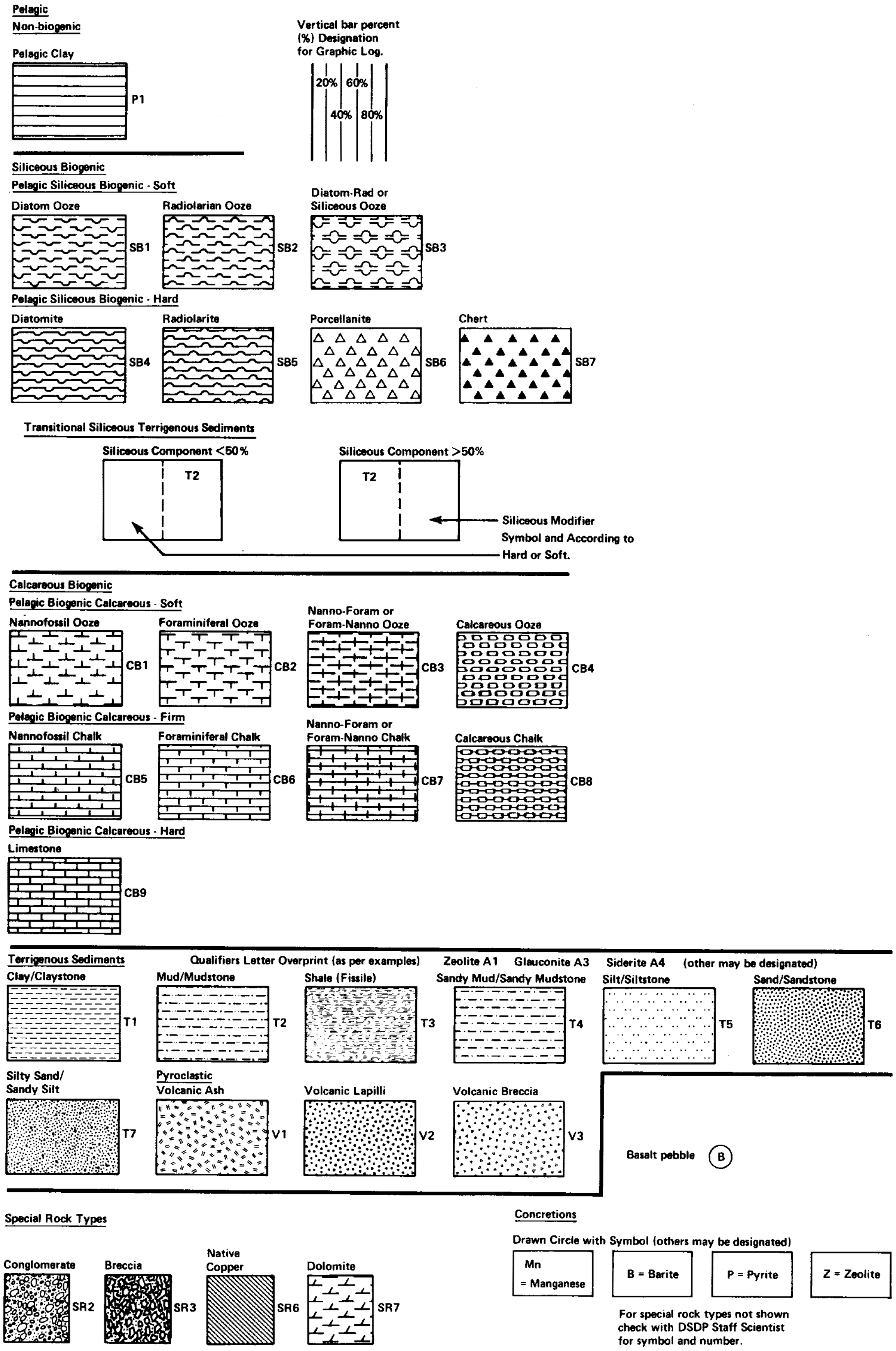


Figure 3. Graphic symbols corresponding to the lithologic visual core descriptions for sediment and sedimentary rocks.

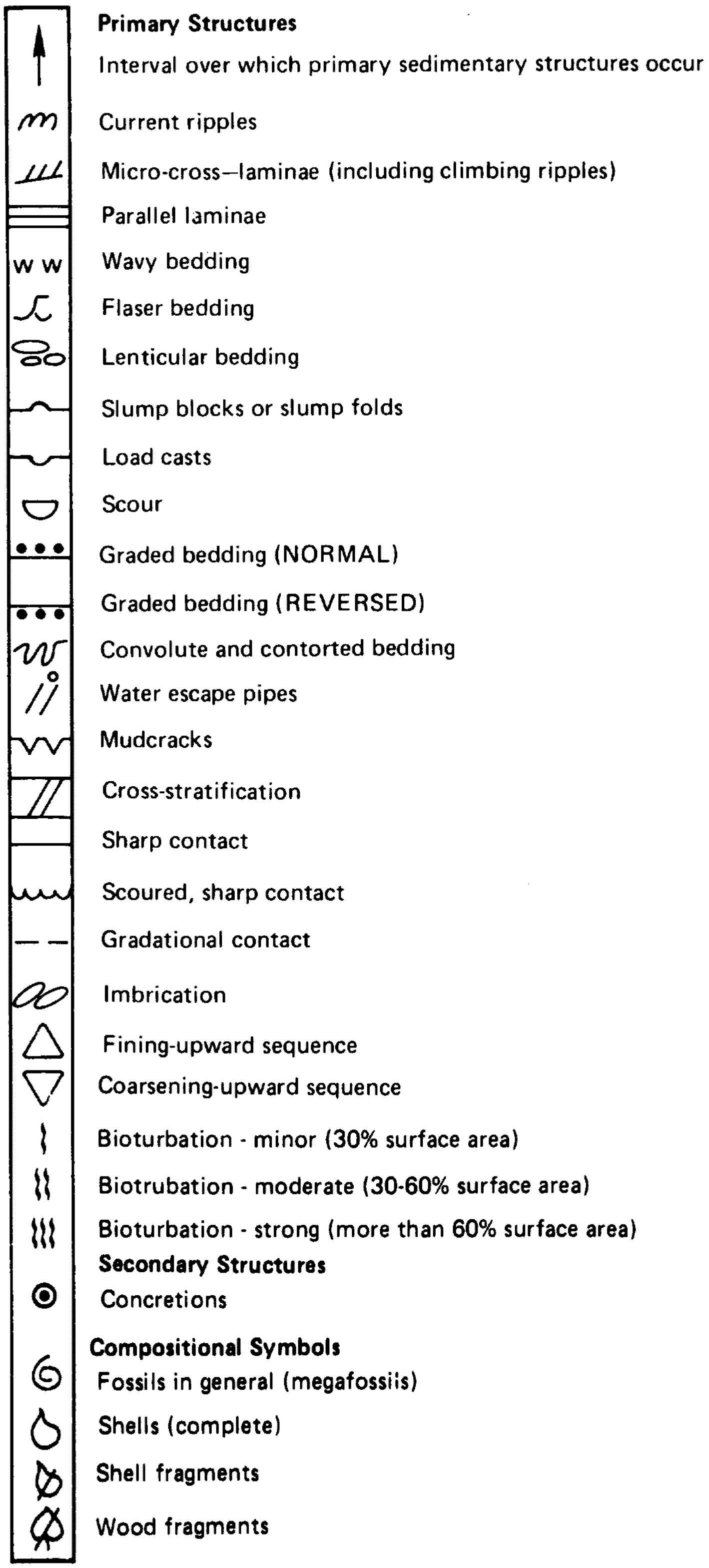


Figure 4. Structure symbol code for sediments.

	Millimeters		Phi (ϕ) units	Wentworth size class
	2.00	2	1.0	Granule
SAND	1.68		0.75	
	1.41		0.5	Very coarse sand
	1.19		0.25	
	1.00	1	0.0	
	0.84		0.25	
	0.71		0.5	Coarse sand
	0.59		0.75	
	0.50	1/2	1.0	
	0.42		1.25	
	0.35		1.5	Medium sand
	0.30		1.75	
	0.25	1/4	2.0	
	0.210		2.25	
	0.177		2.5	Fine sand
	0.149		2.75	
	0.125	1/8	3.0	
	0.105		3.25	
	0.088		3.5	Very fine sand
	0.074		3.75	
	0.0625	1/16	4.0	
SILT	0.053		4.25	
	0.044		4.5	Coarse silt
	0.037		4.75	
	0.031	1/32	5.0	
	0.0155	1/64	6.0	Medium silt
	0.0078	1/128	7.0	Fine silt
	0.0039	1/256	8.0	Very fine silt
MUD	0.0020		9.0	
	0.00098		10.0	Clay
	0.00049		11.0	
	0.00024		12.0	
	0.00012		13.0	
	0.00006		14.0	

Figure 5. Grade scales for terrigenous sediments.

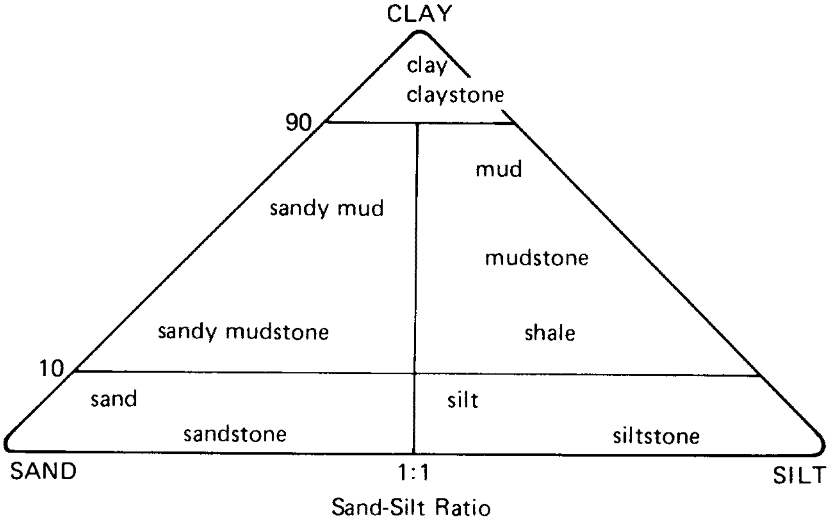


Figure 6. Class boundaries for terrigenous sediments.

CLASSIFICATION OF SEDIMENTS

Several lithologic classifications designed for the construction of the several graphic core and hole summaries have been used during the lifetime of the Deep Sea Drilling Project. The classification system described here has been devised by the JOIDES Panel on Sedimentary Petrology and Physical Properties and adopted for use by the JOIDES Planning Committee in March 1974.

Principles Used in Classification

1 This is a lithologic summary classification designed to generalize core descriptive material of greater detail into a form suitable for standard core and hole logs. Its systematic use will facilitate core to core and leg to leg comparisons.

2 The classification covers most of the lithologic types encountered so far but does not attempt to be comprehensive. A category "Special Rock Types" shows additional definitions and terminology at the discretion of the shipboard staff for rock types not covered.

3 Sediment names are those in common usage and have been defined within the limits of existing definitions.

4 Categories are based on sediment parameters measured on board ship. Refinement by shore laboratory data is possible but not necessary.

5 The classification is descriptive and genetic implications are not intended.

6 The degree of detail of the classification is scaled to the space limitations of printed graphic hole and core summaries.

Shipboard Parameters Measured

Sediment and rock names are defined solely on the basis of compositional and textural parameters. The compositional factors are most important for description of those deposits more characteristic of open marine conditions, with textural factors becoming more important for the classification of hemipelagic and near-shore facies. Sediment names are thus based solely upon these parameters as determined in smear slides aided by compositional and textural properties apparent to the naked eye or under the hand lens. Other descriptive parameters include: induration, sediment disturbance, sedimentary structures, and color. The determination of these parameters is as follows:

1) Composition – biogenic and mineral components are estimated in percent from smear slides. $CaCO_3$ content is estimated by using the carbonate bomb available on the ship. Even with rapid use, a value to ±5% is achievable.

2) Texture – visual estimates from smear slide examination.

3) Induration – The determination of induration is highly subjective, but field geologists have successfully made similar distinctions for many years. The categories suggested here are thought to be practical and significant. The criteria of Moberly and Heath (1971) are used for calcareous deposits; subjective estimate or behavior in core cutting for others. There are three classes for calcareous sediments; two for all others.

a) Calcareous sediments

(i) Soft: Oozes have little strength and are readily deformed under the finger or the broad blade of a spatula.

(ii) Firm: Chalks are partly indurated oozes: they are friable limestones that are readily deformed under the fingernail or the edge of a spatula blade. More indurated chalks are termed limestones (see below).

(ii) Hard: Limestones as a term should be restricted to cemented rocks.

b) The following criteria are recommended for all but calcareous sediments:

(i) If the material is low state of induration as to allow the core to be split with a wire cutter, the sediment name only is used (e. g., silty clay: mud).

(ii) If the core must be cut on the band saw or diamond saw, the suffix 'stone' is used (e. g., silty claystone: mudstone; or shale, if fissile.)

4) Sediment Disturbance – Deformational structures are generally of the type found in piston cores, and are usually simple to visualize and interpret.

a) Soft to firm sediment: The following categories are recommended.

(i) Slightly deformed – bedding contacts are slightly bent.

(ii) Moderately deformed – bedding contacts have undergone extreme bowing.

(iii) Very deformed – bedding is completely disturbed, sometimes showing symmetrical diapir-like structure.

(iv) Soupy – water saturated intervals which have lost all aspects of original bedding.

b) Hard sediments: There is also the need to indicate the degree of fracturing in hard sediments/rock. This is best accomplished with a written description in the Lithologic Description portion of the Core Form (Figure 2).

c) Drilling "Biscuits" – semi-indurated sediments are broken into flat 3–5 cm or so "biscuits" which internally are undeformed, but were rotated against each other resulting in lenses of soft, intensely deformed mud or ooze in-between. Description of this is also best accomplished using the Lithologic Description portion of the Core Form (Figure 2).

5) Sedimentary structures – in many cores it is extremely difficult to differentiate between natural and coring-induced structures. Consequently, the description of sedimentary structures is optional. The following approach is suggested as a guideline, but the specialist is encouraged to use his own preferred system and set of symbols.

a) Median grain size profile: For the sections of terrigenous sediments, with interbeds of varying textural characteristics, the construction of median grain size profile based on hand lens observations provides a rapid method for illustrating graded and non-graded beds, bed thickness, and size distribution.

b) Sedimentary structures: A set of suggested symbols is provided for categories shown on Figure 4.

6) Color – According to standard Munsell and GSA color charts.

Use of the Core Form

1) Mandatory Graphic Lithology Column – This graphic column is based on the above classification scheme. Completion of the column using the appropriate symboles (Figure 3) must be done for each site, and will be inclued in the *Initial Core Description* (*ICD*) and *Initial Report Volume*. The "Special Rock Type" category should be used for sediment types not in the classification.

a) Optional graphic column: If circumstances or the special skills and interests of the shipboard staff indicate an additional modified or different classification, another graphic column may be added to the right of the Mandatory Column using definitions, terminology, and symbols that, in the opinion of the shipboard staff, will increase the information yield. This Optional Column must not substitute for the Mandatory Column.

2) Sediment disturbance column – Completion of the sediment disturance column using symbols and distinctions given below is mandatory.

3) Sedimentary structure columns – Structures may be designated on the core form in the sedimentary structure column parallel to the sediment disturbance column, and/or on the median grain size profile (for the sections of terrigenous sediments, with interbeds of varying textural characteristics). The median grain size profile is located in the lithologic description portion of the core form. A set of suggested symbols for a few more common structures has been prepared by DSDP (Figure 4), but the shipboard geologist is free to use whatever additional symbols he may wish. These optional columns may not substitute for the mandatory sediment disturbance column and must be distinct from it.

4) Lithologic description column – Format, style, and terminology of the descriptive portion of the core sheets are not controlled by the mandatory column scheme, beyond the minimal name assignment which should be derived from this classification. However, colors and additional information on structure and textures should normally be included in the textural section of the core description.

Lithologic Classification Scheme

The following define compositional class boundaries and use of qualifiers in the lithologic classification scheme:

1) Compositional Class Boundaries

a) $CaCO_3$ content (determined by $CaCO_3$ bomb): 30% and 60%. With a 5% precision and given the natural frequency distribution of $CaCO_3$ contents in oceanic sediments, these boundaries can be reasonably ascertained.

b) Biogenic opal abundance (expressed as percent siliceous skeletal remains in smear slides): 10%, 30%, and 50%. Smear-slide estimates of identifiable siliceous skeletal material generally imply a significantly higher total opal abundance. The boundaries have been set to take this into account.

c) Abundance of authigenic components (zeolites, Fe, and Mn micronodules etc), fish bones, and other indicators of very slow sedimentation (estimated in smear slides); semiquantitative boundary: common 10%. These components are quite conspicuous and a semiquantitative estimate is adequate. Even a minor influx of calcareous, siliceous, or terrigenous material will, because of the large difference in sedimentation rate, dilute them to insignificance.

d) Abundance of terrigenous detrital material (estimated from smear slides): 30%.

e) Qualifiers: Numerous qualifiers are suggested; the options should be used freely. However, components of less than 5% (in smear slide) should not be used as a qualifier except in special cases. The most important component should be the last qualifier. No more than two qualifiers should be used.

Description of Sediment Types

1) Pelagic clay – Principally authigenic pelagic deposits that accumulate at very slow rates. The class is often termed brown clay, or red clay, but since these terms are confusing, they are not recommended.

a) Boundary with terrigenous sediments: Where authigenic components (Fe/Mn micronodules, zeolites), fish debris, etc., become common in smear slides. NOTE: Because of large discrepancy in accumulation rates, transitional deposits are exceptional.

b) Boundary with siliceous biogenic sediments: <30% identifiable siliceous remains.

c) Boundary with calcareous biogenous sediments: Generally the sequence is one passing from pelagic clay through siliceous ooze to calcareous ooze, with one important exception: at the base of many oceanic sections, black, brown, or red clays occur directly on basalt, overlain by or grading up into calcareous sediments. Most of the basal clayey sediments are rich in iron, manganese and metallic trace elements. For proper identification they require more elaborate geochemical work than is available on board. These sediments are placed in the "Special Rock" category, but care should be taken to distinguish them from ordinary pelagic clays.

2) Pelagic siliceous biogenic sediments – These are distinguished from the previous category because they have more than 30% identifiable siliceous microfossils. They are distinguished from the following category by a $CaCO_3$ content of less than 30%. There are two classes: *Pelagic biogenic siliceous sediments* (containing less than 30% silt and clay); and *transitional biogenic siliceous sediments* (containing more than 30% silt and clay and more than 10% diatoms).

a) Pelagic biogenic siliceous sediments:

soft: Siliceous ooze (radiolarian ooze, diatom ooze, depending on dominant component).

hard:	radiolarite	porcellanite
	diatomite	chert

(i) Qualifiers:

Radiolarians dominant: radiolarian ooze or radiolarite.

Diatoms dominant: diatom ooze or diatomite.

Where uncertain: siliceous (biogenic) ooze, or chert or porcellanite, when containing >10% $CaCO_3$, qualifiers are as follows:

indeterminate carbonate: calcareous - -

or

nannofossils only: nannofossil - -

foraminifers only: foraminifer - -

nannofossil-foraminifer - - depending on dominant component

foraminiferal-nannofossil - -

b) Transitional biogenic siliceous sediments:

Diatoms <50%	diatomaceous mud:	soft
	diatomaceous mudstone:	hard
Diatoms >50%	muddy diatom ooze:	soft
	muddy diatomite:	hard

Radiolarian equivalents in this category are rare and can be specifically described.

3) Pelagic biogenous calcareous sediments – These are distinguished from the previous categories by a $CaCO_3$ content in excess of 30%. There are two classes: Pelagic biogenic calcareous sediments (containing less than 30% silt and clay); and transitional biogenic calcareous sediments (containing more than 30% silt and clay).

a) Pelagic biogenic calcareous sediments:

soft: calcareous ooze
firm: chalk
hard: indurated chalk

The term *limestone* should preferably be restricted to *cemented rocks*.

(i) Compositional Qualifiers ⩽–

Principal components are: nannofossils and foraminifers.

One or two qualifiers may be used, for example:

Foram %	Name
<10	Nannofossil ooze, chalk, limestone
10–25	Foraminiferal-nannofossil ooze
25–50	Nannofossil-foraminifer ooze
>50	Foraminifer ooze

Calcareous sediment containing more than 10–20% identifiable siliceous fossils carry the qualifier radiolarian, diatomaceous, or siliceous depending on the quality of the identification. For example, radiolarian-foraminifer ooze.

b) Transitional biogenic calcareous sediments

(i) $CaCO_3$ = 30–60%: marly calcareous pelagic sediments

soft: marly calcareous (or nannofossil, foraminifer, etc.), ooze (see below)
firm: marly chalk
hard: marly limestone

(ii) $CaCO_3$ >60%: Calcareous pelagic sediments.

soft: calcareous (or nannofossil, foraminifer, etc.), ooze (see below)
firm: chalk
hard: limestone

NOTE: Sediments containing 10–30% $CaCO_3$ fall in other classes where they are denoted with the adjective "calcareous." Less than 10% $CaCO_3$ is ignored.

4) Terrigenous sediments

a) Sediments falling in this portion of the classification scheme are subdivided into textural groups on the basis of the relative preportions of three grain size constituents, i. e., clay, silt, and sand. Rocks coarser than sand size are treated as "Special Rock Types." The size limits for these constituents are those defined by Wentworth (1922) (Figure 5).

Five major textural groups are recognized on the accompanying triangular diagram (Figure 6). These groups are defined according to the abundance of clay (> 90%, 90–10%, < 10%) and the ratio of sand to silt (>1 or <1).

The terms *clay, mud, sandy mud, silt,* and *sand* are used for the soft or unconsolidated sediments which are cut with a wire in the shipboard core splitting process. The hard or unconsolidated equivalents for the same textural groups are *claystone, mudstone* (or shale, if fissile), *sandy mudstone, siltstone,* and *sandstone.* Sedimentary rocks falling into the consolidated category include those which must generally be cut with the band saw or diamond saw. Sands medium-, coarse-, or very coarse-grained sands and sandstones according to their median grain size.

(i) Qualifiers – In this group numerous qualifiers are possible, usually based on minor constituents, for example: glaconitic, pyritic, feldspathic. In the sand and sandstone category, conventional divisions such as arkose, graywacke, etc., are, of course, acceptable, providing the scheme is properly identified. Clays, muds, silts, and sands containing 10–30% $CaCO_3$ shall be called calcareous.

b) Volcanogenic sediments

Pyroclastic rocks are described according to the textural and compositional scheme of Wentworth and Williams (1932). The textural groups are:

Volcanic breccia >32 mm

Volcanic lapilli <32 mm

Volcanic ash (tuff, indurated) <4 mm

Compositionally, these pyroclastic rocks are described as vitric (glass), crystal or lithic.

c) Clastic sediments of volcanic provenance are described in the same fashion as the terrigenous sediments, noting the dominant composition of the volcanic grains where possible.

5) Special rock types – The definition and nomenclature of sediment and rock types not included in the system described above are left to the discretion of shipboard scientists with the recommendation that they adhere as closely as practical to conventional terminology.

In this category fall such rocks as:

Intrusive and extrusive igneous rocks;
Evaporites, halite, anhydrite, gypsum (as a rock), etc.;
Shallow water limestone (biostromal, biohermal, coquina, oolite, etc.);
Dolomite;
Gravels, conglomerates, breccias;
Metalliferous brown clays;
Concretions, barite, iron-manganese, phosphorite, pyrite, etc.;
Coal, asphalt, etc.;
and many others.

The mandatory graphic lithology column should be completed by shipboard staff with appropriate symbols for intervals containing special rock types. It is imperative that symbols and rock nomenclature be properly defined and described by shipboard staff.

Basement Description Conventions

Core Forms

Initial core description forms for igneous and metamorphic rocks are not the same as those used for sediments. The sediment barrel sheets are substantially those published in previous *Initial Reports.* Igneous rock representation on barrel sheets is too compressed to provide adequate information for potential sampling. Consequently, Visual Core Description forms, modified from those used on board ship, are used for more complete graphic representation. All shipboard data per 1.5-meter section of core are listed on the modified forms as well as summary hand-specimen and thin-section descriptions. The symbols and a number of format conventions for igneous rocks are presented on Figure 7.

Igneous and metamorphic rocks are split using a rock saw with a diamond blade into archive and working halves. The latter is described and sampled on board ship. On a typical igneous rock description form (Figure 8), the left column is a visual representation of the working half using the symbols of Figure 7. Two closely spaced horizontal lines in this column indicate the location of styrofoam spacers taped between basalt pieces inside the liner. Each piece is numbered sequentially from the top of each section, beginning with the number 1. Pieces are labeled on the rounded, not the sawed surface. Pieces which could be fitted together before splitting are given the same number, but are consecutively lettered, as 1A, 1B, 1C, etc. Spacers are placed between pieces with different number, but not between those with different letters and the same number. In general, addition of spacers represents a drilling gap (no recovery). However, in cores where recovery is high, it is impractical to use spacers. In these cases, drilling gaps are indicated only by a change in numbers. All pieces have orientation arrows pointing to the top of the section, both on archive and working halves, provided the original unsplit piece was cylindrical in the liner and of greater length than the diameter of the liner. Special procedures are used to ensure that orientation is preserved through every step of the sawing and labeling process. All pieces suitable for sampling requiring knowledge of top from bottom are indicated by upward-pointing arrows to the left of the piece numbers on the description forms. Since the pieces are rotated during drilling, it is not possible to sample for declination studies.

Samples are taken for various measurements on board ship. The type of measurement and approximate location are indicated in the column headed "Sample" using the following notation:

X = X-ray fluorescence analysis

M = magnetics measurements

S = sonic velocity measurements

T = thin section

D = density measurements

P = porosity measurements

Up to seven such visual representations can be included on a single igneous rock core description sheet (Figure 9), which includes a summary core description, and petrographic and analytical data.

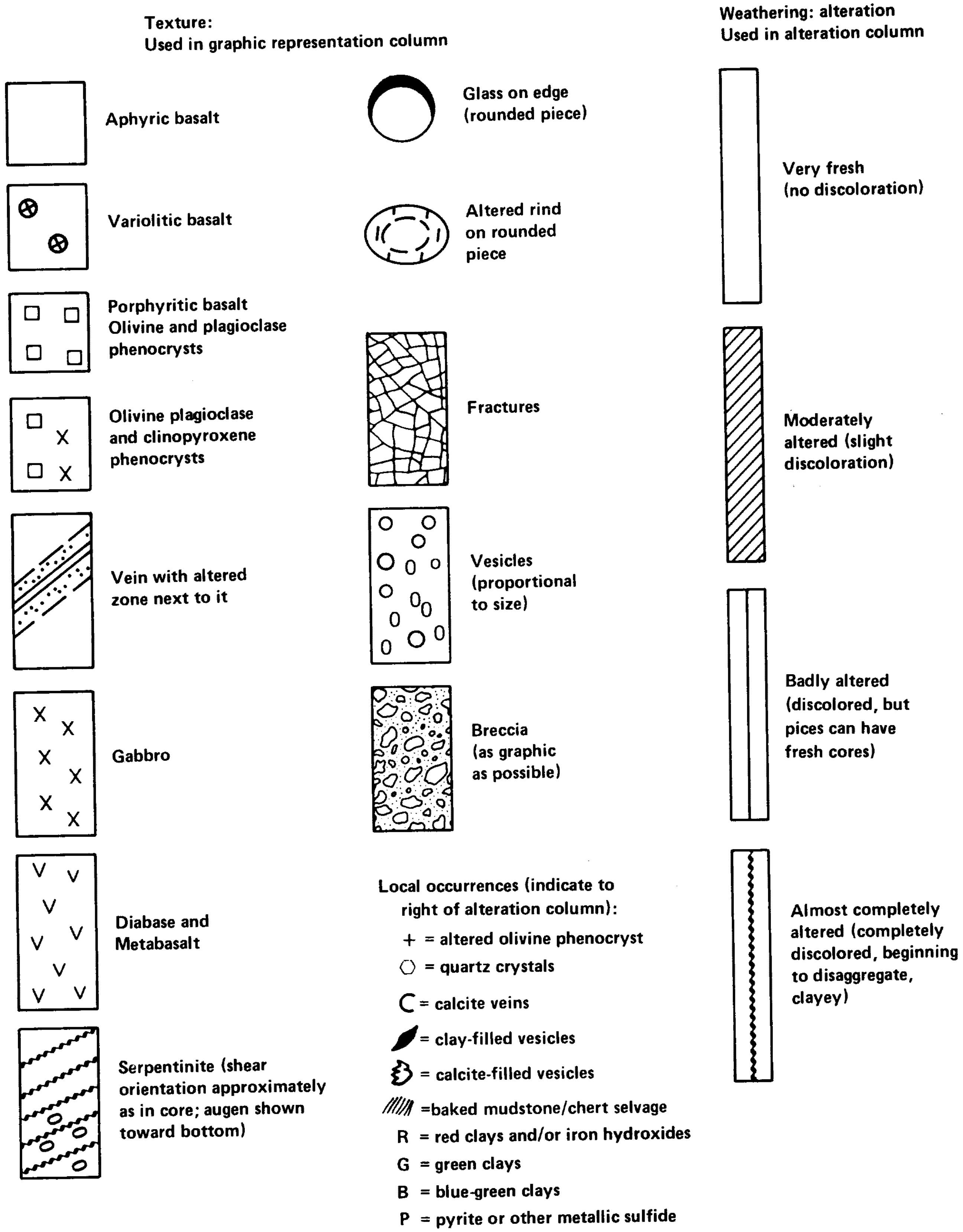
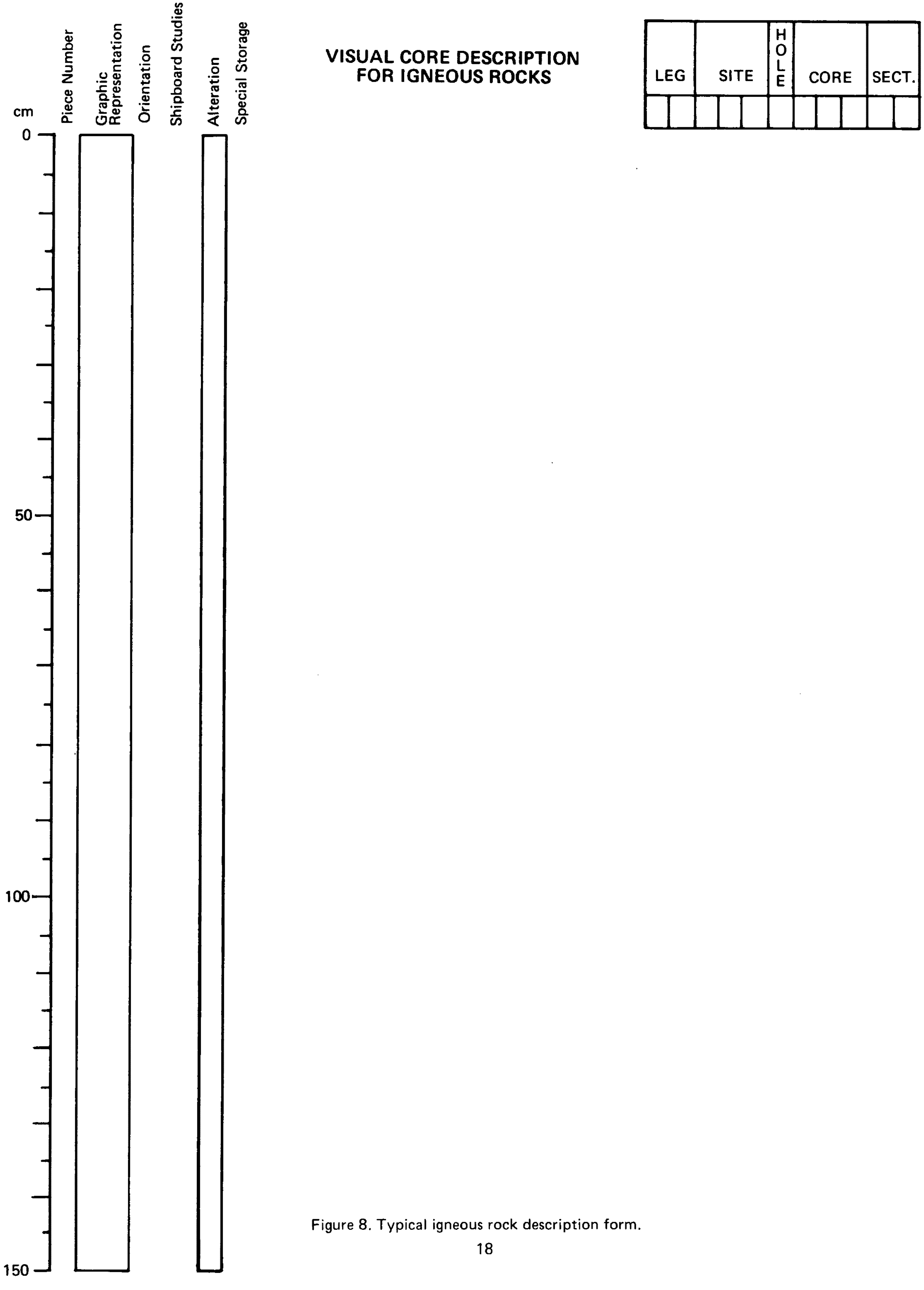


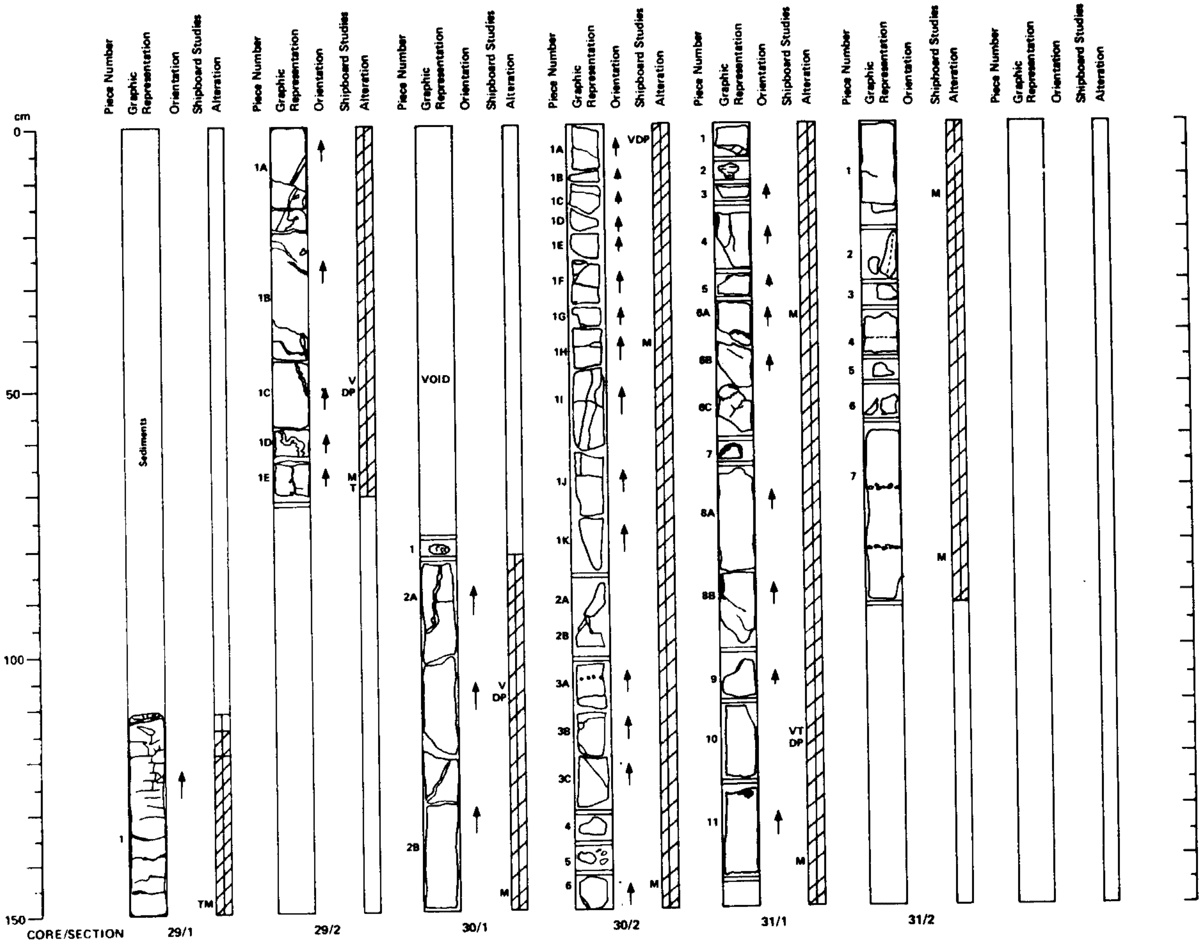
Figure 7. List of symbols for igneous rock description forms.



VISUAL CORE DESCRIPTION
FOR IGNEOUS ROCKS

LEG	SITE	HOLE	CORE	SECT.

Figure 8. Typical igneous rock description form.



SITE 524, CORE 28, SECTION 3, 279.1–279.6 m

Macroscopic Description

See sediment description form

Thin Section Summaries

Contact Zone below claystone at 61 cm, Sec. 3. Dark brown glass with tiny (~0.01 mm and less) spinifex plagioclase (hollow skeletal, swallow tails) microlites rimmed with spherulitic mantles. Spherulite zone noted away from contact. Section too thick and glass too dark for detailed examination (problem with plucking).

Interior of pillow at 71 cm, Sec. 3: Slight phyric basalt with sparse (<1%) relatively large plagioclase phenocrysts (0.7–1.6 mm) set in a hyalopilitic spinifex matrix composed of Na-rich (R. I. <1.55), skeletal (hollow cores with smectite filling and crude swallow tails), elongate (0.04–0.5 mm, L/W < 1/3–1/35) plagioclase microlites, abundant ilmenite dendrite needles (0.001–0.004 mm thick and 0.04–0.2 mm long) in rectangular boxwork pattern, more sparse magnetite cubes and octahedra in two generations (first = 0.02–0.25 mm, second = 0.004–0.015 mm), skeletal pyroxene(?) anhedral (~0.006 mm); and hollow skeletal apatite euhedra (0.004–0.008 mm). All these in a mesostasis of pale green smectite or chlorite (devitrified glass ?). Plagioclase phenocrysts about half replaced by inclusion-filled albite and some smectite or chlorite. Approximate mode: plagioclase phenocrysts < 1, plagioclase microlites 30–40, ilmenite 10–15, magnetite 3–5, clinopyroxene 3–5, apatite 1–3, devitrified glass 40–50.

Shipboard Studies

Sample	D	P	$V_{\perp}$	$V_{\parallel}$	NRM1	NRM2	S. I.
Sec. 3, 71 cm	–	–	–	–	32.014	–38.6	–36
Sec. 3, 110 cm	–	–	–	–	24.443	–49.1	–45

SITE 524, CORE 29, SECTIONS 1–2, 286.1–287.2 m

MAJOR ROCK TYPES – BASALT (or DIABASE), CLAYSTONE, SANDSTONE

Macroscopic Description

Basalt (or Diabase) – Dark gray, aphyric. Sec. 1 has numerous calcite-filled veins arranged perpendicular to core axis and spaced every 2–3 cm. Calcite veins in Sec. 2 more irregular, some with green clay rims.

Sandstone and Claystone – see sediment description form.

Thin Section Summaries

Section 1, Piece 1: Fine- to medium coarse-grained aphyric olivine(?) basalt (or diabase) with intergrown intersertal texture, composed of dominant tabular, weakly compositionally zoned plagioclase anhedra (0.06–0.3 mm, $An_{43-?}$, R. I. <1.55) and subordinate intergranular, mostly subhedra grains of clinopyroxene (0.005–0.1 mm), opaque minerals (0.006–0.36 mm) and apatite needles (0.01–0.15 mm, L/W ~1/12), with intersertal patches of greenish brown smectite. There are sparse smectite patches that appear to be pseudomorphs of small (0.05–0.1 mm) euhedral olivine grains. Note: Sparse (<1%) clinopyroxene microphenocrysts (0.15–0.25 mm). Approximate mode: plagioclase 35–45, clinopyroxene 15–20, opaques 15–20, devitrified glass (smectite) 15–20, apatite 1–2, olivine(?) 2–3.

Section 2, Core-Catcher: Coarse-grained to very coarse-grained basalt or diabase, composed of anhedral to subhedral, strongly zoned (An_{45-17}) plagioclase (0.09–0.95 mm) with intergranular clinopyroxene ($2V_z$ ~55–60) (0.01–0.15 mm) and opaques (magnetite 0.01–0.36 mm and illmenite) and intersertal olive brown smectite (high birefringence). Abundant (for this mineral) apatite (3–5%, 0.02–0.36 mm) of stubby to needle prismatic habit, often with hollow center. Apatite is euhedral and cuts across plagioclase. Ilmenite and magnetite are sometimes hollow skeletal.

Shipboard Studies

Sample	D	P	$V_{\perp}$	$V_{\parallel}$	NRM1	NRM2	S. I.
Sec. 1, Piece 1	–	–	–	–	53.485	–44.7	–74
Sec. 2, Piece 1C	2.70	14.0	4.33	4.65	–	–	–
Sec. 2, Piece 1E	–	–	–	–	52.067	–43.4	–71

SITE 524, CORE 30, SECTIONS 1–2, 289.0–292.0 m

MAJOR ROCK TYPE – BASALT (or DIABASE)

MINOR ROCK TYPE – CALCAREOUS CLAYSTONE

Macroscopic Description

Basalt (or Diabase) – Dark gray, aphyric, coarse-grained basalt or diabase. Even grained, massive with widely spaced fractures (2–10 cm). Fractures in Piece 2A–B (Sec. 1) filled with calcite and minor pyrite; some lined with green clay. Fractures in Pieces 1A, 1C, and 1I–K (Sec. 2) parallel lines of irregular vesicles. Pyrite or blue green clay lines vesicles.

Calcareous Claystone – Piece 1 (Sec. 1) is olive gray calcareous claystone with a large horizontal zoophycos burrow.

Shipboard Studies

Sample	D	P	$V_{\perp}$	$V_{\parallel}$	NRM1	NRM2	S. I.
Sec. 1, Piece 2A	2.73	11.0	4.57	4.76	–	–	–
Sec. 1, Piece 2B	–	–	–	–	55.789	–57.8	–76
Sec. 2, Piece 1A	2.74	11.2	4.64	5.15	–	–	–
Sec. 2, Piece 1H	–	–	–	–	32.663	–64.4	–79
Sec. 2, Piece 6	–	–	–	–	43.596	–49.4	–73

SITE 524, CORE 31, SECTIONS 1–2, 294.5–296.9 m

MAJOR ROCK TYPE – BASALT (or DIABASE)

MINOR ROCK – CALCAREOUS CLAYSTONE

Macroscopic Description

Basalt (or Diabase) – Dark gray, aphyric, coarse, even-grained basalt (or diabase) with rare fractures filled with green clay. Small pyrite crystals in fractures and in discolored zones. Moderate alteration.

Calcareous Claystone – Piece 2 (Sec. 1) is reddish brown calcareous claystone.

Thin Section Summary

Section 1, Piece 10: Rock is very similar in texture and mineralogy to Core 29, Sec. 2, Core-Catcher, but slightly coarser and plagioclase grains show beautifully developed epitaxial mantles of alkali feldspar or oligoclase, optics (Ax. Pl. + 010, $2V_x$ <60°) indicate 3 possibilities, in order of likelihood: 1) anorthoclase or Na-sanidine, 2) oligoclase, and 3) K-rich sanidine. Choice 1 is favored because of sharply defined mantle boundary, oligoclase should give more gradational transition, and smaller R. I. difference than would be expected with K-rich sanidine.

Shipboard Studies

Sample	D	P	$V_{\perp}$	$V_{\parallel}$	NRM1	NRM2	S. I.
Sec. 1, Piece 6A	–	–	–	–	28.924	–56.8	–65
Sec. 1, Piece 10	2.78	11.8	4.46	4.50	–	–	–
Sec. 1, Piece 11	–	–	–	–	28.664	–41.6	–
Sec. 2, Piece 1	–	–	–	–	29.817	–65.9	–66?
Sec. 2, Piece 7	–	–	–	–	30.548	–38.6	–50

Figure 9. Igneous rock description sheet.

Igneous Rock Classification

Igneous rocks are classified mainly on the basis of mineralogy and texture. Thin-section work in general adds little new information to the hand-specimen classification.

Basalts are termed aphyric, sparsely phyric, moderately phyric, or phyric, depending on the proportion of phenocrysts visible with the binocular microscope (~x 12). The basalts are called aphyric if phenocrysts are absent. For practical purposes, this means that if one piece of basalt is found with a phenocryst or two in a section where all other pieces lack phenocrysts, and no other criteria such as grain size or texture distinguish this basalt from the others, then it is described as aphyric. A note on the rare phenocrysts is included in the general description, however. This approach enables us to restrict the number of lithologic units to those that appear to be clearly distinct.

Sparsely phyric basalts are those with 1–2% phenocrysts present in almost every piece of a given core or section. Clearly contiguous pieces without phenocrysts are included in this category, again with the lack of phenocrysts noted in the general description.

Moderately phyric basalts contain 2–10% phenocrysts. Aphyric basalts within a group of moderately phyric basalts are separately termed aphyric basalts.

Phyric basalts contain more than 10% phenocrysts. No separate designation is made for basalts with more than 20% phenocrysts; the proportion indicated in the core forms should be sufficient to guide the reader.

The basalts are further classified by phenocryst type, preceding the terms phyric, sparsely phyric, etc. For example, a plagioclase-olivine moderately phyric basalt contains 2–10% phenocrysts, most of them plagioclase, but with some olivine.

Other rock types which are less commonly recovered, such as gabbro, serpentinite, andesites, granite, or metamorphic rocks, are classified using standard references such as Williams, et al. (1954) or Moorhouse (1959).

ADDITIONAL DATA TO LEG 95 EXPLANATORY NOTES

The following symbols are used in addition to the standard symbols:

▦	Lithology ST1: Indeterminate clay/opal C-T mixture
Ⓟ	Pyrite nodule
Ⓑ	Barite nodule
X	X-ray diffraction sample
≋	Wavy laminae

Drilling disturbances:

	Breccia
	Pervasively fractured
◆◆◆	Drilling biscuits (compaction)

Core type is indicated as follows:

H = hydraulic piston core, R = rotary core, X = extended core, W = wash core

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SAMPLE DISTRIBUTION POLICY

Deep Sea Drilling Project/International Phase of Ocean Drilling

Distribution of Deep Sea Drilling samples for investigation will be undertaken in order to (1) provide supplementary data to support *Glomar Challenger* scientists in achieving the scientific objectives of their particular cruise, and in addition to serve as a mechanism for contributions to the *Initial Reports;* (2) provide individual investigators with materials to conduct detailed studies beyond the scope of the *Initial Reports;* and (3) provide the reference centers where paleontologic materials are stored with samples for reference and comparison purposes.

The National Science Foundation has established a Sample Distribution Panel to advise on the distribution of core materials. This panel is chosen in accordance with usual Foundation practices, in a manner that will assure advice in the various disciplines leading to a complete and adequate study of the cores and their contents. Funding for the proposed research must be secured separately by the investigator. It cannot be provided through the Deep Sea Drilling Project.

The Deep Sea Drilling Project's Curator is responsible for distributing the samples and controlling their quality, as well as preserving and conserving core material. He also is responsible for maintaining a record of all samples that have been distributed, shipboard and subsequent, indicating the recipient and the natures of the proposed investigation. This information is made available to all investigators of DSDP materials as well as to other interested researchers on request.

The distribution of samples is made directly from one of the two existing repositories, Lamont-Doherty Geological Observatory and Scripps Institution of Oceanography, by the Curator or his designated representative.

1. Distribution of Samples for Research Leading to Contributions to *Initial Reports*

Any investigator who wishes to contribute a paper to a given volume of the *Initial Reports* may write to the Chief Scientist, Deep Sea Drilling Project (A-031), Scripps Institution of Oceanography, University of California at San Diego, La Jolla, California 92093, U. S. A., requesting samples from a forthcoming cruise. Requests for a specific cruise should be received by the Chief Scientist TWO MONTHS in advance of the departure of the cruise in order to allow time for the review and consideration of all requests and to establish a suitable shipboard sampling program. The request should include a statement of the nature of the study proposed, size and approximate number of samples required to complete the study, and any particular sampling technique or equipment that might be required. The requests will be reviewed by the Chief Scientist of the Project and the cruise co-chief scientists; approval will be given in accordance with the scientific requirements of the cruise as determined by the appropriate JOIDES Advisory Panel(s). If approved, the requested samples will be taken, either by the shipboard party if the workload permits, or by the curatorial staff shortly following the return of the cores to the repository. Proposals must be of a scope to ensure that samples can be processed and a contribution completed in time for publication in the *Initial Reports.* Except for rare, specific instances involving ephemeral properties, sampling will not exceed one-quarter of the volume of core recovered, with no interval being depleted and one-half of all core being retained as an archive. Shipboard sampling shall not exceed approximately 100 igneous samples per investigator; in all cases co-chief scientists are requested to keep sampling to a minimum.

The co-chief scientists may elect to have special studies of selected core samples made by other investigators. In this event the names of these investigators and complete listings of all materials loaned or distributed must be forwarded, if possible, prior to the cruise or, as soon as possible following the cruise, to the Chief Scientist through the DSDP Staff Science Representative for that particular cruise. In such cases, all requirements of the Sample Distribution Policy shall also apply.

If a dispute arises or if a decision cannot be reached in the manner prescribed, the NSF Sample Distribution Panel will conduct the final arbitration.

Any publication of results other than in the *Initial Reports* within twelve (12) months of the completion of the cruise must be approved and authored by the whole shipboard party and, where appropriate, shore-based investigators. After twelve months, individual investigators may submit related papers for open publication provided they have submitted their contributions to the *Initial Reports.* Investigations not completed in time for inclusion in the *Initial Reports* for a specific cruise may not be published in other journals until final publication of that *Initial Reports* for which it was intended. Notice of submittal to other journals and a copy of the article should be sent to the DSDP Associate Chief Scientist, Science Services.

2. Distribution of Samples for Research Leading to Publication Other Than in *Initial Reports*

A. Researchers intending to request samples for studies beyond the scope of the *Initial Reports* should first obtain sample request forms from the Curator, Deep Sea Drilling Project (A-031), Scripps Institution of Oceanography, University of California at San Diego, La Jolla, California 92093, U. S. A. On the forms the researcher is requested to specify the quantities and intervals of the core required, make a clear statement of the proposed research, state time required to complete and submit results for publication, and specify the status of funding and the availability of equipment and space foreseen for the research.

In order to ensure that all requests for highly desirable but limited samples can be considered, approval of requests and distribution of samples will not be made prior to 2 months after publication of the *Initial Core Descriptions (I. C. D.). ICD's* are required to be published within 10 months following each cruise. The only exceptions to this policy will be for specific instances involving ephemeral properties. Requests for samples can be based on the *Initial Core Descriptions*, copies of which are on file at various institutions throughout the world. Copies of original core logs and data are kept on file at DSDP and at the repository at Lamont-Doherty Geological Observatory, Palisades, New York. Requests for samples from researchers in industrial laboratories will be handled in the same manner as those from academic organizations, with the same obligation to publish results promptly.

B. (1) The DSDP Curator is authorized to distribute samples up to 50 ml per meter of core. Requests for volumes of material in excess of this amount will be referred to the NSF Sample Distribution Panel for review and approval. Experience has shown that most investigations can be accomplished with 10 ml sized samples or less. All investigators are encouraged to be as judicious as possible with regard to sample size and, especially, frequency within any given core interval. The Curator will not automatically distribute any parts of the cores which appear to be in particularly high demand; requests for such parts will be referred to the Sample Distribution Panel for review. Requests for samples from thin layers or important stratigraphic boundaries will also require Panel review.

(2) If investigators wish to study certain properties which may deteriorate prior to the normal availability of the samples, they may request that the normal waiting period not apply. All such requests must be reviewed by the curators and approved by the NSF Sample Distribution Panel.

C. Samples will not be provided prior to assurance that funding for sample studies either exists or is not needed. However, neither formal approval of sample requests nor distribution of samples will be made until the appropriate time (Item A). If a sample request is dependent, either wholly or in part, on proposed funding, the Curator is prepared to provide to the organization to whom the funding proposal has been submitted any information on the availability (or potential availability) of samples that it may request.

D. Investigators receiving samples are responsible for:

(1) publishing significant results; however, contributions shall not be submitted for publication prior to 12 months following the termination of the appropriate leg;

(2) acknowledging, in publications, that samples were supplied through the assistance of the U. S. National Science Foundation and others as appropriate;

(3) submitting five (5) copies (for distribution to the Curator's file, the DSDP repositories, the *Glomar Challenger's* library, and the National Science Foundation) of all reprints of published results to the Curator, Deep Sea Drilling Project (A-012), Scripps Institution of Oceanography, University of California at San Diego, La Jolla, California 92093, U. S. A.;

(4) returning, in good condition, the remainders of samples after termination of research, if requested by the Curator.

E. Cores are made available at repositories for investigators to examine and to specify exact samples in such instances as may be necessary for the scientific purposes of the sampling, subject to the limitations of B (1 and 2) and D, with specific permission of the Curator or his delegate.

F. Shipboard-produced smear slides of sediments and thin sections of indurated sediments and igneous and metamorphic rocks will be returned to the appropriate repository at the end of each cruise or at the publication of the *Initial Reports* for that cruise. These smear slides and thin sections will form a reference collection of the cores stored at each repository and may be viewed at the respective repositories as an aid in the selection of core samples.

G. The Deep Sea Drilling Project routinely processes by computer most of the quantitative data presented in the *Initial Reports.* Space limitations in the *Initial Reports* preclude the detailed presentation of all such data. However, copies of the computer readout are available for those who wish the data for further analysis or as an aid in selecting samples. A charge will be made to recover expenses in excess of $50.00 incurred in filling requests.

3. Other Records

Magnetics, seismic reflection, downhole logging, and bathymetric data collected by the *Glomar Challenger* will also be available for distribution at the same time samples become available.

Requests for data may be made to:

Associate Chief Scientist, Science Services
Deep Sea Drilling Project (A-031)
Scripps Institution of Oceanography
University of California at San Diego
La Jolla, California 92093

A charge will be made to recover the expenses in excess of $50.00 in filling individual requests. If required, estimated charges can be furnished before the request is processed.

4. Reference Centers

As a separate and special category, samples will be distributed for the purpose of establishing up to five reference centers where paleontologic materials will be available for reference and comparison purposes. The first of these reference centers has been approved at Basel, Switzerland.

Revised 8/1/80

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SCRIPPS INSTITUTION OF OCEANOGRAPHY
Deep Sea Drilling Project

The accompanying informal report is a summary of the scientific results of Leg 95 of the Deep Sea Drilling Project, prepared from the shipboard files by the scientists who participated in this cruise. The material contained herein is privileged proprietary information and cannot be used for publication or quotation.

This summary was assembled under time restrictions and is not to be considered a formal publication which incorporates final works or conclusions of the scientists.

The Deep Sea Drilling Project, undertaken on the advice of JOIDES, is managed by Scripps Institution of Oceanography under contract from the National Science Foundation.

Yves Lancelot
Chief Scientist

SUMMARY OF DEEP SEA DRILLING PROJECT, LEG 95

The scientific party aboard D/V Glomar Challenger for Leg 95 of the Deep Sea Drilling Project, International Phase of Ocean Drilling, consisted of:

C. Wylie Poag (U.S. Geological Survey, Woods Hole, Massachusetts)
A. B. Watts (Lamont-Doherty Geological Observatory, Columbia University, Palisades, New York)
Michel Cousin (Universite Pierre et Marie Curie, Departement de Geotectonique, Paris, France)
David Goldberg (Lamont-Doherty Geological Observatory, Columbia University, Palisades, New York)
Malcolm B. Hart (Plymouth Polytechnic, Department of Environmental Sciences, Plymouth, United Kingdom)
Kenneth G. Miller (Lamont-Doherty Geological Observatory, Columbia University, Palisades, New York)
Gregory Mountain (Lamont-Doherty Geological Obsrvatory, Columbia University, Palisades, New York)
Yuji Nakamura (University of Tokyo, Laboratory for Earthquake Chemistry, Nakano, Tokyo, Japan)
Amanda Palmer (Princeton University, Department of Geological and Geophysical Sciences, Princeton, New Jersey)
Paul A. Schiffelbein (Scripps Institution of Oceanography, La Jolla, California)
B. Charlotte Schreiber (Queens College (SUNY), Department of Earth and Environmental Science, Flushing, New York)
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INTRODUCTION

Baltimore Canyon trough, the most intensely studied sedimentary basin of the United States Atlantic margin, encompasses the coastal plain, continental shelf and continental slope of New Jersey (Fig. 1). Outcrop and subsurface investigations of the coastal plain have been carried out since the early 1900's. Offshore studies began in the 1950's (e.g. Drake, et al., 1959) and have intensified since 1973 as a result of renewed interest in offshore petroleum leasing. Forty-one boreholes and numerous seafloor samples now provide a geologic basis for interpreting thousands of kilometers of seismic reflection profiles. Summaries of the structural and stratigraphic framework and depositional history have been published by Klitgord and Grow (1980), Schlee (1981) and Poag (1980; in press). On the basis of the extensive published record of these geological and geophysical investigations, the New Jersey margin was chosen as the most suitable location for constructing the first marginwide stratigraphic transect. As envisioned, the transect would extend from the outcrop belt in central New Jersey to a location 700 km distant on the lower continental rise. Initial DSDP core holes on the slope and upper rise would emphasize the Cenozoic and Upper Cretaceous sections, as dictated by the limitations of open-hole drilling. However, future coring could be expected to provide comparable data from more deeply buried Mesozoic deposits and basement rocks.

Leg 93 began the current phase of drilling on the New Jersey

Transect by placing two shallow core sites (maximum penetration 816.7 m) on the upper continental rise (Sites 604, 605; Figs. 1 through 3). In addition, they established the extreme oceanward end of the transect at Site 603 (Fig. 1) on the lower rise, where a penetration of 1585.2 m nearly reached basement and recovered rocks as old as Valanginian (Early Cretaceous). Leg 95 is principally intended to provide a crucial link between shelf and rise sites.

The U.S. Geological Survey (USGS) and the Bundesanstalt fur Geowissenschaften und Rohstoffe (BGR) have collected more than 6000 km of multichannel and 15,000 km of single-channel, high-resolution seismic reflection profiles in the Baltimore Canyon trough region (Figs. 2 and 3; Robb and Kirby, 1980; Schlee, 1981). A large number of lines have also been collected by Lamont-Doherty Geological Observatory, Woods Hole Oceanographic Institution and other institutions. These lines provide a dense network of seismostratigraphic sections along the New Jersey slope and rise.

Calibration of these profiles is provided by a series of boreholes. Sixteen wells in New Jersey (Olsson, et al., 1980), four wells on the shelf and slope (Poag, 1980; in press) and eight shallow holes on the slope and shelf (Poag, in press), provide the principal geologic control (Fig. 1). Approximately 26 additional commercial wells on the outer shelf have been released to the public domain, but have not yet been analyzed.

The standard reference section for the Baltimore Canyon trough is USGS seismic reflection profile Line 25, which crosses the depocenter in a southeastward direction, beginning 20 km off Atlantic City, New Jersey, and passing 10 km south of the COST B-3 well (Fig. 2). Poag (in press) has integrated seismic and borehole data in a detailed description and analysis of this section. The principal DSDP sites proposed for the New Jersey margin have been located on or near Line 25 in order to maximize the accuracy of seismic correlations in all present and future core sites along the transect.

UNCONFORMITIES, PALEOBATHYMETRIC CYCLES
SEA LEVEL CHANGE

Poag (1980; 1982a,b; in press) and Poag and Schlee (in press) have discussed the widespread and frequent occurrence of stratigraphic gaps in the sedimentary basins of the Atlantic offshore region, including the Baltimore Canyon trough (Fig. 4). In the boreholes, the presence and duration of hiatuses has been documented by the absence of biostratigraphic zones. Seismic sequence analysis also reveals the presence of these unconformities crossing the boreholes and in undrilled sections as well. Within the shelf sequences of the trough, major stage boundaries are often distinguished as distinct reflections and can be seen to truncate underlying reflections at scattered locations along their lengths, indicating erosion. Above them, the reflections often onlap or downlap, indicating intervals of nondeposition. However, the vertical resolution of the seismic systems used is limited to around 5 m at depths of less than 2 km, so that truncated or onlapping strata of lesser thickness would not show up on the profiles studied (Sheriff, 1977). The boreholes show that unconformities sometimes appear to be conformable seismic boundaries in places where they represent gaps. On the continental slope, the angles between reflections are much more disparate, which makes unconformable contacts easier to recognize. As a general rule, the unconformities fall into two categories:

1) those that can be recognized from basin to basin (Blake Plateau basin, Baltimore Canyon trough, Georges Bank basin) and appear to be nearly coincident with the "global" periods of erosion postulated by Vail, et al. (1977); and

2) those that have more limited extent within a single basin and do not necessarily coincide with those of the Vail scheme.

The major unconformities have been correlated by Poag (in press) with the so-called global periods of erosion outlined by Vail, et al. (1977) and Zeigler (1982) and may provide a means of identifying major depositional cycle boundaries (Figs. 4 and 5).

SEA LEVEL CHANGE AND PALEOBATHYMETRIC CYCLES

Studies of paleobathymetric cycles inferred from analyses of Atlantic offshore boreholes by Poag and co-workers have also revealed good correlations with the supercycles of sea level fluctuation described by Vail, et al., 1977; see Poag and Hall, 1979; Poag, 1980, 1982a,b; and Poag and Schlee, in press. Figure 6 shows a comparison of this sea level curve with paleobathymetric curves derived from the B-2, B-3, GE-1 (southeast Georgia embayment) and G-1 and G-2 wells (Georges Bank Basin). In general, the correspondence of deep and shallow bathymetry with high and low sea levels is remarkably close in the Mesozoic section and supercycles are easy to identify; it is more difficult to correlate the Cenozoic section. Depositional cycles are broadly uniform from basin to basin for Mesozoic strata, but interbasin variability increases considerably in the Cenozoic.

SUBSIDENCE HISTORY, THERMAL EVOLUTION, AND CRUSTAL STRUCTURE

The sedimentary rocks that accumulated in the Baltimore Canyon trough record the vertical movements (uplift and subsidence) of the crust and upper mantle that have occurred at the U.S. continental shelf and slope through time. A number of studies have shown that the principal factors contributing to the subsidence of the continental shelf and slope of the Baltimore Canyon trough are thermal contraction and sedimentary loading (Fig. 7; Steckler and Watts, 1978; Watts and Steckler, 1979; Royden and Keen, 1980.

The main contributor to the subsidence history of the Baltimore Canyon trough following rifting is sedimentary loading (e.g. Steckler and Watts, 1978). Sedimentary loading can account for the overall shape of the basement underlying the trough, the existence of a coastal plain, and the occurrence of relative stratigraphic highs near the shelf break. The effects of thermal contraction and sedimentary loading have been combined recently into models for the thermal and mechanical evolution of passive continental margins (e.g., Watts and Steckler, 1979; Beaumont, et al., 1982; Royden and Keen, 1980). In these models thermal contraction occurs following crustal and lithospheric extension at the time of rifting while sedimentary loading occurs by flexure of a crust and lithosphere that progressively increases its flexural rigidity with age.

The models (thermal and mechanical) have implications for the crustal structure of the Baltimore Canyon trough. For example, in order to explain the subsidence history at the COST B-2 well, a substantial amount of crustal and lithospheric thinning (ca. 20 km) is required. If the thickness of the crust prior to rifting was 30-35 km then the subsidence history implies that the crust is only about 10-15 km thick in the vicinity of the well.

An important application of the thermal and mechanical models from the point of view of the New Jersey Transect objectives is that they allow the stratigraphy of the margin to be predicted for different ages following rifting. For example, preliminary modeling studies show that thermal contraction and sedimentary loading, in combination with long-term changes of sea level, may explain some of the main features of the margin that have been identified on seismic reflection

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profiles of the shelf and slope off New Jersey, such as coastal on- and offlap. Measurements of on- and offlap were one of the means by which Vail, et al. (1977) estimated sea-level changes through time. The models predict that following rifting, passive margins should show patterns of onlap as the lithosphere cools and increases its rigidity with time (e.g. Steckler and Watts, 1981). This suggests that since the beginning of many of the "cycles" of on- and offlap correlate with the age of rift/drift transitions in the world's passive margins, the cycles may be partly tectonically controlled. If this is the case, then the major cycles of Vail, et al. (1977) (e.g., their super-cycles) may be widespread, since many widely-separated continental margins rifted at similar times, but they may not be worldwide.

DRILLING RESULTS

Site 612

Site 612 was selected to provide a midslope (1404 m water depth) stratigraphic section along the New Jersey Transect. Its position at the junction of USGS multichannel seismic profile Lines 25 and 34 affords excellent correlation of the sedimentary sequences here with seismic sequences recorded on the dense grid of seismic lines crossing this part of the New Jersey margin (Figs. 8 and 9). The site is located just updip of the broad submarine outcrop of middle Eocene siliceous carbonate-rich strata that was sampled by DSDP Leg 11 at

Site 108. It serves as the stratigraphic link between the COST B-3 well on the upper slope 12 km to the north and Site 605 on the upper rise, 14 km to the southeast. Chief operational objectives were to continuously core the section to approximately 800 m and to obtain a suite of downhole geophysical logs.

In terms of scientific goals, this site was selected to provide the most complete Cenozoic and Upper Cretaceous section possible for this part of the margin, given the limitations of open-hole drilling. The principal specific objectives were:

1. To establish the composition, stratigraphic framework and depositional environments of sediments constituting the middle continental slope.

2. To accurately date the biostratigraphic gaps, unconformities, and major seismic reflections in the section.

3. To document the lateral variability of lithofacies and biofacies between the COST B-3 well and Site 605.

4. To identify depositional sequences and evaluate their relationships with seismic sequences, relative sea level changes, oceanic current patterns, water mass composition, sediment provenance and accumulation rates, and with basin subsidence history.

Results

Five distinct lithologic units were documented at Site 612 (Figs. 10 and 11). The lowermost (Unit V) comprises 27.8 m of thin black, foraminifer- or nannofossil chalks alternating with mudstone and shale of late Campanian age. The major component is fine-grained terrigenous detritus (chiefly clay with subordinate amounts of quartz sand or silt and mica). The clay enrichment relative to overlying Maestrichtian beds is clearly reflected in the consistently higher values recorded on the gamma ray log (20-30 GAPI units higher). The dark color is in part attributable to an abundance of organic matter and pyrite. The TOC value of 2.68% is the highest and only significant amount recorded at Site 612.

Rich, varied, diagnostic foraminiferal and calcareous nannoplankton were present in the upper Campanian unit, but radiolarians were not observed. A low planktonic-benthic foraminiferal ratio of 3:1 (in more than 250 μm size fraction) and the general nature of the benthic assemblage are suggestive of shelf deposition. Sedimentation rate cannot be determined because of the incomplete penetration of the Campanian.

The upper boundary of this Campanian unit is an erosional contact with lower Maestrichtian strata that coincides with a distinct upward increase in sonic velocity and a major upward decrease in the abundance of benthic foraminifera. The acoustic impedance at the contact produces a weak, undulating reflection at 2.56 s on Line 25 that can be traced across truncated underlying reflections.

The geometry of this Campanian unit in depth section (Line 25) in conjunction with the paleoecological inferences drawn from foraminiferal assemblages and lithology suggest that Site 612 was an outer shelf location during the late Campanian.

Lithologic Unit IV comprises ca. 84.6 m of dark gray, marly, intensely burrowed foraminifer-nannofossil and nannofossil-foraminifer chalks, including some lithified limestone layers. Terrigenous components are present throughout, but decrease significantly toward the top (e.g., clay ranges from 30-50%). Average sedimentation rate was 2.1 cm/ky.

Calcareous microfossil groups are well represented in these strata and indicate an age of early and middle Maestrichtian. Radiolarians are rare and poorly preserved (only observed in Core 612-61, at the top of the section).

The top of the Maestrichtian unit is placed within a poorly recovered core interval (612-60). Because the distance between the lower Eocene beds above and the middle Maestrichtian below is less than 9 m, it is presumed that the contact is unconformable. This inference is supported by the fact that a similar stratigraphic interval is missing in updip wells. A high-amplitude reflection is found at 24.8 s on Line 25 representing the top of the middle Maestrichtian section and can be widely traced.

The depth-section geometry of the Maestrichtian unit suggests that the shelf edge was still southeastward of Site 612, but paleontologic data suggest that the water deepened relative to late Campanian depths.

A significant increase in gamma ray values between 556 and 552 m (increase of 25 GAPI units) indicates a clay-enriched zone, which also yields lower sonic velocity values. Clay enrichment is a characteristic of Paleocene strata which are present at the B-3 well and at Site 605. Tracing the Paleocene seismic sequence toward Site 612 from 605 and B-3 suggests that a very thin section could be present there. Thus a 4 m Paleocene(?) section is tentatively recognized at Site 612.

The early Eocene brought a major change in depositional region to Site 612, as it did to the shelf and upper slope. Light gray, carbonate-enriched, biosiliceous oozes and chalks dominate. This regime appears to have lasted through the early Oligocene, although interrupted by one significant erosional event. A total of at least 416 m of these deposits is present at Site 612. Diagenetic characteristics have been used to recognize two distinctive lithologic units within this sequence. The upper part, assigned to lithologic Unit II (187.4 m thick) contains well-developed, microfossil assemblages that indicate an early Oligocene to middle Eocene age. The abundance of siliceous microfossils (radiolarians and diatoms) is especially notable in Unit II, and distinguishes it from Unit III. A zone of progressive, downward intensifying silica diagenesis begins around 245 m BSF and culminates in an 8-m zone of porcellanite at the base of the middle Eocene. Sonic velocities reach peak values for the Site in this interval (2.28 km/s on sonic log; 2.52 km/s horizontal measurement from shipboard velocimeter). The top of the porcellanite at 323.4 m is taken as the top of lithologic Unit III (ca. 231 m thick) below which variably intense diagenesis has converted most of the biosiliceous components to silica cements. The top of a zone of high salinities in interstitial waters is nearly coincident with the top of the porcellanite (ca. 300 m).

Both Units II and III contain bathyal microfossil assemblages, as would be expected from evidence of a major Cenozoic marine transgression noted in the shelf and coastal plain borings. The seafloor must have been well oxygenated as indicated by the pervasive, intense burrowing, light colored sediments, and sparsity of organic carbon. The gently seaward sloping geometry seen on the depth section of Line 25 suggests that no distinctive shelf edge was developed. Rather, a wide carbonate ramp formed the continental margin during the Paleogene.

Rates of deposition increased from about 2.1 cm/ky in the middle Maestrichtian to about 3.9 cm/ky in the early Eocene, but decreased again to about 2.5 cm/ky in the middle Eocene.

The Paleogene section is bounded at the top and bottom by erosional unconformities, and contains two additional ones that form the lower Eocene-middle Eocene and middle Eocene-upper Eocene contacts. Each contact is marked by identifiable seismic reflections, permitting regional extrapolation of each depositional sequence. The extrapolations show that the middle Eocene sequence thins significantly updip toward the B-3 well projection on Line 25, and crops out downdip just southeastward of Site 612. The upper Eocene sequence is thickest between the B-3 well and Site 612, and does not appear to be present southeastward from 612 for more than 0.5 km distance. Upper Oligocene strata seen in the B-3 well appear to be absent southeastward of ca. shot point 2960 on Line 25.

The Oligocene-Eocene contact appears to be biostratigraphically and lithostratigraphically conformable, constituting the only significant chronostratigraphic boundary that is not marked by an erosional surface at Site 612. The depositional rate of the interval was also the highest for the Tertiary, reaching 5.2 cm/ky.

A depositional regime characterized by an increase in terrigenous detritus and low carbonate contents (carbonate bomb analysis) invaded Site 612 sometime between the early Oligocene and late Miocene and has been maintained to the present. The sediments resulting from this terrigenous phase are placed in lithologic Unit I (135 m thick), which is subdivided into three parts.

The lower contact of Subunit IC (28.4 m thick) is an unconformity representing a hiatus of ca. 25 m.y. Therefore, the precise beginning of terrigenous influence must be based on evidence from updip wells, which indicate a change near the Oligocene-Miocene transition. Subunit IC is composed of chiefly dark gray to olive gray muds, containing light brown, irregularly-dispersed barite concretions, and abundant diatoms as much as 40%).

The calcareous and siliceous microfossils are moderately well represented and well preserved in this subunit, identifying it as late Miocene in age. A distinct upward increase in gamma ray values on the geophysical log marks the lower unconformable contact, and reflects the increased clay content. This subunit accumulated at the lowest rate of any unit cored at Site 612 (0.5 cm/ky).

Lithologic Subunit IB (69.65 m thick) is separated from Subunit

IC by an erosional contact separating the late Miocene biota from a Pliocene one. The chief lithologic characteristic of Subunit IB is the presence of alternating mud and glauconite sand sequences. The muddy sediments are interrupted repeatedly by glauconite-quartz sand beds, which commonly have sharp, eroded basal contacts. Some beds contain as much as 50% glauconite grains which are fresh, irregular, and unoxidized, indicating very little, if any transport. The glauconite enrichment indicates a high original organic content, but TOC values are low. The rate of sedimentation also was low (1.8 cm/ky).

Lithologic Subunit IA (uppermost Pleistocene) is much like Subunit IC, lacking the plethroa of glauconite sand layers within the terrigenous muds, although containing glauconite-filled burrows.

It is separated from Subunit IB by a basal unconformity, and its microfossils indicate that the lower Pleistocene is missing here. In fact the total Pleistocene section (36.95 m thick) accumulated in no more than about 0.44 m.y., making it by far the most rapidly accumulated unit (greater than 80 cm/ky).

Lithologic Unit I is too thin at Site 612 to be easily separated into subunits on seismic profiles, and is too near the seafloor to have been logged. However, similar sequences were recorded at the ASP 15 core hole.

Site 613

Site 604 (Leg 93) was originally selected as the seawardmost (downdip) coring location on the margin segment of the New Jersey

Transect (Fig. 9). Here the depositional sequences, unconformities and biofacies of the upper continental rise could be analyzed and compared with those of the updip sites (612, 605). It was thought that a fairly complete upper rise stratigraphic sequence could be cored at Site 604, but caving sands of late Miocene age proved to be impossible to penetrate at that location. Thus, Site 613 (2332 m water depth) was a second attempt to penetrate these upper rise strata. It was considered especially important to achieve this penetration, as extrapolation of sequences cored updip at Site 605 indicated that original seismostratigraphic interpretations of the pre-upper Miocene section at Site 604 were probably in error. That is, a major period of channeling thought to represent middle Oligocene sea level fall, appeared more likely to be an intra-Eocene event.

Several different site locations were considered before a pre-site water-gun survey by Challenger showed a spot where the Miocene sand unit was only ca. 10 m thick as it crossed the top of an inter-channel ridge (Fig. 12). This careful survey for the best location proved fully warranted as we experienced no trouble penetrating the Miocene sand which indeed is ca. 10 m thick at Site 613.

In view of the short period of time left for coring at this last site of Leg 95, the upper 116 m section was washed and spot cored. From there, continuous coring with the XCB was maintained to a depth of 581.9 m BSF, except for one 29-m washed interval (154.1-182.9 m BSF).

The pricipal scientific objectives were:

1. To establish the composition, stratigraphic framework, and depositional environments of sediments constituting the upper continental rise.

2. To accurately date the biostratigraphic gaps, unconformities, and major seismic reflections in the section.

3. To establish the timing of two major episodes of seafloor channeling that were indicated on seismic reflection profiles.

4. To document the lateral relationships of lithofacies and biofacies between Sites 605 and 613, especially with regard to silica diagenesis.

5. To identify depositional sequences and evaluate their relationships with seismic sequences, relative sea level changes, oceanic current patterns, water mass composition, sediment provenance, and with subsidence history.

Results

Three distinct lithologic units were documented at Site 613 (Figs. 13 and 14). The lowermost unit penetrated, lithologic Unit III, comprises 139.9 m of porcellaneous nannofossil chalks and limestones and nannofossil porcellanites of early Eocene age. The light greenish gray to light gray sediments are generally densely burrowed, except in some slumped intervals. Slumping is extensive in this unit as opposed to the virtual lack of slumps in its counterpart (lithologic Unit III) at Site 612.

Diagenesis of the porcellaneous strata is not uniform throughout Unit III. Some layers have become hard porcellaneous limestones or nannofossil porcellanites, while others with similar compositions remain poorly lithified chalks. Swelling and cracking when rinsed with fresh water is characteristic of some intervals although very little clay content was detected by X-ray diffraction.

Increased sonic velocities due to the silica diagenesis are notable on the downhole geophysical log and in shipboard measurements. Shipboard values show a downward increase from 1.799 to 2.074 km/s at the top of the unit and peak values of 2.301 and 2.368 km/s between 475 and 490 m. Log values also climb to 2 km/s or more near the top of Unit III and peak to as much as 2.379 in the 481 to 508 m interval. Low gamma ray values reflect the minor clay content.

Microfossil assemblages in Unit III are partly dissolved and moderately to poorly preserved. Etched and dissolved diatoms and radiolarians are present at the very top of Unit III, but the diatoms are absent throughout most of the section. Benthic foraminifers, although poorly preserved, form an association tentatively interpreted as having accumulated in lower bathyal depths. A lower slope paleogeographic position for Site 613 during the early Eocene is supported by the geometry of Unit III as seen on a seismic depth section (Line 25). The unit slopes seaward to the southeast from Site 612, where its gradient flattens, resembling a slope/rise transition, approximately beneath Site 613.

The minimum average sediment accumulation rate for lithologic

Unit III is ca. 2.0 cm/ky, but the presence of numerous slumped intervals indicates that frequently the emplacement of sediment was much more rapid.

The contact between Unit III and overlying Unit II appears on seismic profiles as a deeply scoured erosional surface approximating the middle-lower Eocene contact, but which in places cuts down into Paleocene strata, and Unit III is entirely removed. However, Site 613 was chosen to avoid such channels and is located where Unit III forms a sedimentary ridge between two channels. The middle-lower Eocene contact at Site 613 is a highly disturbed zone of slumping in which lower Eocene beds belonging to Unit III have been incorporated into slump blocks of Unit II (middle Eocene). No biostratigraphic gap was noted however. The separation of Unit III from II is based upon the highest appearance of porcellanite, approximately 2 m below the middle-lower Eocene contact.

Lithologic Unit II (278.4 to 44.0 m BSF) comprises 163.6 m of intensely burrowed, light greenish gray to grayish yellow green siliceous nannofossil chalk. Carbonate from bomb measurements varies from 34 to 61%; biosilica constitutes as much as 45%. Several slumps are present in this unit, displaying overturned folds and variably dipping bedding surfaces that are not burrowed. A single 5-cm thick volcanic ash layer was noted at 400 m. This ash bed may prove to be a useful correlation horizon in this region, as a similar bed was also noted in approximately the same stratigraphic position at Site 605.

The general uniformity of lithologic Unit II is reflected in the gamma ray and sonic velociy logs whose traces display little variation. Sonic velocity gradually increases from ca. 1.9 km/s at the top of the unit to ca. 2.1 km/s near the base. Shipboard velocity measurements yielded somewhat lower values ranging from ca. 1.6-1.8 km/s. The zone of slumping across the Units II/III transition displays a series of gamma ray peaks. The small hole diameter in this interval suggests swelling clays.

Both calcareous and siliceous microfossils are abundant and well preserved in Unit II, and clearly establish the bulk of the unit as being of middle Eocene age. However the last 7 m.y. of middle Eocene time is not represented by deposition here. The precise nature of the disturbed lower-middle Eocene biostratigraphic transition remains to be established by post-cruise studies.

Benthic foraminiferal assemblages of Unit II are again of the lower bathyal type, but faunas which are generally thought to have preferred abyssal depths are present in moderate to large numbers. The geometry of the unit as seen on the Line 25 depth section is similar to that of the lower Eocene, suggesting that the slope/rise transition was near Site 613. Similar conditions to the early Eocene are also indicated by the similar average sedimentation rate of 3.3 cm/ky.

Lithologic Unit I comrpises the upper 270 m of Site 613 and is composd of a complex sequence of interbedded, greenish gray to dark greenish gray mud or calcareous mud (containing variable amounts of diatoms), glauconitic or pyritic silty sand, and sandy mud. The section was not continuously cored, which along with poor recovery of certain intervals, complicates the lithologic interpretation.

Three subunits were recognized, as in Unit I of Site 612. Subunit IA (0.0-119.8 m) was only partly cored and recovery was poor. Four mineralogically distinct zones were recognized. Zones 1 and 3 contain interlayered, glauconitic, quartzose sand, silty sand, sandy mud, and mud; Zones 2 and 4 are comprised of mud, marly nannofossil ooze, and nannofossil diatomaceous ooze. Middle Eocene lithoclasts are also incorporated into Zones 2 and 4. A conglomeratic mud, containing 3-cm pebbles of quartz sandstone and calcareous sandstone marks an erosion surface at the basal contact with Subunit IB.

The upper part of Subunit IB (total interval 119.8-186.6 m) is chiefly greenish gray unbedded homogeneous mud to calcareous mud with sporadic glauconitic silty sand. The glauconite decreases downward between ca. 145-154 m and silty, pyritic and calcareous mud becomes prominent. A significant downward increase of ca. 30 GAPI units on the gamma ray log corresponds to the glauconite decrease. Evidence of slumping is seen in this section.

Within wash core 10X (154.0-183.9 m) the calcareous, greenish gray mud interlayered with coarse sandy glauconitic mud similar to the upper part of Subunit IB, reappears. A major decrease of gamma ray values ca. 178.5 m suggests that this is the top of the lower interval of greenish gray mud and glauconitic mud.

The basal contact of Subunit IB is a sharp erosional break at 186.6 m that is coincident with the Pliocene-Pleistocene contact.

Lithologic Unit IC (186.6-278.0 m) is chiefly structureless, dusky yellow green, nannofossiliferous, siliceous mud containing sporadic silty, glauconitic-quartzose laminae. Glauconite rarely occurs in laminae and is never found in beds thicker than 1 cm. A zone of especially fine-grained clay-rich sediments between 223 and 233 m shows up as a significant bridge on the caliper log and an increase in gamma ray values. The base of Subunit IC contain a glauconitic, conglomeratic sand mixed with nannofossiliferous mud. Granule-size pebbles overlie a scoured surface at 266.45 m that approximates the Pliocene-upper(?) to middle(?) Miocene contact. Subunit IC extends to the bottom of Core 19 at 269.0 m. A coring gap of ca. 9.4 m follows, at the bottom of which 20 cm of middle Eocene Unit II was recovered. The gamma ray characteristics suggest that the unconformable contact between Units I and II is at ca. 278 m BSF.

The microfossils of Unit I are variably abundant and preservation is good to poor, depending upon the sediment type (sands generally have poorer assemblages). Shipboard identification of biozones and chronostratigraphic boundaries are approximate and need to be refined by further studies onshore. Benthic foraminifers of the Neogene-Quaternary section are generally bathyal assemblages, but mixtures of displaced shallow water associations are typical in the Pleistocene strata.

Average sedimentation rates within Unit 1 range from ca. 1 cm/ky in the Miocene, to 2.4 cm/ky in the Pliocene, to 11.7 cm/ky in the Pleistocene.

Seismostratigraphic analysis shows that the Miocene unit is chiefly a series of chaotic channel fill deposits that smoothed the deeply channeled middle Eocene surface, following a period (or periods) of erosion and nondeposition. Some authors have attributed the erosion to a mid-Oligocene sea level fall, but we find no evidence of Oligocene sediments in this region, and thus, cannot comment on the precise timing of the erosional event(s).

Reflections in the top of the Miocene unit are truncated and Pliocene reflections onlap them. More uniform deposition took place in the region during the Pliocene and Pleistocene, but slumping and downslope displacement of strata appear to have been common.

SUMMARY AND CONCLUSIONS

Two continuously cored drill sites on the New Jersey middle slope and upper rise have completed the second phase of scientific ocean drilling along the New Jersey Transect. The transect was conceived as a means of analyzing the stratigraphic framework and depositional history of an entire passive continental margin, beginning on the New Jersey Coastal Plain and terminating on the lower continental rise. The abundance of publicly available geological and geophysical data on the coastal plain shelf, and upper slope provides an extensive data base for the shoreward segment of this transect. USGS multichannel seismic Line 25 serves as the key control line, providing detailed seismostratigraphic data across the depocenter of the Baltimore Canyon trough, and extending from the inner shelf to the middle continental rise (Fig. 15).

Phase one of the DSDP-IPOD New Jersey Transect drilling was undertaken by Leg 93, which drilled two sites on the upper rise (Sites 604 and 605) and also drilled a 1576-m section at Site 603, which serves as the basinward termination of the transect.

Phase two of the New Jersey Transect drilling involved establishment of two additional stratigraphic reference sections; one on the middle slope (Site 612) and one on the upper rise, downdip from Site 605 (Site 613). Both sites were nearly continuously cored and a suite of downhole geophysical logs was obtained at each.

The stratigraphic studies of Poag and co-workers (Poag, 1979, 1980, in press; Poag and Schlee, in press; Schlee, 1981; Libby-French, 1981) have established the broad regional stratigraphic and depositional framework of the shelf and upper slope of New Jersey. In particular, they have documented a series of depositional episodes punctuated by widespread erosion, whose pattern resembles a response to sea level fluctuations, such as envisioned in the widely discussed Vail model (Vail, et al., 1977; Vail and Hardenbol, 1979; Vail and Todd, 1981). In a general sense, the depositional sequences documented at Sites 612 and 613 fit very well into the previously established shelf-slope framework (Fig. 16).

For example, at Site 612, seven unconformable sequence boundaries were penetrated, and six of the contacts were recovered undisturbed in our cores. Except for one exceptionally long hiatus, these unconformities have equivalents on the shelf, and can be traced widely on the seismic profiles. At Site 613, four major sequence boundaries were penetrated. Three are unconformable contacts, but only two were recovered. The fourth sequence boundary comprises a disturbed "zone" of intense slumping, separating the lower and middle Eocene strata.

One of the most interesting new developments regarding unconformities along this segment of the margin is our documentation of a long period (35-37 m.y.) of erosion and/or nondeposition at both sites between the middle Eocene and the late Miocene (at Site 612 a small part of the late Eocene and early Oligocene is present unconformably between the middle Eocene and upper Miocene strata). Extrapolation of the core data along the grid of seismic lines suggests that upper Eocene, lower and upper Oligocene and lower and middle Miocene strata are virtually absent from the lower slope and upper rise. However, we cannot rule out the possibility that very thin layers of these units might exist undetected by the limited resolution of our seismic lines.

Seismic Line 35, which crosses the depositional strike through Site 604 and near Sites 604A and 613, clearly reveals a series of stacked buried channels, whose ages and origins have challenged seismostratigraphers since they were discovered. Under the influence of the Vail model of sea level change, the general consensus has been that the channeling resulted from a mid-Oligocene sea level fall. Our drilling at Site 613 has revealed that one series of channels was formed between the early and middle Eocene. The lower Eocene surface is generally eroded from the shoreline (Island Beach No. 1 well; Poag, in press) across the shelf (truncations on seismic lines, although biostratigraphic data are indeterminate due to poor preservation), through Sites 612, 605 and 613, and basinward (seismic extrapolations seaward of 613).

Biostratigraphic gaps have been documented on the shelf and slope, indicating the removal of section from these updip regions. On Line 35, some channels can be seen to completely remove the lower Eocene strata, cutting deeply in the Paleocene section. At Site 613, however, which appears to have been near the slope-rise transition during the early and middle Eocene, the presence of frequent slumps indicates a depositional regime in which displaced sediments were accumulating. These base-of-the-slope accumulations increased during the middle Eocene and eventually filled the channels on the lower Eocene-Paleocene surface.

A second series of channels is stacked above the middle-lower Eocene series, upon the middle Eocene surface. This chronostratigraphic unit has had a complex history of erosion, as revealed by its wide outcrop belt along the lower slope, and by truncated reflections in its upper strata. It has presumably undergone several periods of erosion since the late Eocene, and is still being worn away along its outcrop. Middle Eocene clasts have been recorded in the Miocene and Pleistocene strata at Site 613 and in surficial piston cores along the lower slope and rise (Poag, unpub. data).

Filling of these middle Eocene channels took place during the late Miocene, as revealed at Sites 604, 604A, and 613, perhaps during the low stand of sea level associated with the Messinian salinity crisis. The coarse sands, gravels and lithoclastic conglomerates at Sites 604 and 613 indicate that the channel fill came from the shelf and was dumped on the lower slope and upper rise in rather chaotic fashion.

These findings demonstrate that with continuously cored, shallow-penetration sections, carefully placed on seismic transect lines, we can easily obtain the fundamental geologic data necessary to unravel the complex Cenozoic stratigraphy and depositional history of sediment-rich passive margins. The concept of multi-site transects has developed late in the DSDP program but the immense value of their systematic approach to margin evolution has been amply demonstrated by the reuslts of such legs as 78, 80, 93 and 95. Moreover, we would hope that the sections now drilled constitute only the initial steps toward a more comprehensive appraisal of margin development. The New Jersey Transect, in particular should stimulate new proposals for additional sites along Line 25 and its joining seismic grid, especially those aimed at deeper targets within the Mesozoic sequences.

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FIGURE CAPTIONS

Figure 1. Chief control wells and proposed Leg 95 sites.

Figure 2. Multichannel seismic grid available for studies relative to the New Jersey Transect.

Figure 3. Single channel high-resolution seismic grid in the New Jersey Transect area.

Figure 4. Composite geologic columns showing major sedimentary sequences and unconformities of Baltimore Canyon trough.

Figure 5. Stratigraphic columns for control borings in the New Jersey Transect region. Undulating lines represent unconformities.

Figure 6. Comparison of sea level curve and paleoenvironmental curve for U.S. Atlantic margin wells. GE-1 well is in southwest Georgia embayment (Blake Plateau basin); G-1 and G-2 wells are in Georges Bank basin.

Figure 7 a) Summary map showing location of COST B-2 and B-3 wells and exploratory wells off New Jersey.

b) Tectonic subsidence and sediment accumulation at the COST B-2 and B-3 wells. The tectonic subsidence has been computed using "backstripping" techniques.

Figure 8. Map of multichannel and *Challenger* lines in vicinity of Sites 612, 605, 108, 604, and 613.

Figure 9.	Segment of U.S.G.S. multichannel Line 25 showing location of Sites 612, 605, 613 and 604. Sites 605 and 613 are projected onto the line.
Figure 10.	Lithostratigraphic column for Site 612.
Figure 11.	Biostratigraphic columns for Site 612.
Figure 12.	Segment of U.S.G.S. Line 35 showing proposed location of undrilled Site NJ-11 and NJ-10 and drilled Sites 604 and 613. Site 613 is projected to the line.
Figure 13.	Lithostratigraphic column for Site 613.
Figure 14.	Biostratigraphic columns for Site 613.
Figure 15.	Chronostratigraphic section across depocenter of Baltimore Canyon trough (from Poag, in press).
Figure 16.	Comparison of depositional sequences and unconformities of New Jersey margin and Goban Spur (Site 548, Leg 80) with position of major unconformities in Vail model.

TABLE 1, CORING SUMMARY SITE 603 HOLE 603D

Core No.	Date 1983	Time	Depth From Drill Floor (m) Top Bottom	Depth Below Sea Floor (m) Top Bottom	Length Cored (m)	Length Recovered (m)	Per Cent Recovered
1R	2 Sept.	1600	4851.0-4860.6	200.0-209.6	9.6	9.47	99
				HOLE 603E			
1R	6 Sept	0215	5588.4-5598.0	936.4-946.0	9.6	0.58	6
2W	8 Sept	1240	5910.0-5923.4	1258.0-1271.4			(wash)
3W	8 Sept	2320	5929.0-5931.0	1277.0-1279.0			(wash)
4W	9 Sept	1540	5931.0-5941.7	1279.0-1289.7			(wash)
				HOLE 603F			
1W	10 Sept	1700	4650.0-4682.6	0.0-32.6			(wash)
2W	12 Sept	0230	4682.6-5630.5	32.6-980.5			(wash)
3W	12 Sept	1445	5630.5-5850.1	980.5-1200.8			(wash)
4W	13 Sept	0820	5850.8-6023.2	1200.8-1373.2			(wash)
5W	13 Sept	1745	6023.2-6147.8	1373.2-1497.8			(wash)
6R	13 Sept	2140	6147.8-6157.3	1497.8-1507.3	9.5	9.84	104
7R	14 Sept	0115	6157.3-6166.4	1507.3-1516.4	9.1	5.0	55
8W	14 Sept	0920	6166.4-6190.2	1516.4-1540.2			(wash)
9R	14 Sept	1245	6190.2-6195.7	1540.2-1545.7	5.5	2.95	54

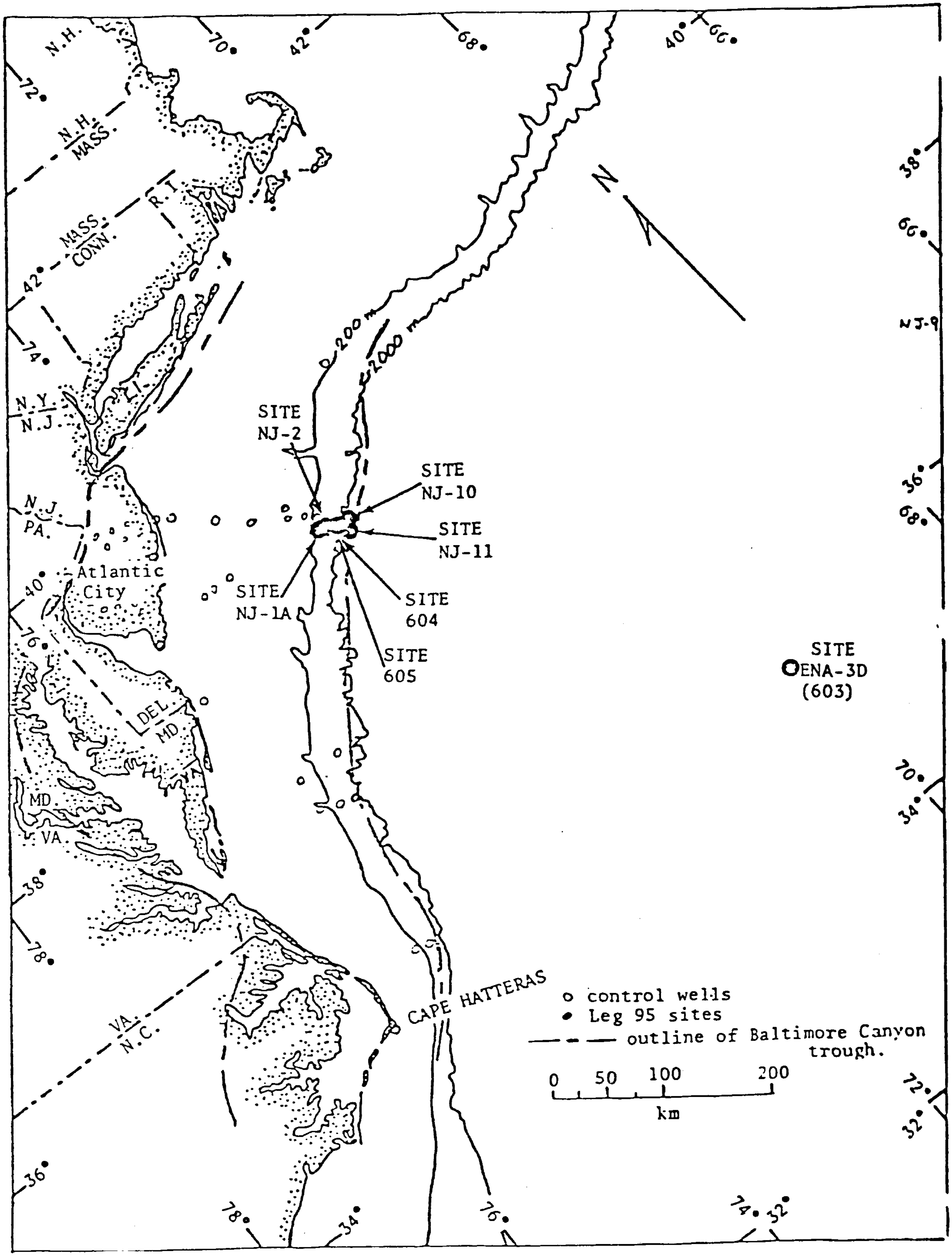
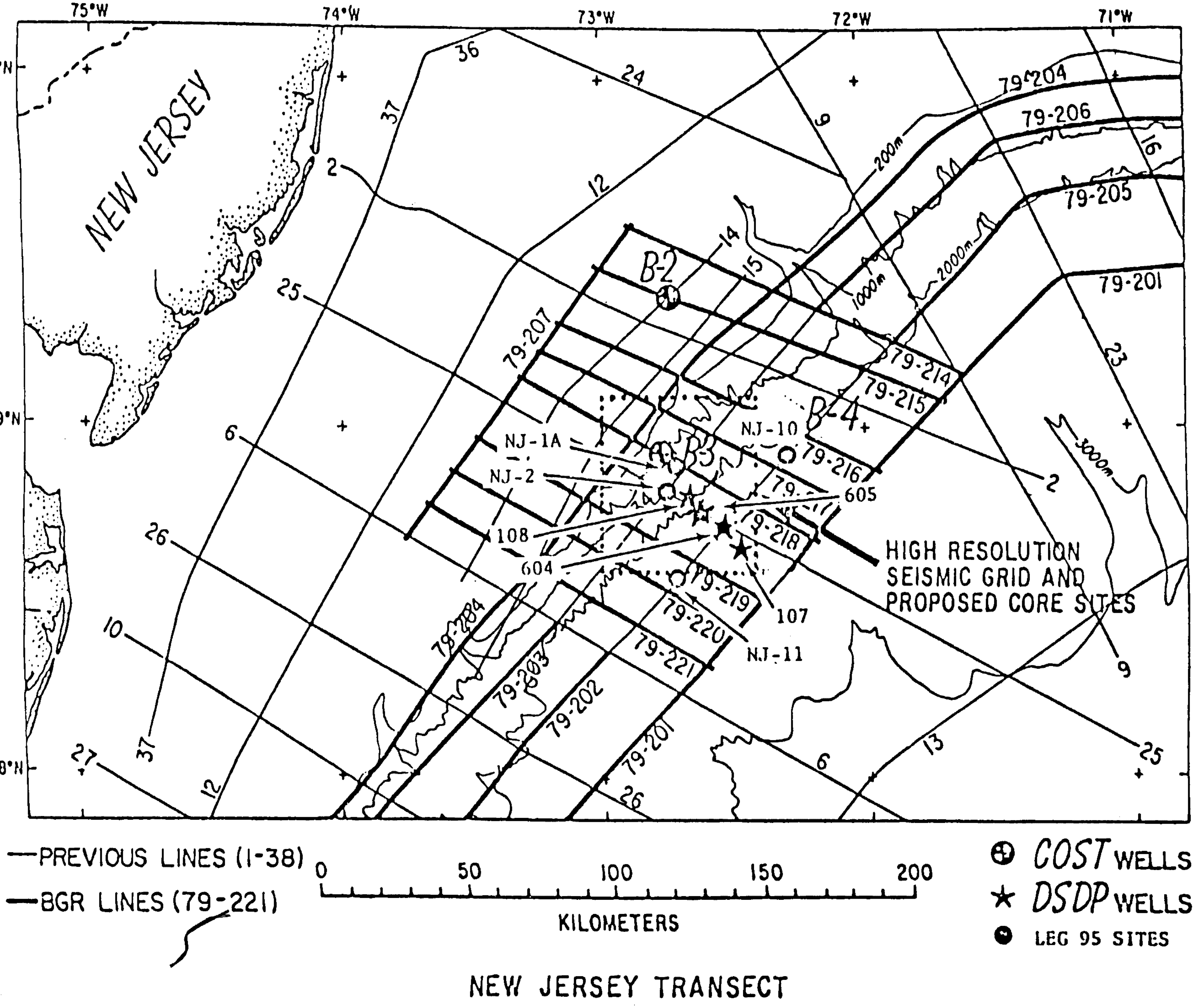
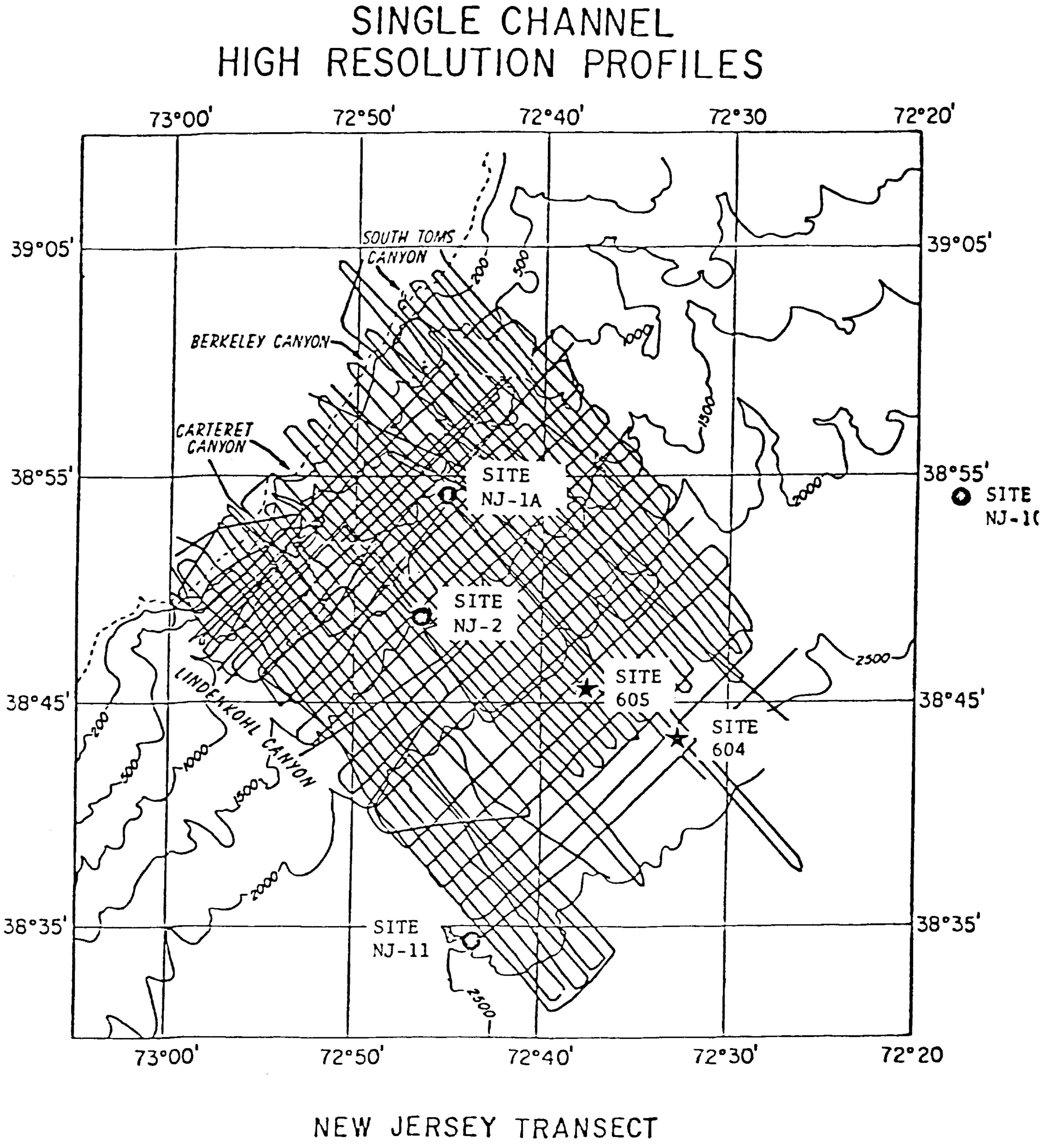


Figure 1. Chief control wells and Leg 95 sites.



USGS MULTICHANNEL SEISMIC LINES

Figure 2. Multichannel seismic grid available for studies relative to the New Jersey Transect.



○ Rotary coring sites proposed for Leg 95.

★ Rotary coring sites drilled on Leg 93.

Figure 3. Single channel high-resolution seismic grid in the New Jersey Transect area.

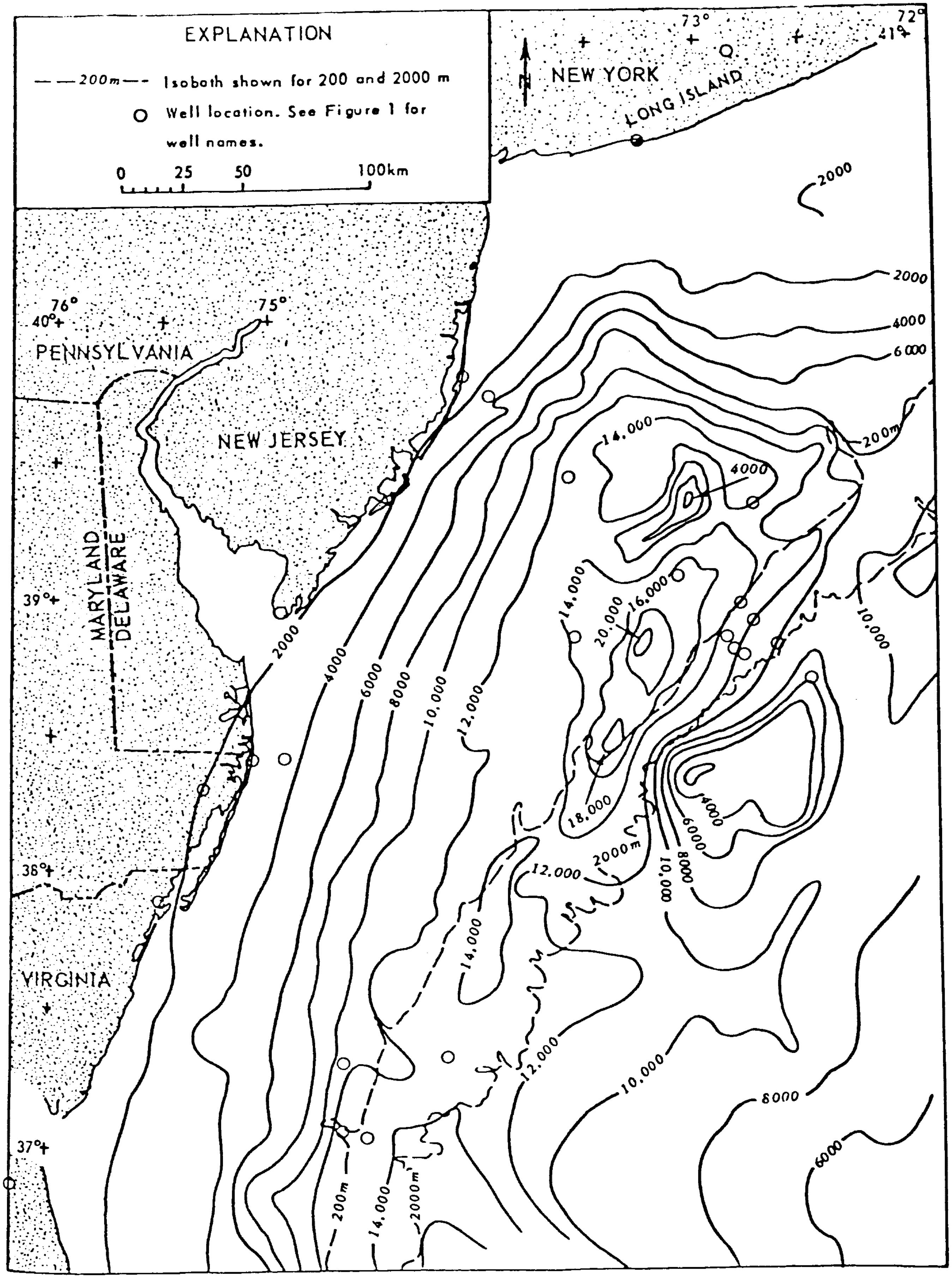


Figure 4. Isopach map of sedimentary fill in Baltimore Canyon Trough. (Data from Mattick and Bayer, 1980.)

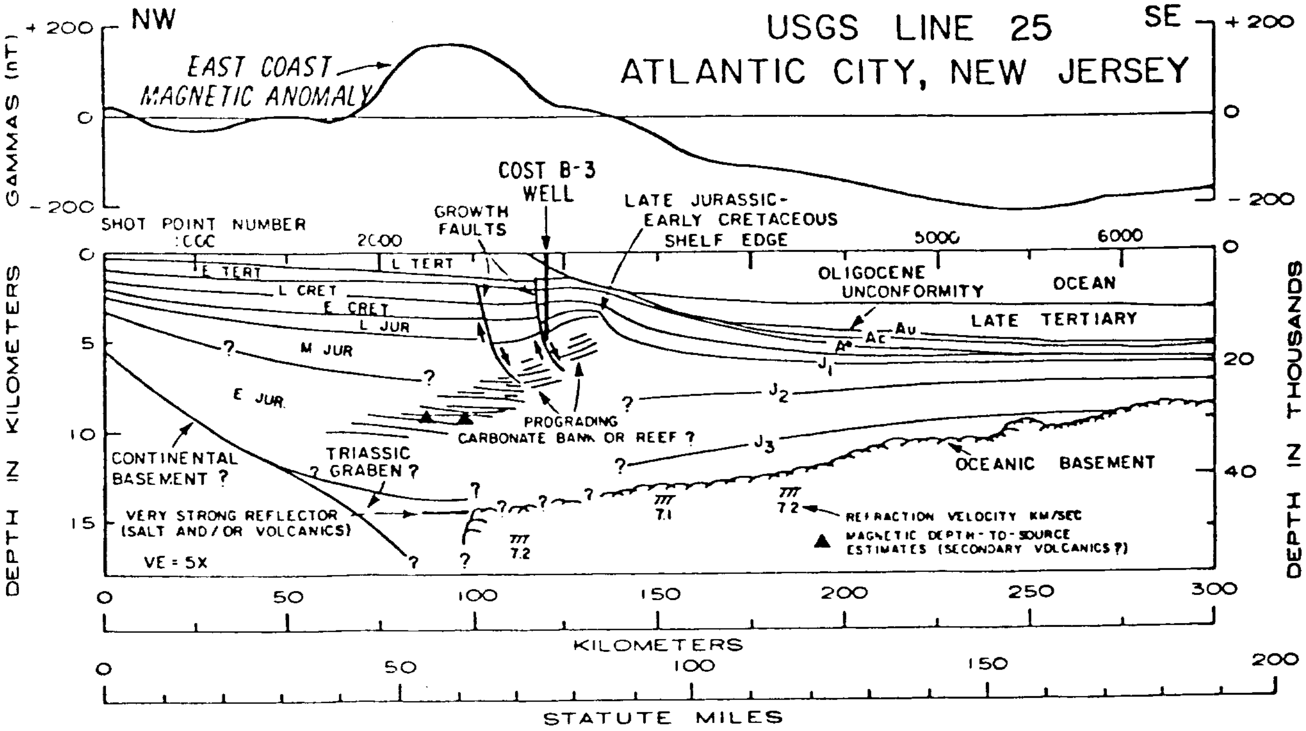


Figure 5. Schematic structural cross section of Baltimore Canyon Trough along USGS Line 25. (From Grow, 1980.)

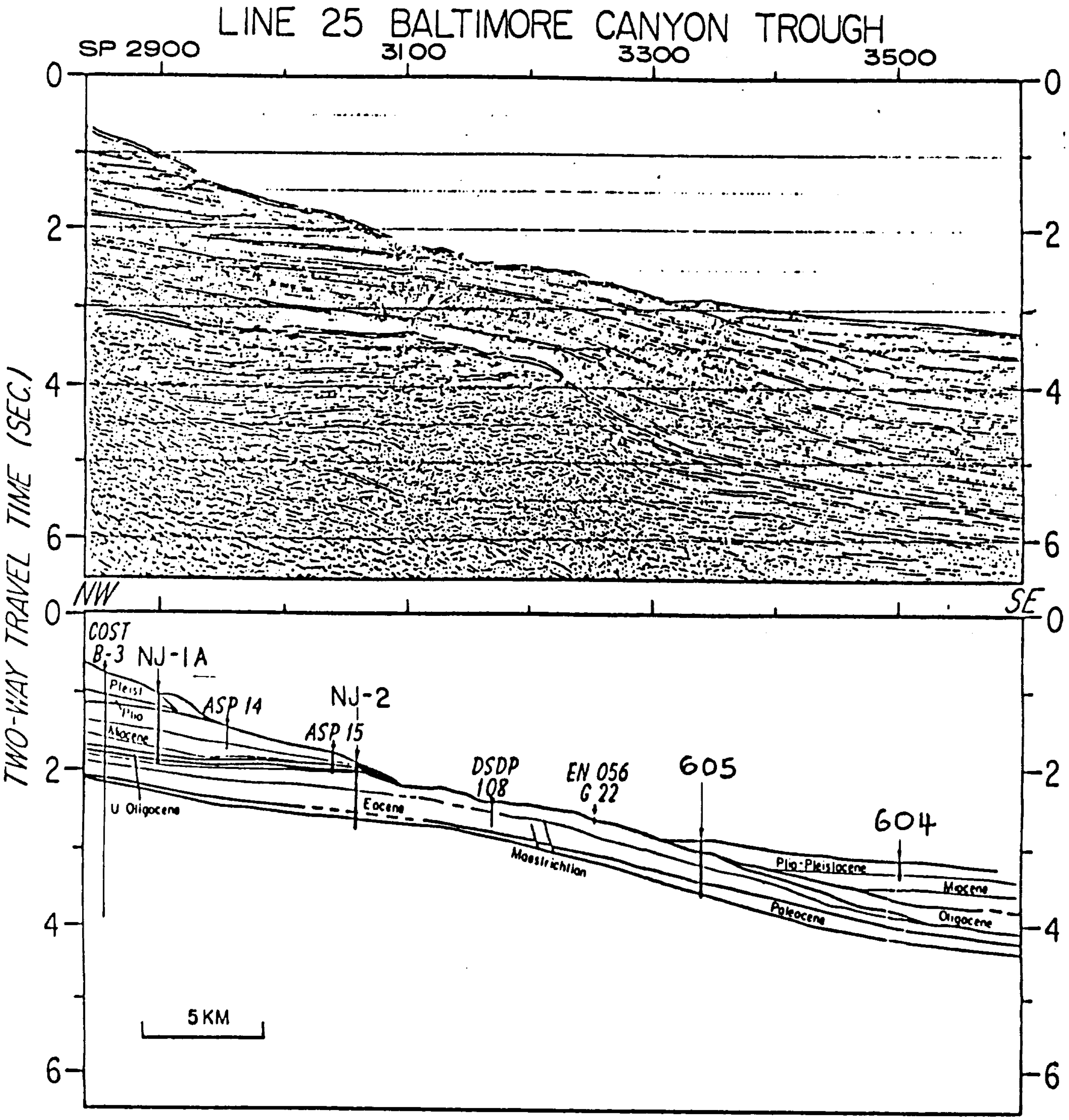


Figure 6. Leg 95 site locations and general stratigraphy along Line 25.

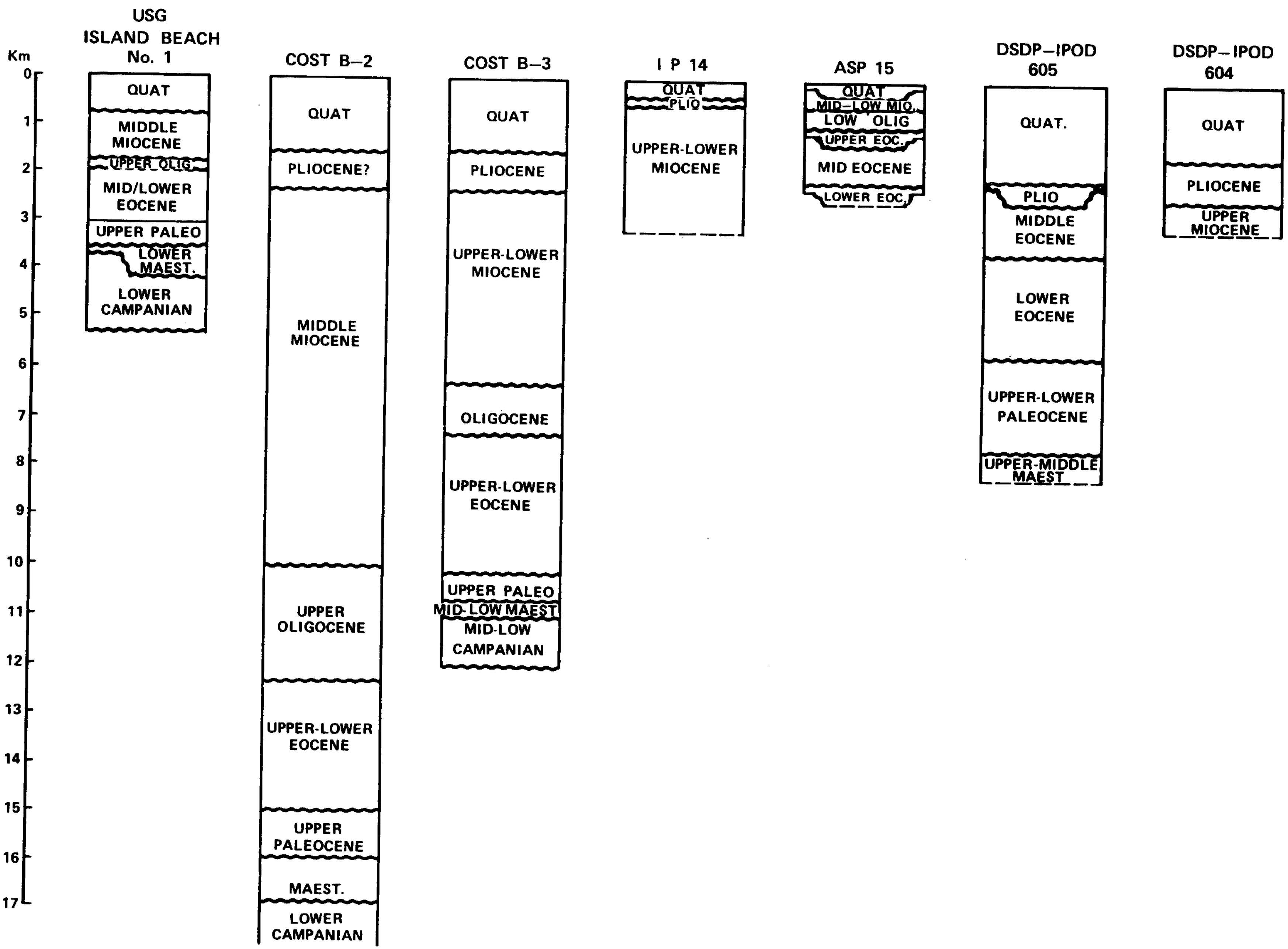
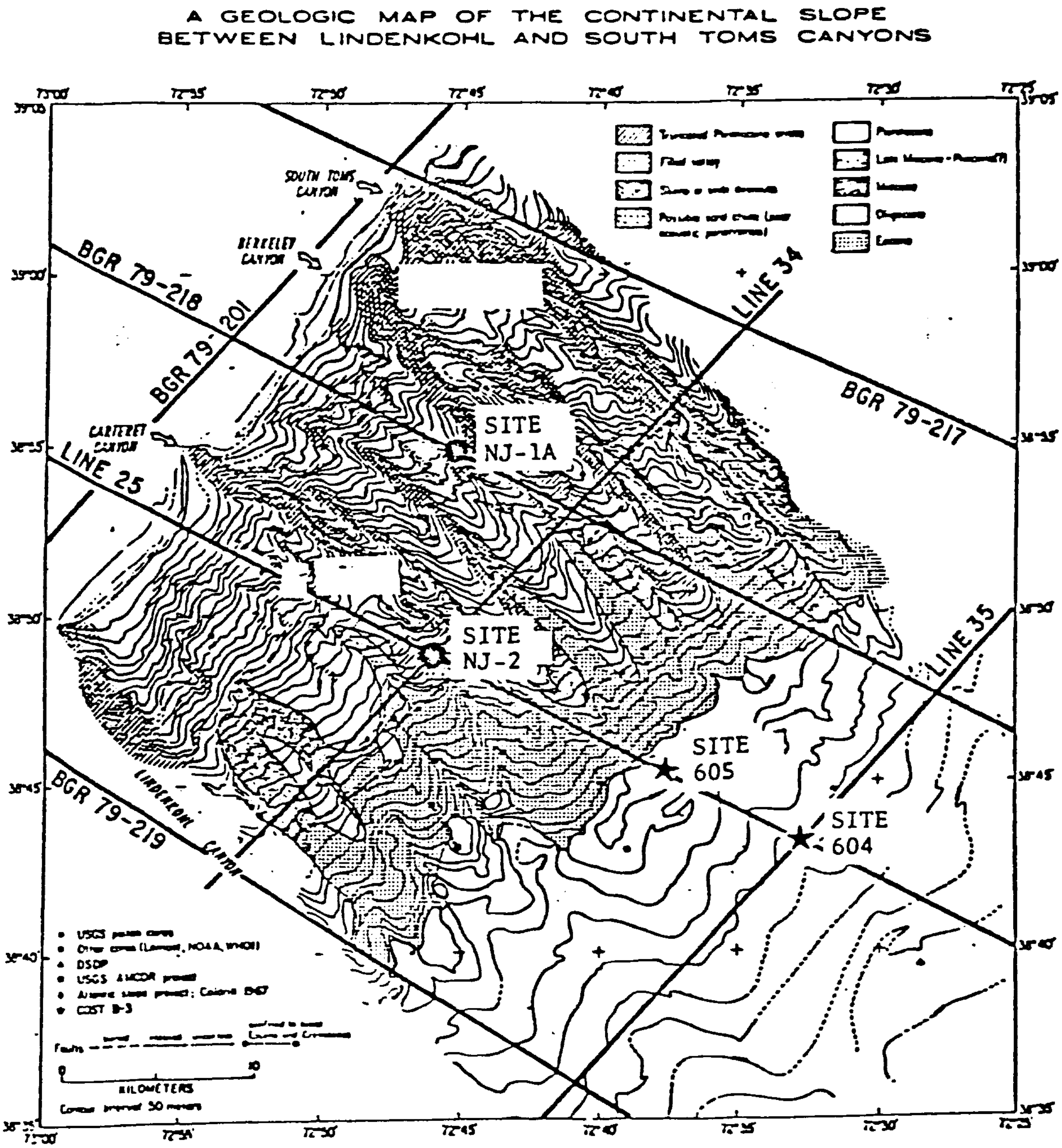


Figure 7. Stratigraphic columns for control borings in the New Jersey Transect region. Undulating lines represent unconformities.



NEW JERSEY TRANSECT

○ Rotary coring sites proposed for Leg 95.

★ Rotary coring sites drilled on Leg 93.

——— Multichannel seismic lines.

Figure 8. Geological map of New Jersey margin in vicinity of Leg 95 coring sites. (From Robb et al., 1981.)

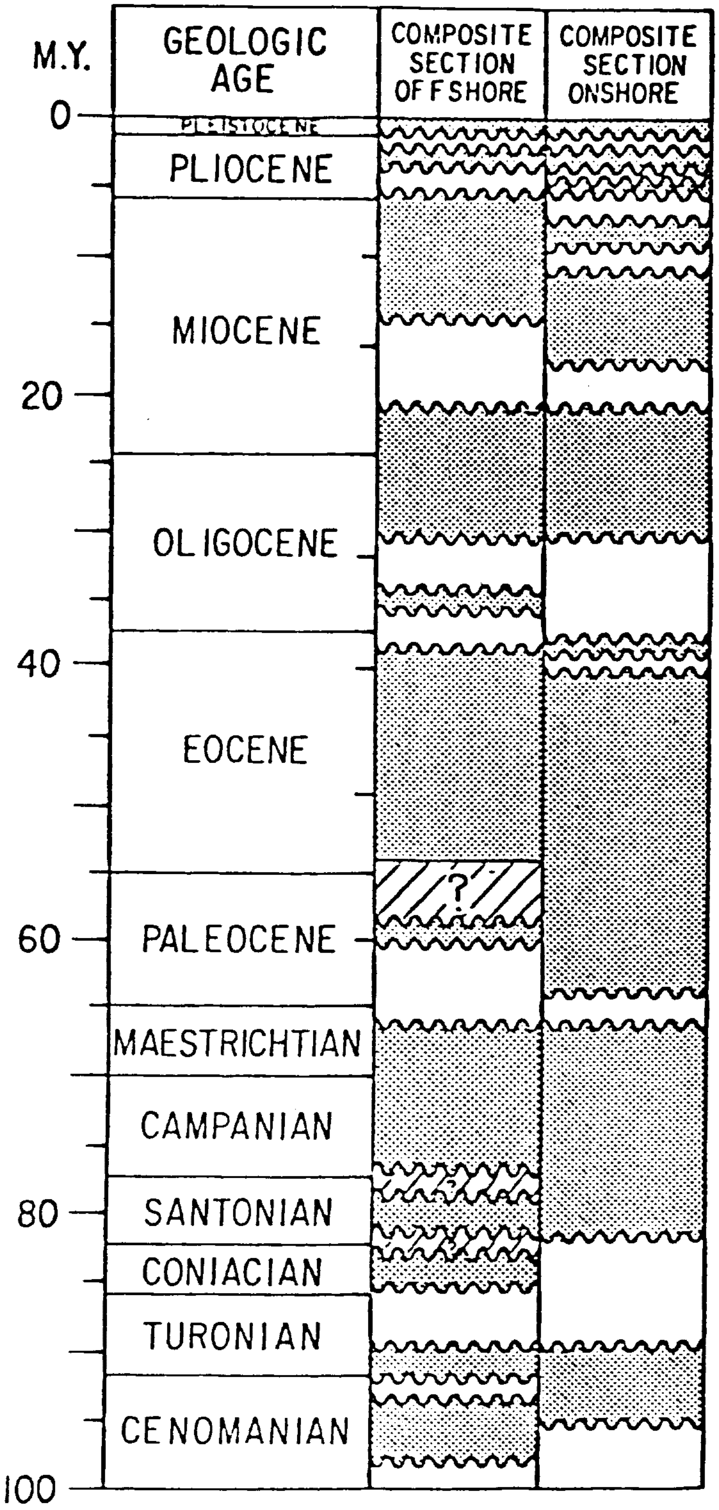


Figure 9. Composite geologic columns showing major sedimentary sequences and unconformities of Baltimore Canyon Trough.

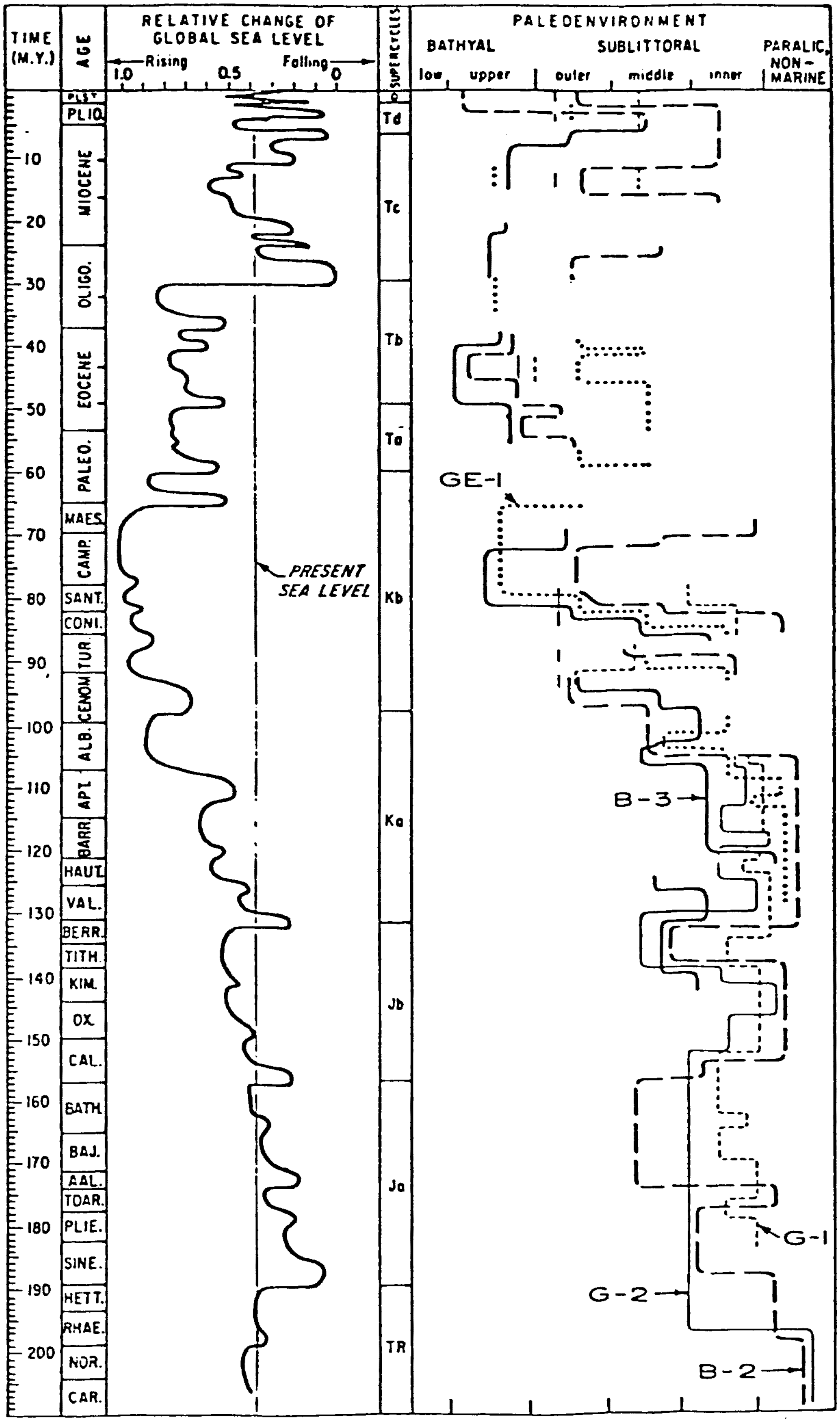


Figure 10. Comparison of sea level curve and paleoenvironmental curve for U.S. Atlantic margin wells. GE-1 well is in southeast Georgia embayment; G-1 and G-2 wells are in Georges Bank basin.

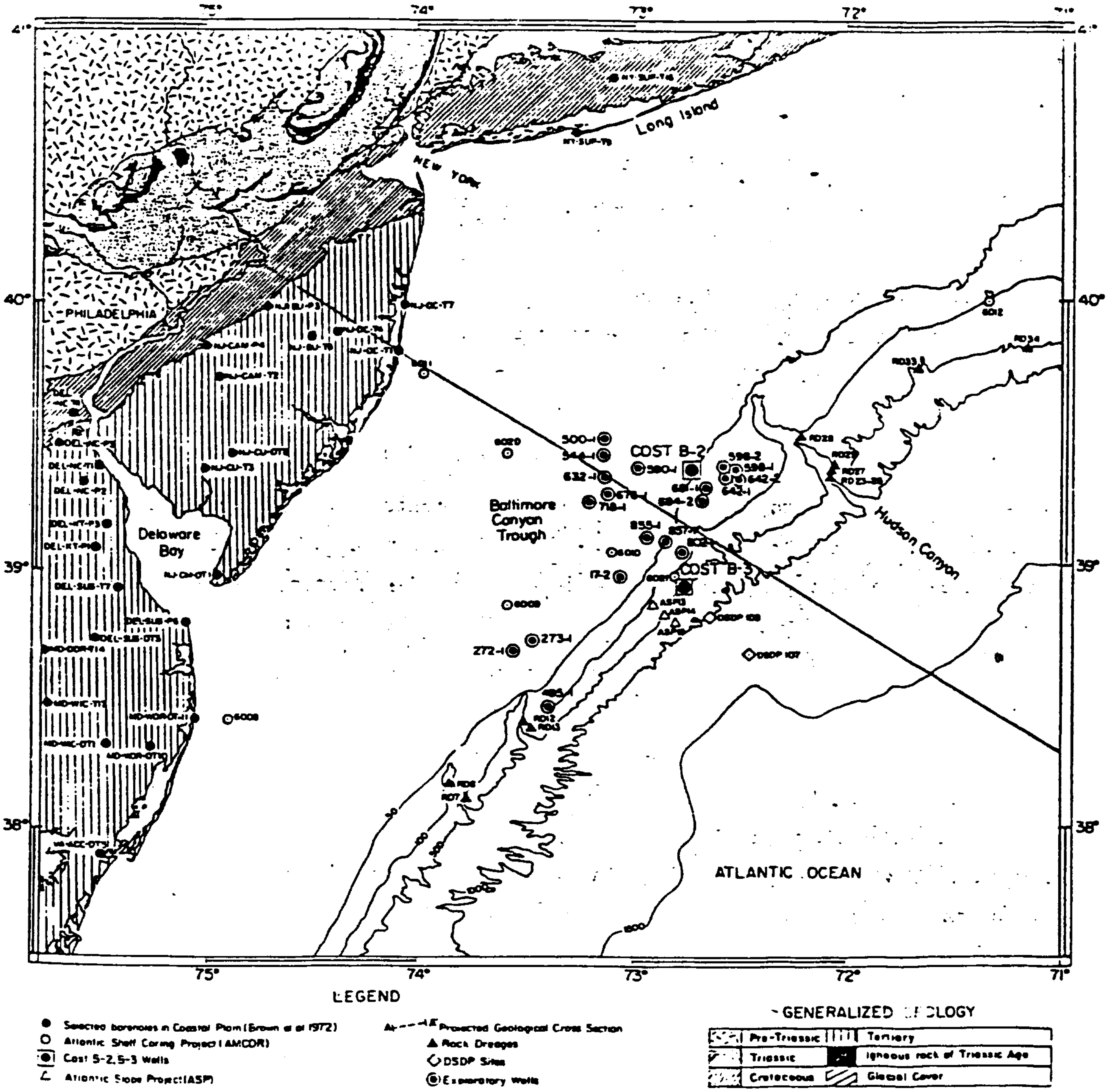


Figure 11a. Summary map showing location of COST-B-2 and B-3 wells and exploratory wells off New Jersey.

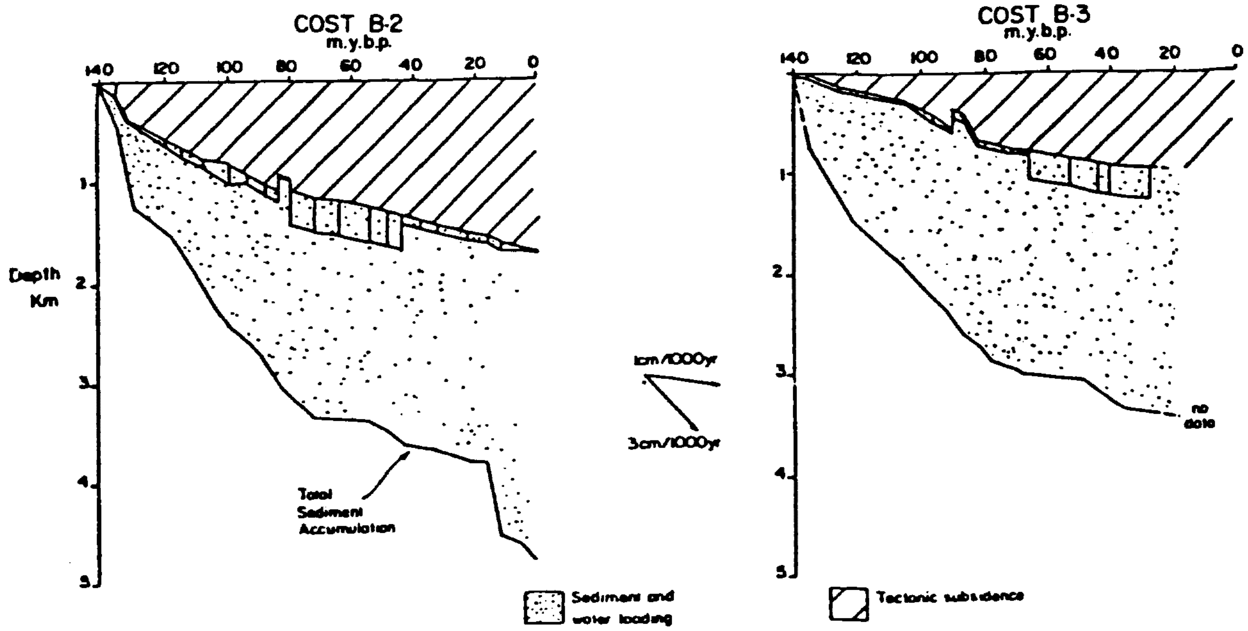


Figure 11b. Tectonic subsidence and sediment accumulation at the COST B-2 and B-3 wells. The tectonic subsidence has been computed using "backstripping" techniques.

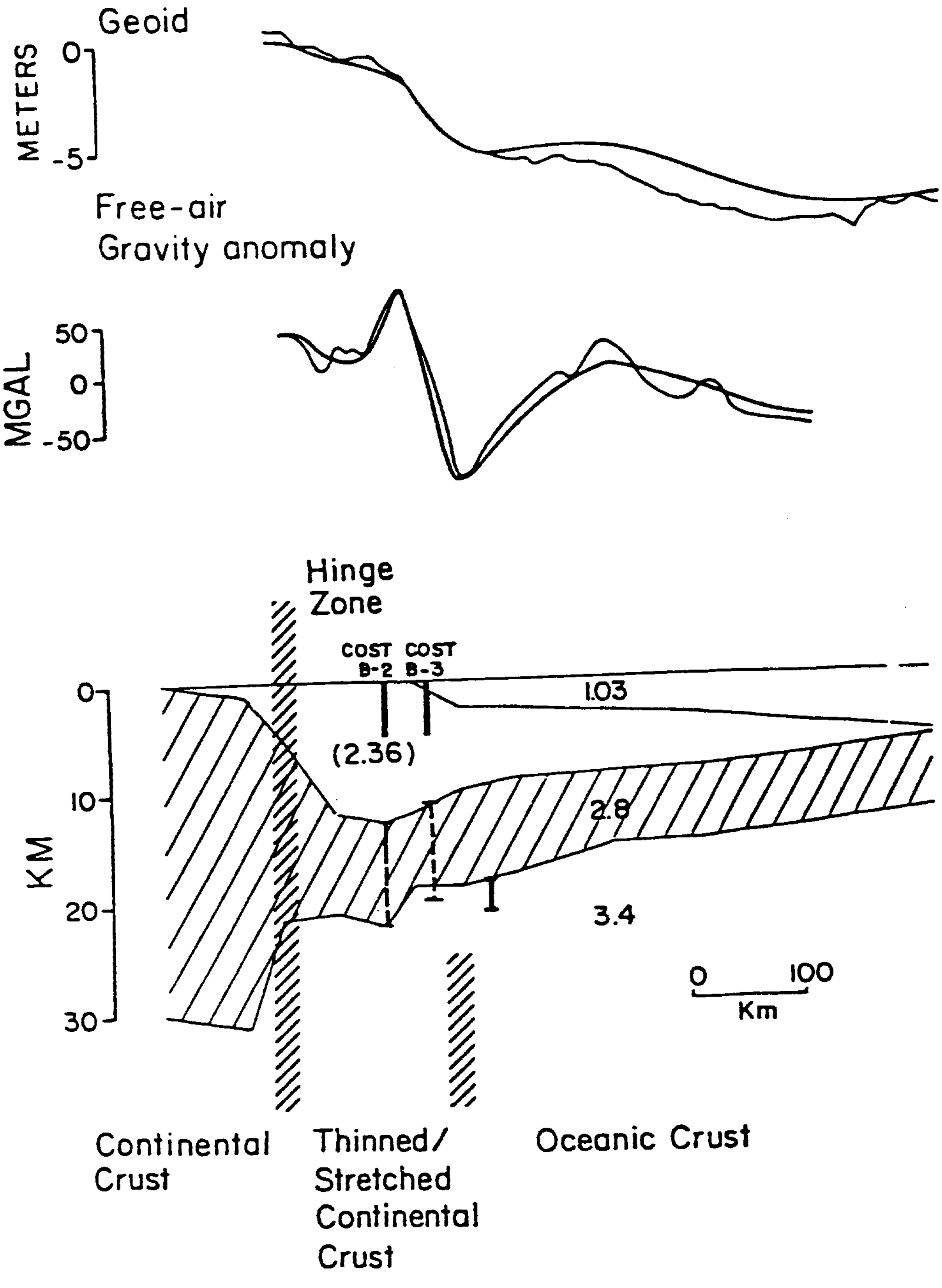


Figure 12. Simple model of the crustal structure of the Baltimore Canyon Trough bored on available seismic refraction (heavy vertical bar), well (dashed vertical bar) and gravity and geoid data.

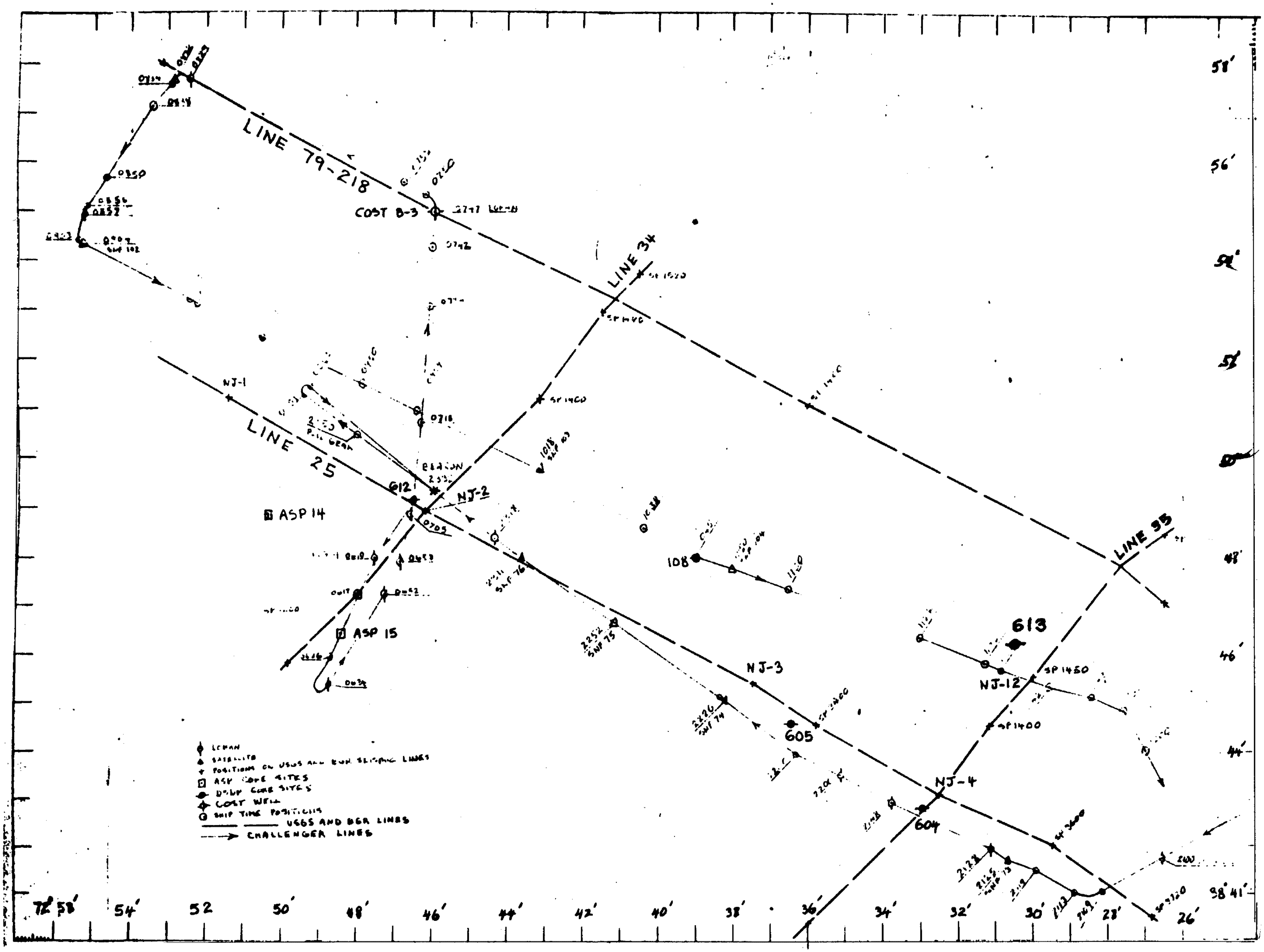


Figure 13. Map of multichannel and Challenger lines in vicinity of Sites 612, 605, 108, 604, and 613.

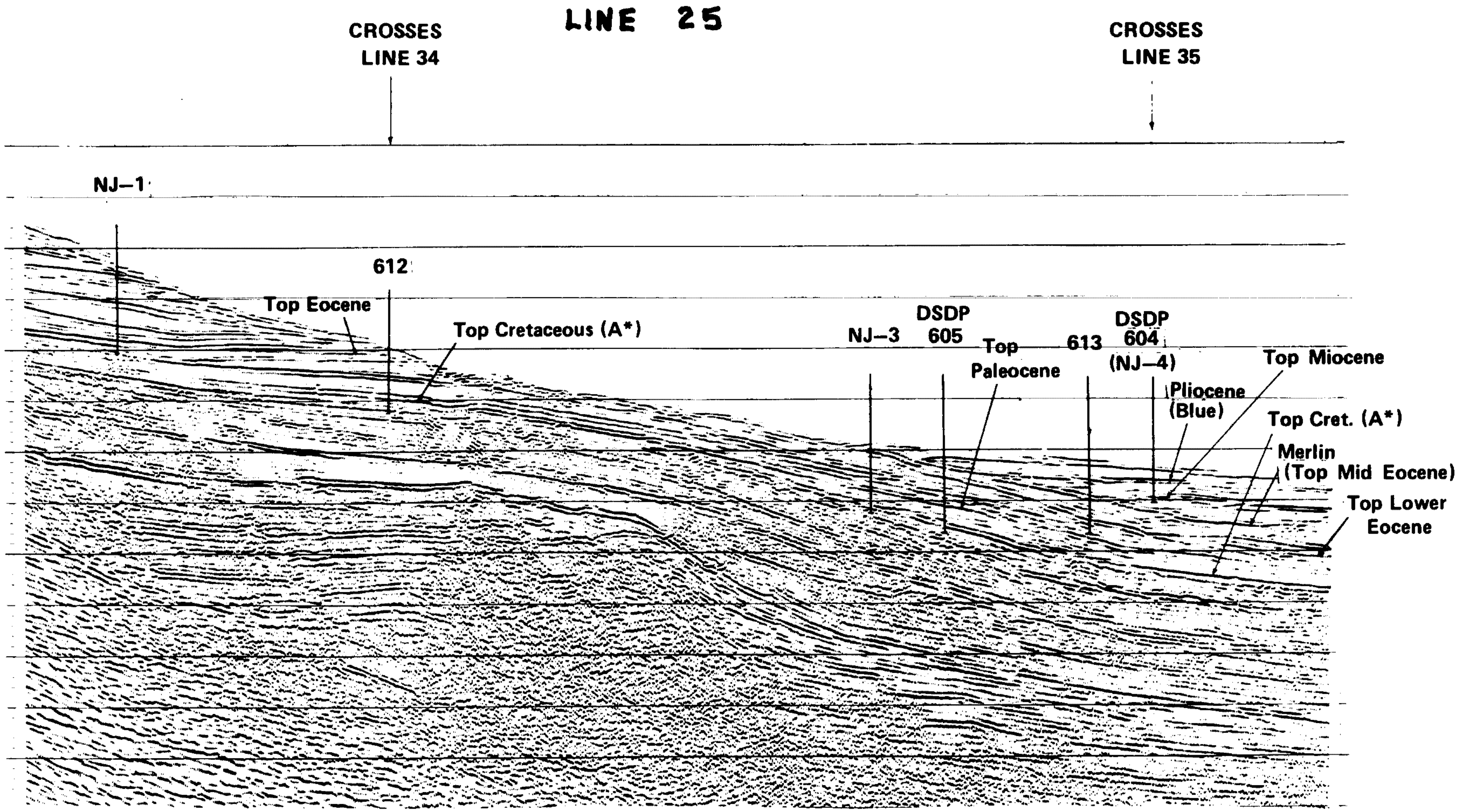


Figure 14. Segment of USGS multichannel Line 25 showing location of Sites 612, 605, 613 and 604. Sites 605 and 613 are projected onto the line.

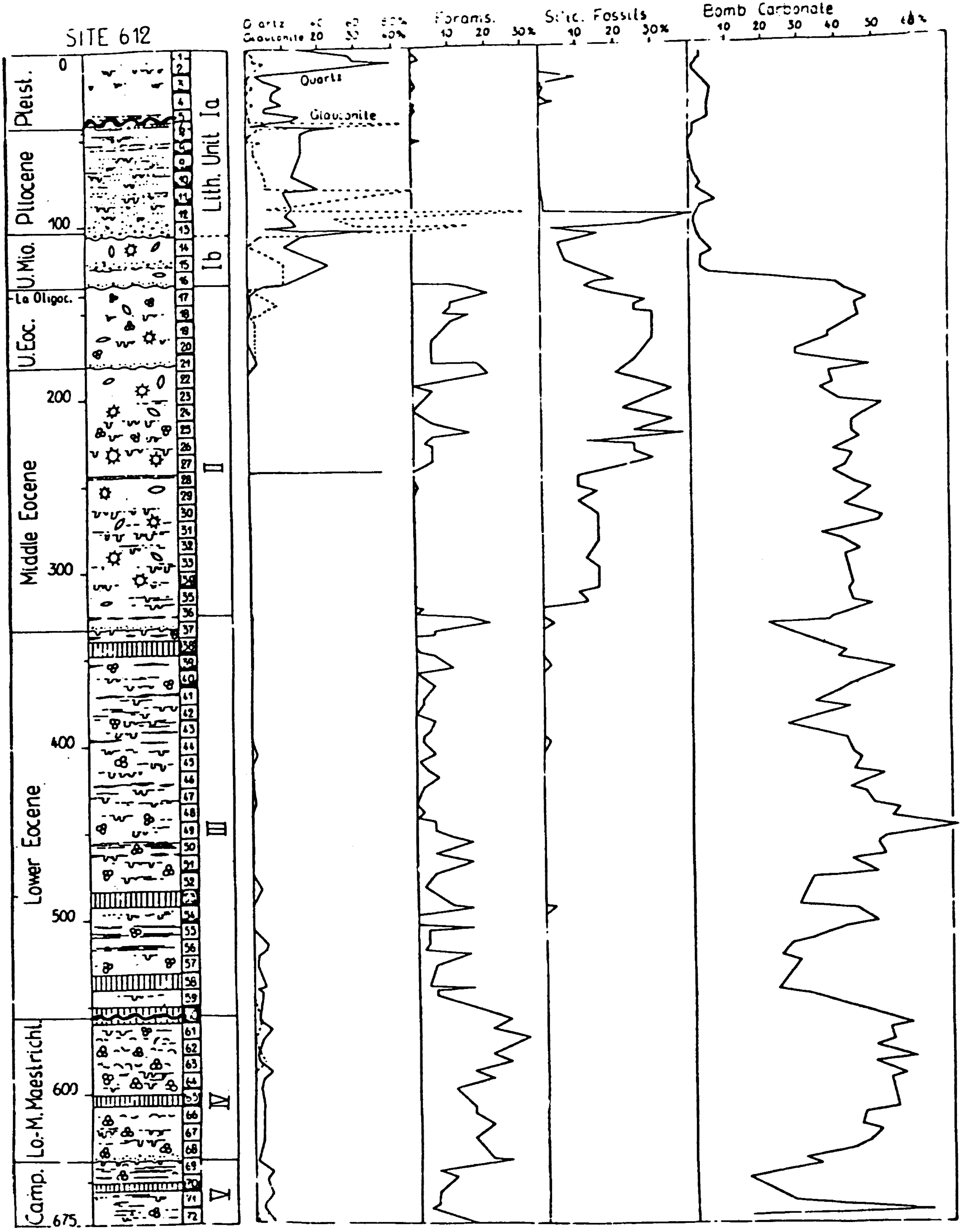


Figure 15. Lithostratigraphic column for Site 612.

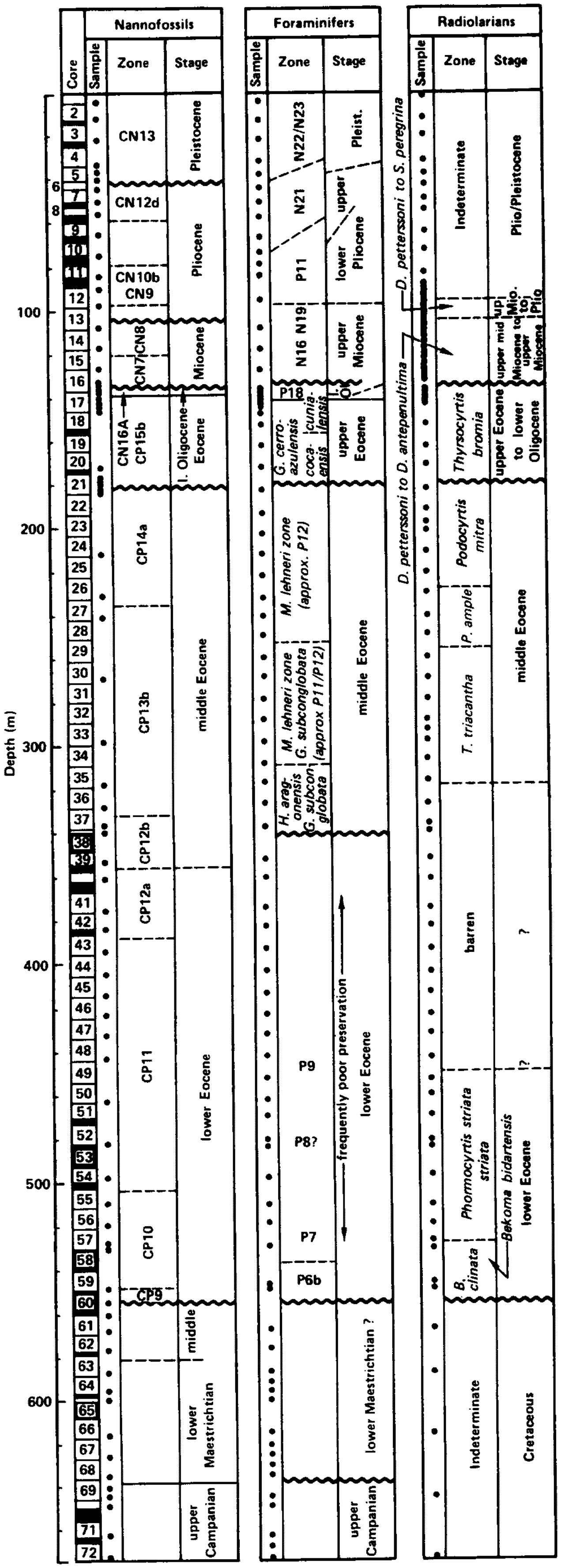


Figure 16. Biostratigraphic columns for Site 612.

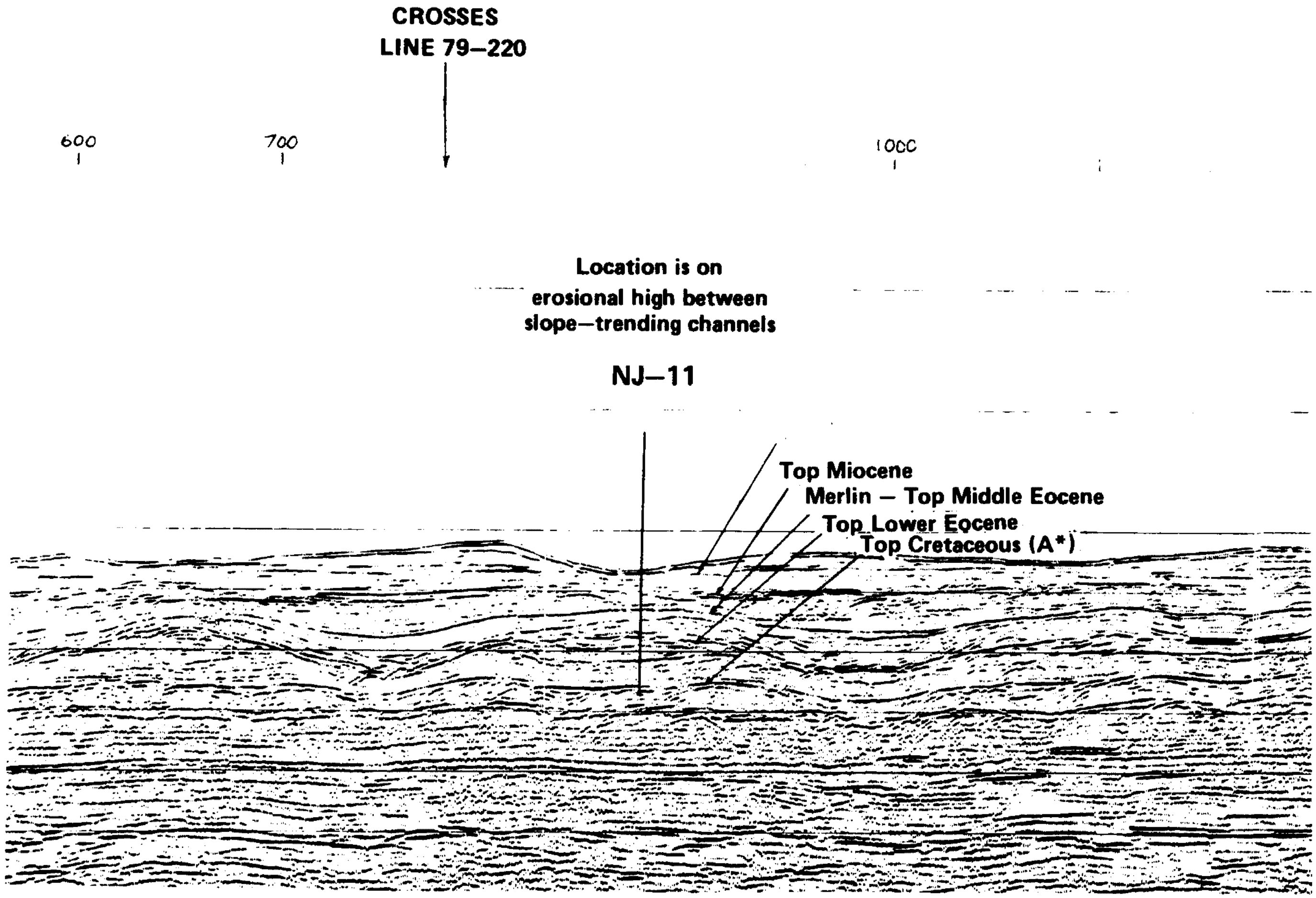


Figure 17. Segment of USGS Line 35 showing proposed locations of undrilled Site NJ-11 and NJ-10 and drilled Sites 604 and 613. Site 613 is projected to the line.

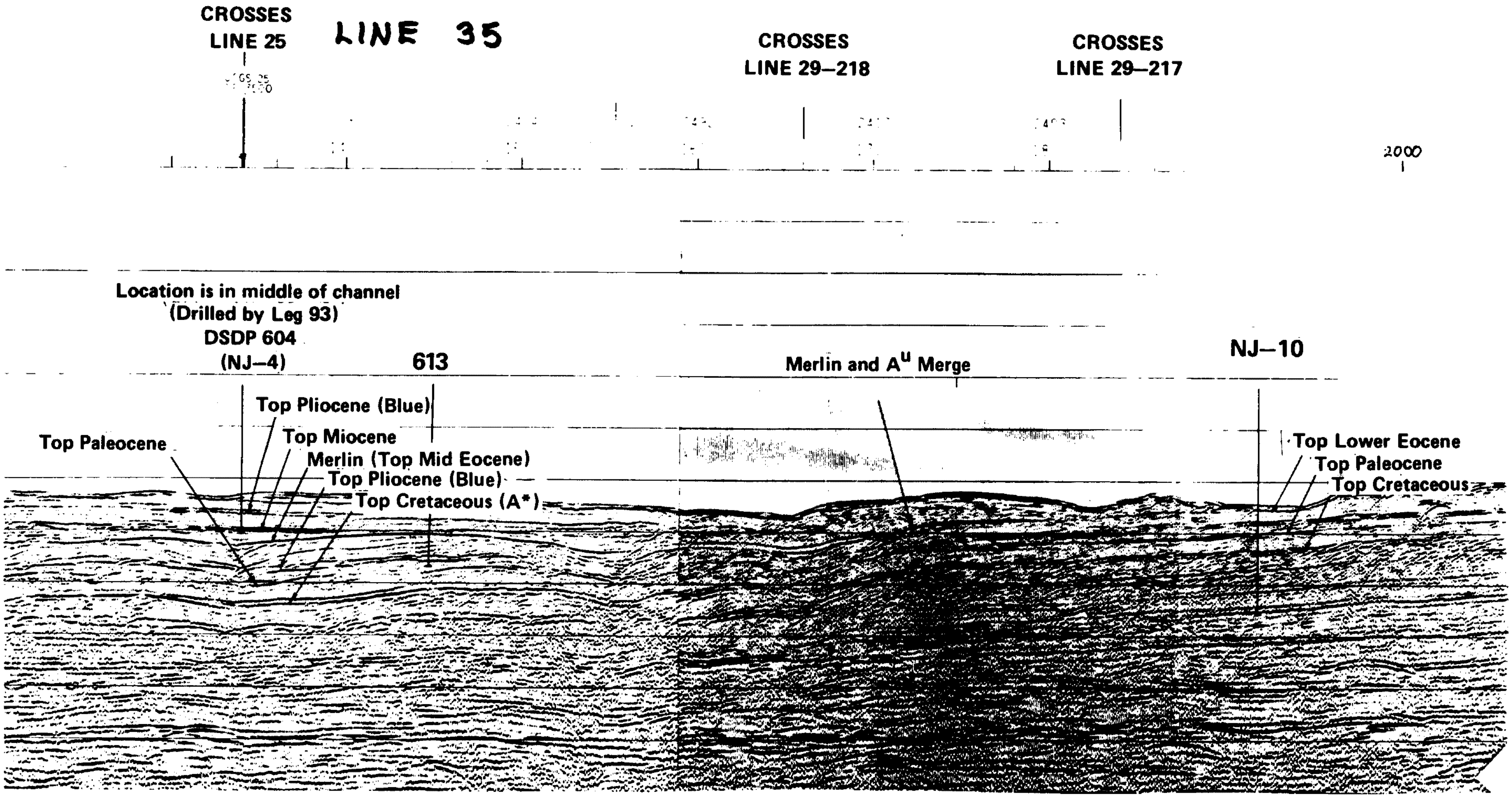


Figure 17
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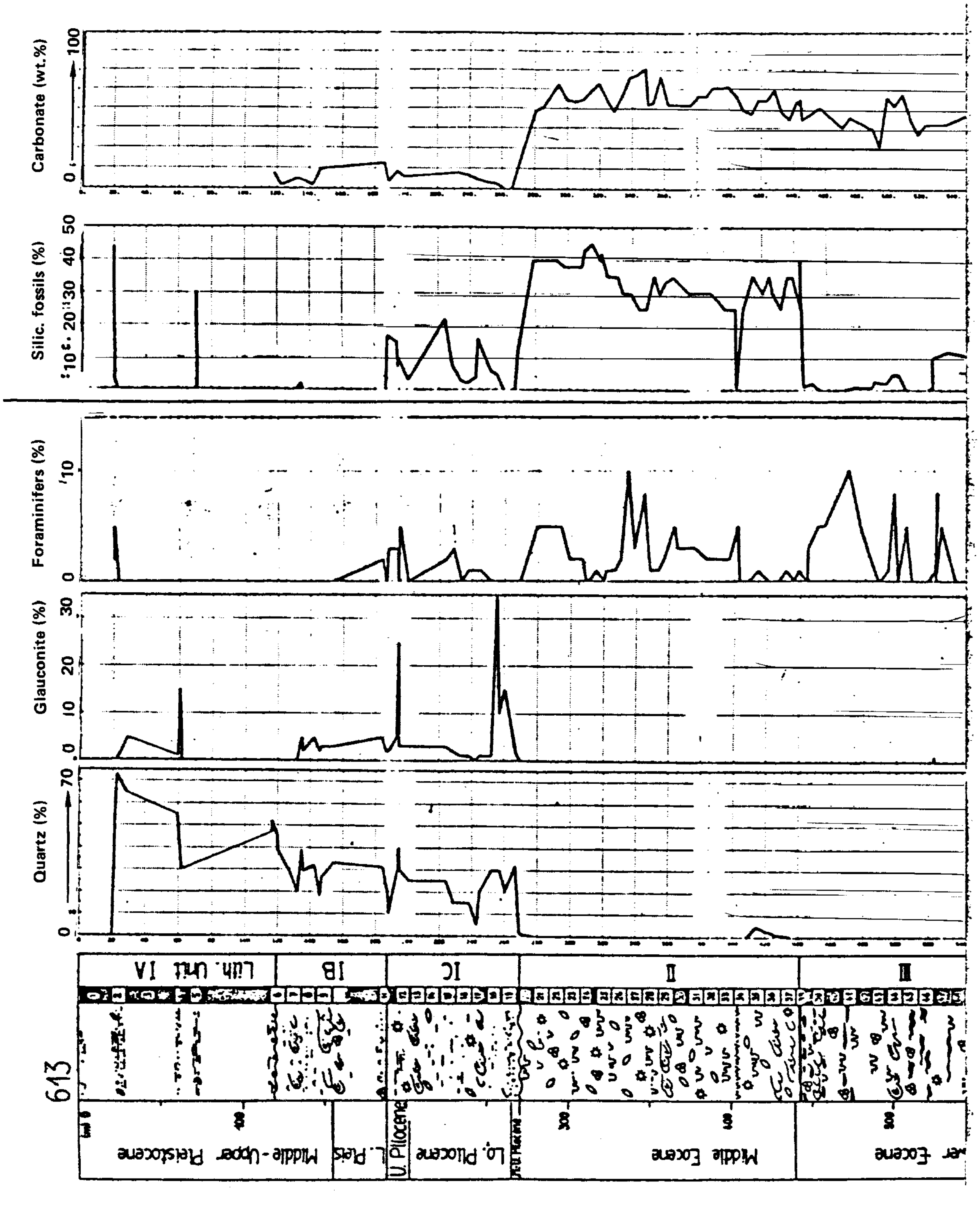

Figure 18. Lithostratigraphic column for Site 613.

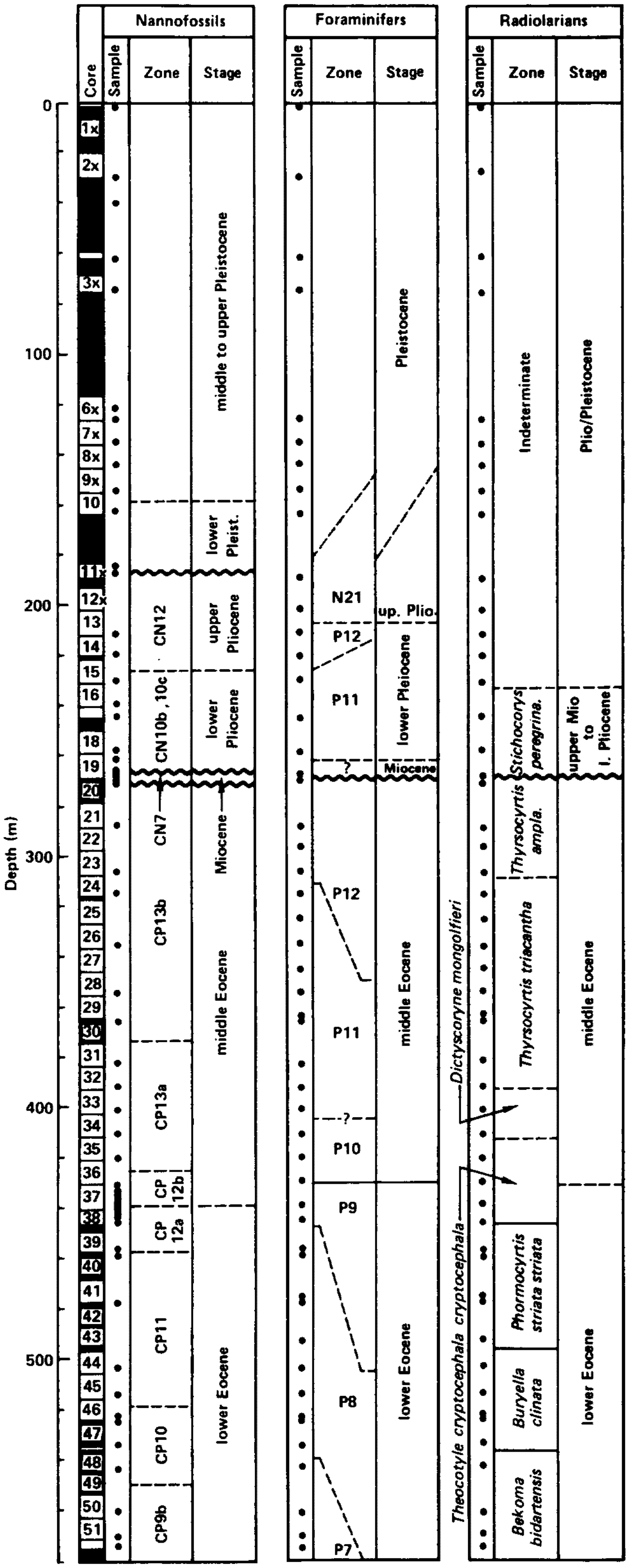

Figure 19. Biostratigraphic columns for Site 613.

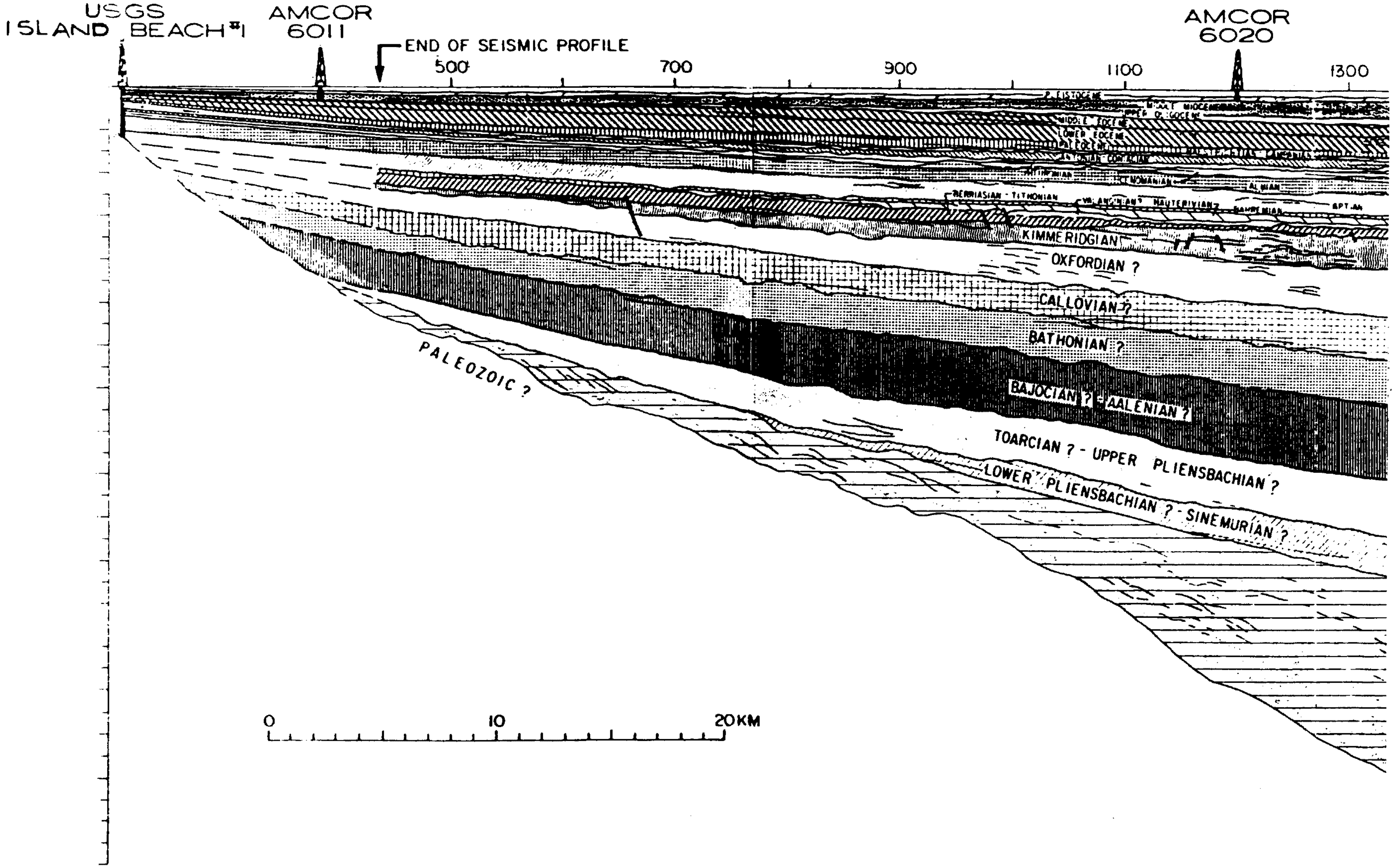

Figure 20. Chronostratigraphic section across depocenter of Baltimore Canyon Trough (from Poag, in press).

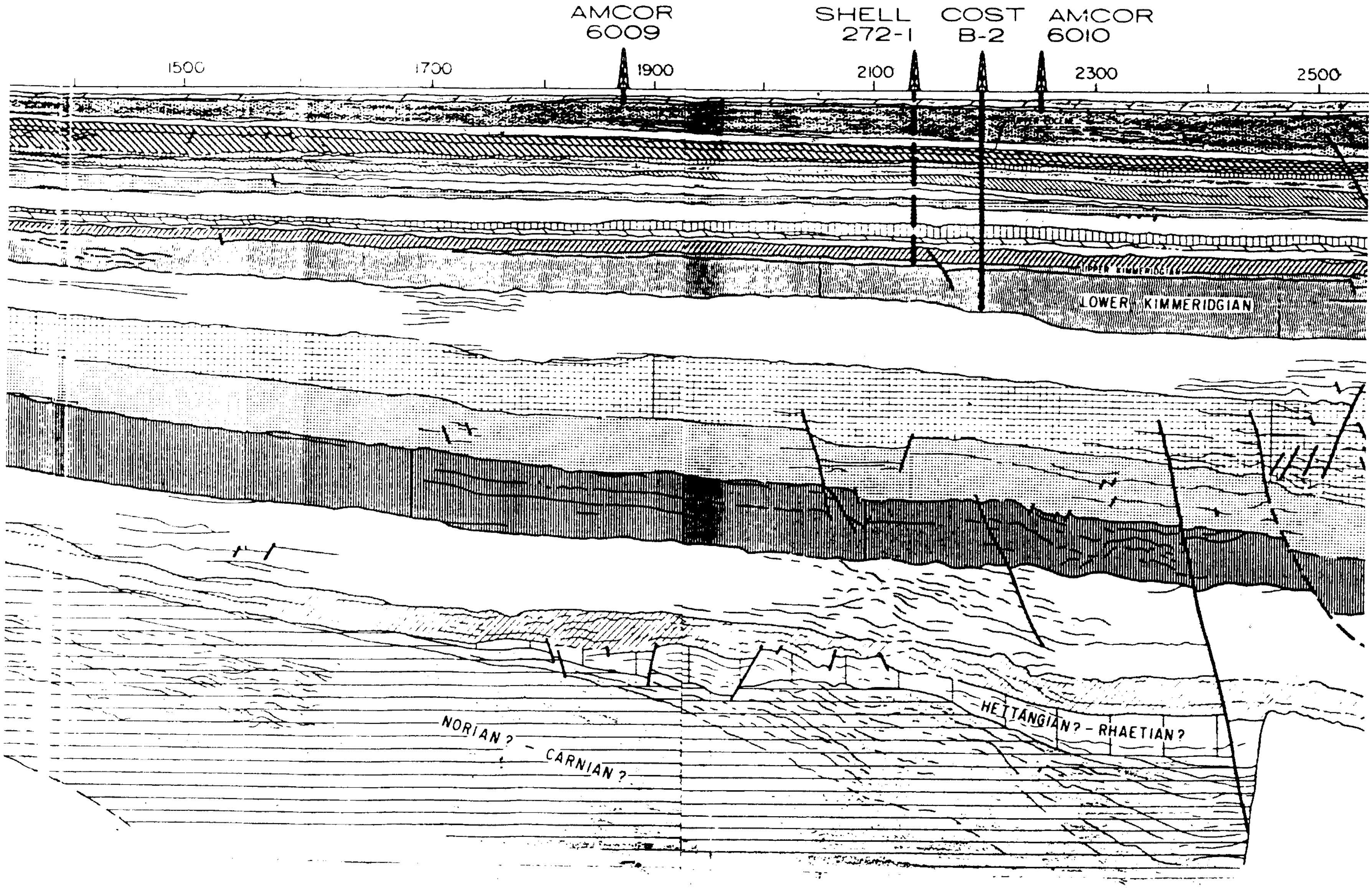

Figure 20
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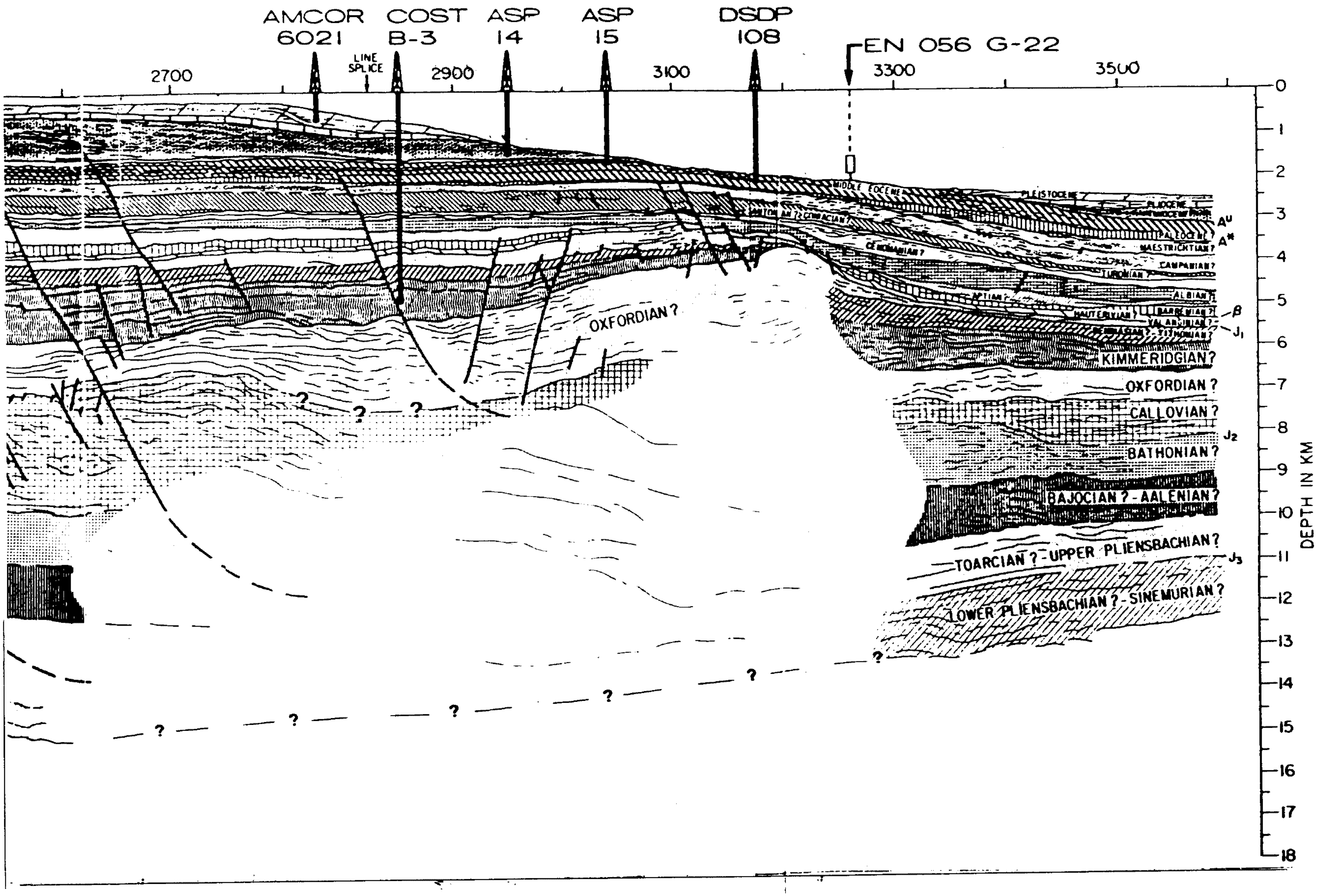

Figure 20
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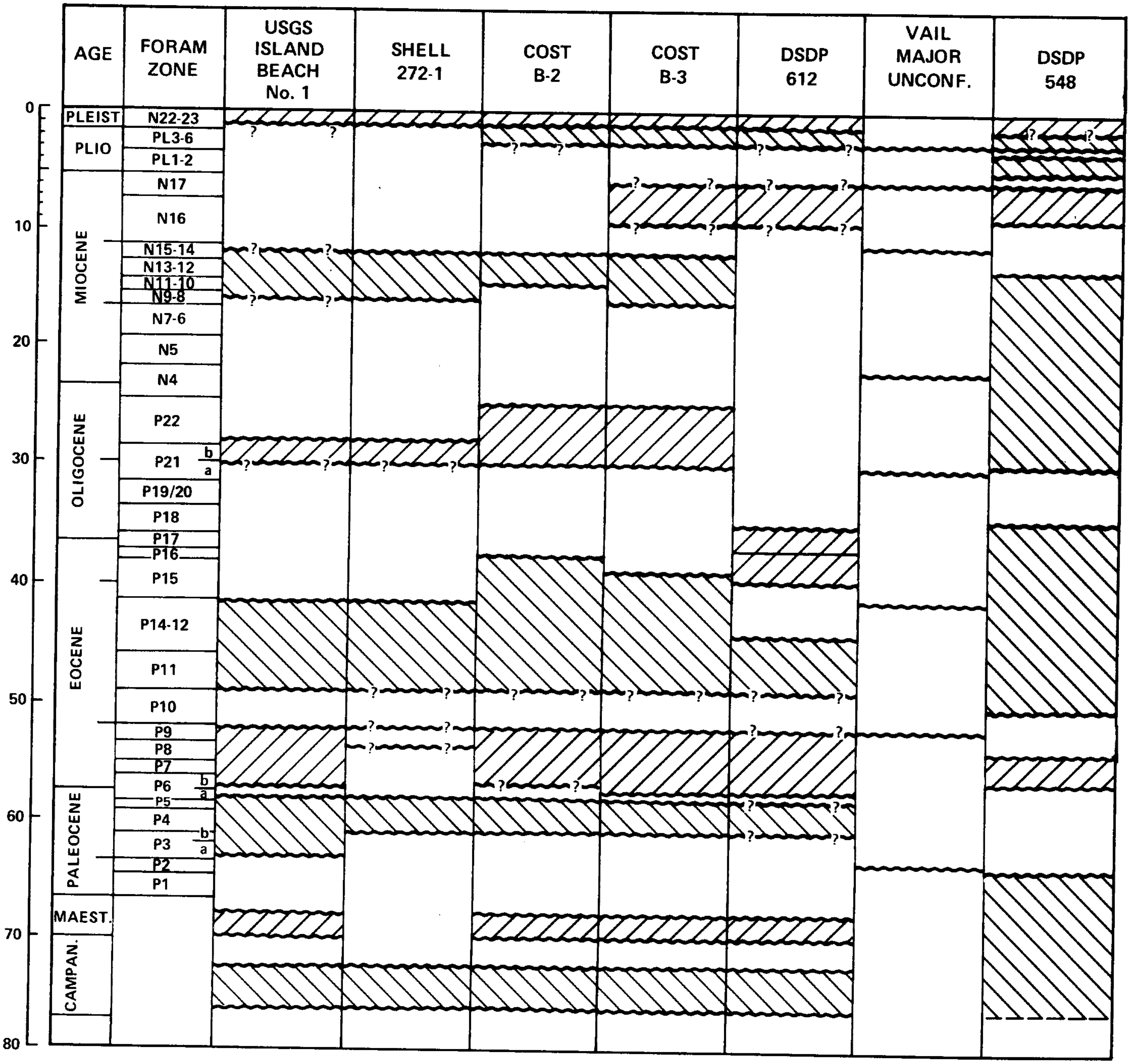


Figure 21. Comparison of depositional sequences and unconformities of New Jersey margin and Goban Spur (Site 548, Leg 89) with position of major unconformities in Vail model.

SITE 603

A. SITE SUMMARY AND PRINCIPAL RESULTS

We spent 14 days unsuccessfully attempting three times to drill a single-bit uncored hole to 1576 m, the point at which coring was terminated when Leg 93 lost its drill string. The objective was to continuously core from 1576 m to basement and log this seaward termination hole of the New Jersey Transect.

The first attempt with the PDC bit failed when gale force winds interfered with our station-keeping ability. The second attempt failed when the standard rotary core bit wore out. Logging during another gale was not successful

There were no significant scientific results from these efforts.

SITE 603

HOLE 603D

Date Occupied: 1 September 1983

Date Departed: 3 September 1983

Time on Hole: 53 hours

Position (latitude; longitude): 38°29.986'N; 70°01.407'W

Water depth (sea level; corrected m, echo-sounding): 4641

Water depth (rig floor; corrected m, echo-sounding): 4651

Bottom felt (m, drill pipe): 4652

Penetration (m): 639.7

Number of cores: 1

Total length of cored section (m): 9.6

Total core recovered (m): 9.47

Core recovery (%): 98.6

Oldest sediment cored:

Depth sub-bottom (m): 208.6

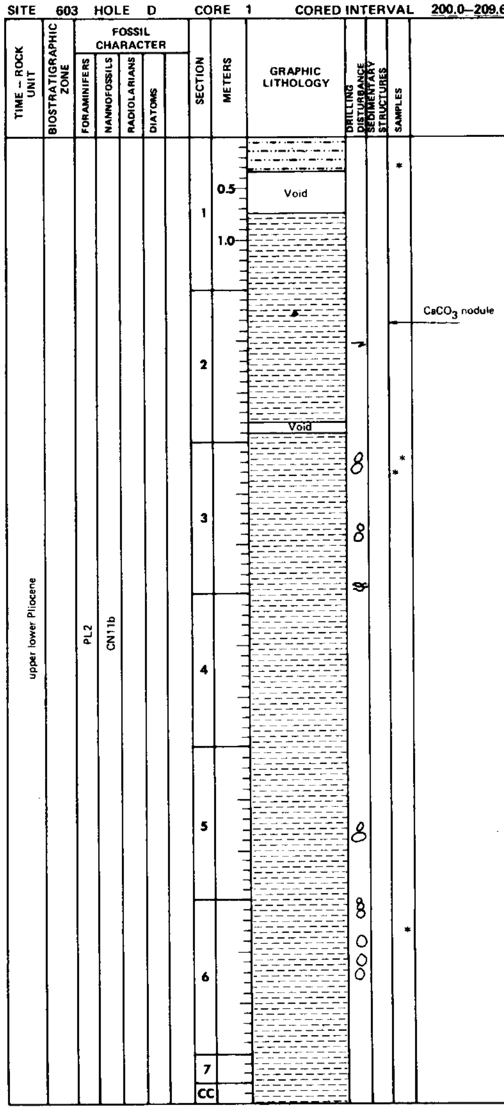
Nature: nannofossil, silty mud to silty clay

Age: M. Pliocene

Measured velocity (km/s): NA

Basement: Not attempted

SITE 603 HOLE D CORE 1 CORED INTERVAL 200.0–209.6 m



LITHOLOGIC DESCRIPTION

SILTY NANNOFOSSIL MUD to CLAY (near bottom), dark greenish gray (5GY 4/1), uniform massive structureless silty mud to mud. The upper part of the core contains nannofossil silt (~5% or less) which disappears toward the base. A few foraminifer fragments were present in the smear slides.

Sediment is unburrowed but was very gassy and self extruded.

SMEAR SLIDE SUMMARY (%):

	1, 30	3, 20[a]	3, 30	6, 30
Texture:				
Sand	4	–	3	1
Silt	15	–	8	5
Clay	81	–	89	94
Composition:				
Quartz	4	–	2	1
Mica	1	–	2	3
Heavy minerals	1	–	2	2
Clay	81	–	88	94
Glauconite	1	–	–	–
Pyrite	3	–	2	–
Carbonate unspec.	1	95	1	–
Calc. nannofossils	6	5	3	4
Discoasters	3	–	–	–

[a] Nodule

SITE 603

HOLE 603E

Date Occupied: 3 September 1983

Date Departed: 10 September 1983

Time on Hole: 157.8 hours

Position (latitude; longitude): 35°29.98'N; 70°01.367'W

Water depth (sea level; corrected m, echo-sounding): 4641

Water depth (rig floor; corrected m, echo-sounding): 4651

Bottom felt (m, drill pipe): 4652

Penetration (m): 1290

Number of cores: 1

Total length of cored section (m): 9.6

Total core recovered (m): 0.58

Core recovery (%): 6.0

Oldest sediment cored:

Depth sub-bottom (m): 946.0

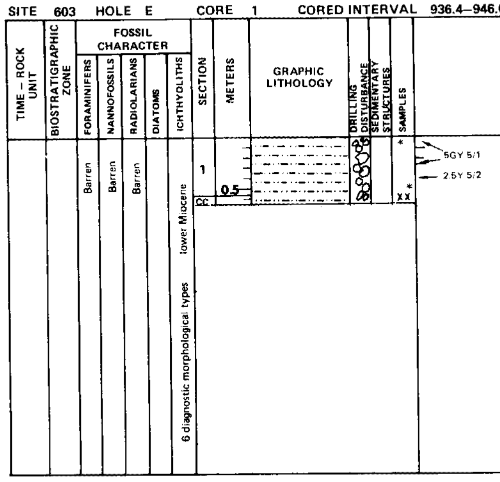
Nature: mudstone

Age: L(?)-M. Miocene

Measured velocity (km/s): NA

Basement: Not attempted.

SITE 603 HOLE E CORE 1 CORED INTERVAL 936.4–946.0 m



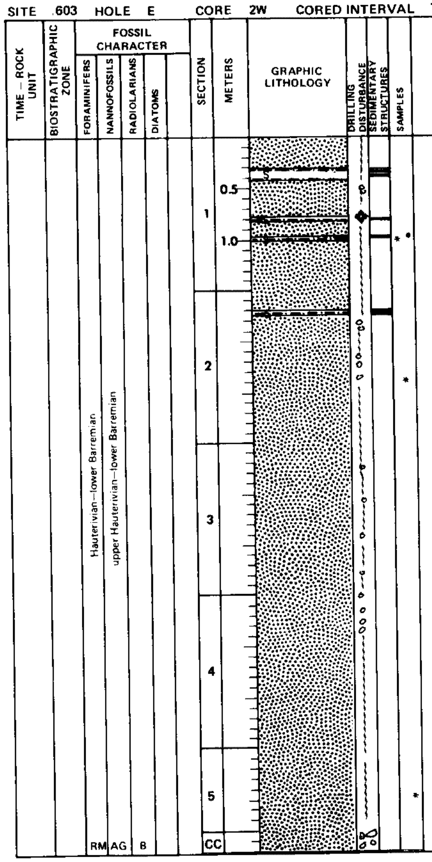
LITHOLOGIC DESCRIPTION

MUDSTONE, greenish gray (5GY 5/1) and grayish brown (2.5Y 5/2). Sharp contacts between colors. Sporadic burrow mottles of grayish brown in greenish gray interval. Large glauconite grains (coarse sand to granule) at 0–5 cm. Rare, very dark gray granules (pyrite?) in the grayish brown intervals. Numerous pits on split surface of core indicate medium sand-sized grains plucked from core; dolomite?

SMEAR SLIDE SUMMARY (%):

	1, 2 M	1, 52 D
Texture:		
Silt	50	50
Clay	50	50
Composition:		
Quartz	44	44
Mica	5	5
Heavy minerals	TR	TR
Clay	50	50
Glauconite	TR	–
Pyrite	TR	TR
Zeolite	1	1

SITE 603 HOLE E CORE 2W CORED INTERVAL 1258.0–1271.4 m



LITHOLOGIC DESCRIPTION

SAND with siderite-rich MUDSTONE INTERBEDS. The entire core is dark olive gray (5Y 3/2) and is very much disturbed by coring (wash). The sands are medium to coarse grained quartz plus a great deal of heavy mineral sand. The heavies are fresh (extremely so) and unabraded, of metamorphic origins.

The silty-clay (mudstones) are mm lamina with considerable muscovite on bedding. Nannofossils are well preserved. Fine organic fragments (?wood?) are also present.

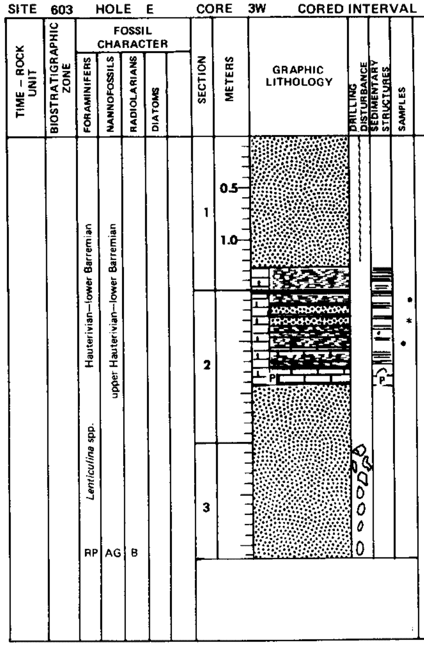
SMEAR SLIDE SUMMARY (%):

	1, 100	2, 92	5, 45
Texture:			
Sand	1	80	70
Silt	59	19	30
Clay	40	1	TR
Composition:			
Quartz	3	70	60
Feldspar	–	10	10
Mica	–	–	2
Heavy minerals	–	18	26
Clay	25	–	–
Pyrite	2	–	–
Zeolite	TR	–	–
Carbonate unspec.	40	–	–
Calc. nannofossils	–	1	1
Fish remains	TR	–	–
Plant debris	30	–	–
Opaques	–	1	1

ORGANIC CARBON AND CARBONATE (%):

	1, 97
Organic carbon	3.42
Carbonate LECO	54.81
+ (siderite) BOMB	43.00

SITE 603 HOLE E CORE 3W CORED INTERVAL 1277.0–1279.0 m



LITHOLOGIC DESCRIPTION

General color: 5Y 4/1 sands and black (5Y 2.5/1) for limestone to shale sections.

Sands, coarse fairly well sorted, very fresh angular grains with coring artifacts, breccias of limestone to shale fragments (coring) and LIMESTONE is less laminar to massive. The shale to limestones range from finely laminar shale (mm) to somewhat burrowed, to small slump sections (pyrite cemented). One segment in Section 2 has an elegant fine scoured surface overlain by a 3 cm weakly graded bed (silty).

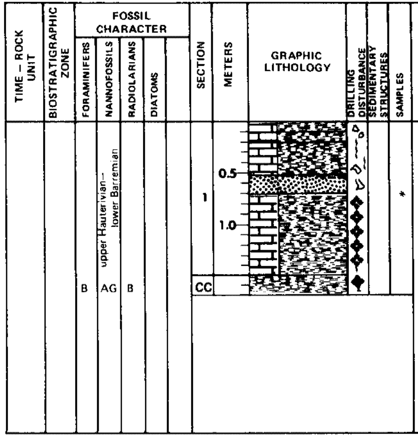
SMEAR SLIDE SUMMARY (%):

	2, 35
Texture:	
Sand	8
Silt	26
Clay	66
Composition:	
Quartz	3
Mica	1
Clay	66
Pyrite	TR
Zeolite	TR
Carbonate unspec.	5
Calc. nannofossils	25

ORGANIC CARBON AND CARBONATE (%):

	2, 12	2, 55
Organic carbon	—	—
Carbonate LECO	91.13	20.16
+ (siderite) BOMB	78.0	20.0

SITE 603 HOLE E CORE 4W CORED INTERVAL 1279.0–1289.7 m



LITHOLOGIC DESCRIPTION

Black (5Y 2.5/1) to very dark gray (5Y 3/1) NANNOFOSSIL SHALE (~ 20% carbonate) to MARLY NANNOFOSSIL LIMESTONE, laminar to burrowed organic-rich, pyritiferous.

SMEAR SLIDE SUMMARY (%):

	1, 75
Texture:	
Sand	2
Silt	40
Clay	58
Composition:	
Quartz	1
Mica	2
Clay	58
Pyrite	TR
Zeolite	1
Calc. nannofossils	35
Plant debris	3

SITE 603

HOLE 603F

Date Occupied: 10 September 1983

Date Departed: 15 September 1983

Time on Hole: 138.9 hours

Position (latitude; longitude): 35°29.873'N; 70°01.357'W

Water depth (sea level; corrected m, echo-sounding): 4640

Water depth (rig floor; corrected m, echo-sounding): 4650

Bottom felt (m, drill pipe): 4650

Penetration (m): 1545.7

Number of cores: 3

Total length of cored section (m): 24.1

Total core recovered (m): 17.8

Core recovery (%): 73.8

Oldest sediment cored:

Depth sub-bottom (m): 1545.7

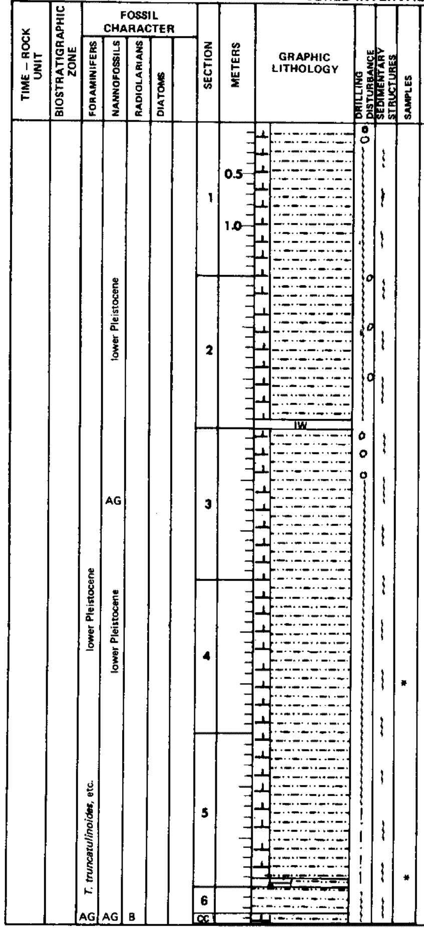
Nature: nannofossil limestone, marly nannofossil limestone to nannofossil marl

Age: Valanginian

Measured velocity (km/s): 2.4

Basement: Not attempted

SITE 603 HOLE F CORE 1W CORED INTERVAL 0.0–32.6 m



LITHOLOGIC DESCRIPTION

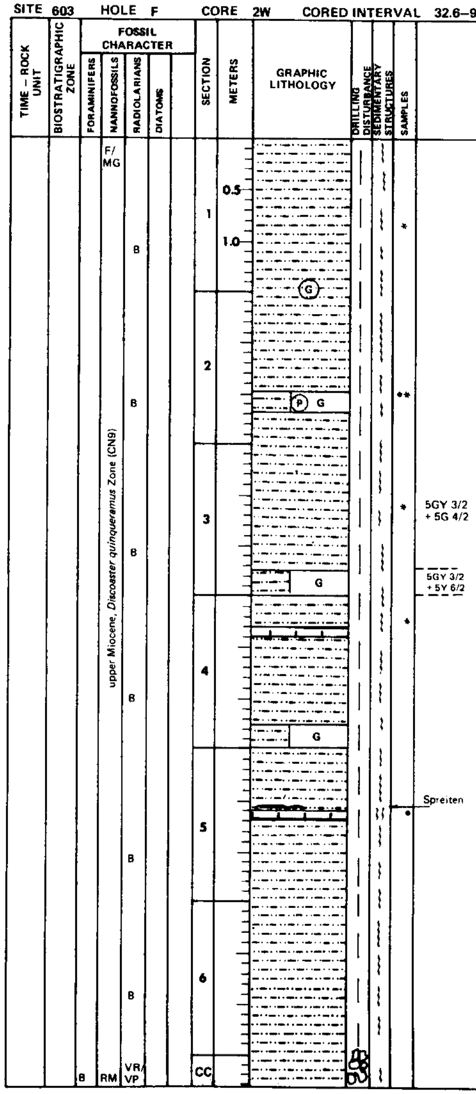
NANNOFOSSILIFEROUS MUD, gray (5G 5/1) with dark gray (5G 4/1) thin layers and mottles (burrows). Upper sections soupy and strongly disturbed by drilling. Below 50 cm of Section 3 less disturbed. Thin silty layers. Throughout the sections up to mm large spherical foraminifera, enriched in burrows and layers (Section 5, 140–145 cm). Rare pyritized well preserved burrows (vertical with 5 mm long horizontal spicules).

Uppermost 15 cm of core olive (5Y 5/3) color by oxidation of ubiquitous fine dispersed sulfides.

SMEAR SLIDE SUMMARY (%):

	4, 100	5, 142
	D	M
Texture:		
Sand	1	20
Silt	29	50
Clay	70	30
Composition:		
Quartz	20	15
Mica	TR	TR
Heavy minerals	TR	TR
Clay	58	30
Pyrite	2	5
Zeolite	TR	–
Carbonate unspec.	5	20
Foraminifers	TR	5
Calc. nannofossils	15	25

SITE 603 HOLE F CORE 2W CORED INTERVAL 32.6–980.5 m



LITHOLOGIC DESCRIPTION

Grayish olive green (5GY 3/2) to dark greenish gray (5G 4/1) with burrows of greenish black (5GY 2/1) to greenish black (5G 2/1) (SILTY) MUDSTONE extensively burrowed. Sideritic burrows are grayish brown (2.5Y 5/2) and contain small light specks. Smear slide of burrow shows discoasters (well preserved).

Most burrows are flattened but the grayish brown ones are quite rounded or only slightly compacted (early lithification).

Sporadic interlayered (Section 3, 125–150 cm) grayish olive green MUDSTONE and light olive gray (5Y 6/2) SIDERITE.

SMEAR SLIDE SUMMARY (%):

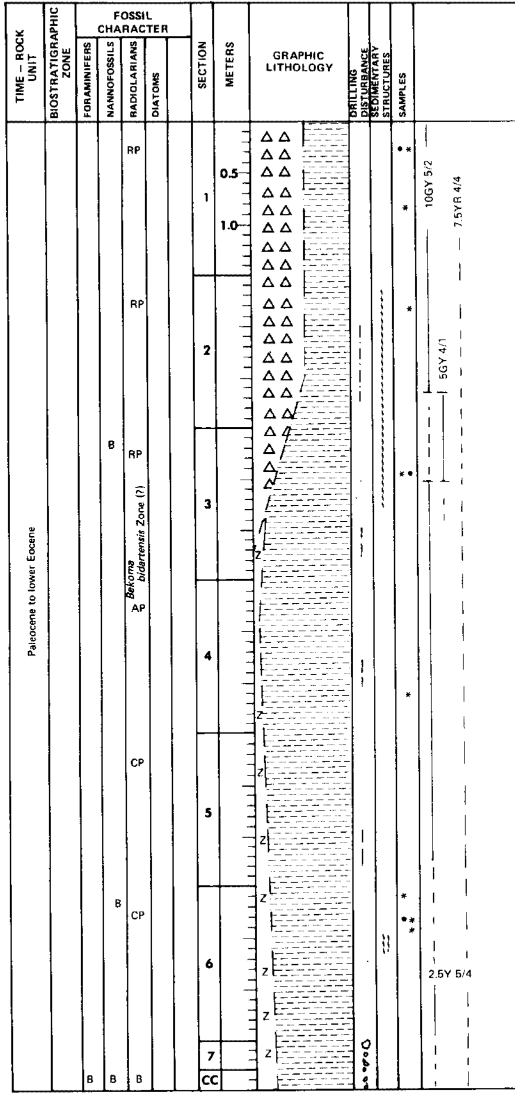
	1, 85	2, 103[a]	4, 25
Texture:			
Sand	–	–	50
Silt	20	90	50
Clay	80	10	–
Composition:			
Quartz	10	3	5
Mica	1	1	TR
Heavy minerals	TR	TR	TR
Clay	80	10	42
Pyrite	2	–	1
Zeolite	–	–	TR
Carbonate unspec.	5	86	2
Foraminifers	–	–	TR
Calc. nannofossils	2	–	50
Plant debris	TR	–	TR

[a] Siderite

ORGANIC CARBON AND CARBONATE (%):

	2, 102	5, 64
Organic carbon	0.3	0.48
Carbonate LECO	26.74	9.50
Carbonate BOMB	20	6

SITE 603 HOLE F CORE 3W CORED INTERVAL 980.5–1200.8 m



LITHOLOGIC DESCRIPTION

PORCELLANITIC CLAYSTONE to ZEOLITIC CLAYSTONE

Unbedded or irregularly thin laminated, grayish green (dominant color: 10GY 5/2) porcellanitic claystone.

Thin layers with white (5Y 8/1) punctuated radiolarians(?).

Sporadic white stringers and nodules of zeolites at Section 4, 5, and 6.

Dark greenish gray (5GY 4/1) with black (5Y 2/1) flattened burrows at Section 2, 25 cm and Section 3, ⟵ 80 cm. Other burrows at Section 6.

Pervasive or diffuse dark brown (7.5YR 4/4) color, especially at Section 5, 120 cm and Section 6, ⟵ 60 cm.

Sporadic light olive brown (2.5Y 5/4) layers at Section 6, 80–90 cm.

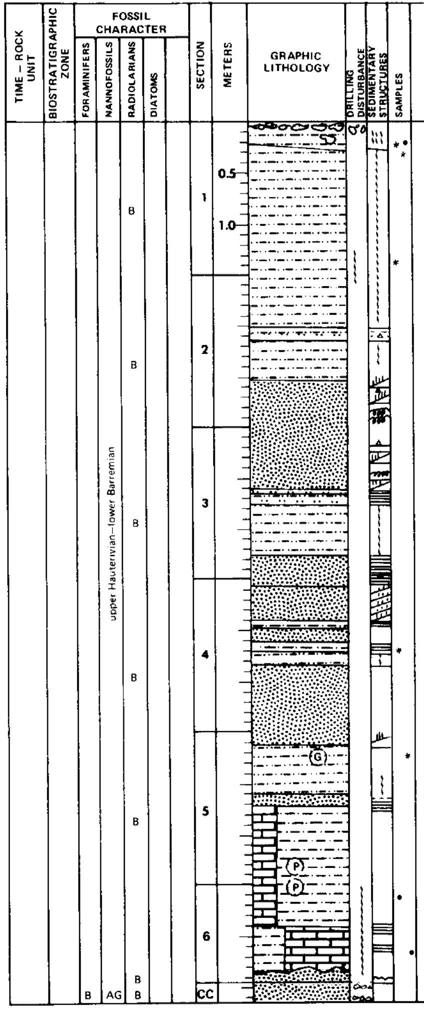
SMEAR SLIDE SUMMARY (%):

	1, 80	2, 35	4, 115	6, 10	6, 45
	D	M	D	M	D
Texture:					
Silt	10	10	20	–	20
Clay	90	90	80	–	80
Composition:					
Quartz	3	2	2	TR	2
Mica	2	1	2	–	2
Clay and silica	93	92	92	–	80
Pyrite	TR	3	1	–	1
Zeolite	2	2	3	100	15
Radiolarians	–	–	–	TR	–
Fish remains	–	–	TR	TR	–

ORGANIC CARBON AND CARBONATE (%):

	1, 30	3, 49	6, 36
Organic carbon	0.15	0.12	0.10
Carbonate LECO	0.42	1.00	1.00
Carbonate BOMB	0.00	0.00	0.00

SITE 603 HOLE F CORE 4W CORED INTERVAL 1200.8–1373.2 m



LITHOLOGIC DESCRIPTION

Three major lithologies and two minor ones:

(1) MUDSTONE – dark brown (7.5YR 4/4) with minor burrow mottling of very light brown; with no compositional change this sediment grades into greenish gray (5GY 5/1) intervals in a) haloes around burrows; b) adjacent to laminae; and c) downwards towards slightly coarser intervals; this lithology is most common in Sections 1 and 2.

(2) SANDSTONE – greenish gray to dark greenish gray (5GY 6/1, 5/1, 4/1); never burrowed; good examples of cross-stratification, parallel/convolute laminae, intraclasts of gray mudstone, possible dewatering structures and rare graded bedding; this lithology is dominant in Sections 3 and 4.

(3) NANNOFOSSIL MUDSTONE – black (N2.5) very faintly laminated with very dark gray (N3) at 70–90 cm, Section 5; nearly structureless below this except for rare pyrite fragments.

(4) At bottom of Section 6, SANDY NANNOFOSSIL LIMESTONE is found as a single representation of this lithology.

(5) Siltstone; much as (2) sandstone but fine grained.

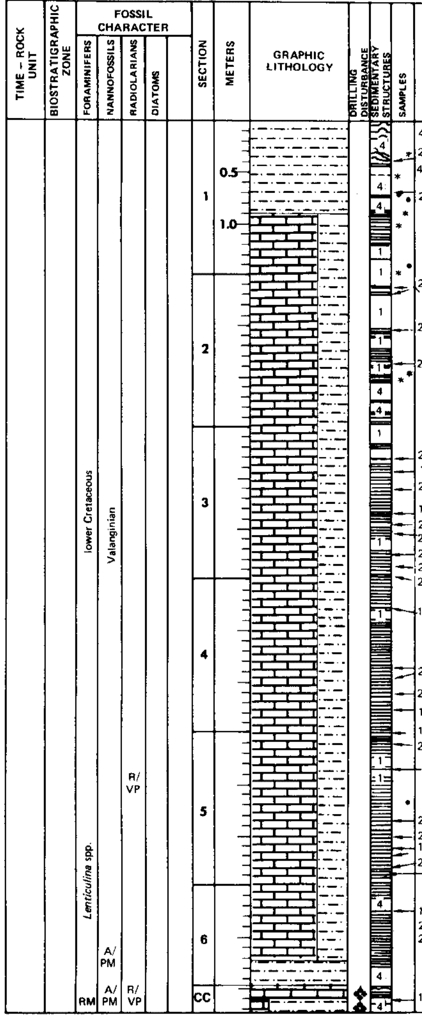
SMEAR SLIDE SUMMARY (%):

	1, 25	1, 35	3, 140	4, 70	5, 29	6, 120
	D	D	D	D	M	D
Texture:						
Sand	5	3	50	30	10	3
Silt	45	60	45	50	60	57
Clay	50	37	5	20	30	40
Composition:						
Quartz	40	51	70	46	40	5
Feldspar	TR	3	5	3	3	–
Mica	5	3	3	7	–	3
Heavy minerals	2	3	10	20	10	2
Clay	50	35	5	20	30	35
Glauconite	TR	TR	–	–	10	–
Pyrite	TR	–	–	–	TR	5
Carbonate unspec.	–	–	2	1	TR	–
Calc. nannofossils	–	–	–	–	–	25
Fish remains	–	–	–	TR	5	TR
Plant debris	3	5	5	3	2	20

ORGANIC CARBON AND CARBONATE (%):

	6, 16	6, 70	1, 26
Organic carbon	2.49	1.90	1.93
Carbonate LECO	20.16	25.07	23.74
Carbonate BOMB	19.0	47	17

SITE 603 HOLE F CORE 5W CORED INTERVAL 1373.2–1497.8 m



LITHOLOGIC DESCRIPTION

The three important components in this core are:
MUDSTONE, LIMESTONE, and COALY MATTER.

Core is made up of four lithologies:

1. NANNOFOSSIL LIMESTONE, light gray (5Y 7/1) to gray (5Y 5/1). Intensely burrowed (see smear slide Section 1, 105 cm).
2. MARLY to COALY NANNOFOSSIL CHALK to MUDSTONE, grayish black (N2), massive to rarely laminar. Varies from nearly all nannofossil ooze to nearly all coaly components (see smear slide Section 2, 90 cm).
3. MARLY NANNOFOSSIL LIMESTONE, ▬ millimetric laminated limestone, olive gray (5Y 4/2) to dark olive gray (5Y 3/2) (See smear slide Section 1, 92 cm).
4. NANNOFOSSIL SANDY MUDSTONE, unbedded to somewhat bedded, dark olive gray (5Y 3/2) to olive gray (5Y 4/2). See upper section of Section 1 for slumps and bedding structure (see smear slide, Section 1, 57 cm). Most zones are about 10.3% $CaCO_3$ but top of sandy section may be about 20%. There are a few stringers of an indeterminant gray green color. Cause of color unknown.

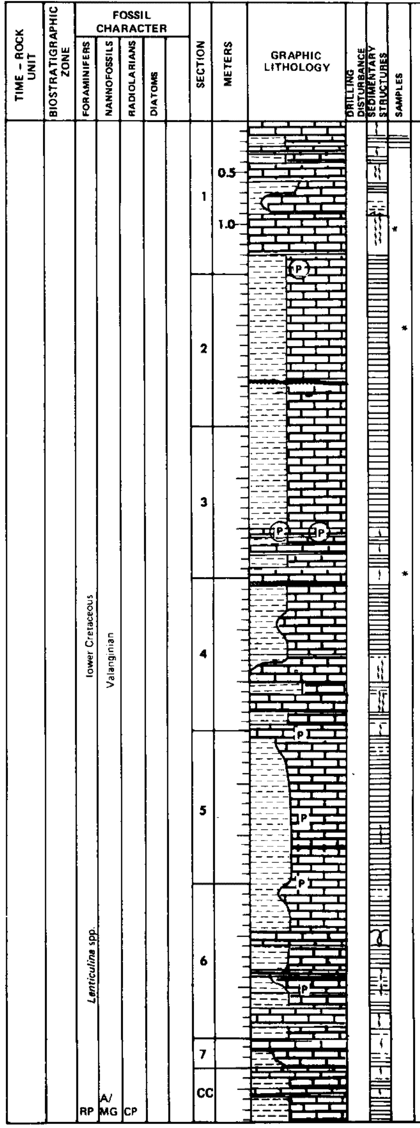
SMEAR SLIDE SUMMARY (%):

	1, 57	1, 92	1, 105	2, 90	2, 103
Texture:					
Sand	40	0	2	TR	15
Silt	35	70	68	50	55
Clay	25	30	30	50	30
Composition:					
Quartz	} 55	} 2	2	–	} 30
Feldspar			–	–	
Heavy minerals	3	TR	TR	TR	3
Clay and silica	25	28	25	42	32
Volcanic glass	–	–	TR?	–	–
Zeolite	–	–	TR?	–	–
Calc. nannofossils	12	65	70	50	30
Sponge spicules	–	–	TR	–	–
Plant debris	5	5	3	8	5
Lithology	4	3	1	2	4

ORGANIC CARBON AND CARBONATE (%):

	1, 74	1, 148	1, 77	5, 70
Organic carbon	0.20	0.16	1.55	1.04
Carbonate LECO	7.08	78.64	10.33	84.72
Carbonate BOMB	3	84	7	67

SITE 603 HOLE F CORE 6R CORED INTERVAL 1497.8–1507.3 m



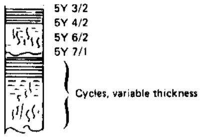
LITHOLOGIC DESCRIPTION

5Y 7/1
5Y 4/2

5Y 7/1
5Y 4/2
5Y 6/2

5Y 4/2
+ 5Y 3/2

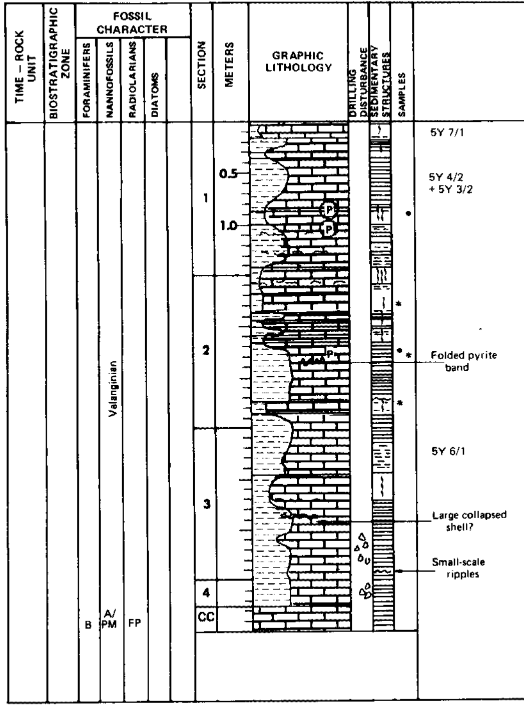
NANNOFOSSIL LIMESTONE, light gray (5Y 6/1–5Y 7/1), more or less intensely burrowed. Passes to the top over a more laminated greenish gray part into a homogeneous, fine laminated MARLY NANNOFOSSIL LIMESTONE, olive gray (5Y 4/2) to dark olive gray (5Y 3/2), lamination mm-thick or less. Many white streakes (mm) flattened? microfossils? Many fish remains (bones = vertabrae, teeth et al.), aptychi, and some pyritized radiolaria all throughout the core. Streaks and thin layers of coal.



SMEAR SLIDE SUMMARY (%):

	1, 105	2, 56	3, 140
	D	D	M
Texture:			
Sand	–	–	40
Silt	60	40	50
Clay	40	60	10
Composition:			
Quartz	10	3	–
Clay	30	40	–
Glauconite	–	–	1
Pyrite	TR	–	–
Carbonate unspec.	50	30	1
Calc. nannofossils	10	25	–
Plant debris	–	–	?8

SITE 603 HOLE F CORE 7R CORED INTERVAL 1507.3–1516.4 m



LITHOLOGIC DESCRIPTION

Cycles (see Core 6R) of:

1) Fine laminated MARLY NANNOFOSSIL LIMESTONE, light gray to gray (5Y 7/1 to 5Y 6/1), more or less intensely burrowed, grading over gray (5Y 6/1) faintly laminated parts into
2) Fine laminted (mm or less) MARLY NANNOFOSSIL LIMESTONE, olive gray (5Y 4/2) to dark olive gray (5Y 3/2) throughout, with disseminated pyrite and fish remains, aptychi, and layers of large *Inoceramus* shells.

At the bottom of Section 3 small-scaled current ripples on bedding surface.

Cycles cut on top of laminated facies or transition into limestone.

In laminated facies much organic matter.

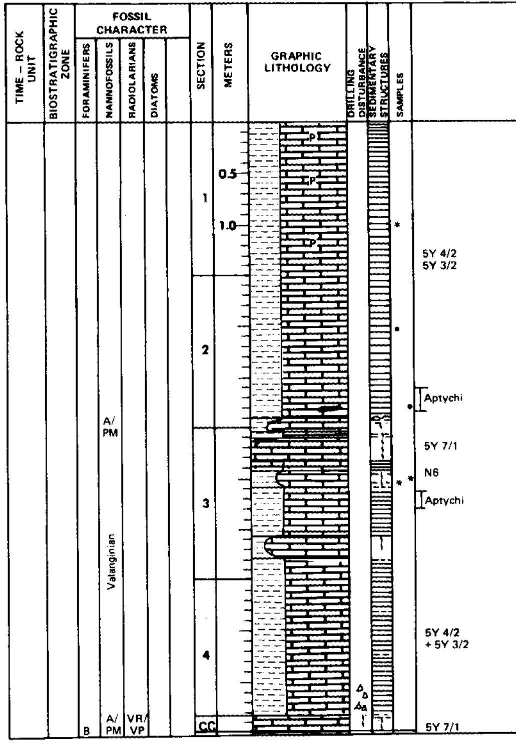
SMEAR SLIDE SUMMARY (%):

	2, 30	2, 82	2, 130
	D	D	D
Texture:			
Silt	60	50	60
Clay	40	50	40
Composition:			
Quartz	–	TR	–
Clay	40	50	40
Pyrite	TR	2	TR
Carbonate unspec.	55	15	50
Calc. nannofossils	5	30	10
Plant debris	–	3	–

ORGANIC CARBON AND CARBONATE (%):

	1, 90–92	2, 77–80
Organic carbon	0.18	1.25
Carbonate LECO	60.23	61
Carbonate BOMB	78	64.64

SITE 603 HOLE F CORE 8W CORED INTERVAL 1516.4–1540.2 m



LITHOLOGIC DESCRIPTION

1) Fine laminated MARLY NANNOFOSSIL LIMESTONE, olive gray (5Y 4/2) to dark olive gray (5Y 3/2), (mm laminae) (disseminated pyrite) growing occasionally into
2) Light gray (5Y 7/1) to gray (N6) NANNOFOSSIL LIMESTONE, more or less burrowed.

IN LAMINATED FACIES over all the core aptychi (especially in Section 2, 100–130 cm and Section 3, 70–80 cm). In Section 2, 135 cm large incoaled plant stem with pyrite nodules. Much organic matter and plant debris.

SMEAR SLIDE SUMMARY (%):

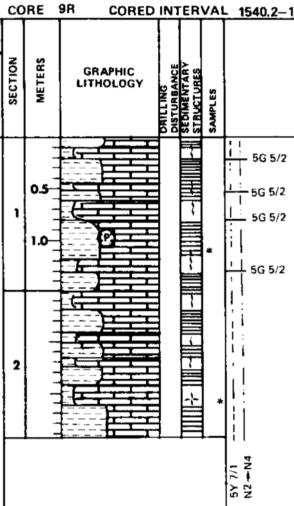
	1, 100	3, 56
	D	D
Texture:		
Sand	2	TR
Silt	48	30
Clay	50	70
Composition:		
Quartz	8	TR
Clay	42	67
Carbonate unspec.	–	10
Calc. nannofossils	45	20
Plant debris	5	3

ORGANIC CARBON AND CARBONATE (%):

	2, 57	2, 131
Organic carbon	1.33	19.05
Carbonate LECO	64.56	9.00
Carbonate BOMB	52	4.00

SITE 603 HOLE F CORE 9R CORED INTERVAL 1540.2–1545.7 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER: FORAMINIFERS	FOSSIL CHARACTER: NANNOFOSSILS	FOSSIL CHARACTER: RADIOLARIANS	FOSSIL CHARACTER: DIATOMS
			Valanginian AM		



LITHOLOGIC DESCRIPTION

Interbedded:

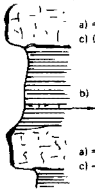
a) Light gray (5Y 7/1) massive or irregularly thin laminated NANNOFOSSIL LIMESTONE, intensely burrowed.

b) Medium gray (N5) to medium dark gray (N4) even thin laminated MARLY NANNOFOSSIL LIMESTONE.

Contact a) → b) is gradual

Contact b) → a) is often sharp (with thin grayish green [5G 5/2] layers at Section 1: c)

Inoceramus shells (Section 2, 110 cm)



SMEAR SLIDE SUMMARY (%):

	1, 111 M	2, 110 M
Texture:		
Sand	–	40
Silt	40	50
Clay	60	10
Composition:		
Clay	57	10
Carbonate unspec.	5	80
Calc. nannofossils	35	10
Plant debris	3	–

SITE 612

HOLE 612

Date Occupied: 2332 hr. 26 August 1983

Date Departed: 0525 hr. 01 September 1983

Time on Hole: 5 days, 6 hr., 25 min.

Position (latitude; longitude): 38°49.21'N; 72°46.43'W

Water depth (sea level; corrected m, echo-sounding): 1386

Water depth (rig floor; corrected m, echo-sounding): 1396

Bottom felt (m, drill pipe): 1414.3

Penetration (m): 675.3

Number of cores: 72

Total length of cored section (m): 675.3

Total core recovered (m): 580.66

Core recovery (%): 86.0

Oldest sediment cored:

Depth sub-bottom (m): 675.3

Nature: black, glauconitic, foraminiferal, marly shale

Age: Campanian

Measured velocity (km/s): 2.03

Basement: Not attempted

SITE 612

A. SITE SUMMARY AND PRINCIPAL RESULTS

HOLE 612

Hole 612 was drilled on the middle part of the New Jersey Slope (1404 m water depth) approximately 5 km northwest of a broad seafloor outcrop of middle Eocene carbonates. The site is approximately at the junction of U.S.G.S. multichannel Lines 25 and 34 and is on strike with corehole ASP #15, located 6.4 km to the southwest.

Using the advanced piston corer (APC) and extended core barrel (XCB), we continuously cored a 675.3 m sequence of Quaternary through upper Campanian outer neritic and bathyal sediments. Downhole geophysical logs were successfully run following the termination of coring.

The most significant achievements at Site 612 are:

1. Recovery, in undisturbed condition, of seven stratigraphically significant erosional unconformities that bound distinct chronostratigraphic units.
2. Documentation of a zone of progressive silica diagenesis that is most intense at the base of the middle Eocene section, where it causes a major reflection on seismic reflection Line 25.
3. Recovery of a thick (413 m) series of Eocene carbonate-rich slope facies in which turbidites and debris flows play a subordinate role to hemipelagic deposition.
4. Recovery of variably rich assemblages of calcareous

nannoplankton, foraminifera and radiolarians together in the same strata, providing an excellent opportunity for calibrating the biozonation of these groups.

5. Documentation of a distinct change in paleoenvironments from outer shelf-types in the Campanian to slope-types in the Maestrichtian and younger sequences.
6. Documentation of a significant high-salinity anomaly in the interstitial waters of Site 612, which is nearly identical to that noted by previous investigators at nearby Site ASP #15.
7. Documentation of low total organic carbon in the entire section, except for a peak value of 2.68% in the Campanian.
8. Correlation of sedimentology, paleontology, downhole logging and seismostratigraphy with equivalent data on the adjacent upper slope and shelf, demonstrating a synchrony between depositional and erosional episodes across this segment of the margin.

Five lithologic units were recognized:

I. 0 - 136 m BSF. Interbedded dark gray to olive gray muds and very dark gray glauconitic sands. Pleistocene-upper Miocene. Middle bathyal. Includes 3 subunits. Glauconite in sands is fresh, irregular and unoxidized. Includes erosional unconformities at Pleistocene/Pliocene and Pliocene/upper Miocene contacts and at base of upper

Miocene (middle Miocene, lower Miocene, upper Oligocene and part of lower Oligocene missing).

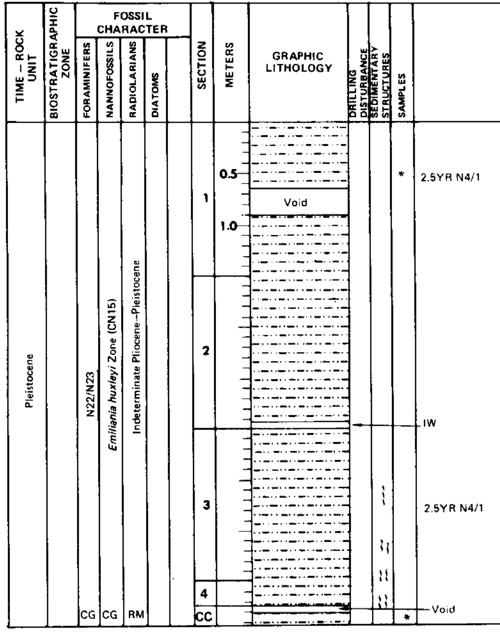
II. 136 - 323.4 m BSF. Light gray, siliceous, nannofossil oozes and chalks. Lower Oligocene to middle Eocene. Middle bathyal. Sediments and microfossils reflect high primary productivity and well oxygenated seafloor. Gradual conversion of siliceous fossils to siliceous cements near base of unit, includes erosional unconformities at upper Eocene/middle Eocene contact.

III. 323.4 - ca. 555 m BSF. Laminar to intensely burrowed, light greenish gray, light olive to brownish gray, siliceous nannofossil chalk to porcellanite. Middle to Lower Eocene. Upper 8 m markedly altered by silicification just above unconformable middle Eocene/ lower Eocene contact. Unconformable contact with middle Maestrichtian presumed present in poorly recovered section at base.

IV. ca. 555 m - 639.6 m BSF. Dark gray, marly foram-nannofossil (nannofossil-foram) chalks. Middle and lower Maestrichtian. Upper contact not recovered. Sediment massive, intensely burrowed. Unconformable contact with upper Campanian at base.

V. 639.6 - 675.3 m BSF. Black foraminifer (or nannofossil) mudstone interlayered with chalk. Campanian. Major component is fine-grained terrigenous detritus. Fissile shale in upper part. Highest TOC recorded at Site (2.68%).

SITE 612 HOLE CORE 1H CORED INTERVAL 0.0–4.8 m



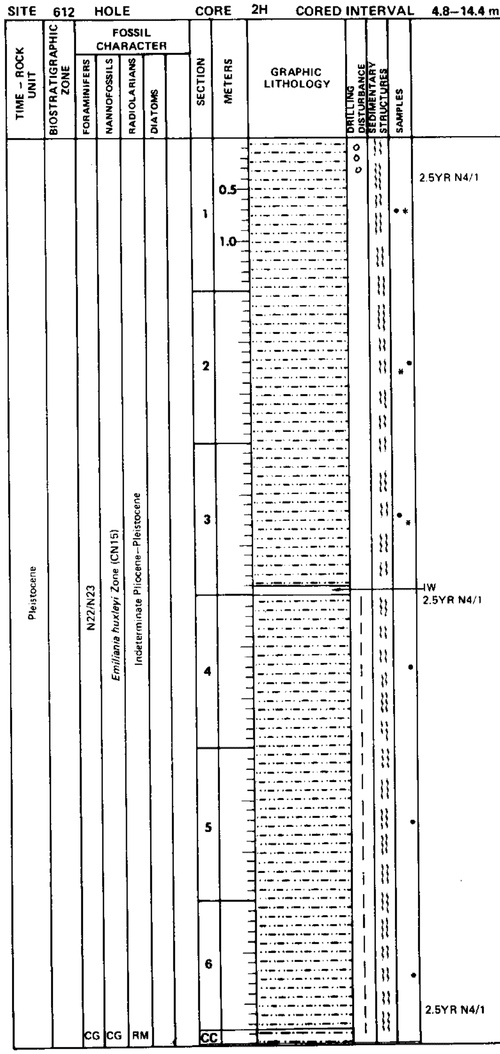
LITHOLOGIC DESCRIPTION

Unbedded homogeneous dark gray MUD. Numerous pyritic black mottles (→ bioturbation). Homogeneous color dark gray.

SMEAR SLIDE SUMMARY (%):

	1, 50	CC, 15
	D	D
Sand	5	25
Silt	20	35
Clay	75	40
Composition:		
Quartz	30	58
Feldspar	TR	2
Mica	2	TR
Heavy minerals	TR	5
Clay	64	30
Volcanic glass	TR	TR
Glauconite	TR	2
Pyrite	2	–
Micronodules	–	1
Carbonate unspec.	2	2
Foraminifers	TR	TR
Diatoms	–	TR

SITE 612 HOLE CORE 2H CORED INTERVAL 4.8–14.4 m



LITHOLOGIC DESCRIPTION

Unbedded (Section 1, 2) to irregularly thin to medium bedding (Section 3–6).

Homogeneous dark gray MUD (exceptionally sand mud in Core Catcher).

Numerous pyritic black burrow-mottles filled by medium to coarse quartz sand well rounded with graded bedding and containing large quantity of disseminated organic matter.

Numerous minor erosion? surfaces (Section 3–6) → irregularly thin to medium bedded.

SMEAR SLIDE SUMMARY (%):

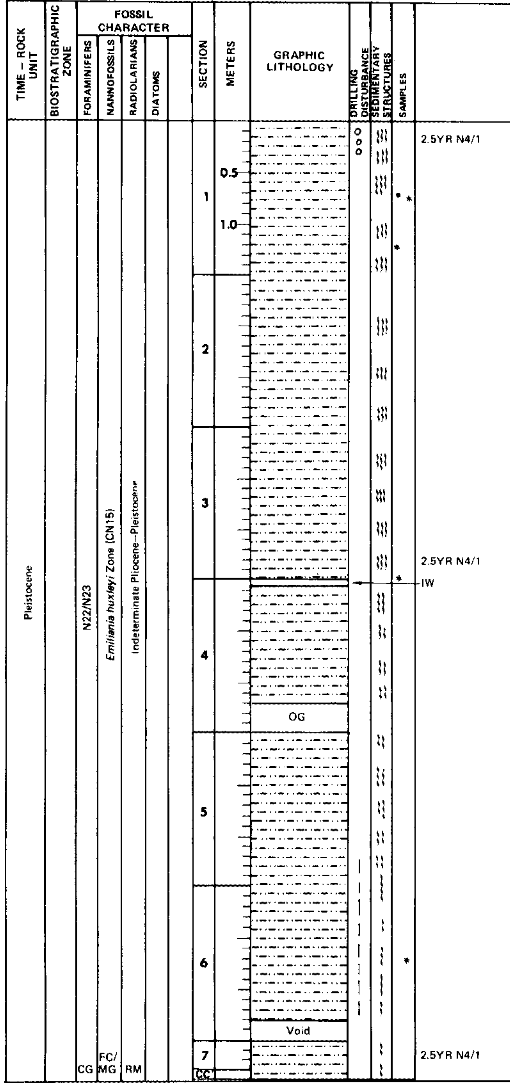
	2, 83	3, 80
	M	D
Texture:		
Sand	100	100
Composition:		
Quartz	60	80
Feldspar	20	2
Heavy minerals	14	12
Glauconite	2	5
Pyrite	2	1
Foraminifers	2	–

ORGANIC CARBON AND CARBONATE (%):

	1, 76	2, 76	3, 76	4, 76
Organic carbon	–	–	–	0.47
Carbonate	3	3	3	2

	5, 76	6, 76
Organic carbon	–	–
Carbonate	2	1

SITE 612 HOLE CORE 3H CORED INTERVAL 14.4–24.0 m



LITHOLOGIC DESCRIPTION

Irregulary thick bedded (Section 1, 2, and 3) to unbedded or very irregularly and discontinuous thick bedded (Section 4, 5, and 6).

Homogeneous dark gray (2.5YR N4/1) MUD.

Pyritic black burrow-mottles filled by medium to coarse quartz sand well rounded with sometimes graded bedding and disseminated organic matter (bioturbation). These burrow-mottles are less and less frequent from Section 3 to Section 6.

Presence of fragments of molluscs shells (size —•1 cm) in Section 4, 5, and 6.

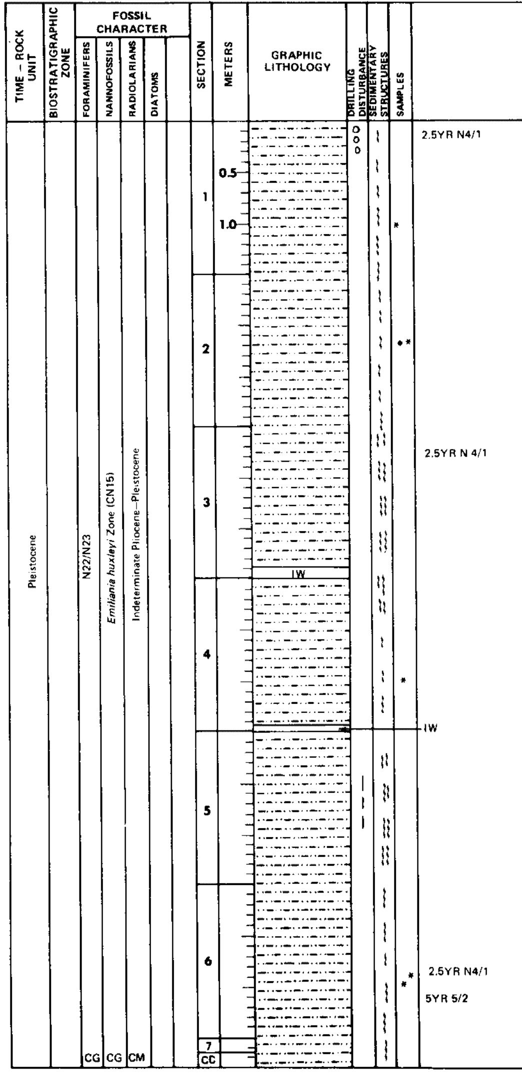
SMEAR SLIDE SUMMARY (%):

	1, 120	4, 1	6, 75
	M	D	D
Texture:			
Sand	5	18	15
Silt	10	6	15
Clay	85	76	70
Composition:			
Quartz	5	10	20
Feldspar	2	2	3
Mica	TR	–	–
Heavy minerals	2	2	5
Clay	90	76	70
Glauconite	1	TR	2
Pyrite	TR	–	–
Foraminifers	–	–	TR
Diatoms	TR	8	TR
Sponge spicules	TR	2	TR
Fish remains	TR	–	–

ORGANIC CARBON AND CARBONATE (%):

	1, 74
Organic carbon	–
Carbonate	1

SITE 612 HOLE CORE 4H CORED INTERVAL 24.0–33.6 m



LITHOLOGIC DESCRIPTION

Unbedded homogeneous MUD.

Pyritic black burrow-mottles filled by medium to coarse quartz sand well rounded with sometimes graded bedding and disseminated organic matter (bioturbation). These burrow-mottles have an irregular distribution (see symbol { and }}).

The color changes sharp in Section 6, from the dark gray MUD to reddish gray (5YR 5/2) MUD.

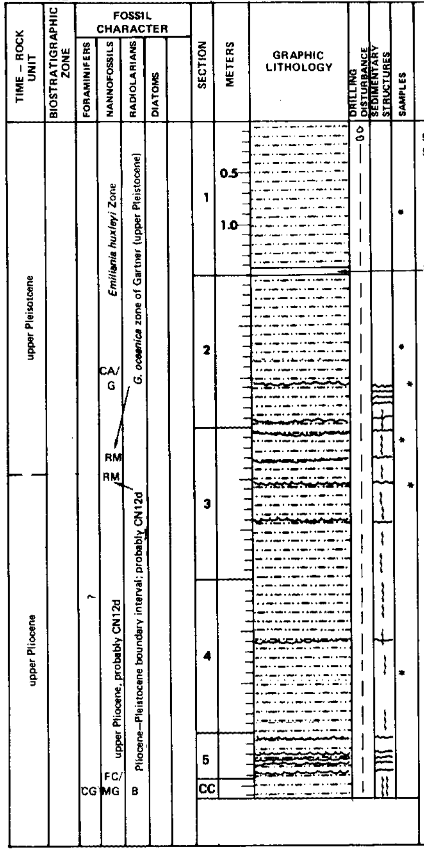
SMEAR SLIDE SUMMARY (%):

	1, 100	4, 100	6, 94	6, 100
		D	D	D
Texture:				
Sand	2	3	15	10
Silt	15	12	19	5
Clay	83	85	66	85
Composition:				
Quartz	15	14	20	10
Feldspar	–	–	2	1
Heavy minerals	1	1	8	–
Clay	83	85	62	82
Glauconite	–	–	2	TR
Pyrite	TR	–	TR	–
Carbonate unspec.	–	–	4	2
Foraminifers	–	–	TR	1
Calc. nannofossils	TR	–	–	–
Diatoms	–	–	1	3
Sponge spicules	1	TR	1	1

ORGANIC CARBON AND CARBONATE (%):

	2, 72
Organic carbon	–
Carbonate	6

SITE 612 HOLE CORE 5H CORED INTERVAL 33.6–40.6 m



5YR 4/1 (T2)
5Y 3/1 (T6)

IW

2.5Y 5/2
2.5YR 5/0

2.5YR 4/0
10YR 4/1

LITHOLOGIC DESCRIPTION

Unbedded homogeneous dark gray MUD, mottled to burrow-mottled. Some dark mottles are clearly burrows with sand-silt filling (0.5–1.0 cm).

Note: Section 2, 100 cm to bottom shows a series of eroded surfaces each with a thin glauconite sand.

Reaction to HCl noted at Section 2, 70 cm.
Section 2, 80–100 cm: 5Y 5/1 clasts in 5YR 5/1 matrix unusal reverse bedded layer.

Mudstone alternation with glauconite sands at Section 2, 100 cm to Section 3, 90 cm.

Section 4, 45–90 cm: Alternations of mudstones with glauconite sands.

Section 5, 6 cm–43 cm: repeated scoured surfaces with wood fragments and very large mica flakes and glauconite.

Core Catcher: 5Y 4/1 burrow mottled mudstone (with glauconite).

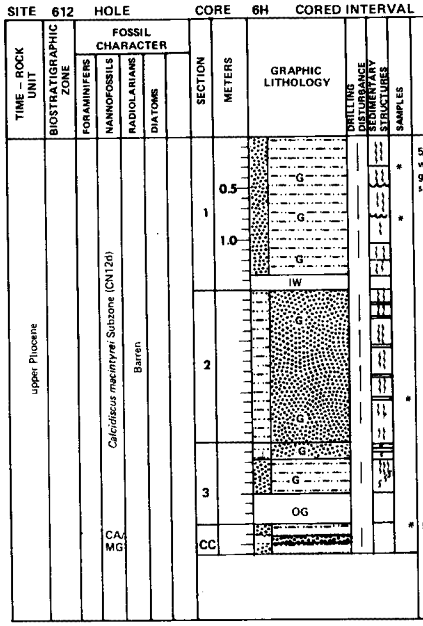
SMEAR SLIDE SUMMARY (%):

	1, 90 D	2, 110 D	3, 15 D	3, 60 D	4, 95 M
Texture:					
Sand	3	5	3	60	25
Silt	47	35	47	30	35
Clay	50	60	50	10	40
Composition:					
Quartz	10	10	10	10	30
Feldspar	TR	–	–	TR	–
Mica	28	10	28	–	10
Heavy minerals	5	3	5	–	10
Clay	50	60	50	10	40
Glauconite	–	TR	–	80	1
Pyrite	2	1	2	–	1
Carbonate unspec.	5	–	5	–	3
Foraminifers	–	1	–	–	TR
Calc. nannofossils	–	15	–	–	5
Diatoms	TR	–	–	–	–
Sponge spicules	TR	TR	–	–	–

ORGANIC CARBON AND CARBONATE (%):

	2, 75–77
Organic carbon	–
Carbonate	5

SITE 612 HOLE CORE 6H CORED INTERVAL 40.6–44.6 m



5Y 4/1 mud with 5Y 3/1 glauconite sands

5Y 5/1 mud
5Y 3/1 sand

LITHOLOGIC DESCRIPTION

GLAUCONITIC, dark gray MUD with glauconite-filled burrow and glauconite sand interlayers. Core is extensively burrowed.
Section 1: glauconitic mud with glauconite-filled burrows.
Section 2: glauconite sands in beds of variable thickness with clay interbeds.
Section 3: glauconitic sand going to glauconitic muds with glauconite burrows and stringers.
Core Catcher: alternate beds of glauconitic sand and mud.

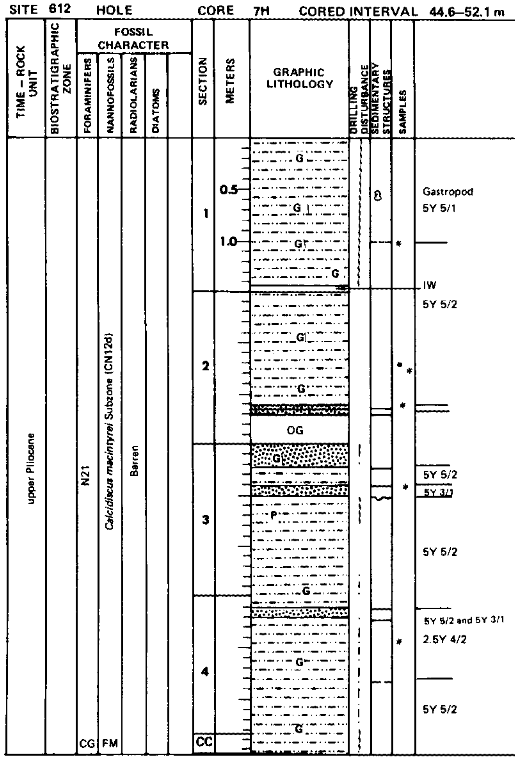
SMEAR SLIDE SUMMARY (%):

	1, 35 D	1, 84 D	CC, 6 D
Texture:			
Sand	30	10	20
Silt	40	30	30
Clay	30	60	50
Composition:			
Quartz	30	25	2
Mica	15	8	TR
Heavy minerals	5	2	–
Clay	30	60	50
Glauconite	15	2	48
Pyrite	2	2	–
Carbonate unspec.	2	–	–
Foraminifers	TR	–	–
Calc. nannofossils	1	1	–

ORGANIC CARBON AND CARBONATE (%):

	2, 110–112
Organic carbon	–
Carbonate	5

SITE 612 HOLE CORE 7H CORED INTERVAL 44.6–52.1 m



LITHOLOGIC DESCRIPTION

MUD, olive gray (5Y 5/2) faintly mottled with dark gray sulfide stains; interbedded with GLAUCONITIC SAND, very dark gray (5Y 3/1) usually in discrete 2–5 cm layers, but occasionally mixed in mud matrix.

Section 3, 76–150 cm: occasional pyritized worm tubes.
Section 4, 27–80 cm: mica flakes visible on surface of split core.

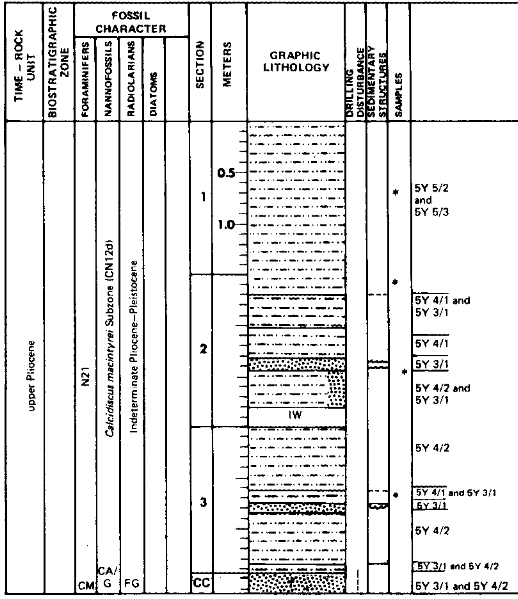
SMEAR SLIDE SUMMARY (%):

	1, 102	2, 80	4, 47
	D	D	D
Texture:			
Sand	1	–	5
Silt	60	40	45
Clay	39	60	50
Composition:			
Quartz	50	35	30
Feldspar	2	–	5
Mica	1	1	5
Heavy minerals	TR	TR	2
Clay	34	59	57
Glauconite	3	3	1
Micronodules	–	2	TR
Carbonate unspec.	10	–	–
Foraminifers	–	–	TR

ORGANIC CARBON AND CARBONATE (%):

	2, 75–77
Organic carbon	0.78
Carbonate	1

SITE 612 HOLE CORE 8X CORED INTERVAL 52.1–59.0 m



LITHOLOGIC DESCRIPTION

MUD: predominantly olive gray (5Y 4/2) occasionally olive (5Y 5/3) or dark gray (5Y 4/1); with faint very dark gray sulfide mottling throughout; rare shell fragments interbedded or occasionally thoroughly mixed with GLAUCONITIC SAND: very dark gray (5Y 3/1); massive, no apparent grading; sharp basal contact, occasionally scoured; upper contact with mud occasionally burrowed, often gradational.

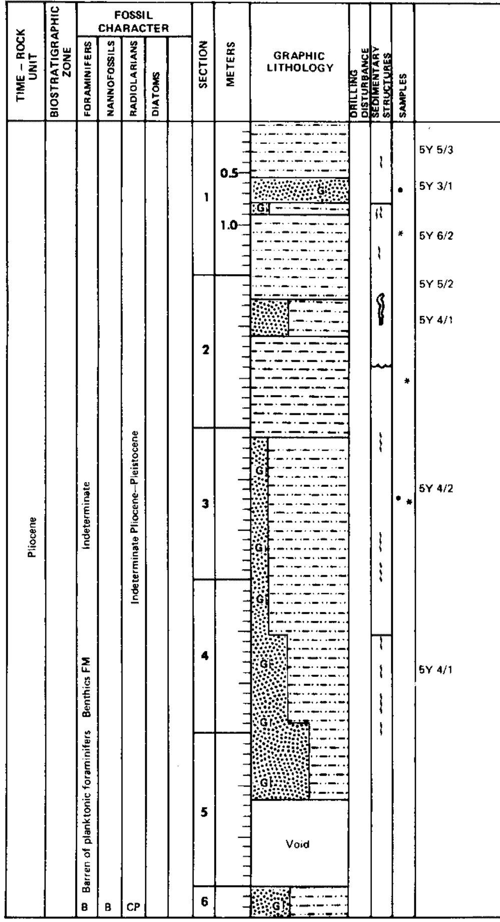
SMEAR SLIDE SUMMARY (%):

	1, 70	2, 10	2, 98
	D	D	D
Texture:			
Sand	1	5	5
Silt	20	25	25
Clay	79	70	70
Composition:			
Quartz	30	30	30
Feldspar	–	1	–
Mica	2	3	3
Heavy minerals	1	2	2
Clay	66	56	61
Glauconite	TR	4	2
Pyrite	–	} 2	2
Micronodules	1		–
Foraminifers	–	2	TR

ORGANIC CARBON AND CARBONATE (%):

	3, 70–73
Organic carbon	–
Carbonate	0

SITE 612 HOLE CORE 9X CORED INTERVAL 59.0–68.7 m



LITHOLOGIC DESCRIPTION

MUD: dark gray (5Y 5/3) with sand filled burrows and rare pyrite nodules.

SANDY MUD: dark gray (5Y 4/1) to light olive gray (5Y 3/1) micaceous with abundant burrows filled with glauconitic sand.

SAND: dark gray (5Y 3/1) glauconitic quartz sand in more or less thick (cm to dm) layers, mostly with sharp lower and upper contact.

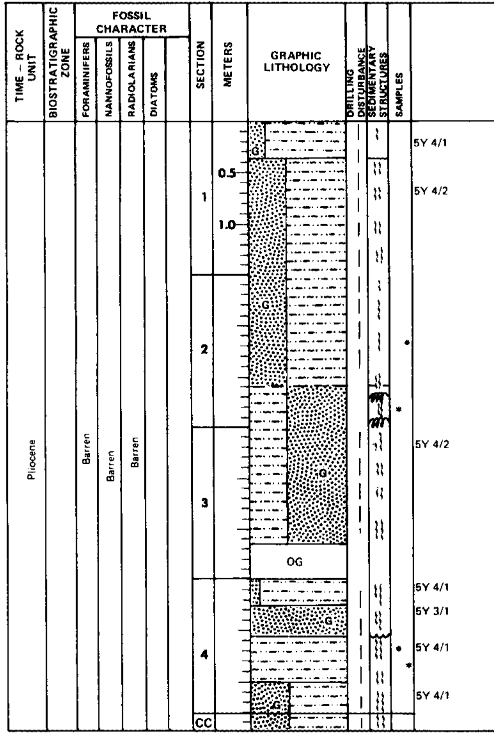
SMEAR SLIDE SUMMARY (%):

	1, 111	2, 106
	D	M
Texture:		
Sand	5	50
Silt	44	40
Clay	51	10
Composition:		
Quartz	30	35
Mica	3	–
Heavy minerals	2	–
Clay	51	10
Glauconite	2	50
Pyrite	2	5
Foraminifers	TR	–
Calc. nannofossils	10	–
Radiolarians	–	TR
Sponge spicules	–	TR

ORGANIC CARBON AND CARBONATE (%):

	1, 70–73	3, 70–73
Organic carbon	–	0.93
Carbonate	no data	0

SITE 612 HOLE CORE 10X CORED INTERVAL 68.7–78.4 m



LITHOLOGIC DESCRIPTION

MUD: dark gray (5Y 4/1) with layers of olive gray (5Y 4/2) sand. Intensively burrowed. Burrows filled with sand. Irregular, sometimes scoured bedding planes. Burrow tubes occasionally bleached to white gray glauconitic mud.

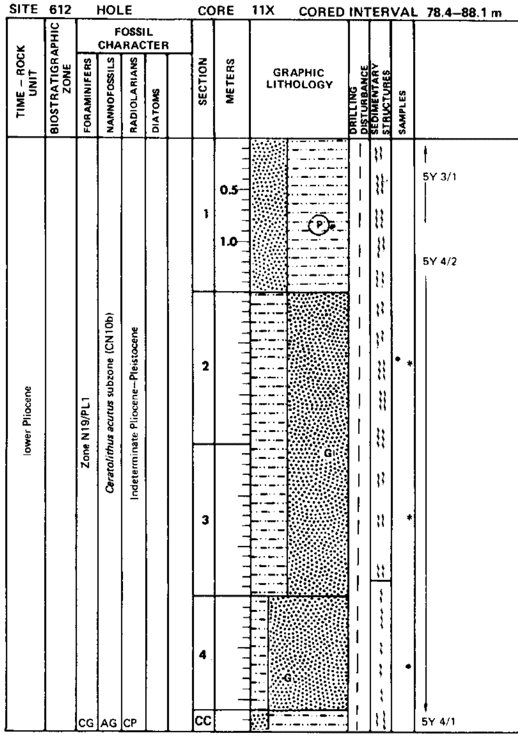
SMEAR SLIDE SUMMARY (%):

	2, 133	4, 87
	M	D
Texture:		
Sand	30	5
Silt	40	35
Clay	30	60
Composition:		
Quartz	40	25
Feldspar	TR	–
Mica	–	5
Clay	30	60
Glauconite	15	5
Pyrite	3	2
Carbonate unspec.	10	1
Foraminifers	TR	–
Calc. nannofossils	2	2

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	–	–
Carbonate	1	1

SITE 612 HOLE CORE 11X CORED INTERVAL 78.4–88.1 m



LITHOLOGIC DESCRIPTION

MUD: olive gray (5Y 4/2) with burrows (some are large and round: echinoids) interlayered with SAND: very dark gray (5Y 3/1) to olive gray (5Y 4/2) glauconitic. Minor burrowing at the base arenitic biodetritus.

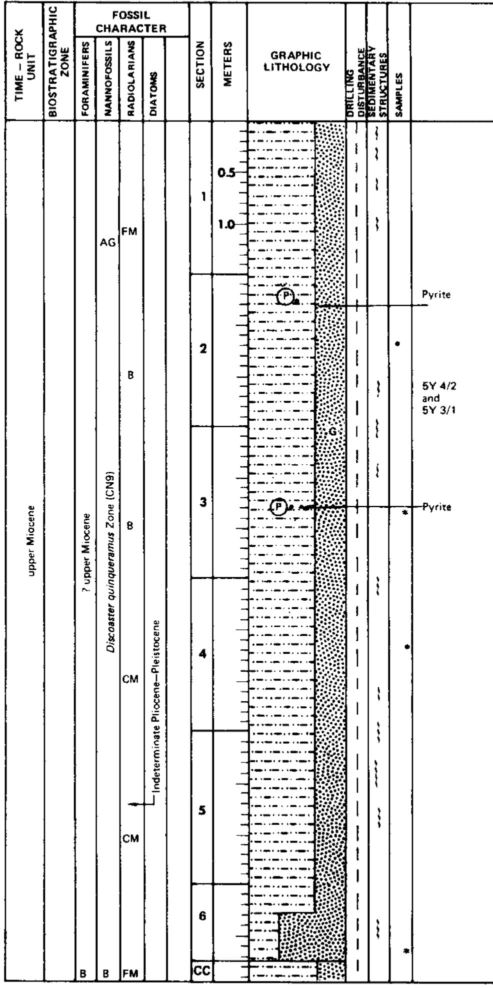
SMEAR SLIDE SUMMARY (%):

	2, 71	3, 72
	D	D
Texture:		
Sand	10	60
Silt	50	20
Clay	40	20
Composition:		
Quartz	40	20
Mica	3	TR
Heavy minerals	–	TR
Clay	40	20
Glauconite	5	50
Pyrite	1	10
Carbonate unspec.	1	TR
Foraminifers	TR	–
Calc. nannofossils	10	TR
Plant debris	TR	TR

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 72 -73
Organic carbon	–	–
Carbonate	3	2

SITE 612 HOLE CORE 12X CORED INTERVAL 88.1–97.8 m



LITHOLOGIC DESCRIPTION

MUD: olive gray (5Y 4/2) with numerous burrows, lenses, irregular mottles (but not discrete laminae) of GLAUCONITIC SAND: very dark gray (5Y 3/1).

Mud layers contain:
- large oval burrows (echinoids?)
- vertical burrows
- occasional pyrite nodules
- very rare shell fragments
- very rare mottles of buff-colored very fine quartz sand

SMEAR SLIDE SUMMARY (%):

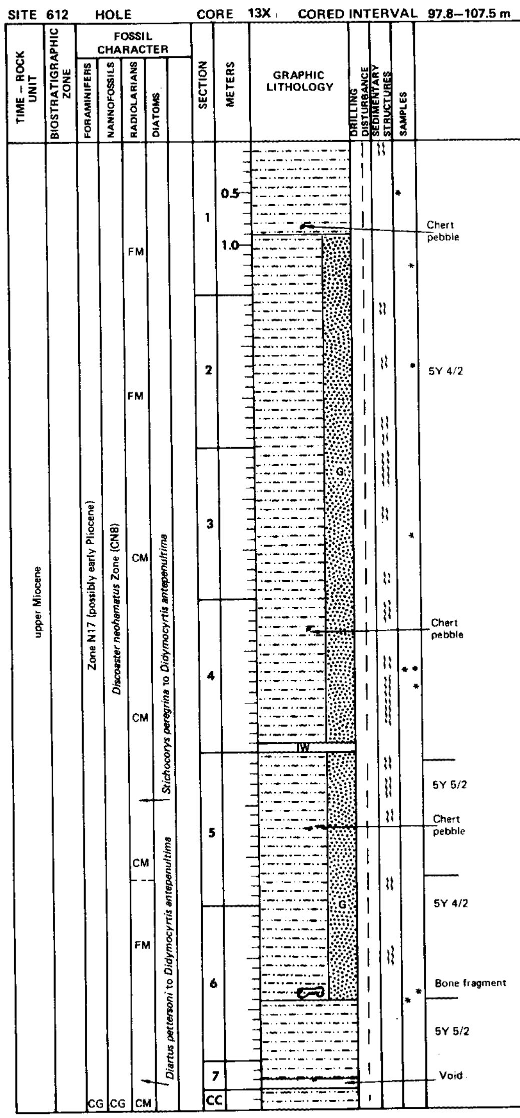
	3, 87	6, 67
	D	D
Texture:		
Sand	15	80
Silt	20	15
Clay	65	5
Composition:		
Quartz	25	21
Mica	1	–
Heavy minerals	1	1
Clay	65	–
Glauconite	5	76
Pyrite	1	1
Foraminifers	–	TR
Calc. nannofossils	1	–
Diatoms	TR	TR
Radiolarians	–	1
Sponge spicules	1	TR
Silicoflagellates	–	TR

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	–	–
Carbonate	7	3

109

SITE 612 HOLE CORE 13X CORED INTERVAL 97.8–107.5 m



LITHOLOGIC DESCRIPTION

MUD: olive gray (5Y 4/2) with irregular mottles, burrows filled with GLAUCONITIC SAND: very dark gray (5Y 3/1) throughout most of the entire core.

Dominant mud also contains:
- 1 mm–6 mm mud intraclasts, light olive gray (5Y 6/2), beginning at 90 cm in Section 1 and increasing in number down core
- Occasional chert pebbles
- Mica flakes throughout
- Bone fragment at 81 cm in Section 6; olive brown (2.5Y 4/4) with very smooth "saddle", and pitted on opposite side; approx. 3 cm x 1 cm

Very sharp, very irregular contact at 93 cm, Section 6, with change to MUD; olive gray (5Y 5/2) with mica flakes, mud intraclasts like above, but without any glauconitic sand.

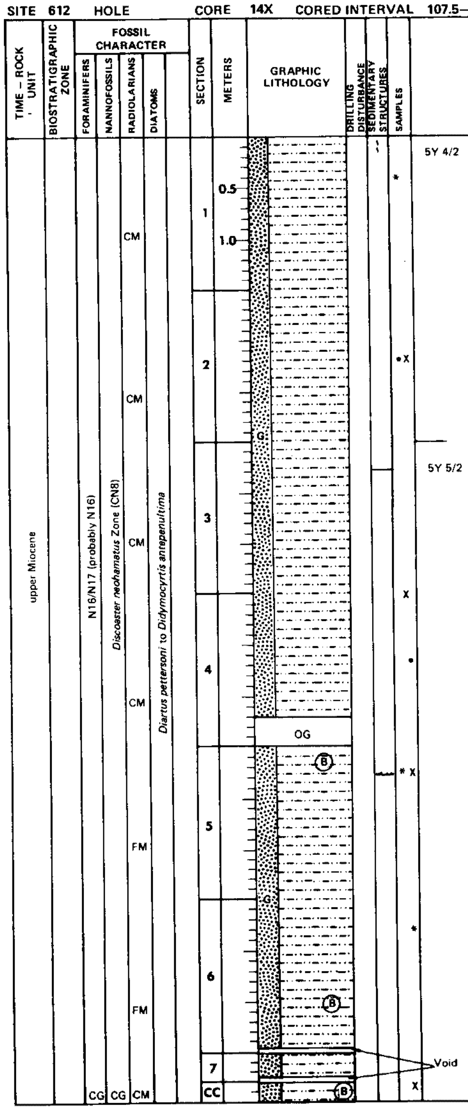
SMEAR SLIDE SUMMARY (%):

	1, 52 D	1, 128 M	3, 90 M	4, 89 M	6, 87 M	6, 98 M
Texture:						
Sand	50	20	50	50	50	5
Silt	45	30	35	40	30	80
Clay	5	50	15	10	20	15
Composition:						
Quartz	25	26	27	10	30	70
Feldspar	–	–	–	–	–	5
Mica	–	–	–	–	–	1
Heavy minerals	–	–	TR	–	TR	5
Clay	8	40	10	2	20	14
Glauconite	25	30	30	60	45	2
Pyrite	1	3	2	1	2	1
Foraminifers	–	–	TR	–	–	–
Calc. nannofossils	–	–	TR	–	–	–
Diatoms	40	1	30	25	2	2
Radiolarians	TR	–	TR	TR	1	–
Sponge spicules	1	–	1	1	TR	TR
Silicoflagellates	TR	TR	–	1	–	–

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	0.83	–
Carbonate	1	1

SITE 612 HOLE CORE 14X CORED INTERVAL 107.5–117.2 m



LITHOLOGIC DESCRIPTION

Olive gray micaceous MUD with darker burrow mottles and cm to mm thick occasional layers of SAND, rarely with sharp scoured lower contact.

Rare pyritic nodules and brown barite nodules.

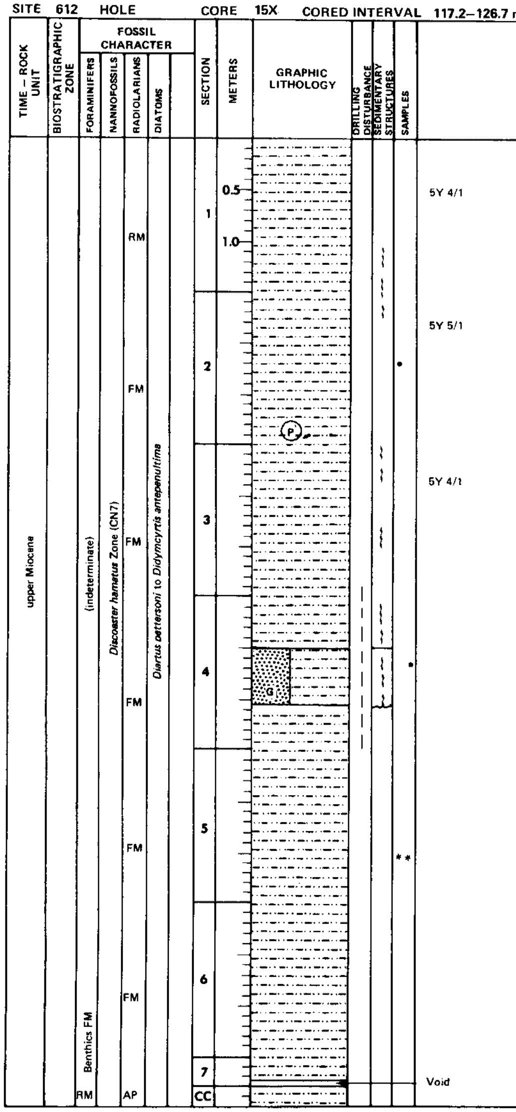
SMEAR SLIDE SUMMARY (%):

	1, 41 D	5, 28 M	6, 32 M
Texture:			
Sand	20	2	40
Silt	25	18	30
Clay	55	80	30
Composition:			
Quartz	30	20	60
Mica	–	–	5
Heavy minerals	TR	–	TR
Clay	45	35	15
Glauconite	3	–	5
Calc. nannofossils	7	20	5
Diatoms	10	} 5	} 10
Radiolarians	5	}	
Plant debris	–	20	–

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	–	–
Carbonate	2	3

SITE 612 HOLE CORE 15X CORED INTERVAL 117.2–126.7 m



LITHOLOGIC DESCRIPTION

MUD: dark gray (5Y 4/1) micaceous, with occasional sandy burrow mottles. In Section 4 thin layers of glauconitic sand. In Section 5 and 6 patches of white reworked nanno ooze.

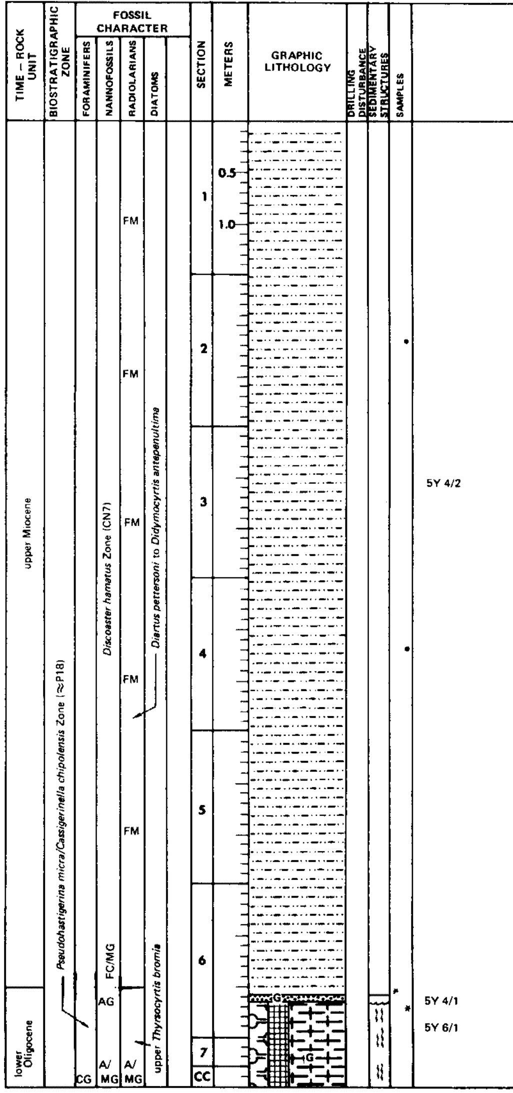
SMEAR SLIDE SUMMARY (%):

	5, 105	5, 107
	D	–
Texture:		
Sand	20	35
Silt	40	35
Clay	40	30
Composition:		
Quartz	45	55
Feldspar	–	2
Mica	1	–
Clay	20	15
Glauconite	10	10
Pyrite	10	8
Calc. nannofossils	7	5
Diatoms	7	5
Radiolarians		
Plant debris	TR	TR

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	–	–
Carbonate	6	3

SITE 612 HOLE CORE 16X CORED INTERVAL 126.7–136.2 m



LITHOLOGIC DESCRIPTION

MUD: homogeneous, olive gray (5Y 4/2) micaceous, with reworked light gray mud patches. Toward the bottom of Section 6 color turning to light gray, faintly glauconitic.

SAND: dark gray (5Y 4/1) 5 cm thick, with sharp, scoured lower erosional surface, short transition to mud on top. Coarse grained, well sorted quartz sand, glauconitic.

RADIOLARIAN (FORAMINIFERAL) NANNOFOSSIL OOZE: light gray, burrowed (chondrites-like) burrows filled with green gray glauconitic silt.

SMEAR SLIDE SUMMARY (%):

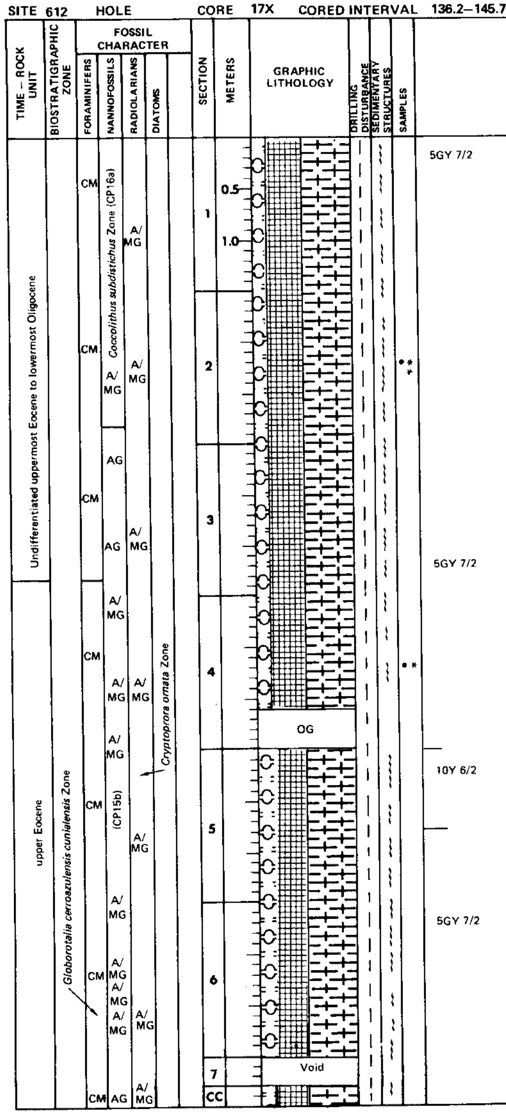
	6, 108	6, 120
	D	D
Texture:		
Sand	10	25
Silt	75	60
Clay	15	15
Composition:		
Quartz	20	10
Feldspar	3	
Mica	2	–
Heavy minerals	–	5
Clay and silica[a]	15	15
Glauconite	10	10
Pyrite	–	5
Foraminifers	–	10
Calc. nannofossils	30	30
Diatoms	20	15
Radiolarians		

[a] Combined mixture of nonspecified terrigenous clay and biogenic Opal A

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	1.58	–
Carbonate	3	5

SITE 612 HOLE CORE 17X CORED INTERVAL 136.2–145.7 m



LITHOLOGIC DESCRIPTION

SILICEOUS FORAMINIFERAL NANNOFOSSIL OOZE, unbedded and homogeneous layers, very slightly deformed.

Color:
grayish yellow green (5GY 7/2) (Section 1–4)
pale olive (10Y 6/2) (Section 5, 0–77 cm)
grayish yellow green (5GY 7/2) (Section 5, 7–150 cm and Section 6–Core Catcher).

SMEAR SLIDE SUMMARY (%):

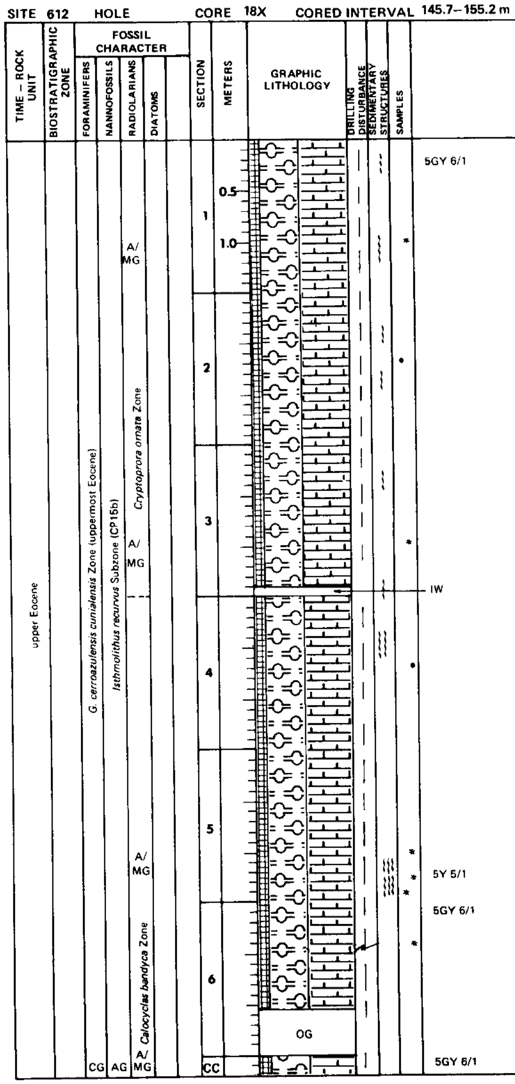
	2, 80 D	4, 70 D
Texture:		
Sand	30	15
Silt	40	50
Clay	30	35
Composition:		
Quartz	5	1
Heavy minerals	1	–
Clay and silica[a]	30	30
Foraminifers	15	20
Calc. nannofossils	37	33
Diatoms }	12	15
Radiolarians }		1
Sponge spicules	–	TR

[a] Combined mixture of nonspecified terrigeneous clay and biogenic Opal A

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	–	–
Carbonate	40	42

SITE 612 HOLE CORE 18X CORED INTERVAL 145.7–155.2 m



LITHOLOGIC DESCRIPTION

SILICEOUS, FORAMINIFERAL NANNOFOSSIL OOZE, 5GY 6/1, homogeneous, weakly-bedded diatomaceous, foraminiferal, NANNOFOSSIL OOZE.

Patch of gray (5Y 5/1), faintly pyritiferous ooze at approximately 100 cm Section 3.

SMEAR SLIDE SUMMARY (%):

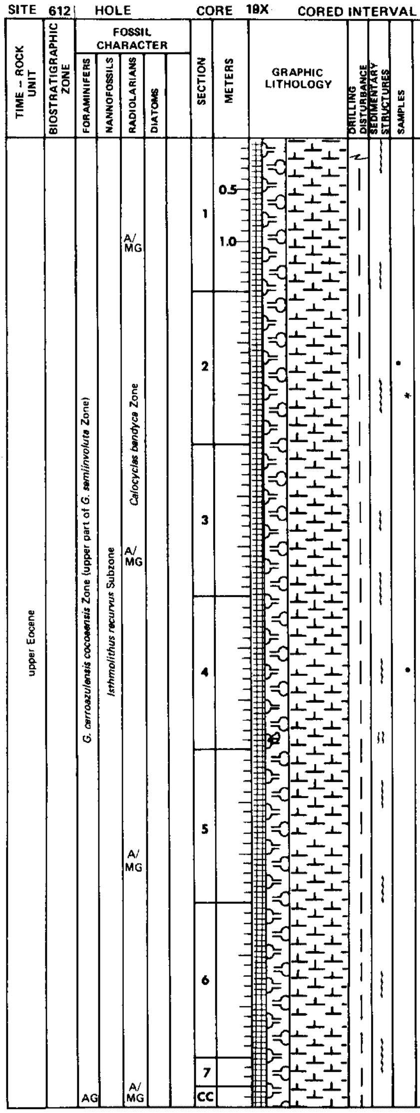
	1, 100 D	3, 100 D	5, 100 D	5, 130 D	5, 145 D	6, 45 D
Texture:						
Sand	10	20	10	15	15	15
Silt	70	65	65	70	60	65
Clay	20	15	25	15	25	20
Composition:						
Quartz	2	2	1	–	1	–
Clay and silica[a]	10	12	20	12	21	12
Glauconite	8	5	3	2	2	1
Pyrite	2	1	3	1	1	2
Foraminifers	10	10	8	10	10	15
Calc. nannofossils	40	45	40	40	40	40
Diatoms }	28	25	25	35	25	30
Radiolarians }						

[a] Combined mixture of nonspecified terrigeneous clay and biogenic Opal A

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	0.28	–
Carbonate	48	45

SITE 612 HOLE CORE 19X CORED INTERVAL 155.2–164.7 m



LITHOLOGIC DESCRIPTION

5GY 7/2

SILICEOUS, FORAMINIFERAL NANNOFOSSIL OOZE, grayish green (5Y 7/2) massive and burrow-mottled.

Foraminiferal content is dropping sharply (foraminiferal) - diatomaceous nannofossil ooze, Section 4.

Pyrite cemented burrow at 140 cm Section 4.

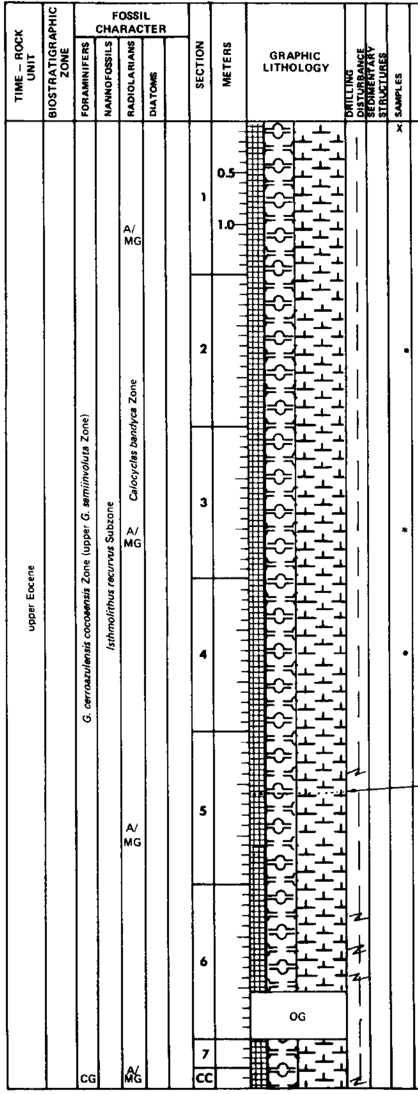
SMEAR SLIDE SUMMARY (%):

	2, 100
	D
Texture:	
Sand	5
Silt	80
Clay	15
Composition:	
Clay and silica	10
Volcanic glass	2
Glauconite	2
Pyrite	1
Foraminifers	10
Calc. nannofossils	45
Diatoms Radiolarians	30

ORGANIC CARBON AND CARBONATE (%):

	2, 72–73	4, 73–75
Organic carbon	–	–
Carbonate	46	44

SITE 612 HOLE CORE 20X CORED INTERVAL 164.7–174.2 m



LITHOLOGIC DESCRIPTION

5GY 7/2

SILICEOUS NANNOFOSSIL OOZE, burrow-mottled with light gray (5Y 7/2).

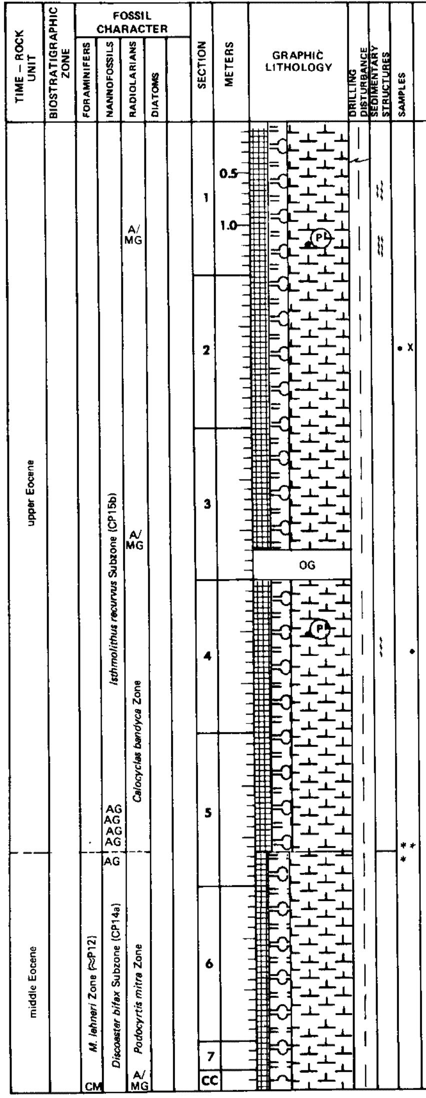
SMEAR SLIDE SUMMARY (%):

	3, 100
	D
Texture:	
Sand	5
Silt	65
Clay	30
Composition:	
Clay and silica	20
Volcanic glass	2
Pyrite	1
Foraminifers	5
Calc. nannofossils	40
Diatoms Radiolarians	30

ORGANIC CARBON AND CARBONATE (%):

	2, 73–75	4, 73–75
Organic carbon	–	–
Carbonate	38	38

SITE 612 HOLE CORE 21X CORED INTERVAL 174.2–183.8 m



LITHOLOGIC DESCRIPTION

5GY 7/2

SILICEOUS NANNOFOSSIL OOZE with considerable mottling, light brownish gray (2.5Y 6/2).

Pyrite-cemented burrow

Section 4: excellent preservation of shell material.

SMEAR SLIDE SUMMARY (%):

	5, 110	5, 117	5, 122
	D	D	D
Texture:			
Sand	2	2	10
Silt	63	33	70
Clay	35	65	20
Composition:			
Quartz	5	–	–
Heavy minerals	3	3	2
Clay and silica	30	30	15
Volcanic glass	TR	–	–
Glauconite	2	2	–
Pyrite	–	–	1
Foraminifers	5	5	12
Calc. nannofossils	35	35	35
Diatoms } Radiolarians	20	25	35

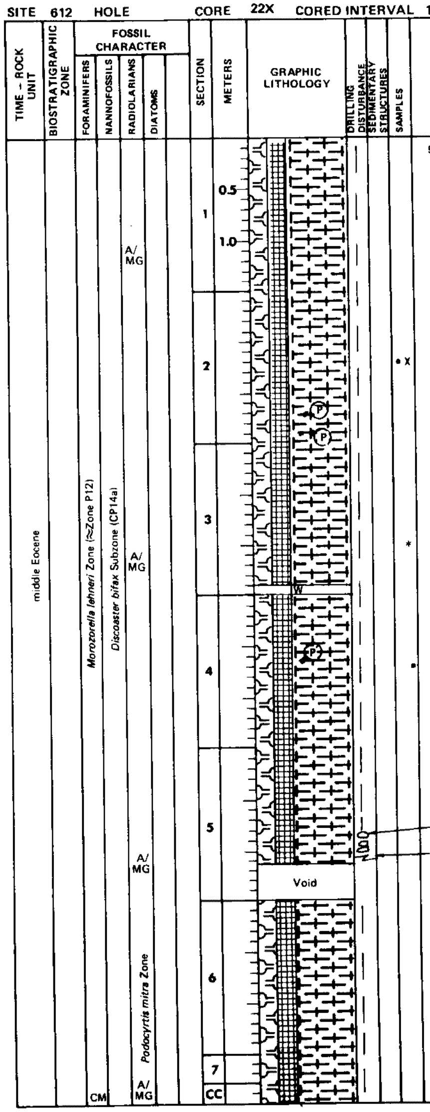
ORGANIC CARBON AND CARBONATE (%):

	2, 73–75	4, 73–75
Organic carbon	0.46	–
Carbonate	29	29

Small pyritic burrow fill

5GY 8/1 Mottled

SITE 612 HOLE CORE 22X CORED INTERVAL 183.8–193.4 m



LITHOLOGIC DESCRIPTION

5GY 8/1

SILICEOUS NANNOFOSSIL OOZE, light greenish gray with light olive gray (5Y 6/1).

SMEAR SLIDE SUMMARY (%):

	3, 100
	D
Texture:	
Sand	2
Silt	73
Clay	25
Composition:	
Heavy minerals	TR
Clay and silica	20
Foraminifers	15
Calc. nannofossils	45
Diatoms } Radiolarians	20

Small pyrite nodules

ORGANIC CARBON AND CARBONATE (%):

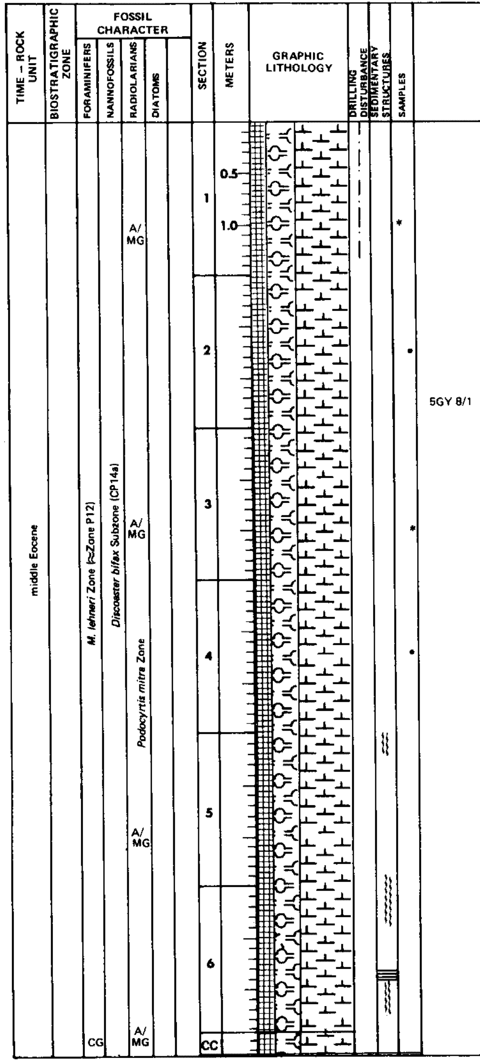
	2, 73–75	4, 73–75
Organic carbon	–	–
Carbonate	49	38

Pyrite layer, probably a burrowed zone

Soupy zone

Fracture in core

SITE 612 HOLE CORE 23X CORED INTERVAL 193.4–203.0 m



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL OOZE, light greenish gray (5GY 8/1) numerous small specks, streaks of dark greenish gray (5G 4/1) and occasional burrows of light olive gray (5Y 6/1); no change of grain size in either type of mottle.

Several intervals in core are fractured by drilling.

SMEAR SLIDE SUMMARY (%):

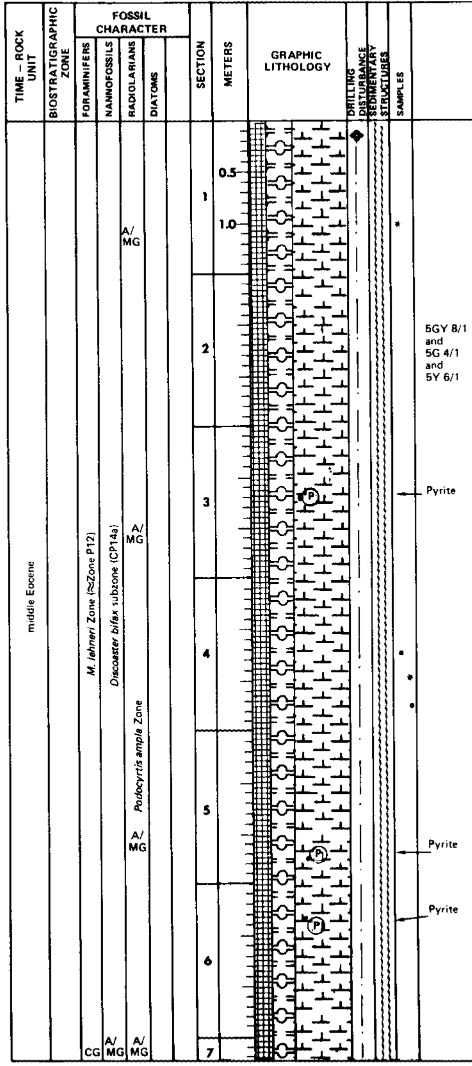
	1, 100	3, 100
	D	D
Texture:		
Sand	2	10
Silt	65	60
Clay	33	30
Composition:		
Clay and silica[a]	20	20
Pyrite	TR	–
Foraminifers	–	5
Calc. nannofossils	50	40
Diatoms Radiolarians	} 30	} 30
Sponge spicules	–	5

[a] Combined mixture of nonspecified terrigeneous clay and biogenic Opal A

ORGANIC CARBON AND CARBONATE (%):

	2, 77–79	4, 75–79
Organic carbon	–	–
Carbonate	39	36

SITE 612 HOLE CORE 24X CORED INTERVAL 203.0–212.6 m



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL OOZE, light greenish gray (5GY 8/1) with numerous small mottles, streaks of dark greenish gray (5G 4/1) and burrows of light olive gray (5Y 6/1) common throughout the core.

Occasional pyrite nodules or pyritized burrows.

Sediment is firm and occasionally broken into 5 cm-thick "biscuits" with soft drilling slurry between.

SMEAR SLIDE SUMMARY (%):

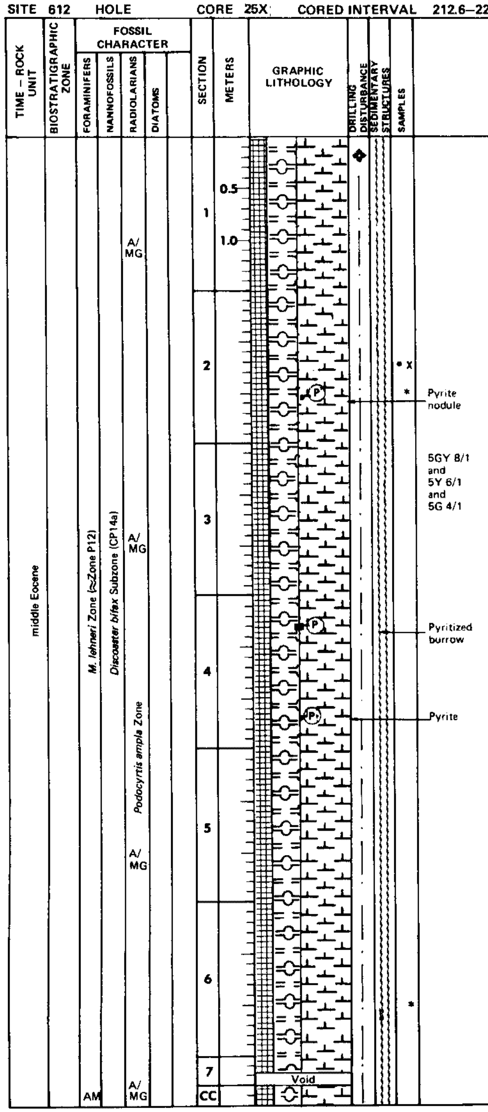
	1, 100	4, 100
	D	D
Texture:		
Sand	10	10
Silt	60	60
Clay	30	30
Composition:		
Clay and silica[a]	28	20
Palagonite	TR	TR
Glauconite	–	TR
Foraminifers	2	–
Calc. nannofossils	43	58
Diatoms Radiolarians	} 25	} 20
Sponge spicules	2	2

[a] Combined mixture of nonspecified terrigeneous clay and biogenic Opal A

ORGANIC CARBON AND CARBONATE (%):

	4, 77–79
Organic carbon	–
Carbonate	52

SITE 612 HOLE CORE 25X CORED INTERVAL 212.6–222.2 m



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL OOZE, light greenish gray (5GY 8/1) moderately burrowed with light olive gray (5Y 6/1). Occasional specks. Streaks of dark greenish gray (5G 4/1) sulfide stains; rare pyrite nodules, pyritized burrows.

"Biscuit" deformation throughout.

SMEAR SLIDE SUMMARY (%):

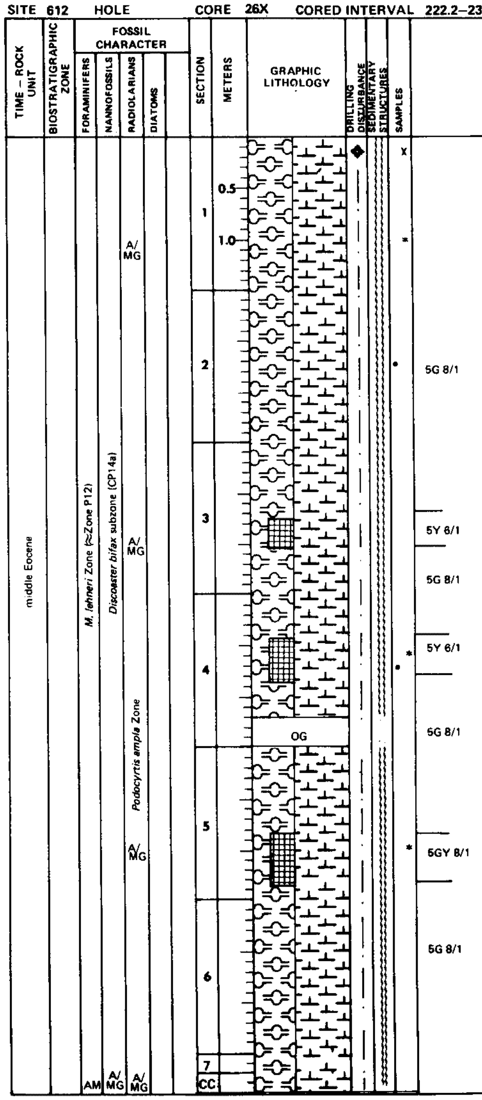
	2, 100 D	6, 100 D
Texture:		
Sand	15	20
Silt	65	50
Clay	20	30
Composition:		
Clay and silica[a]	10	20
Volcanic glass	TR	TR
Pyrite	TR	—
Foraminifers	5	15
Calc. nannofossils	50	40
Diatoms }	30	25
Radiolarians }		
Sponge spicules	5	—

[a] Combined mixture of nonspecified terrigenous clay and biogenic Opal A

ORGANIC CARBON AND CARBONATE (%):

	2, 77–79
Organic carbon	—
Carbonate	47

SITE 612 HOLE CORE 26X CORED INTERVAL 222.2–231.8 m



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1); moderately burrowed with light olive gray (5Y 6/1). Occasional mottles, streaks of dark greenish gray (5G 4/1) (sulfide staining?).

"Biscuit" deformation throughout.

This is first core classified as "chalk".

SMEAR SLIDE SUMMARY (%):

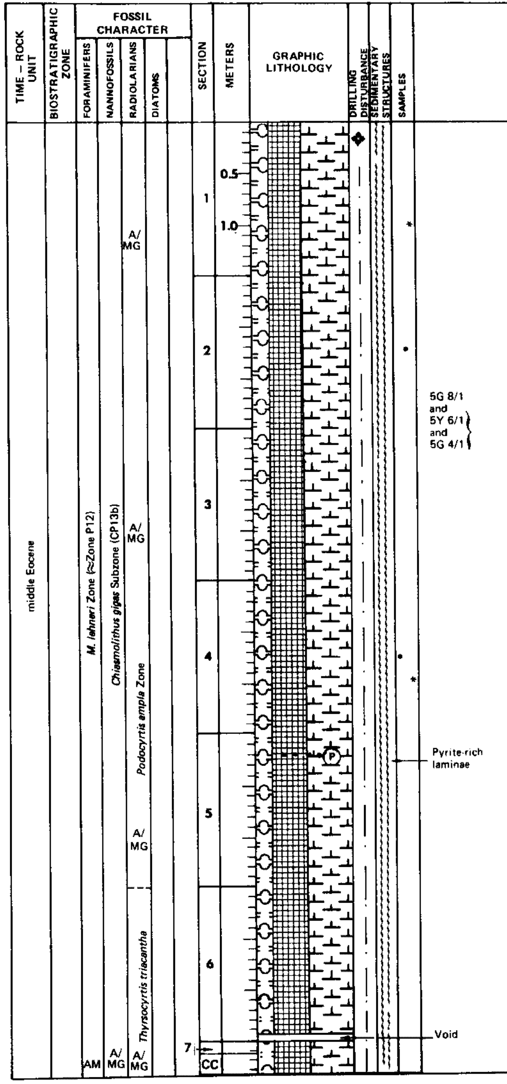
	1, 100 D	4, 60 D	5, 100 D
Texture:			
Sand	35	5	20
Silt	50	40	50
Clay	15	55	30
Composition:			
Clay and silica[a]	6	34	20
Palagonite	1	—	—
Glauconite	TR	—	—
Foraminifers	5	3	5
Calc. nannofossils	50	51	55
Diatoms	10	} 12	10
Radiolarians	25	}	9
Sponge spicules	3	—	1

[a] Combined mixture of nonspecified terrigenous clay and biogenic Opal A

ORGANIC CARBON AND CARBONATE (%):

	2, 77–79	4, 73–75
Organic carbon	—	—
Carbonate	44	46

SITE 612 HOLE CORE 27X CORED INTERVAL 231.8–241.4 m



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1); moderate burrowing – light olive gray (5Y 6/1); occasional mottles. Streaks of dark greenish gray (5G 4/1) (sulfide staining?).

"Biscuit" deformation throughout.

SMEAR SLIDE SUMMARY (%):

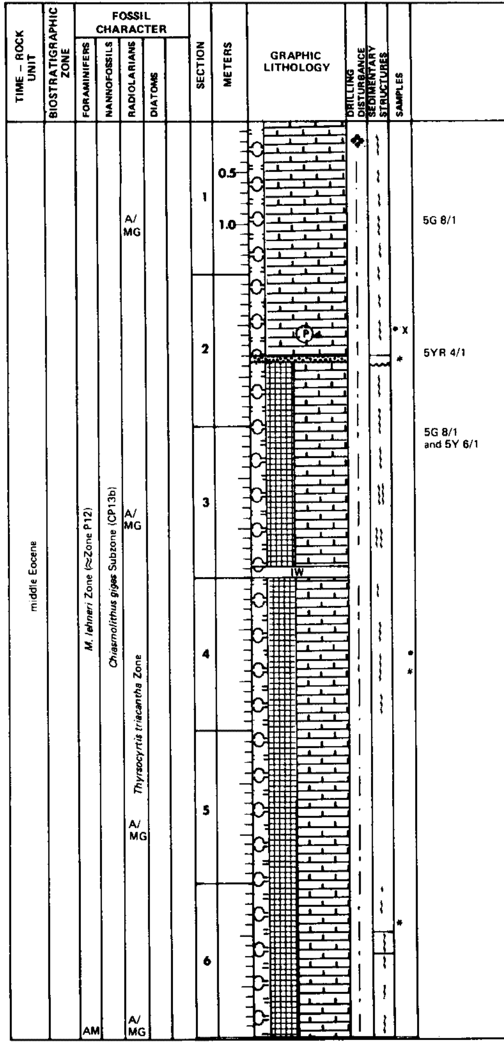
	1, 100	4, 100
	D	D
Texture:		
Sand	20	20
Silt	40	50
Clay	40	30
Composition:		
Clay and silica[a]	30	20
Foraminifers	5	5
Calc. nannofossils	45	50
Radiolarians	10	} 25
Sponge spicules	10	

[a] Combined mixture of nonspecified terrigenous clay and biogenic Opal A

ORGANIC CARBON AND CARBONATE (%):

	2, 75–77	4, 77–79
Organic carbon	–	–
Carbonate	39	44

SITE 612 HOLE CORE 28X CORED INTERVAL 241.4–251.0 m



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1) with dark greenish gray (5G 4/1) streaks and burrows. Occasional pyrite nodules.

SAND: brownish gray (5YR 4/1) medium grained quartz-sand with idiomorphous pyrite crystals.

SMEAR SLIDE SUMMARY (%):

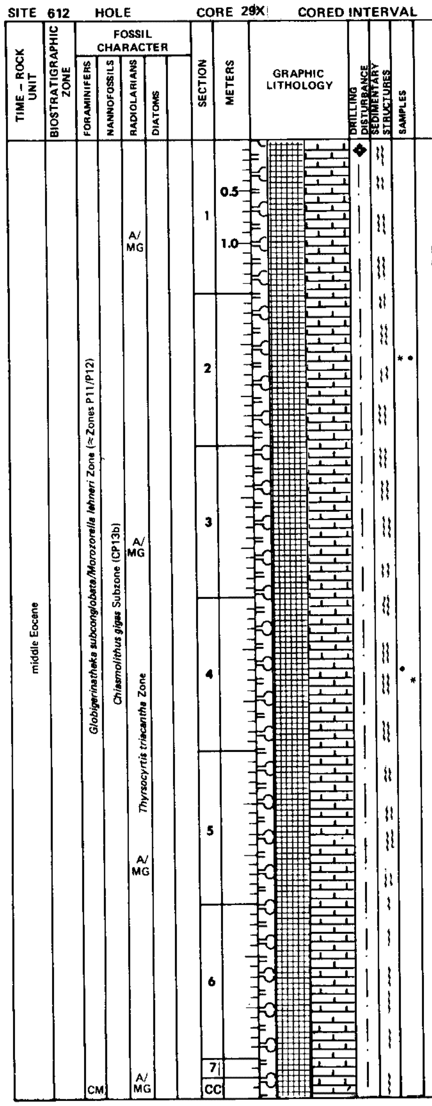
	2, 85	4, 95	6, 37
	M	D	M
Texture:			
Sand	80	5	5
Silt	5	40	60
Clay	15	55	35
Composition:			
Quartz	73	–	–
Mica	–	TR	TR
Heavy minerals	10	–	–
Clay and silica[a]	3	44	30
Glauconite	TR	–	–
Pyrite	2	1	3
Carbonate unspec.	–	–	10
Foraminifers	TR	–	TR
Calc. nannofossils	12	45	47
Diatoms	–	3	3
Radiolarians	TR	5	5
Sponge spicules	TR	2	2

[a] Combined mixture of nonspecified terrigenous clay and biogenic Opal A

ORGANIC CARBON AND CARBONATE (%):

	2, 55–57	4, 75–77
Organic carbon	–	–
Carbonate	42	39

SITE 612 HOLE CORE 29X CORED INTERVAL 251.0–260.6 m



LITHOLOGIC DESCRIPTION

5G 8/1
and
5Y 6/1

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1) with numerous light olive gray (5Y 6/1) layers and burrows.

Biscuit deformation.

SMEAR SLIDE SUMMARY (%):

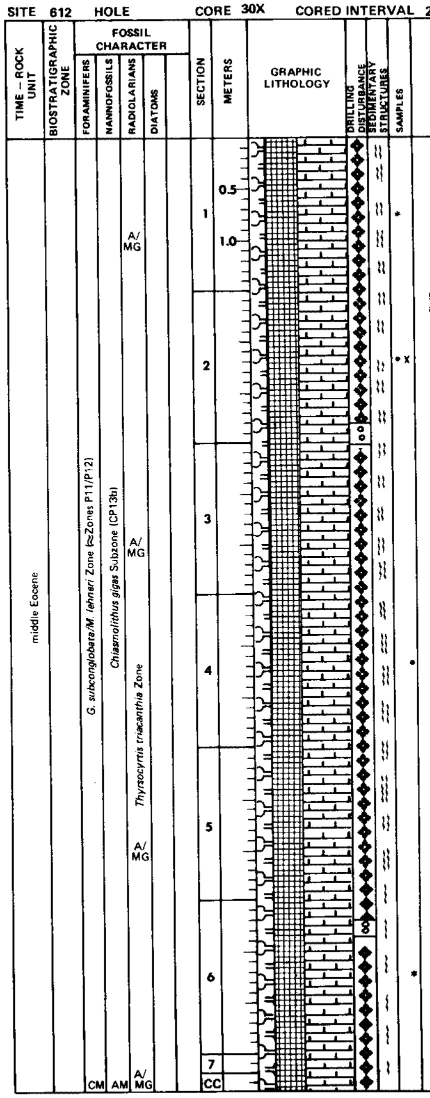
	2, 62	4, 88
	D	D
Texture:		
Sand	5	10
Silt	55	55
Clay	40	35
Composition:		
Mica	–	TR
Clay and silica[a]	40	30
Glauconite	TR	TR
Pyrite	TR	TR
Carbonate unspec.	9	10
Foraminifers	1	TR
Calc. nannofossils	40	45
Diatoms	1	5
Radiolarians	5	5
Sponge spicules	4	5

[a] Combined mixture of nonspecified terrigenous clay and biogenic Opal A

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	–	–
Carbonate	45	49

SITE 612 HOLE CORE 30X CORED INTERVAL 260.6–270.2 m



LITHOLOGIC DESCRIPTION

5G 8/1
and 5Y 8/1

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1) with abundant yellowish gray (5Y 8/1) (chondrites-like) burrows.

Biscuit deformation.

Core in parts strongly deformed.

SMEAR SLIDE SUMMARY (%):

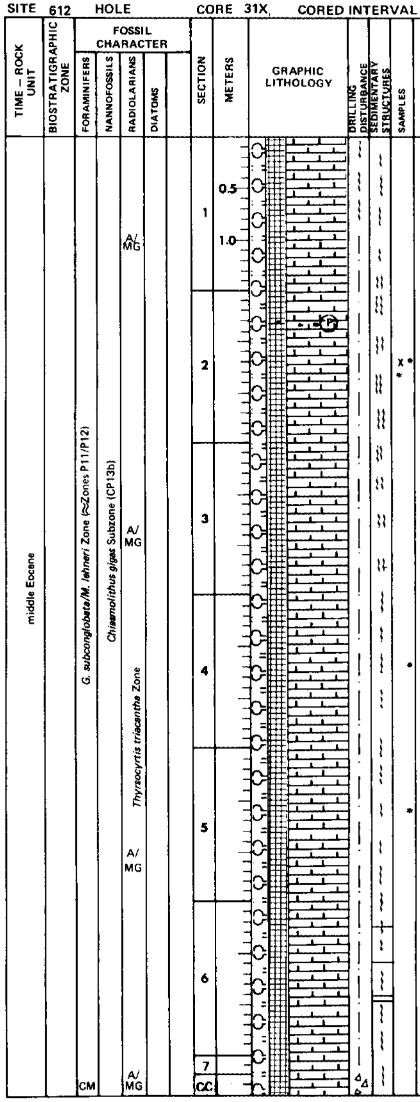
	1, 77	6, 75
	D	D
Texture:		
Sand	5	10
Silt	50	50
Clay	45	40
Composition:		
Quartz	TR	–
Mica	–	TR
Clay and silica[a]	40	35
Pyrite	TR	TR
Carbonate unspec.	10	15
Foraminifers	TR	TR
Calc. nannofossils	40	35
Diatoms	2	5
Radiolarians	3	5
Sponge spicules	5	5

[a] Combined mixture of nonspecified terrigenous clay and biogenic Opal A

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	0.19	–
Carbonate	45	42

SITE 612 HOLE CORE 31X CORED INTERVAL 270.2–279.8 m



LITHOLOGIC DESCRIPTION

5G 8/1
and
5Y 8/1

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1) intensively burrowed (light olive gray (5Y 8/1). Burrows small (horizontal and diagonal spreiten and dwellings).

Pyrite nodules, and occasional fish remains (scales).

SMEAR SLIDE SUMMARY (%):

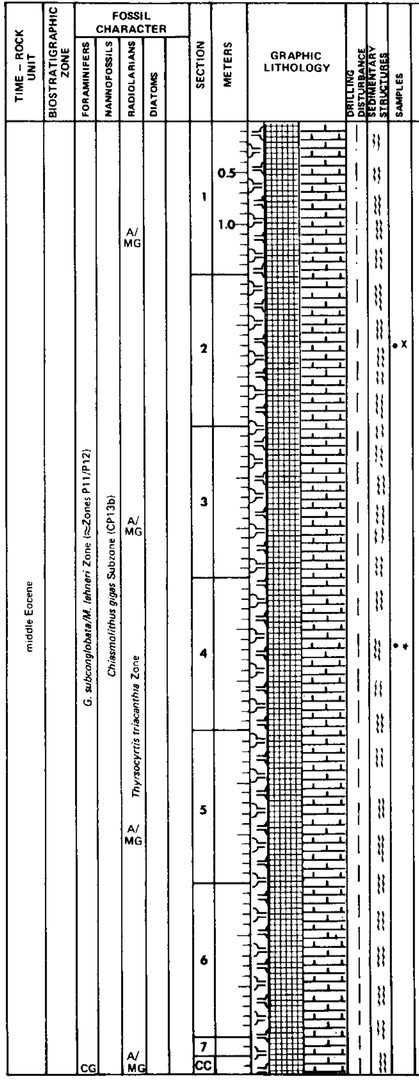
	2, 85	5, 62
	D	D
Texture:		
Sand	5	5
Silt	65	65
Clay	30	30
Composition:		
Mica	TR	–
Clay and silica[a]	20	20
Pyrite	TR	TR
Carbonate unspec.	15	15
Foraminifers	–	TR
Calc. nannofossils	50	50
Diatoms	5	5
Radiolarians	5	5
Sponge spicules	5	5

[a] Combined mixture of nonspecified terrigenous clay and biogenic Opal A

ORGANIC CARBON AND CARBONATE (%):

	2, 75–77	4, 70–73
Organic carbon	–	–
Carbonate	52	51

SITE 612 HOLE CORE 32X CORED INTERVAL 279.8–289.4 m



LITHOLOGIC DESCRIPTION

5G 8/1
and 5Y 8/1

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1) with abundant yellowish gray (5Y 8/1) burrows. In thin parts thin bedded to laminated. Small pyrite nodules.

SMEAR SLIDE SUMMARY (%):

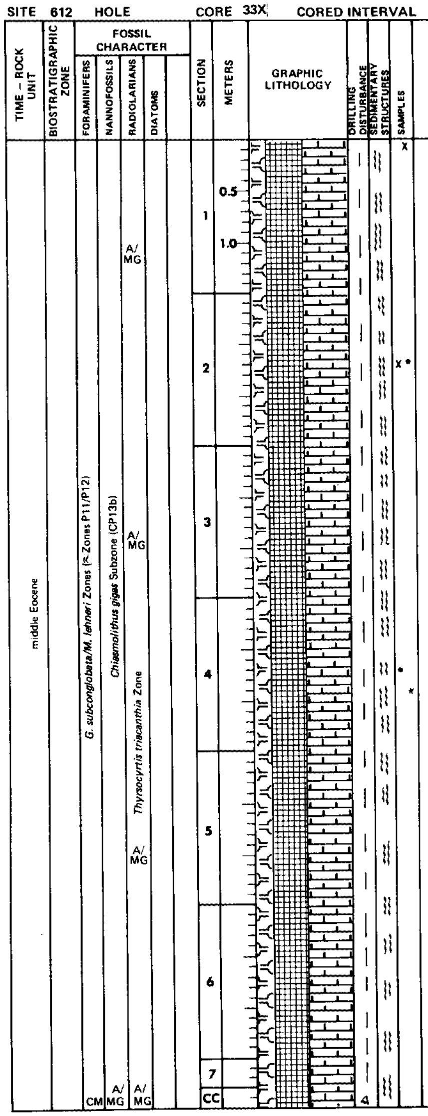
	4, 70
	D
Texture:	
Sand	5
Silt	55
Clay	40
Composition:	
Clay and silica[a]	35
Pyrite	TR
Carbonate unspec.	20
Foraminifers	TR
Calc. nannofossils	30
Diatoms	5
Radiolarians	5
Sponge spicules	5

[a] Combined mixture of nonspecified terrigenous clay and biogenic Opal A

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	–	–
Carbonate	36	41

SITE 612 HOLE CORE 33X CORED INTERVAL 289.4–299.1 m



LITHOLOGIC DESCRIPTION

5G 8/1 and 5Y 8/1

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1) with abundant yellowish gray (5Y 8/1) burrow- and dwelling-structures. Small pyrite nodules and randomly distributed fine grained pyrite. Fish bones and scales (small).

SMEAR SLIDE SUMMARY (%):

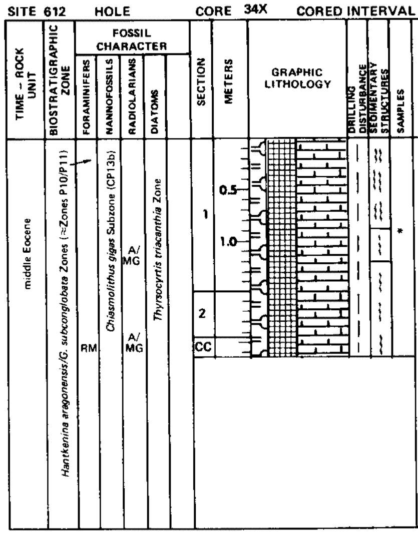
	4, 90
	D
Texture:	
Sand	5
Silt	55
Clay	40
Composition:	
Clay and silica[a]	35
Carbonate unspec.	13
Foraminifers	TR
Calc. nannofossils	40
Diatoms	5
Radiolarians	2
Sponge spicules	5

[a] Combined mixture of nonspecified terrigenous clay and biogenic Opal A

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	–	–
Carbonate	46	42

SITE 612 HOLE CORE 34X CORED INTERVAL 299.1–308.8 m



LITHOLOGIC DESCRIPTION

5Y 8/1

5G 8/1

5Y 8/1 and 5Y 6/1

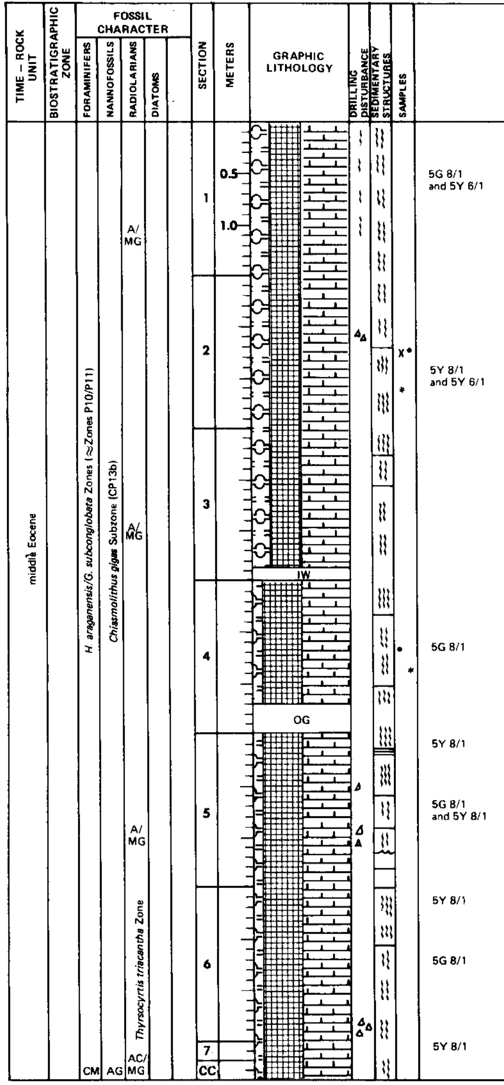
SILICEOUS NANNOFOSSIL CHALK, yellowish gray (5Y 8/1) with abundant light olive gray (5Y 6/1) burrows. From 90–120 cm light greenish gray (5G 8/1) small pyrite nodules and sand-sized fish remains (mainly scales).

SMEAR SLIDE SUMMARY (%):

	1, 92
	D
Texture:	
Sand	5
Silt	55
Clay	40
Composition:	
Clay and silica[a]	30
Glauconite	TR
Pyrite	TR
Carbonate unspec.	15
Foraminifers	TR
Calc. nannofossils	40
Diatoms	5
Radiolarians	5
Sponge spicules	5

[a] Combined mixture of nonspecified terrigenous clay and biogenic Opal A

SITE 612 HOLE CORE 35X CORED INTERVAL 308.8–318.5 m



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1), light olive gray (5Y 6/1), and yellowish gray (5Y 8/1) mixed in layers and burrow structures. In parts irregular to parallel bedding recognized. Burrowing very intensive. Through the whole core occasional small pyrite nodules and sand grained fish remains.

SMEAR SLIDE SUMMARY (%):

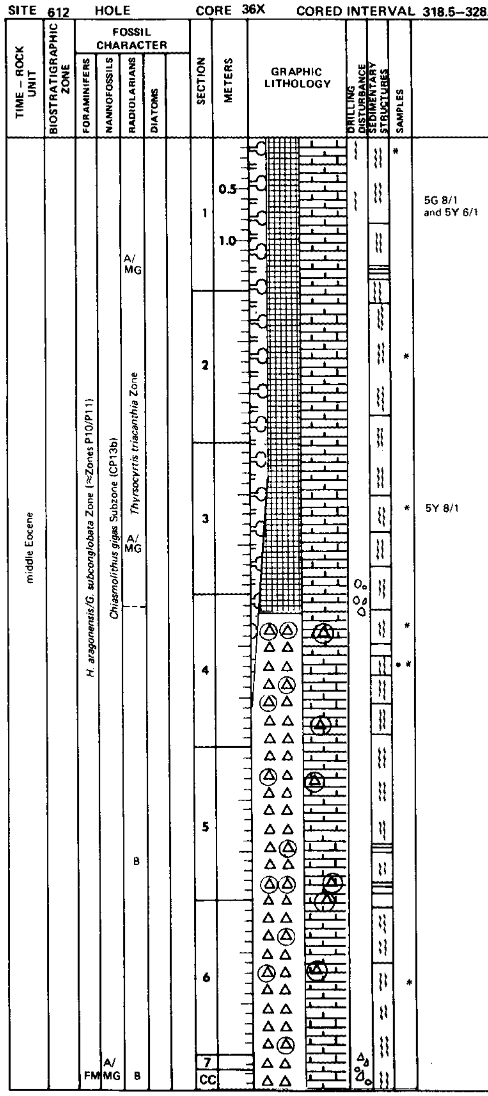
	2, 118	4, 90
	M	D
Texture:		
Sand	5	5
Silt	55	55
Clay	40	40
Composition:		
Clay and silica[a]	30	35
Pyrite	TR	TR
Carbonate unspec.	15	15
Foraminifers	TR	TR
Calc. nannofossils	40	40
Diatoms	5	2
Radiolarians	5	3
Sponge spicules	5	5

[a] Combined mixture of nonspecified terrigenous clay and biogenic Opal A

ORGANIC CARBON AND CARBONATE (%):

	2, 77–79	4, 70–73
Organic carbon	–	–
Carbonate	44	43

SITE 612 HOLE CORE 36X CORED INTERVAL 318.5–328.1 m



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1), light olive gray (5Y 6/1), and yellowish gray (5Y 8/1) mixed up in layers and very numerous burrows. Parts are faintly laminated. Occasional fish remains (scales, teeth).

*In Section 4 radiolaria and other siliceous fossils disappear. They are replaced by layers and by diffuse zones of porcellanite. Below this level, the presence of sub-mm wide, round holes represent the tests of dissolved radiolaria. The clay and silica designation represents a porcellanite-clay mixture of indeterminate composition.

SMEAR SLIDE SUMMARY (%):

	1, 15	2, 65	3, 65	4, 32	6, 84
	D	D	D	M	D
Texture:					
Sand	5	5	3	50	1
Silt	55	55	37	20	49
Clay	40	40	60	30	50
Composition:					
Clay and silica	30	30	60	30	40
Glauconite	–	–	–	–	TR
Pyrite	TR	TR	–	–	–
Carbonate unspec.	15	15	15	68	20
Foraminifers	TR	TR	TR	2	TR
Calc. nannofossils	43	43	20	TR	40
Diatoms	2	2	–	–	–
Radiolarians	5	5	TR	TR	TR
Sponge spicules	5	5	5	TR	–

ORGANIC CARBON AND CARBONATE (%):

	4, 70–73
Organic carbon	–
Carbonate	49

SITE 612 HOLE CORE 37X CORED INTERVAL 328.1–337.7 m

TIME – ROCK UNIT: middle Eocene

BIOSTRATIGRAPHIC ZONE

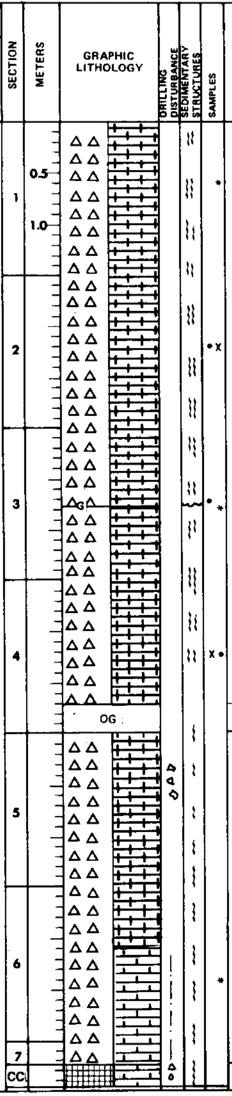
FOSSIL CHARACTER

FORAMINIFERS: *H. aragonensis/G. subconglobata* Zones (≈Zones P10/P11); F/PM

NANNOFOSSILS: *Rhabdosphaera inflata* Subzone (CP12b); AG

RADIOLARIANS: Indeterminate; RP

DIATOMS



5G 8/1 and 5Y 6/1

5G 8/1 and 10YR 4/4

10YR 4/4 dominant

10YR 4/4 dominant

5GY 7/2 and 2.5Y 4/3

2.5Y 4/2

LITHOLOGIC DESCRIPTION

SILICEOUS FORAMINIFERAL NANNOFOSSIL CHALK (Section 1, 2, 3, 4, and 5) and SILICEOUS NANNOFOSSIL CHALK (Section 6, 7, and Core Catcher)

Interlayered firm chalk and slightly harder chalk.
Irregularly and discontinuous thin laminated bedding.
Bioturbation is often parallel to the bedding.
Numerous oblique unstructured burrows and *Rhizocorallium*- or *Zoophycos*-shaped burrows.
Sporadic (Section 1, 2, and 3,→78 cm) lightly glauconitic layers.
Erosion surface at Section 3, 78 cm.
Color:
Section 1–4: light greenish gray (5G 8/1) with numerous bioturbated mottles; plus Section 1: light olive gray (5Y 6/1) and Section 2, 3, and 4: dark yellowish brown (10YR 4/4).
Section 5: grayish yellow green (5GY 7/2) and olive brown (2.5Y 4/3) interlayered.
Core Catcher: dark grayish brown (2.5Y 4/2).

SMEAR SLIDE SUMMARY (%):

	1, 68	3, 80	6, 90
	D	D	D
Texture:			
Sand	1	5	1
Silt	44	40	40
Clay	55	55	59
Composition:			
Quartz	1	1	1
Mica	–	–	2
Clay and silica[a]	50	46	50
Carbonate unspec.	4	–	–
Foraminifers	15	20	5
Calc. nannofossils	30	30	42
Radiolarians	TR	3	TR

[a] See Core 36 (*lithologic description)

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	3, 75–77	4, 77–79
Organic carbon	–	0.72	–
Carbonate	39	38	21

SITE 612 HOLE CORE 38X CORED INTERVAL 337.7–347.3 m

TIME – ROCK UNIT: middle Eocene

BIOSTRATIGRAPHIC ZONE

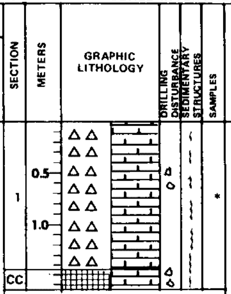
FOSSIL CHARACTER

FORAMINIFERS: *M. aragonensis (M. caucasica?)* probably P9; FP

NANNOFOSSILS: *Rhabdosphaera inflata* Subzone (CP12b); A/MG

RADIOLARIANS: Indeterminate; RP

DIATOMS



5GY 7/2 and 2.5Y 4/2

5GY 7/2 and 2.5Y 4/2

LITHOLOGIC DESCRIPTION

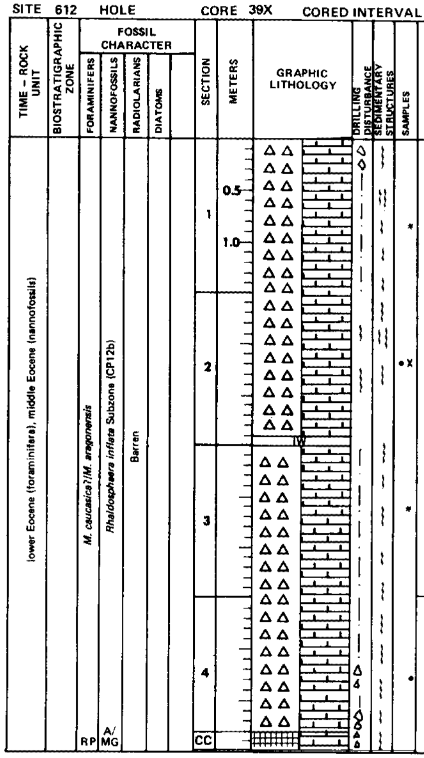
SILICEOUS NANNOFOSSIL CHALK, grayish yellow green (5GY 7/2) and dark grayish brown (2.5Y 4/2) interlayered.
Bioturbation (dark layers) is often parallel to the bedding.
Irregularly and discontinuous thin laminated bedding.

SMEAR SLIDE SUMMARY (%):

	1, 78
	D
Texture:	
Sand	1
Silt	50
Clay	49
Composition:	
Quartz	1
Clay and silica[a]	45
Pyrite	2
Carbonate unspec.	15
Foraminifers	5
Calc. nannofossils	30
Radiolarians	TR
Authigenic mineral	2

[a] See Core 36 (*lithologic description)

SITE 612 HOLE CORE 39X CORED INTERVAL 347.3–357.0 m



LITHOLOGIC DESCRIPTION

5GY 7/2 and 2.5Y 4/2

SILICEOUS NANNOFOSSIL CHALK, interlayered: grayish yellow green (5GY 7/2) and olive brown (2.5Y 4/3) or dark grayish brown (2.5Y 4/2) – bioturbation and organic mottles.

Irregularly and discontinuous thin laminated bedding.

Bioturbation: numerous dwelling structures (burrows) – Section 1, 60 cm and Section 2, 58–66 cm. Sporadic narrow vertical burrows – Section 4, 93–97 cm.

SMEAR SLIDE SUMMARY (%):

	1, 83	3, 67
	D	
Texture:		
Sand	–	2
Silt	50	40
Clay	50	58
Composition:		
Quartz	–	TR
Clay and silica[a]	47	50
Pyrite	1	1
Zeolite	–	TR
Carbonate unspec.	–	4
Foraminifers	1	5
Calc. nannofossils	50	40
Radiolarians	TR	–
Fish remains	TR	–
Authigenic mineral	1	–

[a] See Core 36 (*lithologic description)

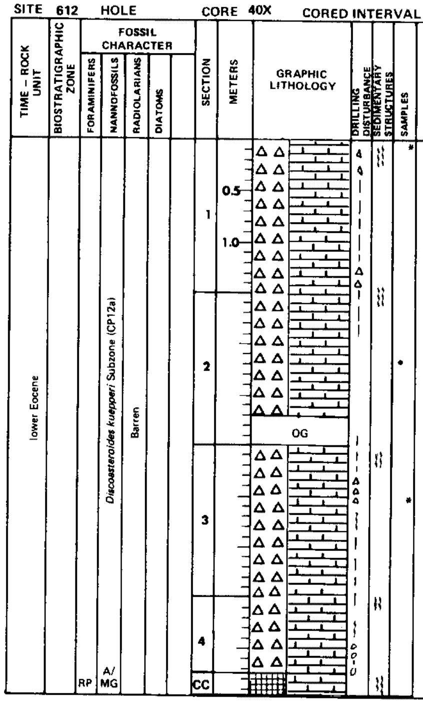
5GY 7/2 and 2.5Y 4/3

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 81–83
Organic carbon	–	–
Carbonate	42	40

5GY 7/2 and 2.5Y 4/3

SITE 612 HOLE CORE 40X CORED INTERVAL 357.0–366.7 m



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, interlayered: grayish yellow green (5GY 7/2) and grayish brown (10YR 5/2) – bioturbation and organic mottles.

Irregularly and discontinuous thin laminated bedding.

5GY 7/2 and 10YR 5/2

Bioturbation: numerous burrows filled with pyrite (framboidal); sporadic oblique burrows (Section 3, 105–106 cm).

SMEAR SLIDE SUMMARY (%):

	1, 8	3, 55
	D	D
Texture:		
Sand	5	TR
Silt	60	50
Clay	35	50
Composition:		
Quartz	1	TR
Heavy minerals	TR	–
Clay[a]	36	40
Pyrite	1	1
Zeolite	TR	TR
Carbonate unspec.	–	19
Foraminifers	10	–
Calc. nannofossils	50	40
Diatoms	TR	–
Radiolarians	1	TR
Sponge spicules	1	–
Fish remains	TR	–

5GY 7/2 and 10YR 5/2

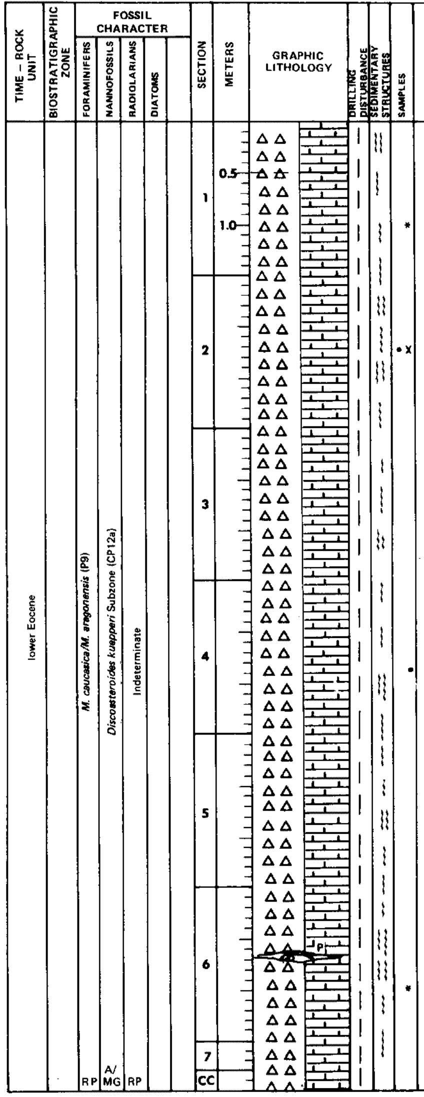
[a] See Core 36 (*lithologic description)

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73
Organic carbon	–
Carbonate	55

5GY 7/2 and 10YR 5/2

SITE 612 HOLE CORE 41X CORED INTERVAL 366.7–376.4 m



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, matrix grayish brown (2.5Y 5/2) mottled by dusky yellow green (5GY 5/2) and grayish brown (10YR 4/2) also very dark gray (2.5Y 3/0) pyritic zones. Mottles are primarily caused by burrows; mostly horizontal but some are oblique. Below Section 1, 56 cm the matrix is grayish yellow green (5GY 7/2). Bedding is irregularly horizontal and disturbed by burrowing.

Section 6, 60–70 cm: very large nodule of pyrite marcasite with a gypsum rim. Deformed sediment surrounds nodule.

SMEAR SLIDE SUMMARY (%):

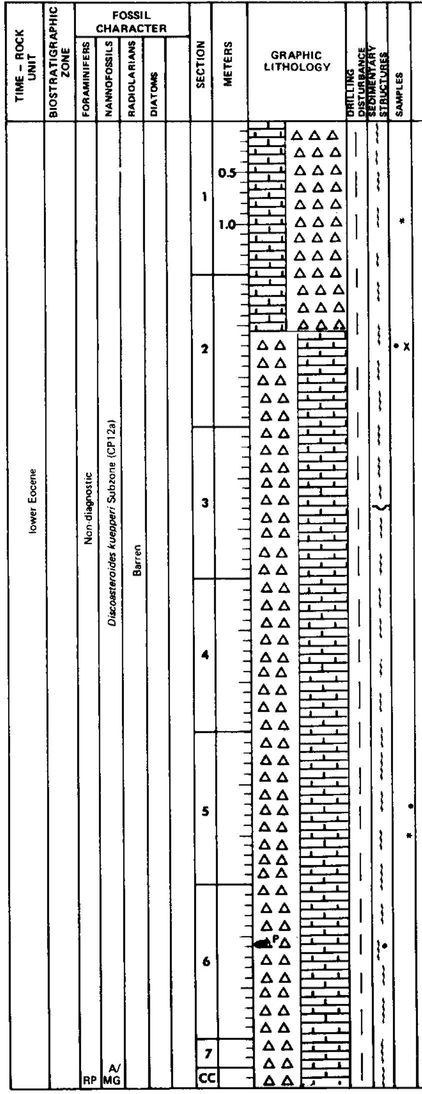
	1, 100	6, 100
Texture:		
Sand	3	TR
Silt	45	50
Clay	52	50
Composition:		
Clay and silica[a]	48	50
Pyrite	2	TR
Carbonate unspec.	10	13
Foraminifers	5	2
Calc. nannofossils	35	35
Radiolarians	TR	TR
Sponge spicules	–	TR

[a] See Core 36 (*lithologic description)

ORGANIC CARBON AND CARBONATE (%):

	2, 79–81	4, 90–92
Organic carbon	–	–
Carbonate	43	40

SITE 612 HOLE CORE 42X CORED INTERVAL 376.4–386.0 m



LITHOLOGIC DESCRIPTION

5Y 6/2

SILICEOUS NANNOFOSSIL CHALK, olive gray (5Y 5/2) matrix with mottles and burrow-fills of dark grayish brown and very dark grayish brown (5Y 4/2 and 5Y 3/2). Thin, irregularly bedded, burrowed chalk top of Section 2. Matrix color change—gray yellow green (5GY 7/2) at Section 2, 55 cm. Large burrow or small channel cut with bedded infill at Section 3, 80 cm. Section 6, 60 cm: large, pyrite-filled burrow (concentric structure).

SMEAR SLIDE SUMMARY (%):

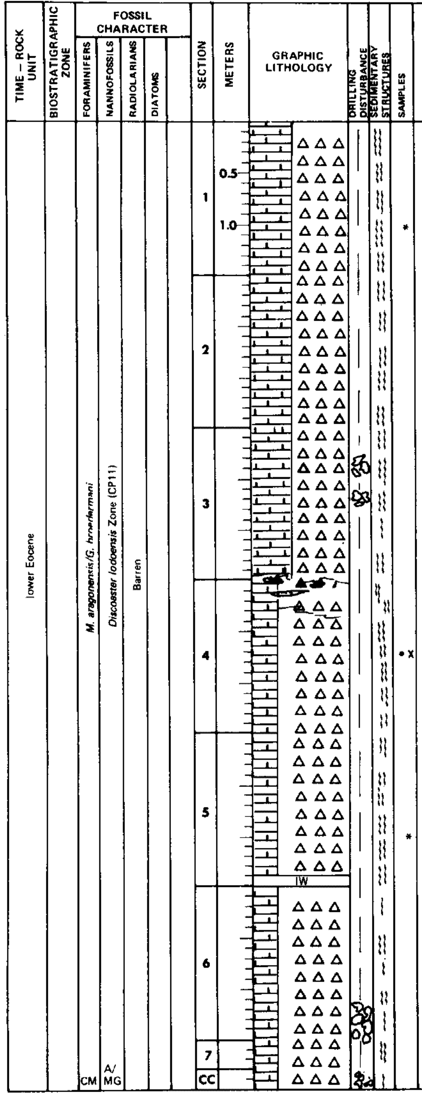
	1, 100	5, 100
Texture:		
Sand	TR	TR
Silt	50	50
Clay	50	50
Composition:		
Quartz	–	TR
Clay and silica[a]	60	48
Pyrite	1	2
Carbonate unspec.	7	–
Foraminifers	2	TR
Calc. nannofossils	30	50

[a] See Core 36 (*lithologic description)

ORGANIC CARBON AND CARBONATE (%):

	2, 73–75	5, 75–77
Organic carbon	0.31	–
Carbonate	34	43

SITE 612 HOLE CORE 43X CORED INTERVAL 386.0–395.6 m



LITHOLOGIC DESCRIPTION

Siliceous NANNOFOSSIL CHALK, grayish yellow green (5GY 7/2) matrix with mottles and burrows of dark grayish brown and very dark grayish brown (5Y 4/2 and 5Y 3/2). Section 4: transition to darker color and NANNOFOSSIL PORCELLANITE, olive gray (5Y 5/1 to 5Y 4/1) with lower carbonate content.

SMEAR SLIDE SUMMARY (%):

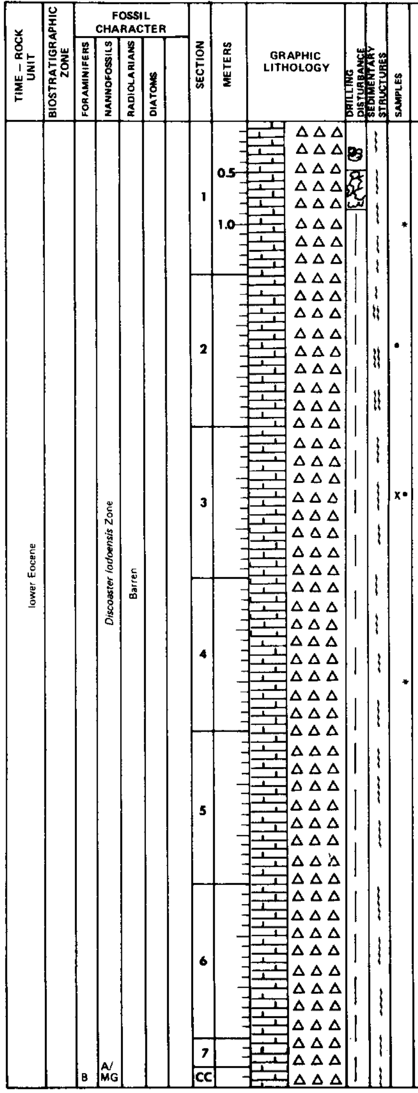
	1, 100	5, 100
Texture:		
Sand	5	4
Silt	34	25
Clay	56	70
Composition:		
Quartz	1	–
Clay and silica[a]	56	70
Pyrite	1	1
Carbonate unspec.	2	–
Foraminifers	5	4
Calc. nannofossils	35	25

[a] See Core 36 (*lithologic description)

ORGANIC CARBON AND CARBONATE (%):

	4, 75–79
Organic carbon	–
Carbonate	26

SITE 612 HOLE CORE 44X CORED INTERVAL 395.6–405.2 m



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, mottled, burrowed, grayish yellow green (5GY 7/2) matrix with darker fillings, dark grayish brown (5Y 4/2) and very dark gray (5Y 3/2).

Most burrows are flattened and nearly horizontal and semi-parallel to the thin, somewhat irregular bedding. Matrix has a chalky texture due to the opal CT mix with clay.

SMEAR SLIDE SUMMARY (%):

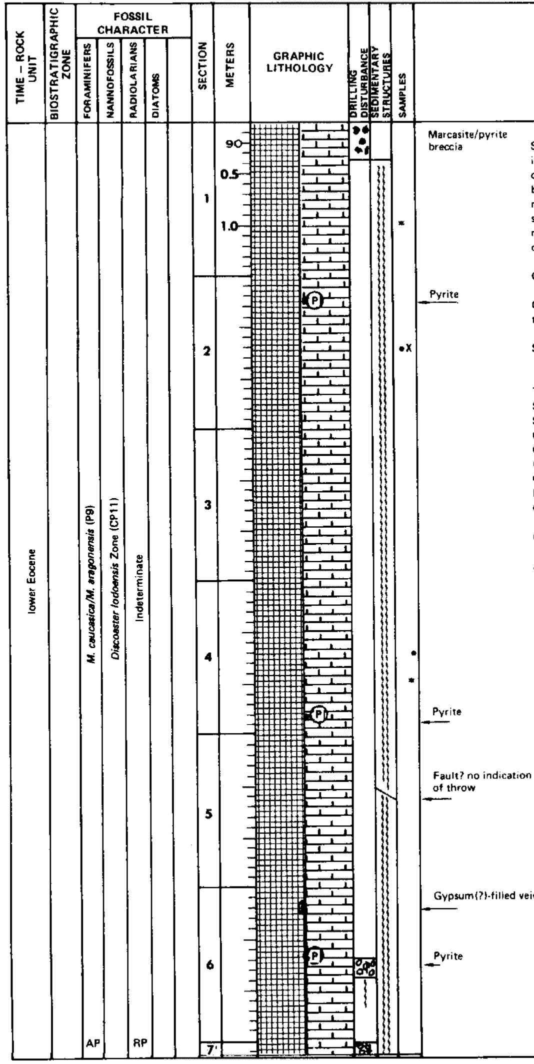
	1, 100	4, 100
Texture:		
Sand	2	2
Silt	45	46
Clay	53	52
Composition:		
Quartz	TR	–
Clay and silica[a]	53	52
Foraminifers	2	2
Calc. nannofossils	45	44
Diatoms	–	2
Radiolarians	TR	–

[a] See Core 36 (*lithologic description)

ORGANIC CARBON AND CARBONATE (%):

	2, 70–72	3, 70–72
Organic carbon	–	–
Carbonate	39	42

SITE 612 HOLE CORE 45X CORED INTERVAL 406.2–414.9 m



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, background color is grayish yellow green (5GY 7/2), but moderate burrowing of dark grayish brown (5Y 4/2) and very dark grayish brown (5Y 3/2) gives core an overall darker value; all mottles, burrows are flattened and lens-shaped; very fine sand-sized white specks are visible on split core (forams?); marcasite/pyrite nodules, granules scattered throughout core, and are concentrated in breccia at top of Section 1.

Core is less than 1/2 round, but intact.

Core expands 1 to 4 cm/section within 1/2 hr. after splitting and develops shaley partings.

SMEAR SLIDE SUMMARY (%):

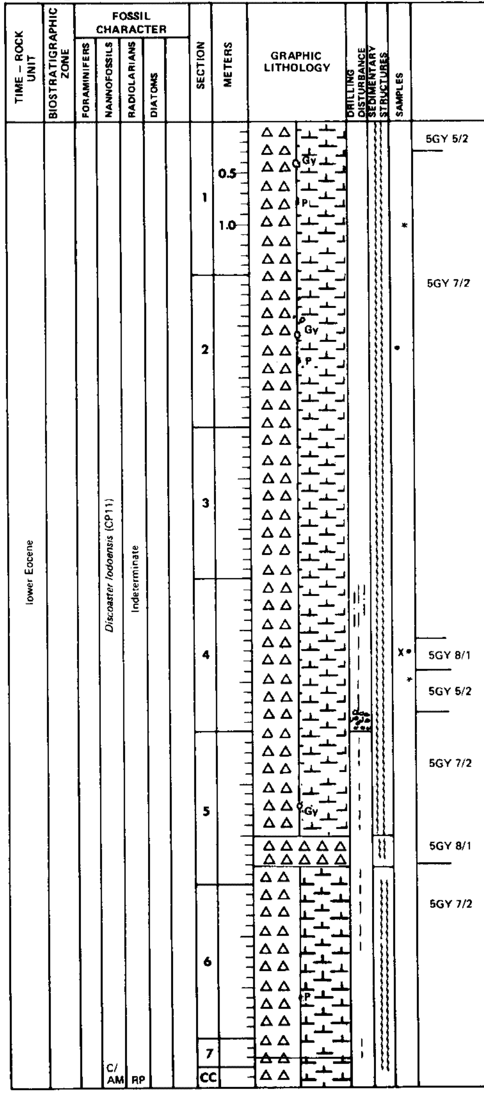
	1, 100	4, 100
	D	D
Texture:		
Sand	8	5
Silt	42	43
Clay	50	52
Composition:		
Quartz	3	1
Clay and silica[a]	45	50
Pyrite	–	TR
Carbonate unspec.	5	4
Foraminifers	5	1
Calc. nannofossils	42	44

[a] See Core 36 (*lithologic description)

ORGANIC CARBON AND CARBONATE (%):

	2, 75–77	4, 75–77
Organic carbon	–	–
Carbonate	44	46

SITE 612 HOLE CORE 46X CORED INTERVAL 414.9–424.6 m



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, generally grayish yellow green (5GY 7/2), although the top of Section 1 is darker dusky yellow green (5GY 5/2); moderately burrowed with dark grayish brown (5Y 4/2) and very dark grayish brown (5Y 3/2); burrows are flattened, elongated and lens-shaped; similar to Core 45, this one includes:

- very fine sand-size white specks – foraminifers?
- marcasite/pyrite-filled burrows and nodules
- gypsum-filled veins
- expands after splitting

Truncated vertical burrows or dewatering veins suggest bottom currents.

PORCELLANITE: Section 5, 100–130 cm light greenish gray (5GY 8/1); hard; burrows are much less flattened and are very well preserved.

SMEAR SLIDE SUMMARY (%):

	1, 100	4, 100
	D	D
Texture:		
Sand	3	10
Silt	45	45
Clay	52	45
Composition:		
Quartz	TR	1
Clay and silica[a]	52	42
Palagonite	–	TR
Pyrite	TR	–
Carbonate unspec.	–	4
Foraminifers	3	6
Calc. nannofossils	45	47
Fish remains	–	TR

[a] See Core 36 (*lithologic description)

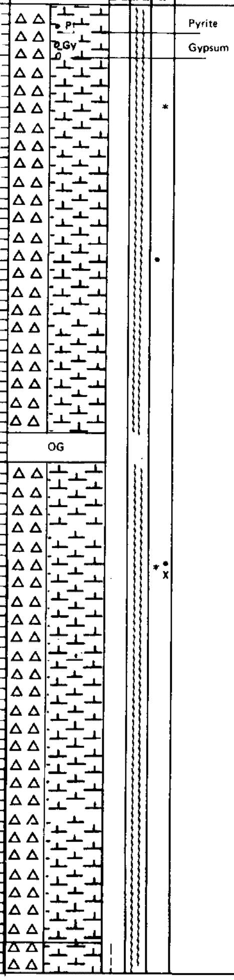
ORGANIC CARBON AND CARBONATE (%):

	2, 75–77	4, 75–77
Organic carbon	0.26	–
Carbonate	44	52

SITE 612 HOLE CORE 47X CORED INTERVAL 424.6–434.3 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER: FORAMINIFERS	FOSSIL CHARACTER: NANNOFOSSILS	FOSSIL CHARACTER: RADIOLARIANS	FOSSIL CHARACTER: DIATOMS	SECTION	METERS
lower Eocene		*Morozovella caucasica/G. quetra* (lower P9)	*Discoaster lodoensis* Zone (CP11)	*Phormocyrtis striata striata* Zone		1	0.5 1.0
						2	
						3	
						4	
						5	
						6	
						7	
		CP	A/MG	RP		CC	

GRAPHIC LITHOLOGY / DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / SAMPLES



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, similar to Core 46: background is grayish yellow green (5GY 7/2) with moderate burrowing of 5Y 4/2 and 5Y 3/2; occasionally intervals are slightly lighter; most burrows, mottles are flattened and elongated, but there may also be some soft sediment deformation and erosional truncation; very fine sand-size white specks (forams?) visible on split surface; gypsum nodules; marcasite/pyrite-filled burrows, though fewer than Core 46.

Core expands after splitting.

Drilling disturbance becoming minimal by Section 6, although core diameter remains less than liner.

SMEAR SLIDE SUMMARY (%):

	1, 100	4, 100
	D	D
Texture:		
Sand	9	2
Silt	41	55
Clay	50	43
Composition:		
Quartz	1	–
Heavy minerals	4	1
Clay and silica[a]	43	43
Carbonate unspec.	2	TR
Foraminifers	2	1
Calc. nannofossils	48	55

[a] See Core 36 (*lithologic description)

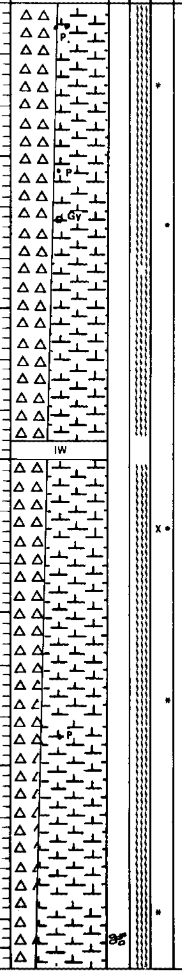
ORGANIC CARBON AND CARBONATE (%):

	2, 100–102	4, 100–102
Organic carbon	–	–
Carbonate	43	47

SITE 612 HOLE CORE 48X CORED INTERVAL 434.3–444.0 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER: FORAMINIFERS	FOSSIL CHARACTER: NANNOFOSSILS	FOSSIL CHARACTER: RADIOLARIANS	FOSSIL CHARACTER: DIATOMS	SECTION	METERS
lower Eocene			*Discoaster lodoensis* (CP11)	Indeterminate		1	0.5 1.0
						2	
						3	
						4	
						5	
						6	
						7	
			A/MG	RP		CC	

GRAPHIC LITHOLOGY / DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / SAMPLES



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, similar to Core 47: dominantly grayish yellow green (5GY 7/2) with extensive burrowing of 5Y 4/2 and 5Y 3/2, flattened and elongated; very fine sand-size white specks (forams?); occasional marcasite/pyrite-filled burrows and nodules; occasional gypsum.

Slight expansion after splitting.

Narrow diameter core, but good recovery.

SMEAR SLIDE SUMMARY (%):

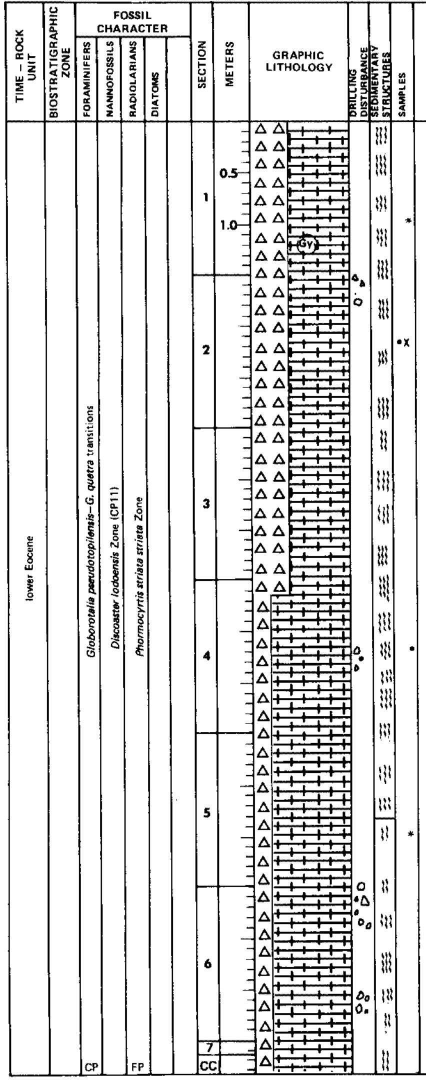
	1, 83	5, 88	6, 145
	D	D	D
Texture:			
Sand	TR	2	3
Silt	50	55	60
Clay	50	43	37
Composition:			
Quartz	2	TR	TR
Clay and silica[a]	45	35	30
Pyrite	TR	–	–
Carbonate unspec.	TR	2	–
Foraminifers	–	2	–
Calc. nannofossils	50	60	65
Anhydrite?	3	1	5

[a] See Core 36 (*lithologic description)

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	–	–
Carbonate	49	56

SITE 612 HOLE CORE 49X CORED INTERVAL 444.0–453.7 m



LITHOLOGIC DESCRIPTION

5GY 7/2
(+ 5Y 6/1,
5Y 5/1,
and 5GY 4/1)

FORAMINIFERAL SILICEOUS NANNOFOSSIL CHALK, dominant color grayish yellow green (5GY 7/2), burrows light olive gray (5Y 6/1, 5Y 5/1) and dark greenish gray (5GY 4/1) burrows are strongly flattened and give to sediment flaser-like aspect. Occasional nodules and crystals of gypsum (Gy). Foraminifers are about 15% under binocular.

SMEAR SLIDE SUMMARY (%):

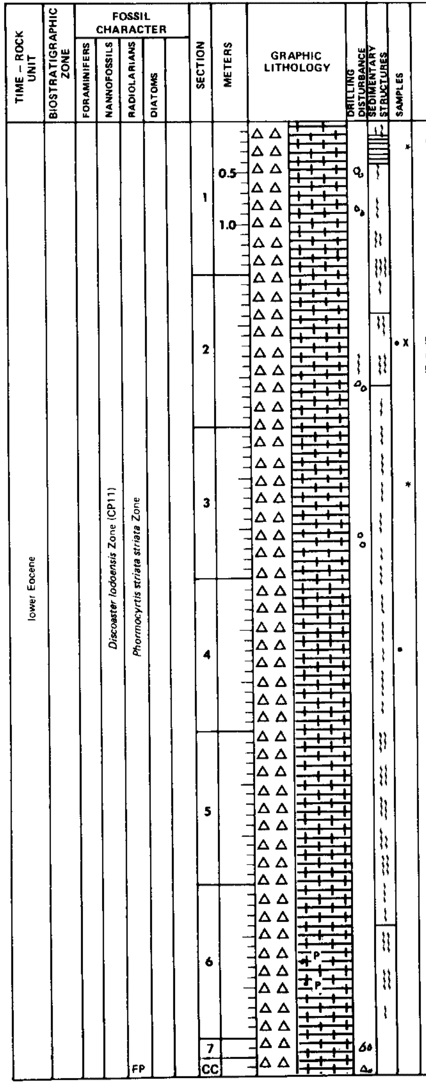
	1, 100 D	5, 100
Texture:		
Sand	2	2
Silt	58	78
Clay	40	20
Composition:		
Clay and silica[a]	40	20
Pyrite	TR	–
Carbonate unspec.	30	50
Foraminifers	5	5
Calc. nannofossils	25	25

[a] See Core 36 (*lithologic description)

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	–	–
Carbonate	54	71

SITE 612 HOLE CORE 50X CORED INTERVAL 453.7–463.4 m



LITHOLOGIC DESCRIPTION

5Y 4/2

SILICEOUS FORAMINIFERAL NANNOFOSSIL CHALK, grayish yellow green (5Y 6/1) with many olive gray (5Y 5/2) and some dark gray (5GY 7/2) burrows.

In Section 1 (15–40 cm) lamination. Color grayish olive, with many foraminifers and organic material.

Foraminifers concentrated in thin layers. In Section 6 vertically arranged pyrite nodules.

5Y 6/1
(+ 5GY 7/2 and
5Y 5/2)

SMEAR SLIDE SUMMARY (%):

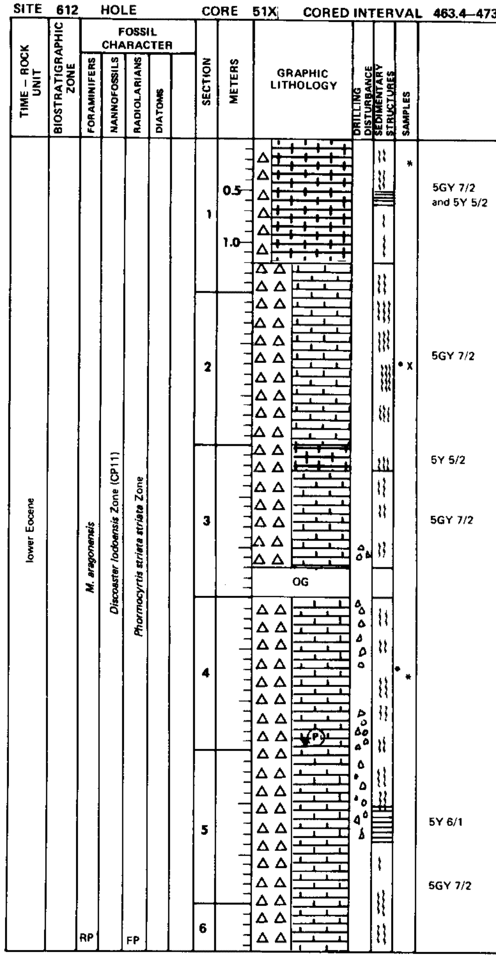
	1, 27 D	3, 60 D
Texture:		
Sand	5	1
Silt	55	59
Clay	40	40
Composition:		
Clay and silica[a]	40	40
Pyrite	TR	TR
Carbonate unspec.	25	20
Foraminifers	10	15
Calc. nannofossils	25	25

[a] See Core 36 (*lithologic description)

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 72–74
Organic carbon	0.38	–
Carbonate	52	50

SITE 612 HOLE CORE 51X CORED INTERVAL 463.4–473.1 m



LITHOLOGIC DESCRIPTION

SILICEOUS FORAMINIFERAL NANNOFOSSIL CHALK interlayered with SILICEOUS NANNOFOSSIL CHALK, grayish yellow green (5GY 7/2) burrow structures and certain beds light olive gray (5Y 5/2). Extensively burrowed.

In middle parts of Sections 1 and 5 laminated, color light olive gray (5Y 6/1), occasional diffuse dark pyrite mottles.

SMEAR SLIDE SUMMARY (%):

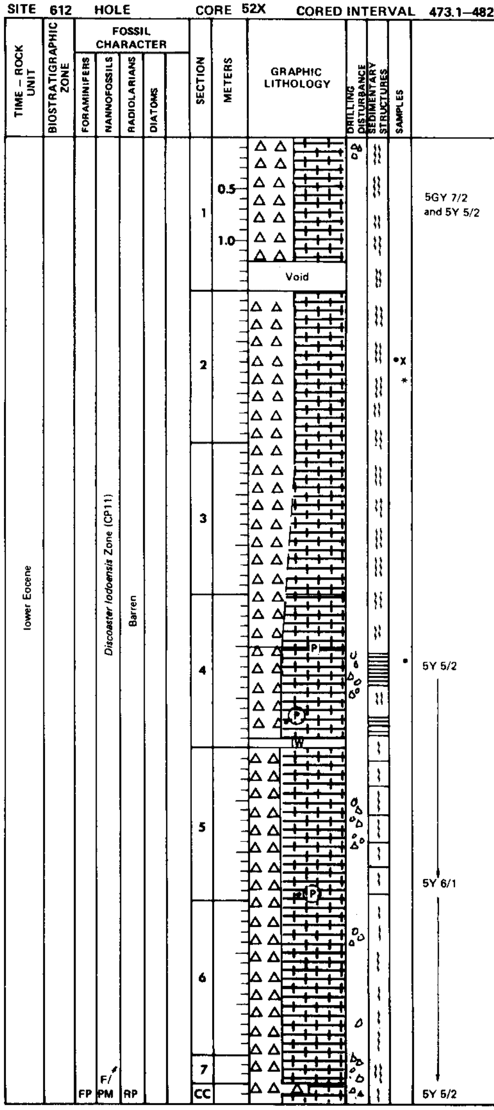
	1, 25	4, 80
	M	D
Texture:		
Sand	2	2
Silt	78	58
Clay	20	40
Composition:		
Clay and silica[a]	20	40
Volcanic glass	TR	TR
Pyrite	–	TR
Carbonate unspec.	70	20
Foraminifers	5	15
Calc. nannofossils	5	25

[a] See Core 36 (*lithologic description)

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	–	–
Carbonate	52	43

SITE 612 HOLE CORE 52X CORED INTERVAL 473.1–482.8 m



LITHOLOGIC DESCRIPTION

SILICEOUS FORAMINIFERAL NANNOFOSSIL CHALK, thinly interbedded with SILICEOUS NANNOFOSSIL CHALK, grayish yellow green (5GY 7/2) and light olive gray (5Y 5/2) moderately burrowed. In Sections 4 and 5 irregular lamination. Color here olive gray (5Y 5/2).

Core Catcher stronger lithified, porcellanitic (0–11 cm).

SMEAR SLIDE SUMMARY (%):

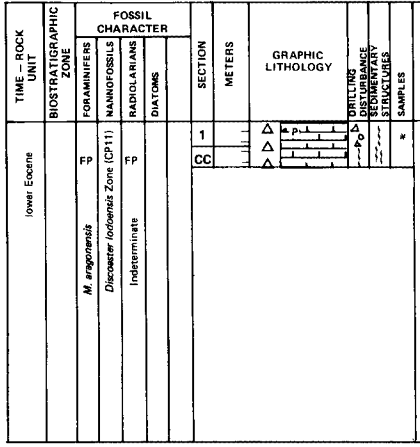
	2, 90
	D
Texture:	
Sand	2
Silt	58
Clay	40
Composition:	
Clay and silica[a]	40
Pyrite	TR
Carbonate unspec.	30
Foraminifers	5
Calc. nannofossils	25

[a] See Core 36 (*lithologic description)

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	–	–
Carbonate	50	33

SITE 612 HOLE CORE 53X CORED INTERVAL 482.8–492.5 m



LITHOLOGIC DESCRIPTION

5GY 7/2
and 5Y 5/2

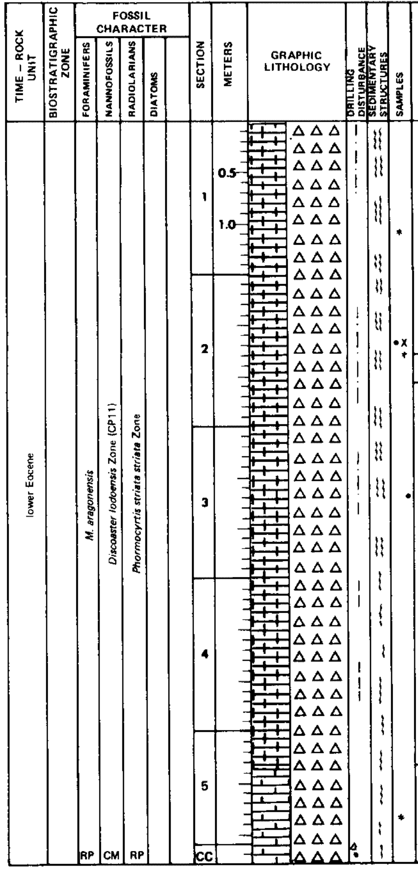
SILICEOUS NANNOFOSSIL CHALK, grayish yellow green (5GY 7/2) with flattened olive gray (5Y 5/2) burrows. Irregularly laminated.

SMEAR SLIDE SUMMARY (%):

	1, 20
	D
Texture:	
Sand	2
Silt	58
Clay	40
Composition:	
Quartz	5
Clay and silica[a]	30
Pyrite	1
Carbonate unspec.	12
Foraminifers	2
Calc. nannofossils	50

[a] See Core 36 (*lithologic description)

SITE 612 HOLE CORE 54X CORED INTERVAL 492.5–502.0 m



LITHOLOGIC DESCRIPTION

5GY 7/2
and 5Y 5/2

5Y 5/2 only

5GY 7/2
and 5Y 5/2

5GY 5/2

5GY 5/2

SILICEOUS FORAMINIFERAL NANNOFOSSIL CHALK, Section 1, 2, 3, 4 and 5, ←38 cm) and SILICEOUS NANNOFOSSIL CHALK (Section 5, 38–110 cm and Core Catcher).

Irregular and discontinuous thin bedding. At Section 3, 5, and Core Catcher, parallel, thin laminated bedding.

Interlayered (Section 1→Section 5, 38 cm):
grayish yellow green (5GY 7/2)
light olive gray (5Y 5/2).

Dusky yellow green (5GY 5/2) at Section 5, 38 cm→Core Catcher).
Bioturbation:
many flattened burrows early horizontal (subparallel to bedding)
sporadic oblique or vertical burrows
some burrows are filled with pyrite

SMEAR SLIDE SUMMARY (%):

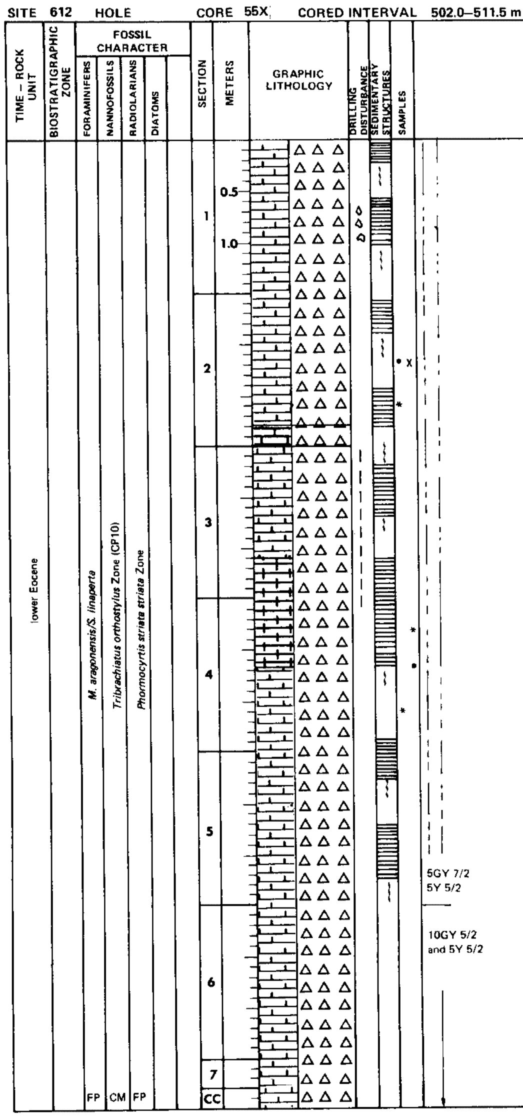
	1, 110	2, 80	5, 85
	D	D	D
Texture:			
Sand	5	20	1
Silt	30	30	40
Clay	65	50	59
Composition:			
Quartz	TR	–	–
Heavy minerals	–	TR	–
Clay and silica[a]	60	50	55
Zeolite	–	3	–
Carbonate unspec.	5	–	–
Foraminifers	10	15	1
Calc. nannofossils	25	29	44
Radiolarians	TR	3	TR

[a] See Core 36 (*lithologic description)

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	3, 70–73
Organic carbon	–	0.22
Carbonate	29	39

SITE 612 HOLE CORE 55X CORED INTERVAL 502.0–511.5 m



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, exceptionally: SILICEOUS NANNOFOSSIL LIMESTONE (Section 2, 136–152 cm) and SILICEOUS FORAMINIFERAL NANNOFOSSIL CHALK (Section 3, 107 cm → Section 4, 67 cm).

Cycles of sequences (A and B) – Section 1 → Section 5:

A interlayered – even parallel – or nonparallel thin laminated bedding layers light olive gray (5Y 5/2) are rich in organic matter.

B thin, irregular and discontinuous laminated bedding; grayish yellow green (5GY 7/2) layers are dominant.

A : Section 1, 0–20 and 66–100 cm; Section 2, 8–48 and 92–136 cm; Section 3, 18–68 and 107–150 cm; Section 4, 0–67 and 135–150 cm; and Section 5, 0–25 and 69–122 cm.

From Section 6, no distinct sequences and color is grayish green (10GY 5/2) interlayered with light olive gray (5Y 5/2).

SMEAR SLIDE SUMMARY (%):

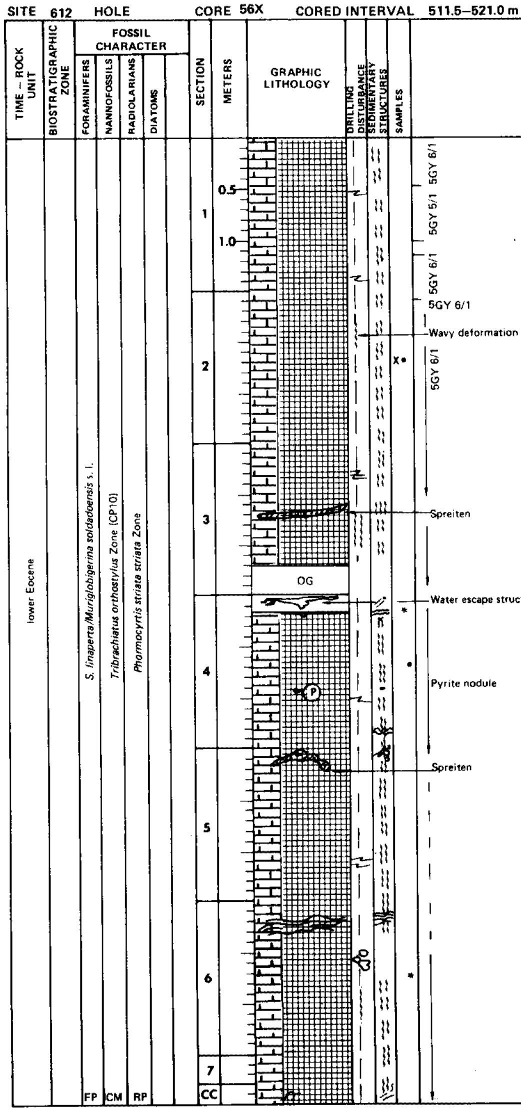
	2, 111	4, 35	4, 112
Texture:			
Sand	–	15	2
Silt	40	25	30
Clay	60	60	68
Composition:			
Quartz	–	TR	1
Mica	–	–	TR
Clay and silica[a]	60	55	60
Pyrite	–	–	TR
Foraminifers	TR	15	3
Calc. nannofossils	40	30	36
Radiolarians	–	TR	TR
Fish remains	–	TR	TR

[a] See Core 36 (*lithologic description)

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	–	–
Carbonate	50	41

SITE 612 HOLE CORE 56X CORED INTERVAL 511.5–521.0 m



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, thin, irregularly bedded chalk with somewhat variable colors of sediment in Section 1. Extensive burrowing throughout with a few excellent "spreiten" and other types of burrows. Most of the core is greenish gray (5GY 6/1) but some variation to gray (5GY 5/1) in Core 1. Mottles are gray (5Y 5/1).

SMEAR SLIDE SUMMARY (%):

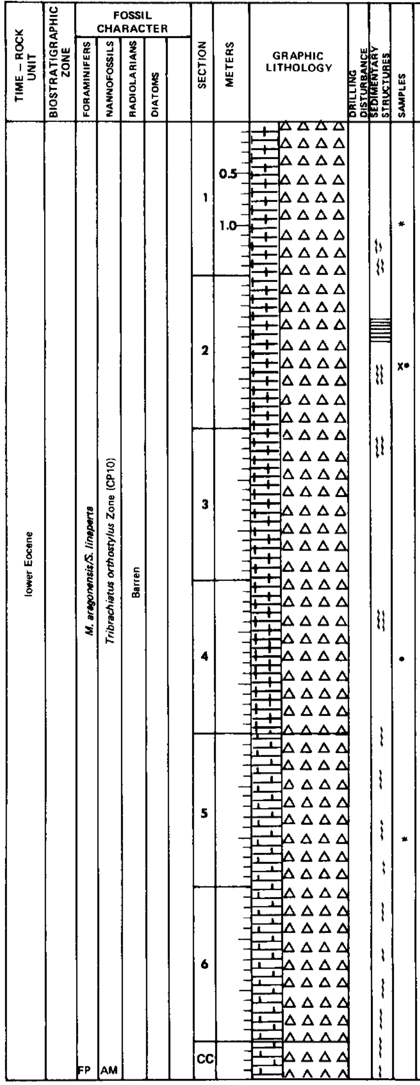
	4, 18 D	6, 75 D
Texture:		
Sand	2	4
Silt	38	26
Clay	60	70
Composition:		
Quartz	8	7
Clay and silica[a]	52	63
Pyrite	2	1
Carbonate unspec.	5	2
Foraminifers	3	2
Calc. nannofossils	30	25
Radiolarians	TR	–

[a] See Core 36 (*lithologic description)

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	–	–
Carbonate	33	27

SITE 612 HOLE CORE 57X CORED INTERVAL 521.0–530.6 m



LITHOLOGIC DESCRIPTION

FORAMINIFERAL NANNOFOSSIL PORCELLANITE (Section 1 to Section 4) to NANNOFOSSIL PORCELLANITE (Section 5, 6, and Core Catcher).

Interlayered:
grayish yellow green (5GY 7/2)
light olive gray (5Y 5/2)

Interlayered:
even parallel/discontinuous, irregular thin laminated bedding

Bioturbation:
- numerous flattened burrows
- sporadic oblique or vertical burrows (Section 1, 120 and 135 cm; Section 2, 95 cm; Section 3, 15–25 cm; and Section 4, 30–40 cm) and pyritic nodules

SMEAR SLIDE SUMMARY (%):

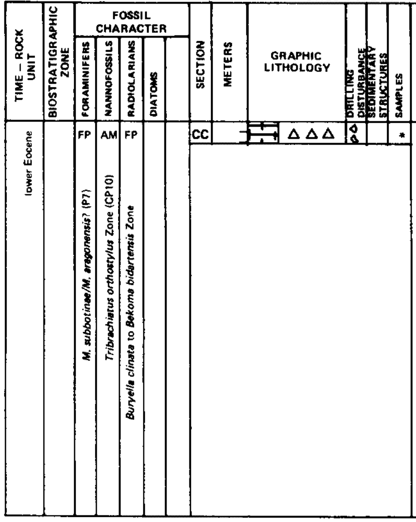
	1, 100	5, 100
	D	D
Texture:		
Sand	TR	TR
Silt	30	40
Clay	70	60
Composition:		
Quartz	3	2
Clay and silica[a]	68	68
Pyrite	–	TR
Foraminifers	14	5
Calc. nannofossils	15	25

[a] See Core 36 (*lithologic description)

ORGANIC CARBON AND CARBONATE (%):

	2, 90–92	4, 80–82
Organic carbon	–	–
Carbonate	24	29

SITE 612 HOLE CORE 58X CORED INTERVAL 530.6–540.2 m



LITHOLOGIC DESCRIPTION

5GY 7/2
and 5Y 5/2

NANNOFOSSIL PORCELLANITE (Core Catcher)

Interlayered:
grayish yellow green (5GY 7/2)
light olive gray (5Y 5/2)

Interlayered:
even, parallel/discontinuous, irregular thin laminated bedding

SMEAR SLIDE SUMMARY (%):

	CC, 15
	D
Texture:	
Sand	TR
Silt	30
Clay	70
Composition:	
Quartz Feldspar	} 7
Clay and Silica[a]	65
Foraminifers	3
Calc. nannofossils	25

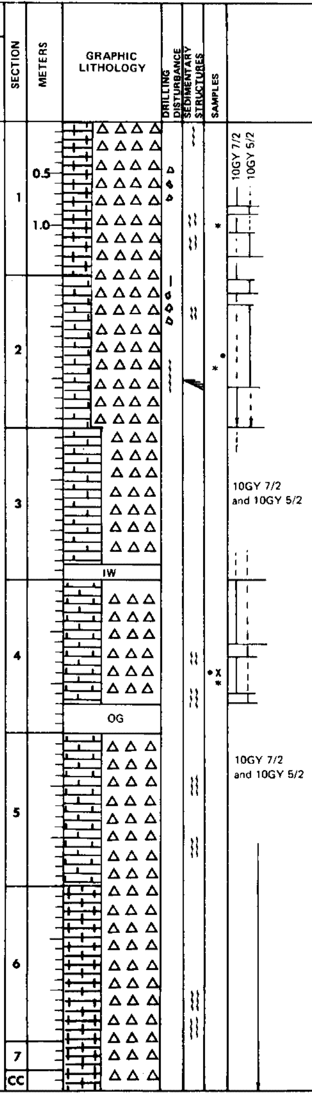
[a] See Core 36 (*lithologic description)

SITE 612 HOLE CORE 59X CORED INTERVAL 540.2–549.8 m

TIME – ROCK UNIT: lower Eocene

BIOSTRATIGRAPHIC ZONE / FOSSIL CHARACTER:

- FORAMINIFERS: *G. subbotinae/M. soldadoensis* (P6b?) FP
- NANNOFOSSILS: *Tribrachiatus orthostylus* Zone (CP10) AM
- RADIOLARIANS: *Buryella clinata* to *Bekoma bidartensis* Zone CP
- DIATOMS



LITHOLOGIC DESCRIPTION

Section 1–2: NANNOFOSSIL FORAMINIFERAL PORCELLANITE (Section 1) to NANNOFOSSIL PORCELLANITE (Section 2).

Section 3–Core Catcher: SILICEOUS NANNOFOSSIL CHALK (Section 3, 4, and 5) to SILICEOUS NANNOFOSSIL FORAMINIFERAL CHALK (Section 6, 7, and Core Catcher).

Color:
pale yellowish green (10GY 7/2)
grayish green (10GY 5/2)

Unbedded or discontinuous, thin laminated layers.
Bioturbation.
Sporadic clear burrows with foraminifera, and chondrites.
Erosion surface (Section 2, 100 cm).

SMEAR SLIDE SUMMARY (%):

	1, 100 D	2, 92 D	4, 100 D
Texture:			
Sand	10	10	10
Silt	20	20	30
Clay	70	70	60
Composition:			
Quartz	2	5	5
Clay and silica[a]	70	70	60
Glauconite	–	TR	TR
Pyrite	TR	TR	TR
Carbonate unspec.	–	5	5
Foraminifers	15	5	5
Calc. nannofossils	13	15	25

[a] See Core 36 (*lithologic description)

ORGANIC CARBON AND CARBONATE (%):

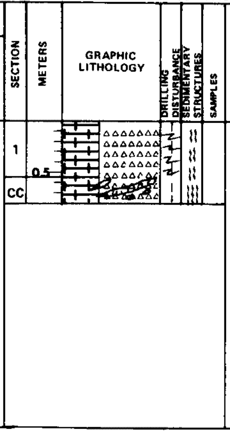
	2, 80–82	4, 90–92
Organic carbon	0.14	–
Carbonate	23	32

SITE 612 HOLE CORE 60X CORED INTERVAL 549.8–559.4 m

TIME – ROCK UNIT: lower Eocene

BIOSTRATIGRAPHIC ZONE / FOSSIL CHARACTER:

- FORAMINIFERS: *Globorotalia subbotinae* (P6b?) FP
- NANNOFOSSILS: *Discoaster diastypus* Zone (CP9) CM
- RADIOLARIANS: Barren
- DIATOMS



LITHOLOGIC DESCRIPTION

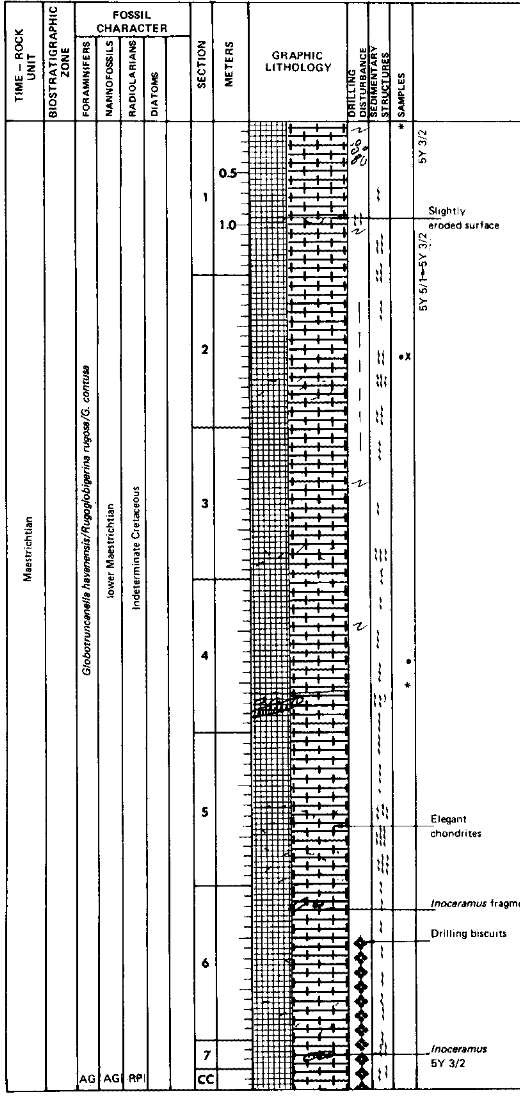
Spreiten to simple burrow

Spreiten

SILICEOUS NANNOFOSSIL CHALK, pale yellowish green (10GY 7/2) with grayish green mottled zones in an unbedded massive siliceous nannofossil chalk.

Very poor recovery.

SITE 612 HOLE CORE 61X CORED INTERVAL 559.4–569.0 m



LITHOLOGIC DESCRIPTION

MARLY FORAMINIFERAL NANNOFOSSIL CHALK, slightly glauconitic and very pyritic (disseminated framboidal) clayey chalk.

Slightly eroded surface at 90 cm of Section 1.

Massive to intensely burrowed with elegant chondrites below Section 5, 70 cm. Dark colored, dark olive gray (5Y 3/2) to gray (5Y 5/1) with common *Inoceramus* shells and shell fragments in Cores 6 and Core Catcher.

Lighter colored (5Y 5/1) matrix with chondrites of 5Y 3/2, Section 3, 120–140 cm.

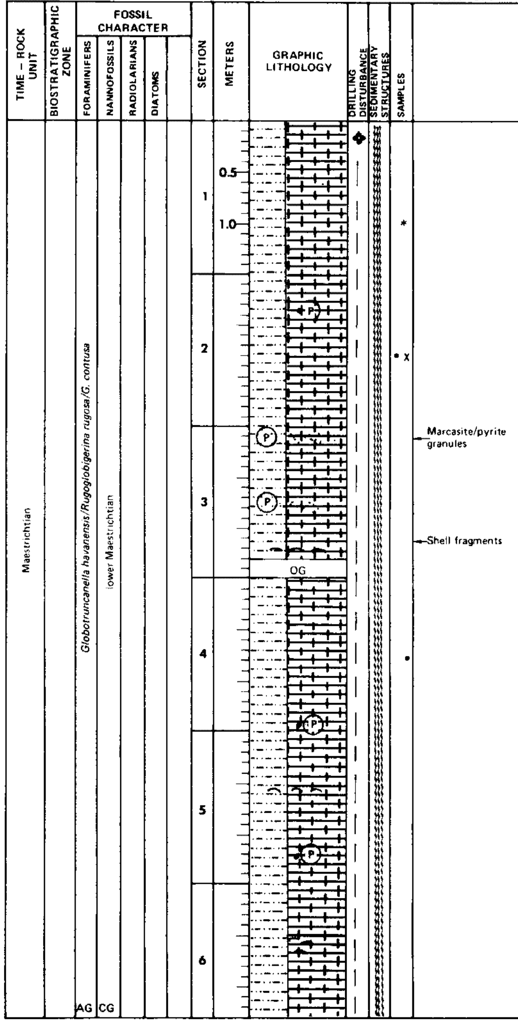
SMEAR SLIDE SUMMARY (%):

	1, 5	4, 100
Texture:		
Sand	5	5
Silt	60	59
Clay	35	36
Composition:		
Quartz	3	10
Feldspar		
Clay and silica	35	36
Glauconite	2	1
Carbonate unspec.	–	3
Foraminifers	25	20
Calc. nannofossils	35	30

ORGANIC CARBON AND CARBONATE (%):

	2, 80–82	4, 80–82
Organic carbon	–	0.47
Carbonate	59	53

SITE 612 HOLE CORE 62X CORED INTERVAL 569.0–578.6 m



LITHOLOGIC DESCRIPTION

MARLY NANNOFOSSIL FORAMINIFERAL CHALK, dark olive gray (5Y 3/2) with extensive burrows of very dark olive gray (5Y 3/1); well preserved foraminifers often concentrated in burrows; glauconite grains (fine sand size); marcasite/pyrite nodules; horizontally oriented shell fragments – *Inoceramus?*

Variable degrees of "biscuit" deformation throughout.

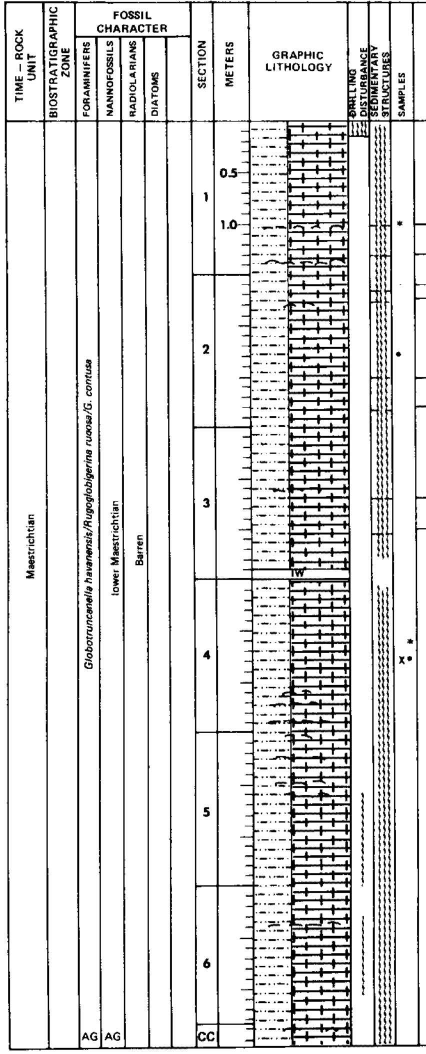
SMEAR SLIDE SUMMARY (%):

	1, 100 D
Texture:	
Sand	30
Silt	40
Clay	30
Composition:	
Quartz	5
Mica	TR
Heavy minerals	TR
Clay	30
Glauconite	TR
Pyrite	1
Carbonate unspec.	19
Foraminifers	30
Calc. nannofossils	15

ORGANIC CARBON AND CARBONATE (%):

	2, 80–82	4, 80–82
Organic carbon	0.59	0.52
Carbonate	54	49

SITE 612 HOLE CORE 63X CORED INTERVAL 578.6–588.3 m



LITHOLOGIC DESCRIPTION

MARLY FORAMINIFERAL NANNOFOSSIL CHALK, similar to Core 62: dark olive gray (5Y 3/2) with extensive burrows of very dark olive gray (5Y 3/1); well preserved foraminifers often concentrated in burrows; shell fragments, more common than in Core 62, and larger.

Occasionally 10–20 cm intervals are slightly lighter in color, dark gray (5Y 4/1).

Portions of Section 5 and 6 fractured and broken up during coring.

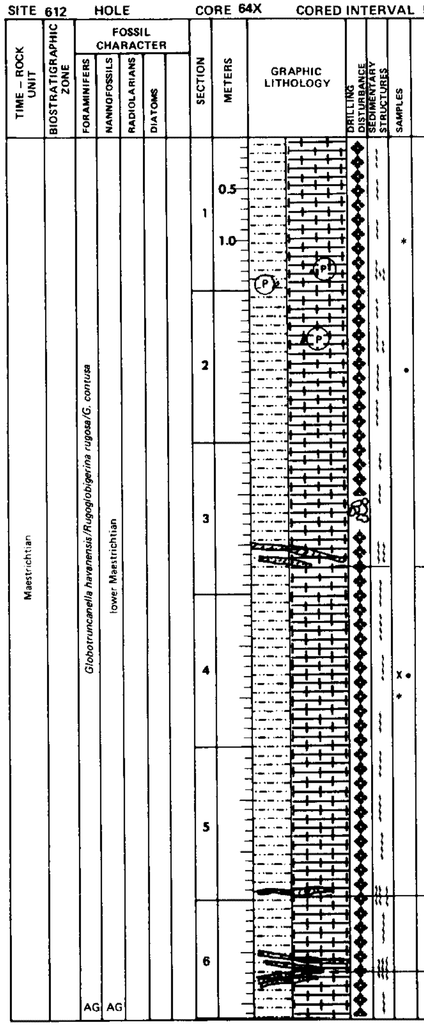
SMEAR SLIDE SUMMARY (%):

	1, 100	4, 65
	D	D
Texture:		
Sand	26	36
Silt	39	25
Clay	35	39
Composition:		
Quartz	2	3
Clay	39	39
Glauconite	2	3
Zeolite	–	2
Carbonate unspec.	2	3
Foraminifers	20	25
Calc. nannofossils	35	25

ORGANIC CARBON AND CARBONATE (%):

	2, 80–82	4, 80–82
Organic carbon	–	0.49
Carbonate	60	49

SITE 612 HOLE CORE 64X CORED INTERVAL 588.3–598.0 m



LITHOLOGIC DESCRIPTION

MARLY FORAMINIFERAL NANNOFOSSIL CHALK, massive burrow-mottled chalk. Foraminifers visible on surface of core. Sediment color is dark gray (10YR 4/1) with very dark gray (10YR 3/1) burrows.

SMEAR SLIDE SUMMARY (%):

	1, 100	4, 100
	D	D
Texture:		
Sand	30	30
Silt	40	40
Clay	30	30
Composition:		
Quartz	10	5
Mica	–	TR
Heavy minerals	TR	1
Clay	30	30
Glauconite	TR	–
Pyrite	1	2
Carbonate unspec.	15	32
Foraminifers	15	20
Calc. nannofossils	29	10
Plant debris	TR	–

ORGANIC CARBON AND CARBONATE (%):

	2, 80–82	4, 80–82
Organic carbon	–	0.64
Carbonate	57	53

SITE 612 HOLE CORE 65X CORED INTERVAL 598.0–607.7 m

TIME – ROCK UNIT: Maestrichtian

BIOSTRATIGRAPHIC ZONE

FOSSIL CHARACTER

FORAMINIFERS: AG *Globotruncanella havanensis/Rugoglobigerina rugosa/G. gansseri/G. contusa*

NANNOFOSSILS: lower Maestrichtian AG

RADIOLARIANS

DIATOMS

SECTION

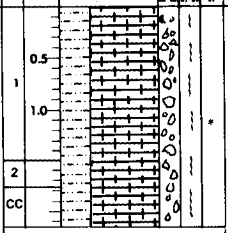
METERS

GRAPHIC LITHOLOGY

DRILLING DISTURBANCE

SEDIMENTARY STRUCTURES

SAMPLES



LITHOLOGIC DESCRIPTION

10YR 4/1
(+10YR 5/1
and 10YR 3/1)

10YR 4/1

MARLY FORAMINIFERAL NANNOFOSSIL CHALK, main color is dark gray (10YR 4/1) with lighter gray (10YR 5/1) and very dark gray (10YR 3/1) streaks, mottles, and burrows. Arenitic shell fragments.

SMEAR SLIDE SUMMARY (%):

	1, 114
	D
Texture:	
Sand	20
Silt	50
Clay	30
Composition:	
Quartz	4
Mica	TR
Heavy minerals	TR
Clay	30
Pyrite	1
Zeolite	TR
Carbonate unspec.	40
Foraminifers	10
Calc. nannofossils	15

SITE 612 HOLE CORE 66X CORED INTERVAL 607.7–617.3 m

TIME – ROCK UNIT: Maestrichtian

BIOSTRATIGRAPHIC ZONE

FOSSIL CHARACTER

FORAMINIFERS: *Globotruncanella havanensis/Rugoglobigerina rugosa/G. contusa* AG

NANNOFOSSILS: lower Maestrichtian AG

RADIOLARIANS: Barren

DIATOMS

SECTION

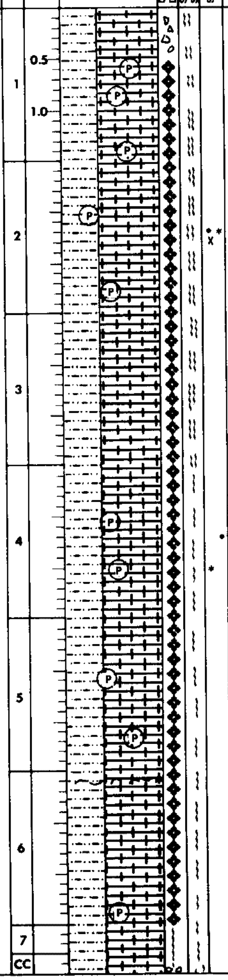
METERS

GRAPHIC LITHOLOGY

DRILLING DISTURBANCE

SEDIMENTARY STRUCTURES

SAMPLES



LITHOLOGIC DESCRIPTION

10YR 4/1
(+10YR 5/1
and 10YR 3/1)

MARLY FORAMINIFERAL NANNOFOSSIL CHALK, dark gray (10YR 4/1), intensively burrowed. Burrows darker gray (10 YR 3/1) or light gray (10YR 5/1). Burrows are mainly diagonal spreiten and chondrites. Large *Inoceramus* shell fragments over all the core, sometimes concentrated in cm-thick layers as in Section 6 (10 cm). Frequent small pyrite and marcasite nodules.

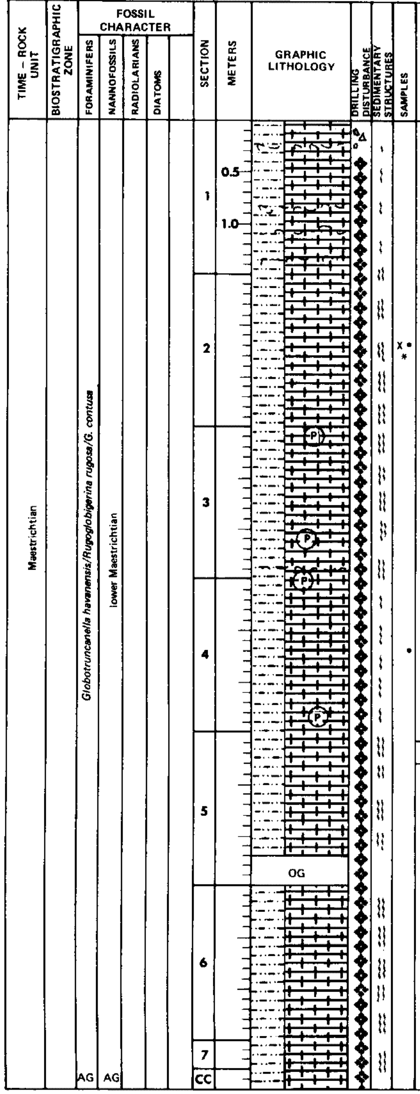
SMEAR SLIDE SUMMARY (%):

	2, 74	4, 105
	M	D
Texture:		
Sand	20	20
Silt	50	50
Clay	30	30
Composition:		
Quartz	5	5
Mica	TR	TR
Heavy minerals	TR	TR
Clay	30	30
Glauconite	TR	–
Pyrite	1	1
Zeolite	TR	1
Carbonate unspec.	34	33
Foraminifers	15	15
Calc. nannofossils	15	15
Plant debris	TR	–

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	0.50	0.73
Carbonate	55	46

SITE 612 HOLE CORE 67X CORED INTERVAL 617.3–626.9 m



10YR 4/1
(+ 10YR 5/1
and 10YR 3/1)

10YR 5/1

10YR 4/1
(+ 10YR 5/1
and 10YR 3/1)

LITHOLOGIC DESCRIPTION

MARLY NANNOFOSSIL FORAMINIFERAL CHALK, dark gray (10YR 4/1) with abundant very dark gray (10YR 3/1) or light gray (10YR 5/1) burrows. In Section 1 numerous cm-thick layers of *Inoceramus* shell fragments. Occasional small pyrite nodules. Subhorizontal spreiten and chondrites-like dwellings.

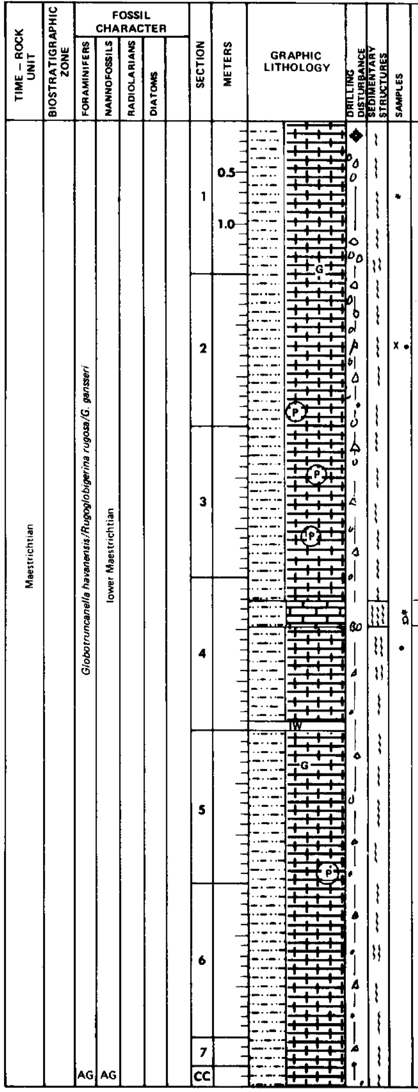
SMEAR SLIDE SUMMARY (%):

	2, 80
	D
Texture:	
Sand	20
Silt	50
Clay	30
Composition:	
Quartz	5
Mica	2
Heavy minerals	TR
Clay	30
Pyrite	2
Zeolite	2
Carbonate unspec.	24
Foraminifers	20
Calc. nannofossils	15

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	0.68	0.65
Carbonate	45	50

SITE 612 HOLE CORE 68X CORED INTERVAL 626.9–636.5 m



10YR 5/1
(+ 10YR 6/1
and 10YR 4/1)

10YR 4/1
(+ 10YR 5/1
and 10YR 3/1)

2.5Y N6/1

10YR 4/1

LITHOLOGIC DESCRIPTION

MARLY NANNOFOSSIL FORAMINIFERAL CHALK, gray (10YR 5/1) with small light gray (10YR 6/1) streaks and specks and dark gray (10YR 4/1) spreiten and dwellings.

From Section 2, darker gray (10YR 4/1) matrix color.

Some layers are lithified → limestone. Pyrite and glauconite grains more abundant.

In Section 4, (20–48 cm) light gray marly limestone with very abundant chondrites burrows. Much arenitic shell detritus.

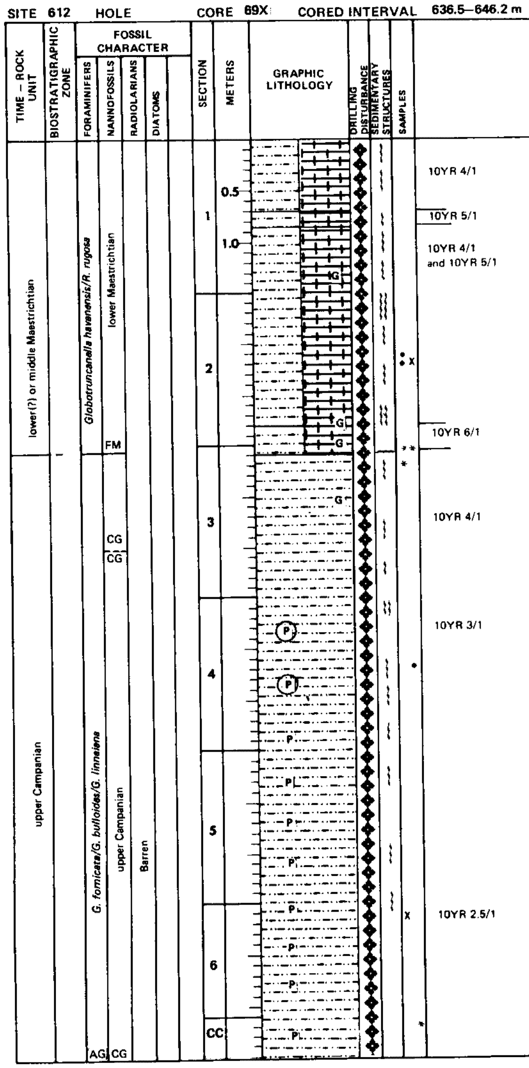
SMEAR SLIDE SUMMARY (%):

	1, 72	4, 36
	D	M
Texture:		
Sand	20	10
Silt	50	45
Clay	30	45
Composition:		
Quartz	5	–
Mica	TR	TR
Heavy minerals	TR	–
Clay	30	45
Glauconite	TR	TR
Pyrite	1	–
Zeolite	1	–
Carbonate unspec.	43	50
Foraminifers	15	5
Calc. nannofossils	5	–

ORGANIC CARBON AND CARBCNATE (%):

	2, 70–73	4, 70–73
Organic carbon	0.51	0.47
Carbonate	47	43

SITE 612 HOLE CORE 69X CORED INTERVAL 636.5–646.2 m



LITHOLOGIC DESCRIPTION

MARLY FORAMINIFERAL NANNOFOSSIL CHALK, dark gray (10YR 4/1), some thin layers stronger lithified and lighter gray (10YR 5/1).

Burrows mainly in layers, exclusively chondrites (rarely spreiten), glauconite, and pyrite. Section 2, 130 cm—Section 3, 10 cm: marly with large fresh glauconite grains. Lower boundary scoured and deeply burrowed.

Below Section 2, very dark gray (10YR 3/1) to black (10YR 2.5/1) FORAMINIFERAL SHALE to CHALK. Foraminifera concentrated in thin layers. Where no chondrites burrows, fissil shale. Much pyrite and (glauconite).

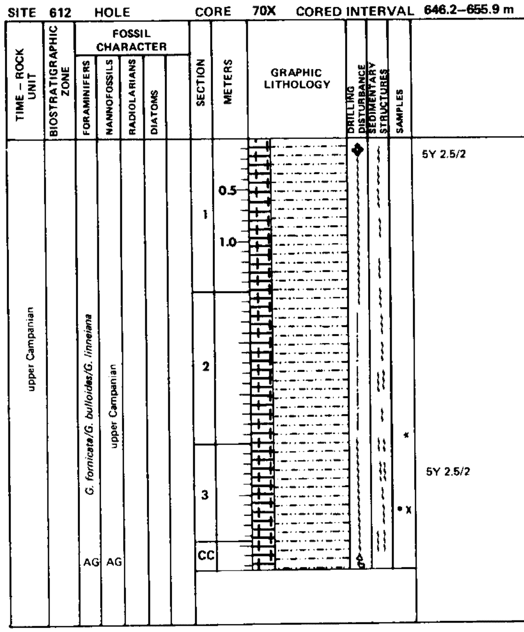
SMEAR SLIDE SUMMARY (%):

	1, 3 M	3, 6 D	3, 20 D	CC, 11 D
Texture:				
Sand	–	30	30	20
Silt	–	20	20	40
Clay	–	50	50	40
Composition:				
Quartz	–	3	2	10
Mica	1	TR	3	5
Clay	–	50	49	40
Glauconite	94	–	TR	TR
Pyrite	–	TR	1	10
Zeolite	–	1	TR	–
Carbonate unspec.	5	11	10	20
Foraminifers	–	20	25	5
Calc. nannofossils	–	15	10	10
Plant debris	–	TR	–	TR

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	1.29	0.80
Carbonate	30	34

SITE 612 HOLE CORE 70X CORED INTERVAL 646.2–655.9 m



LITHOLOGIC DESCRIPTION

Black FORAMINIFERAL NANNOFOSSIL SHALE
Homogeneous unbedded and bioturbated layers.
Bioturbation: horizontal or oblique burrows, and chondrites.

Color: black (5Y 2.5/2) punctuated by pinkish gray (5YR 8/1) foraminifera, shell fragments or chondrites (Section 2, 90–120 cm).

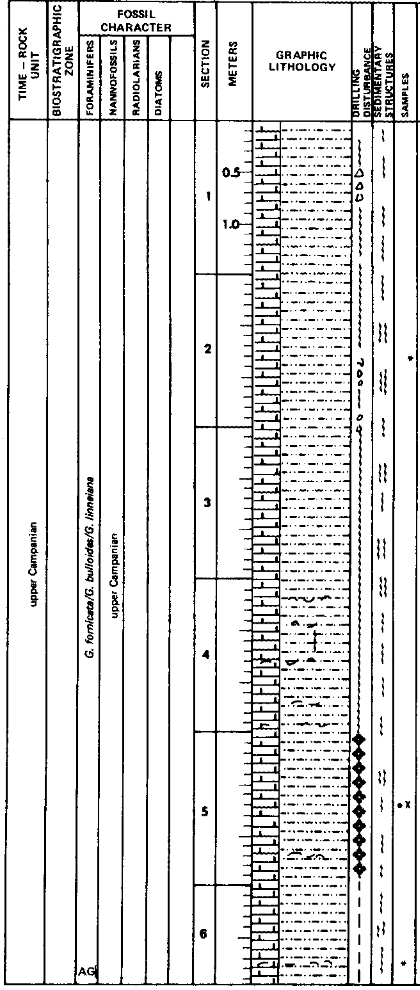
SMEAR SLIDE SUMMARY (%):

	2, 140 D
Texture:	
Sand	10
Silt	30
Clay	60
Composition:	
Quartz	7
Feldspar	TR
Mica	5
Heavy minerals	1
Clay	59
Pyrite	3
Foraminifers	10
Calc. nannofossils	10
Radiolarians	TR
Organics	5

ORGANIC CARBON AND CARBONATE (%):

	3, 70–73
Organic carbon	1.86
Carbonate	14

SITE 612 HOLE CORE 71X CORED INTERVAL 655.9–665.6 m



5Y 2.5/2

5Y 2.5/2

Inoceramus shells

Inoceramus shells

Inoceramus shells

Inoceramus shells

Inoceramus shells

Inoceramus shells

5Y 2.5/2

Inoceramus shells

Inoceramus shells

LITHOLOGIC DESCRIPTION

NANNOFOSSIL MUDSTONE, massive to discontinuous and thinly laminated.

Unbedding to discontinuous and slightly thin laminated bedding.

Black (5Y 2.5/2) color with pinkish gray (5YR 8/1) foraminiferal or shell fragments, small mottles.

Bioturbation: burrows and chondrites (Section 2, 70–150 cm; Section 3, 60–70 and 120–130 cm; and Section 6, 40–70 cm).

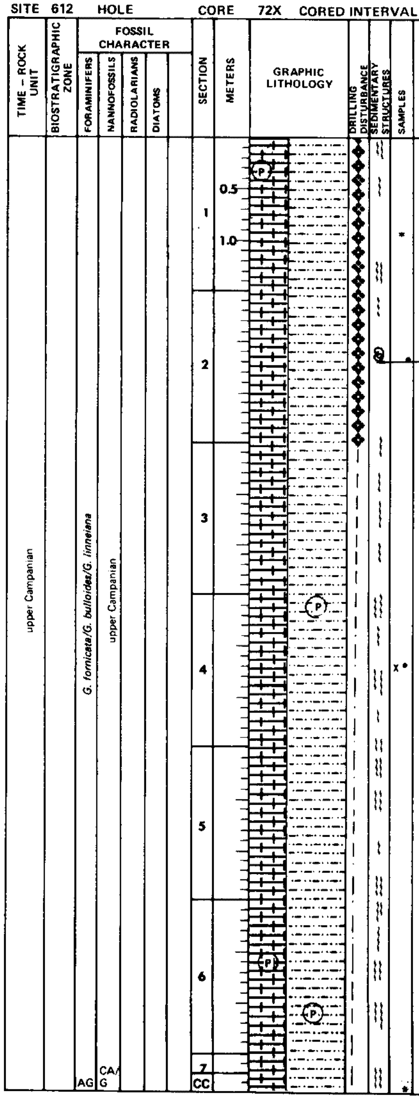
SMEAR SLIDE SUMMARY (%):

	2, 82	6, 75
	D	D
Texture:		
Sand	10	10
Silt	30	30
Clay	60	60
Composition:		
Quartz	10	5
Feldspar	TR	TR
Mica	1	1
Heavy minerals	1	1
Clay	60	60
Glauconite	TR	—
Pyrite	3	3
Zeolite	TR	—
Foraminifers	5	5
Calc. nannofossils	15	15
Organics	5	10

ORGANIC CARBON AND CARBONATE (%):

	5, 70–73
Organic carbon	1.48
Carbonate	27

SITE 612 HOLE CORE 72X CORED INTERVAL 665.6–675.3 m



5Y 2.5/2

Pyritic ammonite

5Y 2.5/2

5Y 2.5/2

5Y 2.5/2

LITHOLOGIC DESCRIPTION

Interlayered: NANNOFOSSIL MUDSTONE and MARLY NANNOFOSSIL FORAMINIFERAL CHALK.

Black (5Y 2.5/2) color with pinkish gray (5YR 8/1) foraminiferal or shell fragments, small mottles.

Unbedding to discontinuous and irregularly thin laminated bedding. Sporadic thin foraminiferal layers (foraminiferal chalk).

Bioturbation: burrows and chondrites (Section 1, 15–30 cm; Section 4, 10–20 and 80–90 cm; Section 5, 40–50, 70–80, and 100–110 cm; Section 6, 0–10 and 40–50 cm; and Core Catcher, 10–20 cm). Sporadic pyritic nodules (Section 1, 34 cm; Section 4, 15 cm; and Section 6, 60 and 110 cm).

SMEAR SLIDE SUMMARY (%):

	1, 98	CC, 26
	D	D
Texture:		
Sand	5	20
Silt	35	30
Clay	60	50
Composition:		
Quartz	5	10
Mica	2	2
Heavy minerals	1	TR
Clay	59	46
Glauconite	—	1
Pyrite	5	3
Zeolite	TR	—
Carbonate unspec.	—	2
Foraminifers	3	15
Calc. nannofossils	20	20
Radiolarians	—	1
Organics	5	—

ORGANIC CARBON AND CARBONATE (%):

	2, 70–73	4, 70–73
Organic carbon	—	2.68
Carbonate	64	11

SITE 613

HOLE 613

Date Occupied: 17 September 1983

Date Departed: 22 September 1983

Time on Hole: 119.9 hours

Position (latitude; longitude): 38°46.264'N; 72°31.427'W

Water depth (sea level; corrected m, echo-sounding): 2309

Water depth (rig floor; corrected m, echo-sounding): 2319

Bottom felt (m, drill pipe): 2333.2

Penetration (m): 581.9

Number of cores: 48

Total length of cored section (m): 456.3

Total core recovered (m): 357.97

Core recovery (%): 78.3

Oldest sediment cored:

Depth sub-bottom (m): 581.7

Nature: nannofossil porcellanite and porcellaneous limestone

Age: Lower Eocene

Measured velocity (km/s): 2.05

Basement: Not attempted

SITE 613

A. SITE SUMMARY AND PRINCIPAL RESULTS

Hole 613 was drilled approximately 8 km seaward of the toe of the New Jersey continental rise wedge (2332 m water depth). It is located ca. 0.1n mi southeast of Challenger profile CP3-B, which is ca. 1n mi updip and 0.75n mi northeast along strike from proposed Site NJ-12 (on Line 35).

Using the extended core barrel (XCB), we washed and spot cored to 182.9 m (Pliocene section) from which point continuous coring was maintained to a total depth of 581.9 m. Quaternary through lower Eocene strata of chiefly bathyal to abyssal origin were encountered. Four downhole geophysical logs were successfully run with the Schlumberger instruments, but the experimental multichannel sonic log produced only a few data of uncertain value.

The most significant achievements at Site 613 are:

1. Establishing unequivocably that the channels in which the sandy conglomeratic Miocene beds were deposited are cut into a dissected middle Eocene surface.
2. Documenting the absence of upper Eocene through middle Miocene deposition sequences at Site 613 and their apparent absence from this part of the continental rise.
3. Establishing the presence of a major channel system on top of the lower Eocene surface.
4. Penetrating at a third location on the margin, the porcellanitic diagenetic front that characterizes the lower/middle Eocene transition.

5. Demonstrating that this upper rise regime contains a deeper-water biota and more slump deposits than the middle slope location at Site 613.

6. Demonstrating that reflection Blue marks the top of the Pliocene, and reflector Merlin marks the top of the middle Eocene.

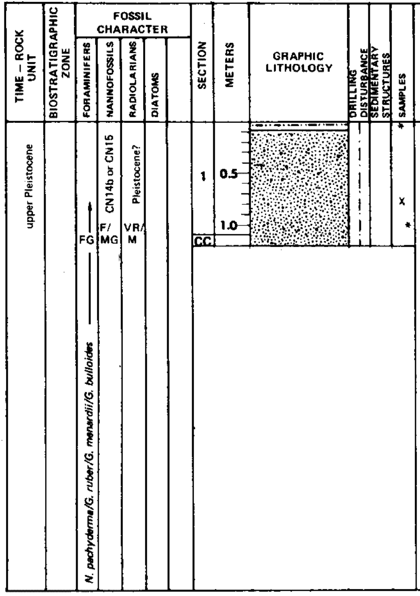
Three lithologic units were recognized:

I. 0 - 278.0 m BSF. Interbedded greenish gray to dark greenish gray, mud to calcareous mud, variably diatomaceous, and glauconitic or pyritic silty sand to sandy mud. Pleistocene-upper(?) to middle(?) Miocene. Lower bathyal. Includes three subunits. Includes erosional contact between Pleistocene/Pliocene and Pliocene/Miocene. Presumed erosional contact at base with middle Eocene was not recovered. Downhole log indicates contact at 278.0 m.

II. 278.0 m - 442 m BSF. Light greenish-gray bioturbated siliceous nannofossil chalk middle Eocene. Lower bathyal. Contains several slumps, one of which obscures lower contact.

III. 442 m - 581.9 m BSF. Greenish gray to gray porcellaneous nannofossil chalks and limestones and nannofossil porcellanites. Lower Eocene. Slumping common. Siliceous organisms converted to porcellanites.

SITE 613 HOLE CORE 1W CORED INTERVAL 0.0–19.8 m



LITHOLOGIC DESCRIPTION

10R 5/1

5G 6/1 to 5G 5/2

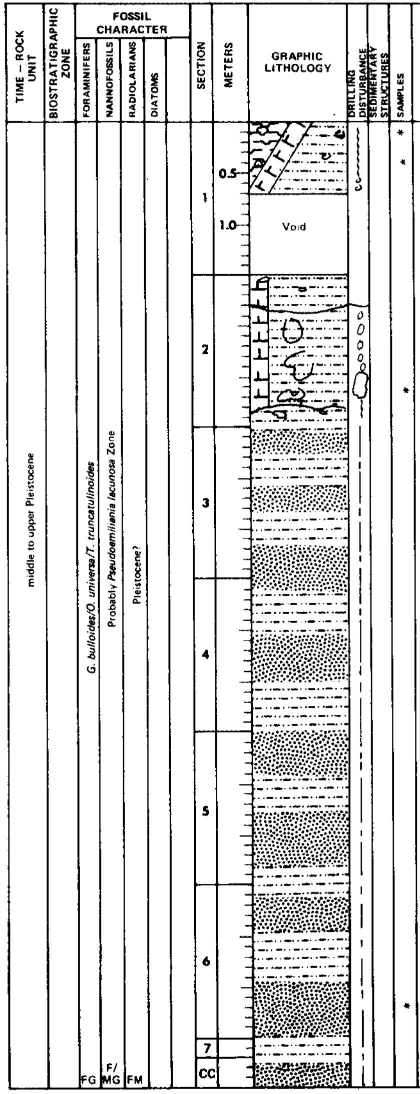
5G 6/1 to 5G 5/2

Homogeneous unbedded moderately deformed: Section 1, 0–3 cm, reddish gray (10R 5/1) MUD and Section 1, 3–112 cm and Core Catcher, greenish gray (5G 6/1) to grayish green (5G 5/2) SILTY SAND.

SMEAR SLIDE SUMMARY (%):

	1, 3	1, 100
	M	D
Texture:		
Sand	15	80
Silt	60	15
Clay	25	5
Composition:		
Quartz	45	65
Feldspar	10	5
Mica	–	1
Heavy minerals	10	15
Clay	25	5
Volcanic glass	TR	TR
Glauconite	2	3
Pyrite	TR	2
Carbonate unspec.	3	3
Foraminifers	2	TR
Plant debris	3	1

SITE 613 HOLE CORE 2X CORED INTERVAL 19.8–29.4 m



LITHOLOGIC DESCRIPTION

5G 6/1

NANNOFOSSIL DIATOMACEOUS MUD

Clasts in upper section are middle Eocene reworked (some hard and some softer). Other fragments also present (undated), colors yellow gray (5Y 8/1) and olive gray (5Y 4/2).

Section 2, 120 cm: grayish brown (5YR 3/2) sandy clast. Lowest part of Section 2 contains Eocene clasts.

5G 6/1

Section 3 and below: becomes alternating MUD and SAND pulses, dark greenish gray (5G 4/1). From Section 3 down there are alternations of mud and sand but with much more mud than sand.

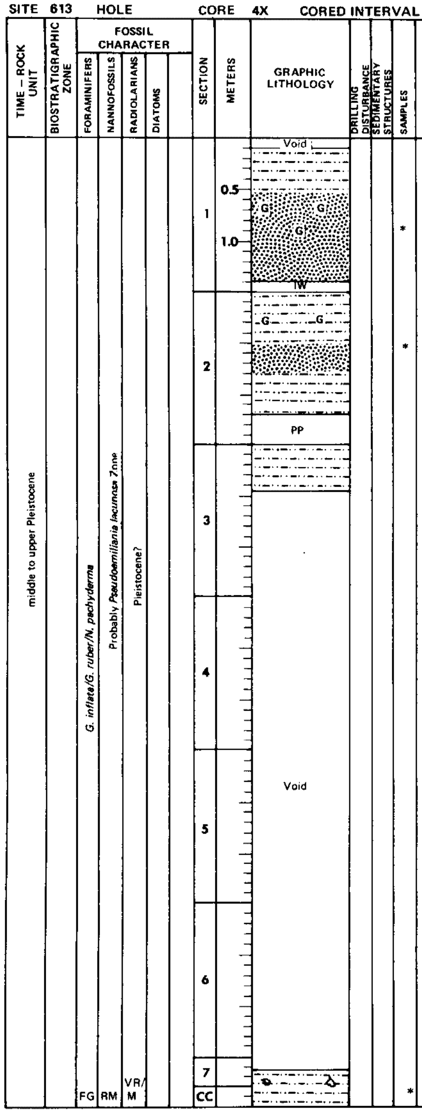
5B 5/1
color change
5B 5/1

SMEAR SLIDE SUMMARY (%):

	1, 10	1, 40	2, 114	6, 120
	D	D	D	M
Texture:				
Sand	15	10	75	75
Silt	45	40	20	20
Clay	40	50	5	5
Composition:				
Quartz	TR	20	73	65
Feldspar	–	–	5	5
Mica	–	TR	10	10
Heavy minerals	–	TR	5	5
Clay	40	50	5	5
Glauconite	–	–	TR	5
Pyrite	TR	1	2	5
Carbonate unspec.	–	1	–	–
Foraminifers	2	5	TR	–
Calc. nannofossils	14	17	TR	–
Diatoms	40	3	TR	–
Radiolarians	1	TR	–	–
Sponge spicules	3	1	TR	–
Silicoflagellates	TR	–	–	–
Plant debris	–	TR	–	–
Unknown spines	–	2	–	–

Core 3, 29.4–58.2 m: no recovery.

SITE 613 HOLE CORE 4X CORED INTERVAL 58.2–67.8 m



LITHOLOGIC DESCRIPTION

5G 4/1

SANDY MUD AND SAND alternations. Sand is GLAUCONITIC QUARTZ SAND. Section 2 has 2 well-developed sand layers (glauconitic: 15%).

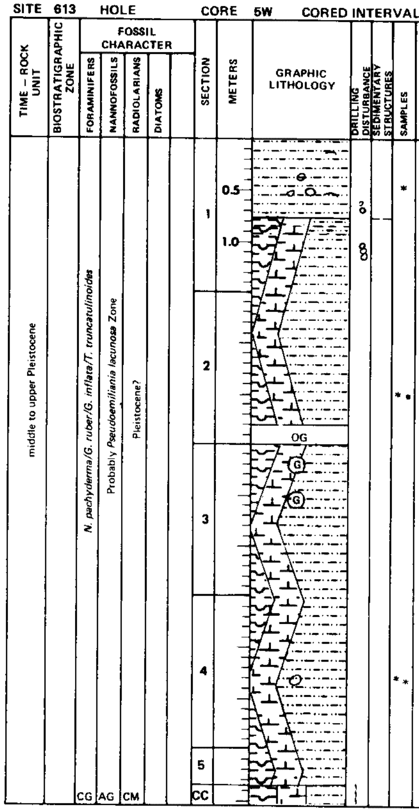
SMEAR SLIDE SUMMARY (%):

	1, 87	2, 51	CC, 5
	D	M	D
Texture:			
Sand	20	80	5
Silt	60	20	40
Clay	20	–	55
Composition:			
Quartz	55	50	30
Feldspar	10	10	2
Mica	10	15	10
Heavy minerals	TR	10	TR
Clay	20	TR	55
Glauconite	1	15	–
Pyrite	1	–	2
Carbonate unspec.	2	–	–
Foraminifers	TR	TR	–
Calc. nannofossils	1	TR	1
Diatoms	–	–	TR
Sponge spicules	–	–	TR
Plant debris	–	–	TR

5GY 4/1

Mud with Eocene clasts

SITE 613 HOLE CORE 5W CORED INTERVAL 67.8–116.0 m



LITHOLOGIC DESCRIPTION

Section 1, 0–76 cm: MUD, dark greenish gray (5GY 4/1); firm, scattered shell fragments; several intraclasts of yellowish gray (5Y 8/1) middle Eocene age " ⬭ ".

Below Section 1, 76 cm: NANNOFOSSIL MUD, occasionally DIATOMACEOUS also dark greenish gray, but more green (5G 4/1); soupy, disturbed gas voids in Section 1; very homogeneous except for:

- several silty laminae in Section 1
- firm, brittle layer at Section 2, 17–19 cm
- mottles of dark grayish green glauconitic-quartzose sand at Section 3, 20 and 50 cm
- middle Eocene clast at Section 4, 82 cm
- widely variable amounts of diatoms

SMEAR SLIDE SUMMARY (%):

	1, 50	2, 100	4, 80	4, 86
	D	D	D	D
Texture:				
Sand	5	20	5	1
Silt	45	50	45	50
Clay	50	30	50	49
Composition:				
Quartz	32	9	15	10
Feldspar	2	–	3	TR
Mica	TR	–	–	–
Heavy minerals	3	TR	1	–
Clay	50	30	50	49
Glauconite	2	–	TR	–
Pyrite	1	1	3	–
Carbonate unspec.	10	–	5	10
Foraminifers	–	TR	24	1
Calc. nannofossils	–	30	–	29
Diatoms	–	30	TR	1
Radiolarians	–	TR	–	–
Sponge spicules	–	TR	TR	–
Fish remains	–	TR	TR	–

ORGANIC CARBON AND CARBONATE (%):

	2, 105
Organic carbon	–
Carbonate	20

SITE 613 HOLE CORE 6X CORED INTERVAL 116.0–125.6 m

TIME – ROCK UNIT: middle to upper Pleistocene

BIOSTRATIGRAPHIC ZONE

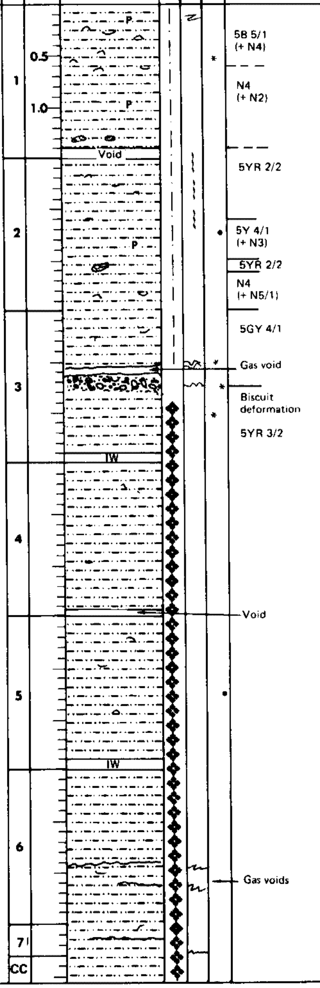
FOSSIL CHARACTER

FORAMINIFERS: *S. dehiscens/G. ruber/G. inflata*; FG

NANNOFOSSILS: Probably *Pseudoemiliania lacunosa* Zone; R/MG; R/MG

RADIOLARIANS: Pleistocene?; VR/P

DIATOMS



LITHOLOGIC DESCRIPTION

Contained much GAS.

MUD (faintly calcareous) in Section 1 bluish gray (5B 5/1) with medium dark gray (N4) mottles (Fe-sulfides).

Color becomes medium dark gray to dusky gray (5YR 2/2) in Section 2. In its top numerous fine sand and silt schlieren and pockets mainly due to drilling disturbance (micaceous).

Color turns to dark gray with abundant pyrite. In Section 3, 76 cm: erosion surface with overlaying conglomeratic mud (3 cm large pebbles of gray quartzitic sandstone and brown calcareous sandstone). Below this erosion surface, homogeneous, firm mud with grayish brown (5YR 3/2), micaceous.

Throughout the core are thin fragments and intact shells of small pelecypods and gastropods. Large, gas generated fractures and voids.

SMEAR SLIDE SUMMARY (%):

	1, 55	3, 50	3, 76	3, 105
	D	D	M	D
Texture:				
Sand	15	5	50	5
Silt	55	55	20	55
Clay	30	40	30	40
Composition:				
Quartz	52	46	45	39
Feldspar	2	2	3	5
Mica	5	5	7	10
Heavy minerals	1	1	2	1
Clay	30	40	30	40
Glauconite	–	–	TR	·
Pyrite	5	2	10	2
Carbonate unspec.	3	3	3	2
Foraminifers	TR	TR	TR	–
Calc. nannofossils	–	–	–	TR
Plant debris	2	1	–	1

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	7	1

SITE 613 HOLE CORE 7X CORED INTERVAL 125.6–135.1 m

TIME – ROCK UNIT: middle to upper Pleistocene

BIOSTRATIGRAPHIC ZONE

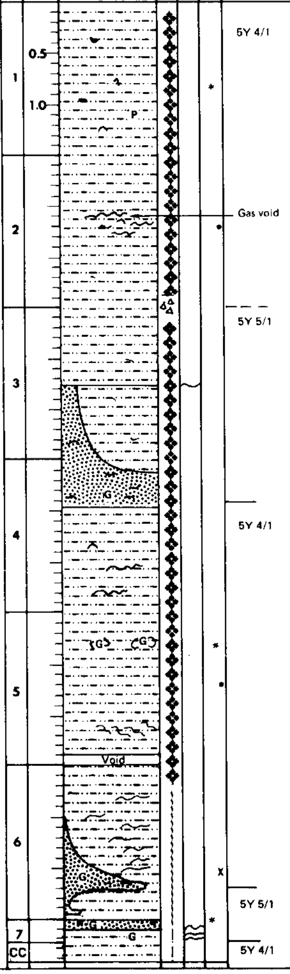
FOSSIL CHARACTER

FORAMINIFERS: *G. inflata/G. menardii/N. pachyderma*; CG

NANNOFOSSILS: Probably *Pseudoemiliania lacunosa* Zone; R/MG

RADIOLARIANS: B

DIATOMS



LITHOLOGIC DESCRIPTION

Contains much GAS (CO_2).

MUD, olive gray (5Y 4/1), homogeneous, micaceous, with ubiquitous shell fragments of small pelecypods and gastropods. Fractures and voids generated by gas. Biscuit deformation indicates a certain degree of induration.

Below the middle of Section 3 are mixtures of glauconite and coarse quartz sand that gradually become glauconitic sand (conglomeratic) layers, all mixed up with mud by drilling disturbance. Color in these parts gray (5Y 5/1).

In Section 7 up to 5 mm large pebbles of quartzite and light green quartz in glauconite sand layer.

The coarse glauconitic-quartzose intervals may be slump deposits; uncertainty due to drilling disturbance.

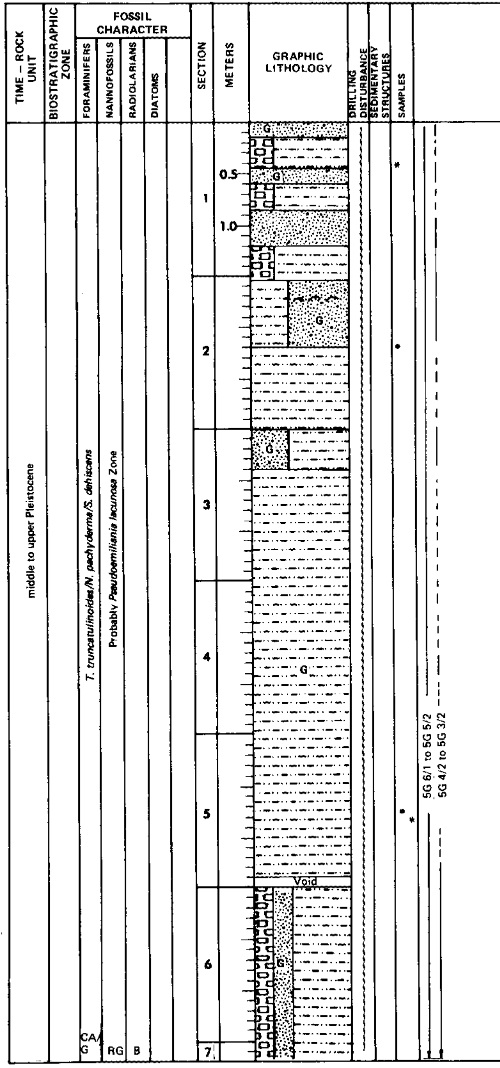
SMEAR SLIDE SUMMARY (%):

	1, 85	5, 36	7, 3
	D	D	D
Texture:			
Sand	10	10	20
Silt	40	40	40
Clay	50	50	40
Composition:			
Quartz	30	20	39
Feldspar	4	3	5
Mica	10	15	1
Heavy minerals	1	2	2
Clay	50	50	40
Glauconite	–	–	5
Pyrite	2	5	1
Carbonate unspec.	3	3	5
Foraminifers	–	–	TR
Calc. nannofossils	TR	1	–
Diatoms	–	–	2
Radiolarians	–	–	TR
Fish remains	–	–	TF.
Plant debris	–	1	–

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	3	5

SITE 613 HOLE CORE 8X CORED INTERVAL 135.1–144.6 m



LITHOLOGIC DESCRIPTION

The dominant lithology consists of: unbedded, homogeneous, greenish gray (5G 6/1) to grayish green (5G 5/2) MUD (Section 2, 3, 4, and 5) to CALCAREOUS MUD (Section 1, 6, and 7).

Sporadic grayish green (5G 4/2) to dusky green (5G 3/2) GLAUCONITIC SILTY SAND areas and layers occur in Section 1, 0–10, 45–60, and 85–120 cm; Section 2, 0–70 cm; Section 3, 0–40 cm; Section 4, 120 cm, Section 6, and Section 7. Grain size up to 3 mm.

Small shell fragments occur throughout the core (well preserved *Cardium* shell at Section 2, 25 cm).

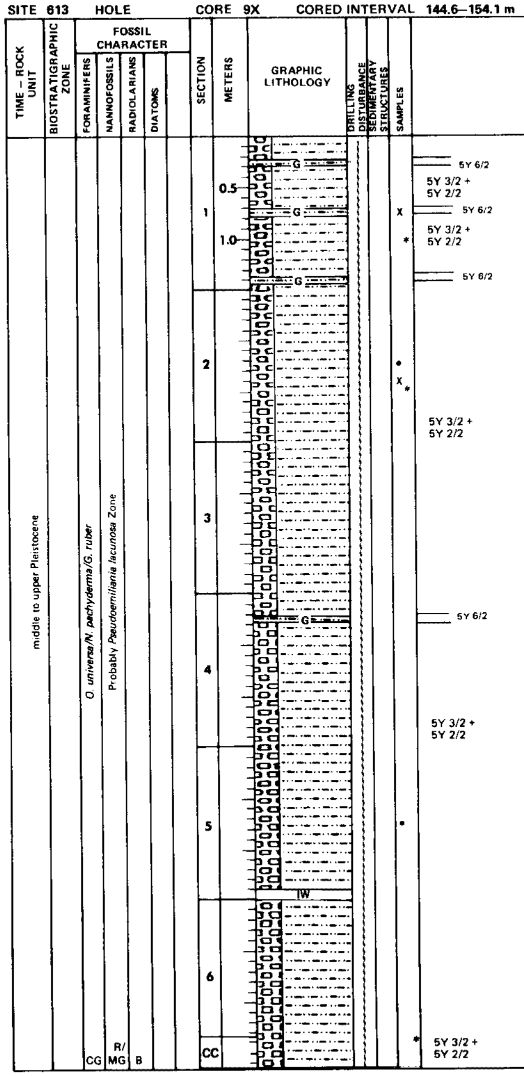
SMEAR SLIDE SUMMARY (%):

	1, 40	5, 85
	D	D
Texture:		
Sand	2	10
Silt	48	40
Clay	50	50
Composition:		
Quartz	29	32
Feldspar	5	5
Mica	2	–
Heavy minerals	5	3
Clay	34	50
Glauconite	2	5
Pyrite	2	2
Carbonate unspec.	20	3
Foraminifers	–	TR
Plant debris	1	TR

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	3.56	1.83

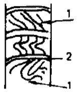
SITE 613 HOLE CORE 9X CORED INTERVAL 144.6–154.1 m



LITHOLOGIC DESCRIPTION

Possible slump deposit. Interlayered: CALCAREOUS MUD, black (5Y 2/2) color occurs in the form of specks and pervasive or diffuse thin layers. Sporadic light olive gray (5Y 6/2) sideritic? layers at Section 1, 22–26, 73–75, and 140 cm and Section 4, 22–26 cm.

Two types of deformation:



1 : convolute deformation = drilling deformation or = primary structures?

2 : subparallel deformation = drilling deformation

1 : convolute? slumps??

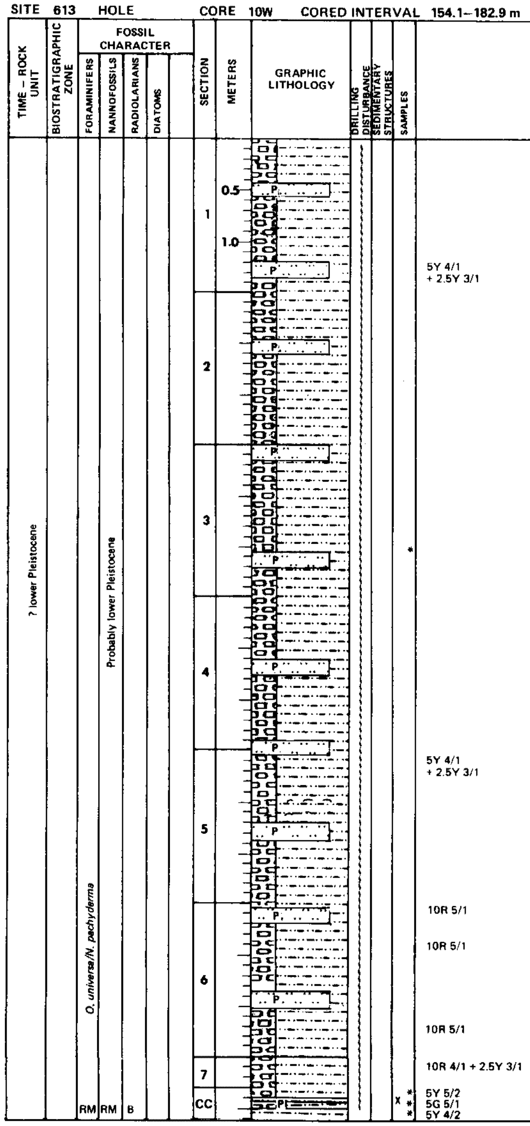
SMEAR SLIDE SUMMARY (%):

	1, 100	2, 100	CC, 5
	D		
Texture:			
Sand	5	5	5
Silt	35	45	55
Clay	60	50	40
Composition:			
Quartz	18	27	33
Feldspar	5	3	3
Mica	2	2	2
Heavy minerals	–	2	2
Clay	55	45	40
Glauconite	2	3	3
Pyrite	3	3	2
Carbonate unspec.	15	15	15
Foraminifers	–	TR	TR
Plant debris	TR	–	TR

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	9	10

SITE 613 HOLE CORE 10W CORED INTERVAL 154.1–182.9 m

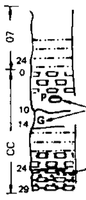


LITHOLOGIC DESCRIPTION

Possible slump deposit. Section 1–Section 6: interlayered and very deformed, dark gray (5Y 4/1) and very dark gray (2.5Y 3/1) CALCAREOUS MUD to SILTY PYRITIC MUD.

Very dark gray (2.5Y 3/1) color occurs in the form of pervasive mottles and diffuse thin layers.

Sporadic reddish gray (10R 5/1) mottles and layers in Section 6, 5–10, 50–55, and 124 cm, and shell fragments in Section 5.



Section 7–Core Catcher:

Dark reddish gray (10R 4/1) to very dark gray (2.5Y 3/1) PYRITIC CALCAREOUS MUD (→CC, 10 cm).

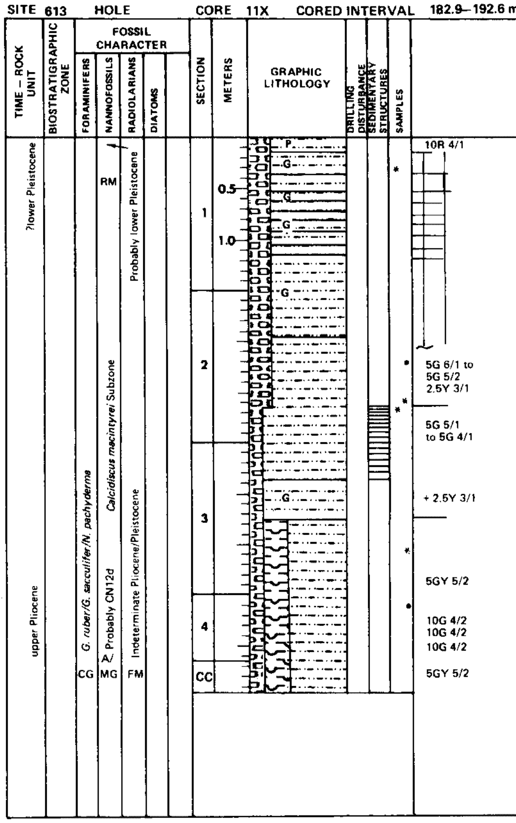
Olive gray (5Y 5/2) SIDERITIC CHALK (nodule) to OOZE (CC, 10–14 cm).

Olive gray (5Y 4/2) coarse SANDY GLAUCONITIC MUD (CC, 24–29 cm).

SMEAR SLIDE SUMMARY (%):

	3, 102	CC, 6	CC, 12	CC, 25
	M	M	M	D
Texture:				
Sand	10	1	–	30
Silt	40	9	5	30
Clay	50	90	95	40
Composition:				
Quartz	30	5	5	36
Feldspar	2	–	–	7
Mica	1	–	–	1
Heavy minerals	TR	–	–	2
Clay	14	15	20	40
Glauconite	–	–	–	5
Pyrite	50	–	–	3
Carbonate unspec.	3	80	75	3
Foraminifers	TR	–	–	TR
Calc. nannofossils	–	–	–	3

SITE 613 HOLE CORE 11X CORED INTERVAL 182.9–192.6 m



LITHOLOGIC DESCRIPTION

Section 1, 0–7 cm: dark reddish gray (10R 4/1) to very dark gray (2.5Y 3/1) PYRITIC CALCAREOUS MUD.

Section 1, 7 cm–Section 3, 73 cm: interlayered greenish gray (5G 6/1) Section 1, 7 cm–Section 2, 113 cm to grayish green (5G 5/2) and Section 2, 113 cm–Section 3, 73 cm greenish gray (5G 5/1) to dark greenish gray (5G 4/1).

CALCAREOUS MUD and GLAUCONITIC CALCAREOUS MUD with numerous very dark gray (2.5Y 3/1) grains of glauconite.

Section 3, 73 cm–Core Catcher: homogeneous unbedded, dusky yellow green (5GY 5/2) NANNOFOSSIL DIATOMACEOUS MUD with thin grayish green (10G 4/2) layers in Section 4.

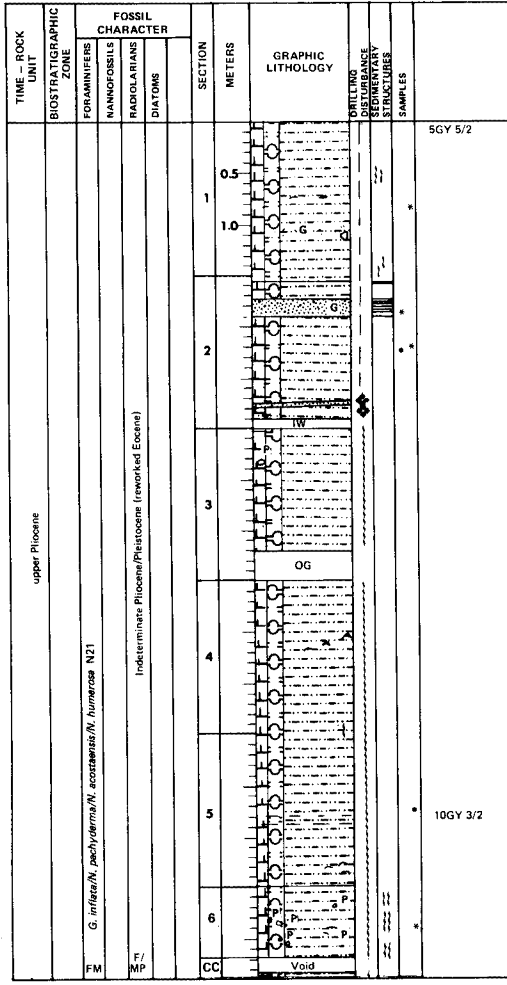
SMEAR SLIDE SUMMARY (%):

	1, 34	2, 110	2, 115	3, 107
	D	D	D	D
Texture:				
Sand	30	2	2	10
Silt	40	38	48	40
Clay	30	60	50	50
Composition:				
Quartz	31	21	23	10
Feldspar	5	5	5	2
Mica	–	–	2	2
Heavy minerals	2	2	5	2
Clay	30	50	50	47
Glauconite	5	2	2	2
Pyrite	–	–	3	5
Carbonate unspec.	25	20	10	5
Foraminifers	2	TR	–	3
Calc. nannofossils	–	–	–	5
Diatoms	–	–	–	15
Radiolarians	–	–	TR	TR
Sponge spicules	–	–	–	2
Plant debris	TR	–	–	–

ORGANIC CARBON AND CARBONATE (%):

	2, 76	4, 17
Organic carbon	–	–
Carbonate	13	4

SITE 613 HOLE CORE 12X CORED INTERVAL 192.6–202.3 m



LITHOLOGIC DESCRIPTION

NANNOFOSSILIFEROUS SILICEOUS MUD
Rock fragment and glauconite sand at 110 cm of Section 1. Section 2, 22–52 cm: sandy silt (glauconitic). Glauconitic silt at Section 2, 125–130 cm.

At Section 4, 50–70 cm small (1 cm) molluscs (crushed) parallel to bedding.

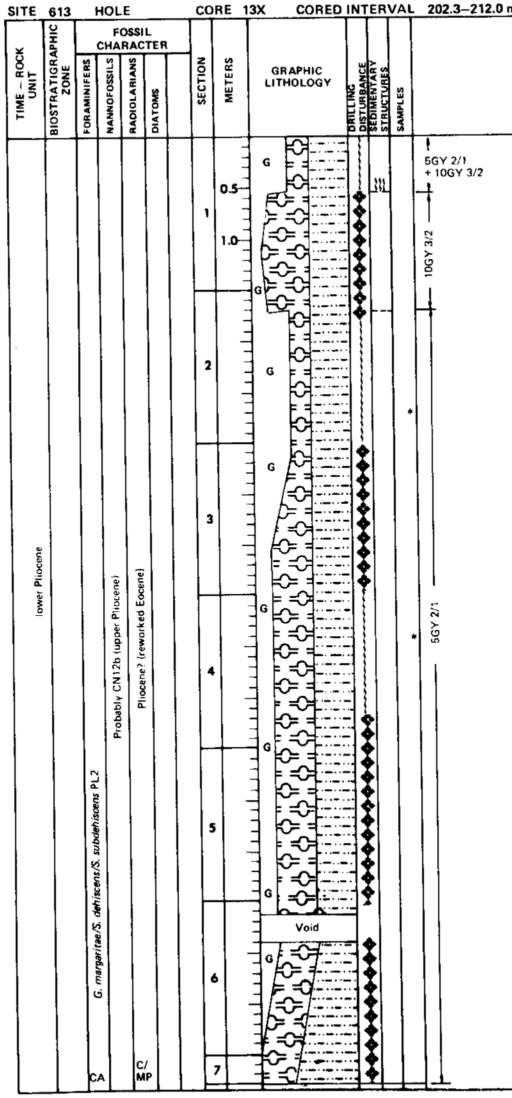
SMEAR SLIDE SUMMARY (%):

	1, 89	2, 40	2, 72	6, 40
Texture:				
Sand	10	25	5	5
Silt	60	65	70	35
Clay	30	10	25	60
Composition:				
Quartz	30	40	30	25
Feldspar	–	–	–	3
Mica	2	1	5	3
Heavy minerals	2	3	–	–
Clay	30	10	24	60
Glauconite	5	25	3	3
Pyrite	10	6	8	TR
Carbonate unspec.	–	8	5	–
Foraminifers	3	–	–	–
Calc. nannofossils	3	–	10	3
Diatoms	15	7	10	3
Radiolarians				

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	8	6

SITE 613 HOLE CORE 13X CORED INTERVAL 202.3–212.0 m



LITHOLOGIC DESCRIPTION

SILICEOUS GLAUCONITIC MUD, greenish black (5GY 2/1) intermixed with dusky yellowish green (10GY 3/2) in Section 1, 0–50 cm; grades downward to totally dusky yellowish green (10GY 3/2), and at 20 cm in Section 2 returns to greenish black (5GY 2/1).

Below 105 cm in Section 3 the core gradually becomes more muddy and grades to GLAUCONITIC SILICEOUS MUD.

Much of core shows "biscuit" drilling disturbance; rare intervals are not broken up, and show mottles of glauconitic-rich silty mud.

Carbonate content is largely ?ANKERITE.

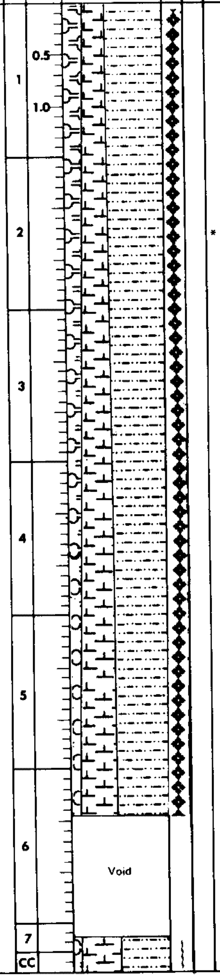
Portions of glauconite-rich core may be slump deposit.

SMEAR SLIDE SUMMARY (%):

	2, 120	4, 46
Texture:		
Sand	35	10
Silt	55	65
Clay	10	25
Composition:		
Quartz	5	20
Clay	10	25
Glauconite	45	10
Pyrite	5	–
Carbonate unspec. (ankerite)	10	8
Calc. nannofossils	–	2
Diatoms	25	35
Radiolarians		
Sponge spicules		

SITE 613 HOLE CORE 14X CORED INTERVAL 212.0–221.5 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS
lower Pliocene		*O. universa/G. inflata* PL1/PL2 CM	lower *Discoaster brouweri* Zone (CN12a, CN12b) (upper Pliocene) CA/MG	Indeterminate (reworked Eocene) FP	



LITHOLOGIC DESCRIPTION

NANNOFOSSIL SILICEOUS MUD, very firm, but not yet a "stone". Dusky yellowish green (10GY 3/2) weakly burrowed to massive.

Section 7, 12 cm—base of Core Catcher: somewhat mottled nannofossil siliceous mud.

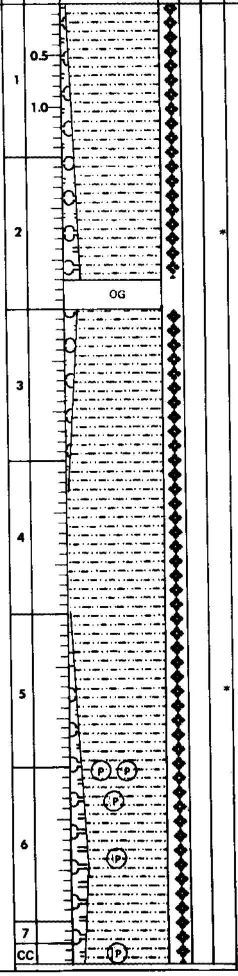
SMEAR SLIDE SUMMARY (%):

	2, 77	5, 76
Texture:		
Sand	5	5
Silt	45	45
Clay	50	50
Composition:		
Quartz	11	14
Clay	50	50
Glauconite	TR	–
Pyrite	5	5
Carbonate unspec.	3	5
Foraminifers	1	3
Calc. nannofossils	10	20
Diatoms	15	1
Radiolarians	2	TR
Sponge spicules	2	2
Silicoflagellates	TR	–
Plant debris	1	TR

10GY 3/2

SITE 613 HOLE CORE 15X CORED INTERVAL 221.5–231.0 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS
lower Pliocene		*G. nepenthes/G. crassaformis/G. ruber* PL1 FG	Probably CN10b, CN10c A/MG	Indeterminate (reworked Eocene) RP	



LITHOLOGIC DESCRIPTION

MUD, sporadically SILICEOUS MUD, dusky yellowish green (10GY 3/2). Gastropods, foraminifera visible on cut surface: rare in Section 1 and 2, increasing to common in underlying sections.

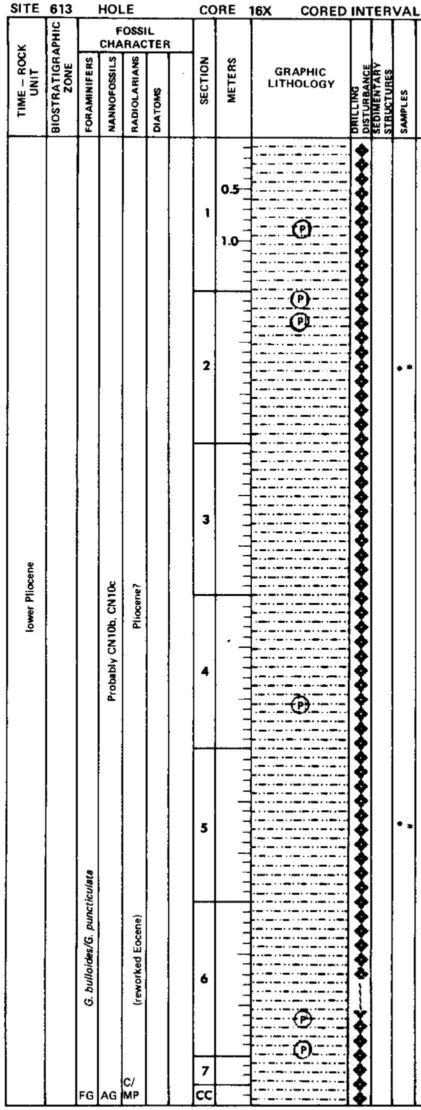
Granular pyrite nodules in Section 6.

Core is very firm and entirely broken into biscuits, with fine- to medium-sand sized glauconite grains, shell fragments within slurry between biscuits, becoming abundant towards bottom of core.

SMEAR SLIDE SUMMARY (%):

	2, 77	5, 79
	D	D
Texture:		
Sand	20	–
Silt	44	–
Clay	36	61
Composition:		
Quartz	25	15
Mica	2	2
Heavy minerals	3	2
Clay	36	61
Glauconite	3	2
Carbonate unspec.	2	5
Foraminifers	2	3
Calc. nannofossils	5	2
Diatoms	20	} 8
Radiolarians	2	}
Silicoflagellates	TR	TR
Fish remains	–	TR

SITE 613 HOLE CORE 16X CORED INTERVAL 231.0–240.5 m



LITHOLOGIC DESCRIPTION

MUD, dusky yellowish green (10GY 3/2), no bedding or bioturbation, occasional gastropods, foraminifera visible on cut surface.

Occasional pitted pyrite nodules, usually in inter-biscuit slurry. Core is very firm, broken into biscuits with glauconite-rich slurry between; especially glauconite-rich in Section 5, 0–16 cm.

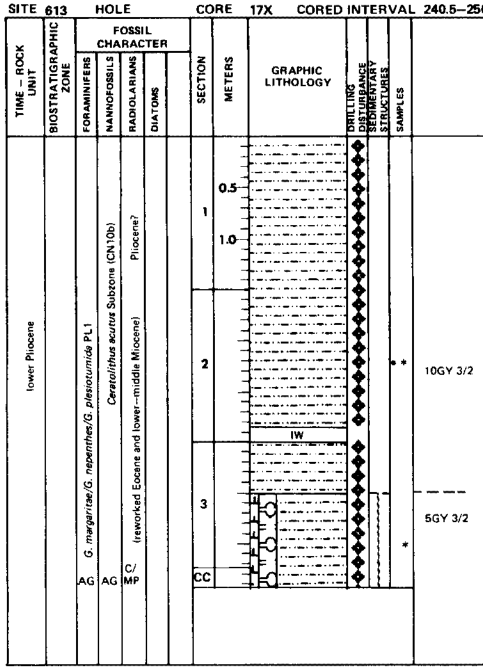
SMEAR SLIDE SUMMARY (%):

	2, 76	5, 78
	D	D
Texture:		
Sand	12	12
Silt	17	18
Clay	71	70
Composition:		
Quartz	15	15
Feldspar	–	1
Mica	2	2
Heavy minerals	2	2
Clay	71	70
Glauconite	1	1
Pyrite	2	1
Carbonate unspec.	1	–
Foraminifers	–	1
Calc. nannofossils	3	5
Diatoms	1	2
Radiolarians	1	–
Sponge spicules	1	–

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	7.89	7.02

SITE 613 HOLE CORE 17X CORED INTERVAL 240.5–250.0 m



LITHOLOGIC DESCRIPTION

Top–Section 3, 50 cm: MUD, dusky yellowish green (10GY 3/2), very firm broken into biscuits with glauconite-rich slurry between. Intact biscuits are homogeneous, unbedded, and unburrowed.

Section 3, 50 cm–bottom:
NANNOFOSSIL SILICEOUS MUD, dusky yellow green (5GY 3/2) like overlying unit, except that irregular, flattened burrow mottles of 10GY 3/2 are clearly visible. Possible slump deposit.

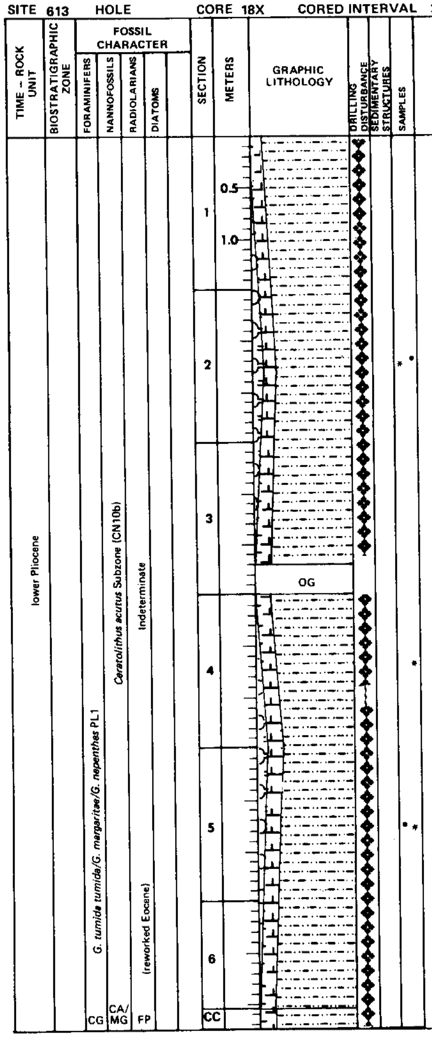
SMEAR SLIDE SUMMARY (%):

	2, 77	3, 104
	D	D
Texture:		
Sand	7	14
Silt	11	42
Clay	82	45
Composition:		
Quartz	5	–
Mica	1	3
Heavy minerals	2	1
Clay	82	45
Glauconite	TR	1
Pyrite	3	1
Foraminifers	1	1
Calc. nannofossils	2	12
Diatoms	3	} 15
Radiolarians	1	
Sponge spicules	–	1

ORGANIC CARBON AND CARBONATE (%):

	2, 76
Organic carbon	–
Carbonate	5.29

SITE 613 HOLE CORE 18X CORED INTERVAL 250.0–259.5 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL MUD, sporadically SILICEOUS NANNOFOSSIL MUD, dusky yellowish green (10GY 3/2).

Similar to the top of Core 17. No bedding or bioturbation is visible in the intact biscuits.

Rare gastropod fragments, foraminifera can be seen on surface of core.

Entire core is very firm and broken into biscuits, with glauconite-rich slurry between.

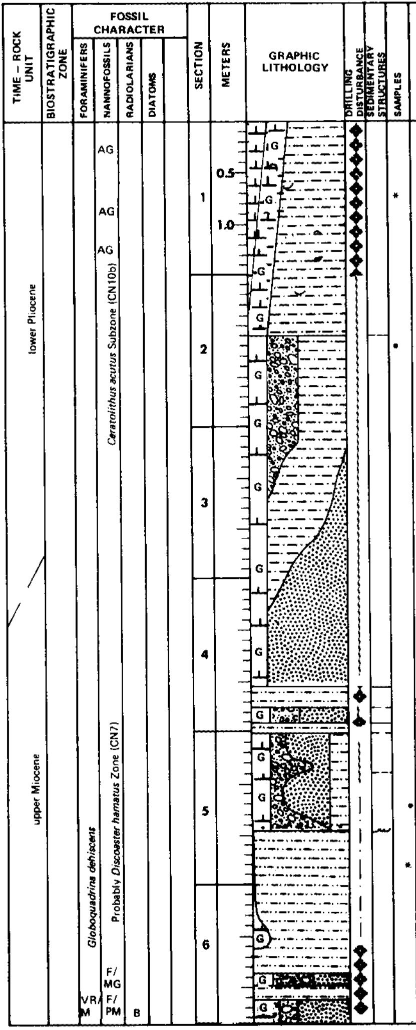
SMEAR SLIDE SUMMARY (%):

	2, 76	4, 70	5, 80
	D	M	D
Texture:			
Sand	2	50	20
Silt	53	25	35
Clay	45	25	45
Composition:			
Quartz	30	30	30
Feldspar	TR	2	2
Mica	–	–	2
Heavy minerals	–	2	1
Clay	43	20	40
Glauconite	4	35	10
Pyrite	2	–	1
Carbonate unspec.	2	2	1
Foraminifers	–	TR	TR
Calc. nannofossils	10	3	10
Diatoms	5	2	1
Radiolarians	3	1	1
Sponge spicules	1	2	1
Fish remains	–	TR	–
Plant debris	TR	1	TR

ORGANIC CARBON AND CARBONATE (%):

	2, 75	5, 76
Organic carbon	–	–
Carbonate	3.12	2.26

SITE 613 HOLE CORE 19X CORED INTERVAL 259.5–269.0 m



LITHOLOGIC DESCRIPTION

10YR 4/1

GLAUCONITIC SANDY MUD, dark gray (10YR 4/1). Quartz and glauconite evenly disseminated in mud, rare pebbles at top ~20% nannofossils and shell debris. In Section 2 conglomeratic, to Section 3 and 4 less mud: GLAUCONITIC CONGLOMERATIC SAND, black (10YR 2/1) to very dark gray (10YR 3/1) to the bottom interlayered with 20 to 10 cm thick mud beds. Base is conglomerate layer at Section 5, 95 cm above scoured surface. Below is micaceous mud with glauconitic, conglomeratic sand layers at base.

10YR 3/1

Entire core more or less disturbed by biscuiting. Layers mixed up by drilling.

SMEAR SLIDE SUMMARY (%):

	1, 76	5, 132
	D	D
Texture:		
Sand	15	30
Silt	50	20
Clay	35	50
Composition:		
Quartz	20	28
Mica	TR	15
Heavy minerals	TR	–
Clay	35	50
Glauconite	15	2
Pyrite	5	5
Carbonate unspec.	10	–
Foraminifers	TR	–
Calc. nannofossils	15	–
Diatoms	TR	–
Radiolarians	TR	TR
Sponge spicules	–	TR
Plant debris	TR	–

10YR 2/1
+ 10YR 3/1

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	0	0

10YR 4/2

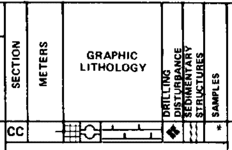
10YR 3/1

10YR 4/2
+ 10YR 3/1

10YR 3/1

SITE 613 HOLE CORE 20X CORED INTERVAL 269.0–278.6 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER FORAMINIFERS	FOSSIL CHARACTER NANNOFOSSILS	FOSSIL CHARACTER RADIOLARIANS	FOSSIL CHARACTER DIATOMS
middle Eocene		CG *T. rohri/M. spinulosa/T. topilensis/M. lehneri* P12	AM *Chiasmolithus gigas* Subzone (CP13b)	A/MG *Thyrsocyrtis triacantha* Zone	



LITHOLOGIC DESCRIPTION

5GY 7/2 (+ 5Y 6/1)

SILICEOUS NANNOFOSSIL CHALK, grayish yellow green (5GY 7/2), intensely burrowed. Burrow structures filled with light olive gray (5Y 6/1) to greenish gray (5GY 6/1) siliceous chalk. Burrows slightly flattened.

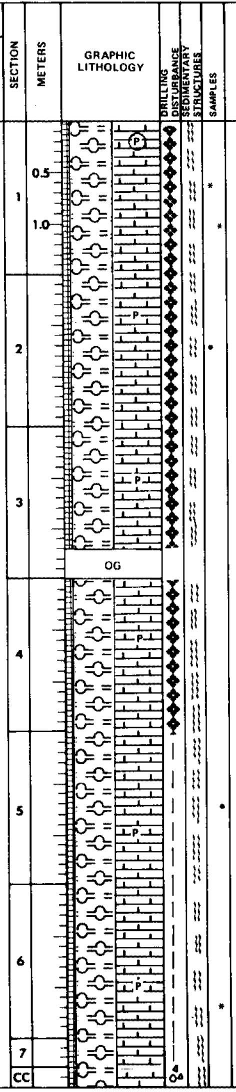
The clay-size fraction of this core and all of those down to Core 37 of Site 613 contains an undetermined amount of biogenic opal-A, and is identified by ┼┼┼┼┼ in the graphic lithology column.

SMEAR SLIDE SUMMARY (%):

	CC, 7 D
Texture:	
Sand	5
Silt	75
Clay	20
Composition:	
Quartz	1
Clay and silica	20
Volcanic glass	TR
Zeolite	TR
Foraminifers	TR
Calc. nannofossils	66
Diatoms	10
Radiolarians	1
Sponge spicules	2
Plant debris	TR

SITE 613 HOLE CORE 21X CORED INTERVAL 278.6–288.2 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER FORAMINIFERS	FOSSIL CHARACTER NANNOFOSSILS	FOSSIL CHARACTER RADIOLARIANS	FOSSIL CHARACTER DIATOMS
middle Eocene		*T. topilensis/G. possagnoensis/M.* cf. *lehneri* P12 CM	*Chiasmolithus gigas* Subzone (CP13b) AM	*Thyrsocyrtis triacantha* Zone A/MG	



LITHOLOGIC DESCRIPTION

5GY 8/1
(+ 10YR 5/2
and 5Y 6/1)

5G 8/1
(+ 5Y 6/1
and 5G 6/1)

N7 (+ 5G 6/1
and 5Y 6/1)

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5GY 8/1) with numerous burrows of grayish brown (10YR 5/2) to light olive gray (5Y 6/1). Matrix color grades at bottom to light gray (N7) with burrows greenish gray (5G 6/1) and olive gray. Pyrite as framboids throughout the core, rare nodules. Burrows ± flattened. Main types: horizontal and diagonal "spreiten"/planolites/large diagonal to vertical pear-shaped dwellings/rare chondrites) (see Site 612). Intense biscuit deformation in top of core.

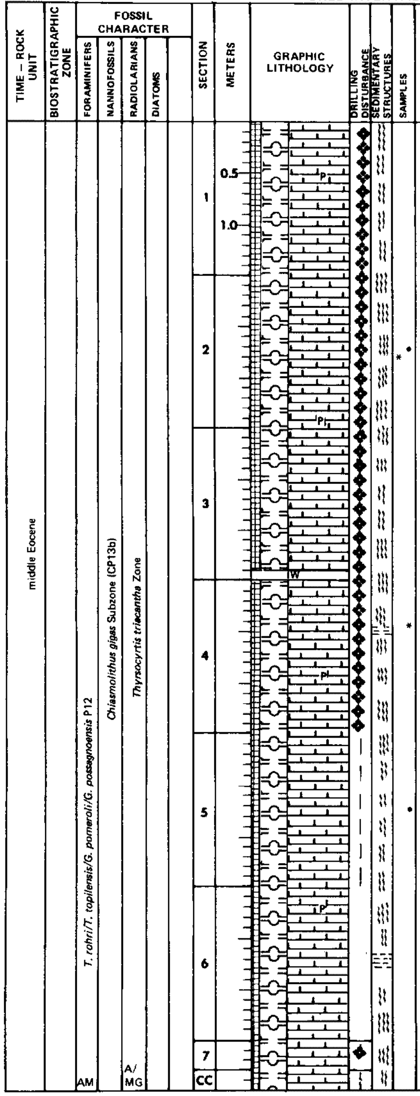
SMEAR SLIDE SUMMARY (%):

	1, 64 M	1, 102 D	6, 120 D
Texture:			
Sand	20	20	20
Silt	70	70	70
Clay	10	10	10
Composition:			
Mica	TR	TR	TR
Clay and silica	10	10	10
Pyrite	TR	TR	TR
Carbonate unspec.	5	5	5
Foraminifers	5	5	5
Calc. nannofossils	40	40	40
Diatoms	35	35	30
Radiolarians	–	–	5
Sponge spicules	5	5	5
Fish remains	TR	–	–

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	39	40

SITE 613 HOLE CORE 22X CORED INTERVAL 288.2–297.8 m



LITHOLOGIC DESCRIPTION

5G 8/1
(+ 5Y 4/1
and 5Y 6/1)

5G 8/1
(+ 5Y 6/1)

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1) with intense burrowing. Burrows light olive gray (5Y 6/1) and olive gray (5Y 4/1). Burrows mostly small and flattened. In Section 4 and 6 there are thin laminated to flasered layers without burrowing.

Pyrite framboids and fish scales disseminated throughout the core. Horizontal bedding indicated by fish scales and other flat components.

Intense biscuit deformation in upper part of core.

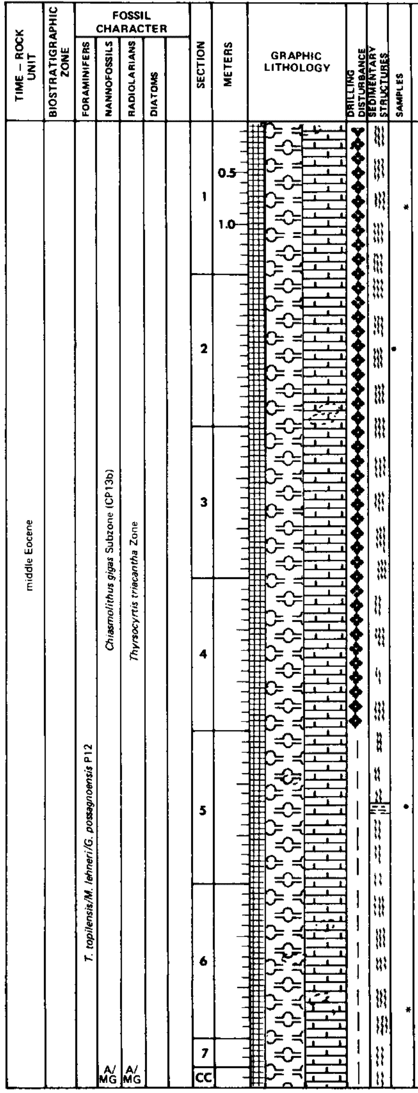
SMEAR SLIDE SUMMARY (%):

	2, 80	4, 48
	D	M
Texture:		
Sand	20	20
Silt	70	70
Clay	10	10
Composition:		
Mica	TR	TR
Clay	10	10
Pyrite	TR	TR
Carbonate unspec.	5	5
Foraminifers	5	5
Calc. nannofossils	40	40
Diatoms	30	30
Radiolarians	5	5
Sponge spicules	5	5

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	47	52

SITE 613 HOLE CORE 23X CORED INTERVAL 297.8–307.4 m



LITHOLOGIC DESCRIPTION

5G 8/1
(+ 5Y 6/1
and N7)

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1) with very numerous burrows of light olive gray (5Y 6/1) to light gray (N7). Some large vertical burrows with second generation of smaller burrow structures. Around some burrows oval-shaped (< 10 cm wide) haloes, of diagenesis, bordered by black lines of pyrite framboid concentration.

Pyrite specks and streaks throughout the core.

Upper part of core disturbed by drilling (biscuits).

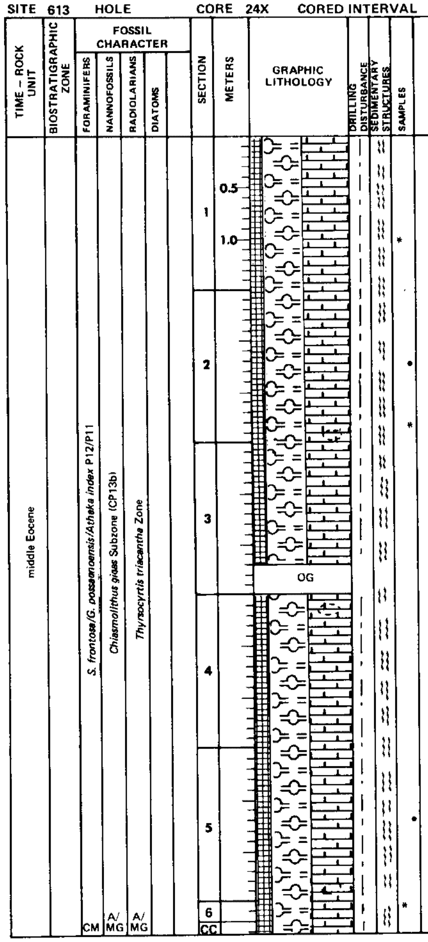
SMEAR SLIDE SUMMARY (%):

	1, 88	6, 123
	D	D
Texture:		
Sand	5	10
Silt	75	70
Clay	20	20
Composition:		
Mica	TR	–
Clay and silica	20	20
Pyrite	TR	TR
Carbonate unspec.	5	10
Foraminifers	2	2
Calc. nannofossils	35	30
Diatoms	30	30
Radiolarians	3	3
Sponge spicules	5	5

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	44	43

SITE 613 HOLE CORE 24X CORED INTERVAL 307.4–317.0 m



5G 8/1
+ 5Y 6/1 to
10YR 5/1

LITHOLOGIC DESCRIPTION

Light greenish gray (5G 8/1) SILICEOUS NANNOFOSSIL CHALK with gray (5Y 6/1) to yellowish brown (10YR 5/1) burrows. Bioturbation consists of: unstructured horizontal, oblique flattened burrows; horizontal and oblique spreiten; chondrites; and narrow and large vertical burrows.

Sporadic pyrite nodules, ⬭ diagenetic haloes, fish remains (Section 2, 60 cm).

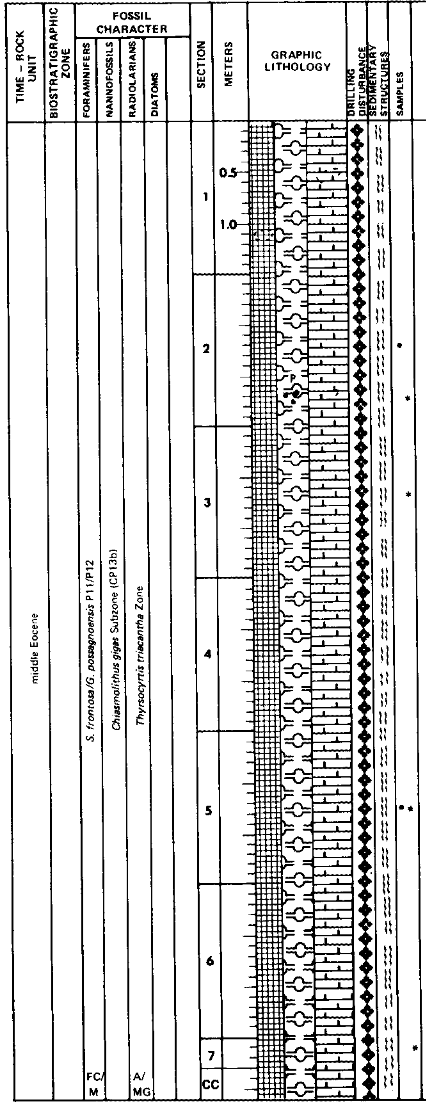
SMEAR SLIDE SUMMARY (%):

	1, 100	2, 135	6, 10
	D	M	D
Texture:			
Sand	5	5	5
Silt	75	75	75
Clay	20	20	20
Composition:			
Clay and silica	15	10	13
Pyrite	TR	TR	1
Zeolite	–	TR	TR
Carbonate unspec.	TR	–	–
Foraminifers	–	TR	1
Calc. nannofossils	47	47	40
Diatoms	30	30	30
Radiolarians	3	3	5
Sponge spicules	5	10	10

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	44.27	49.04

SITE 613 HOLE CORE 25X CORED INTERVAL 317.0–326.6 m



5G 8/1
+ 5Y 6/1
and 10YR 5/1

5G 8/1
+ 5Y 6/1
to 10YR 5/1

5G 5/2

5G 5/2

LITHOLOGIC DESCRIPTION

Light greenish gray (5G 8/1) SILICEOUS NANNOFOSSIL CHALK with gray (5Y 6/1) to yellowish brown (10YR 5/1) burrows.

Bioturbation consists of:
- unstructured horizontal and oblique flattened burrows;
- horizontal and oblique spreiten;
- chondrites;
- dwelling structures, and vertical burrows
  - ⬭ numerous diagenetic haloes, sporadic pyrite specks, and fish remains; and
- sporadic grayish green (5G 5/2) mottles (Section 5, 80 cm and Section 6, 30 cm).

SMEAR SLIDE SUMMARY (%):

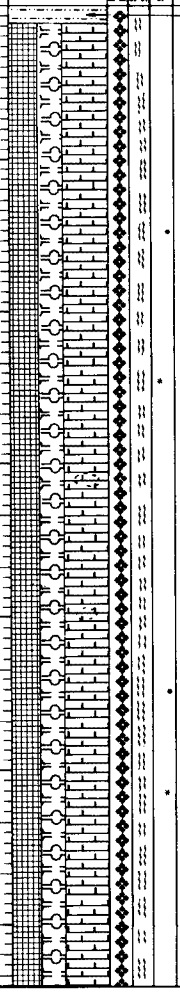
	2, 128	3, 70	5, 80	7, 15
	M	D	M	D
Texture:				
Sand	10	3	5	3
Silt	70	72	65	77
Clay	20	25	30	20
Composition:				
Quartz	–	–	TR	–
Clay and silica	10	17	23	15
Pyrite	10	–	TR	1
Zeolite	–	–	1	TR
Carbonate unspec.	–	–	5	5
Foraminifers	–	1	1	1
Calc. nannofossils	40	40	35	43
Diatoms	30	25	20	20
Radiolarians	5	7	5	10
Sponge spicules	5	10	10	5

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	52.50	44.70

SITE 613 HOLE CORE 26X CORED INTERVAL 326.6–336.2 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER FORAMINIFERS	FOSSIL CHARACTER NANNOFOSSILS	FOSSIL CHARACTER RADIOLARIANS	FOSSIL CHARACTER DIATOMS	SECTION	METERS
middle Eocene		middle Eocene fauna + *O. universa/G. ruber* P11/P12 FM	*Chiasmolithus gigas* Subzone (CP13b) A/ MG	*Thyrsocyrtis triacantha* Zone A/ MG		1 2 3 4 5 6 7 CC	0.5 1.0



LITHOLOGIC DESCRIPTION

Cavings of Miocene

Section 1, 7–13 cm: cavings of grayish green (5G 5/2 to 10G 4/2) Miocene mud with pyritized burrows.

Light greenish gray (5G 8/1) SILICEOUS NANNOFOSSIL CHALK with gray (5Y 6/1) to yellowish brown (10YR 5/1) burrows.

Bioturbation consists of:
unstructured horizontal and oblique flattened burrows;
horizontal and oblique spreiten;
chondrites;
dwelling structures and vertical burrows; and
( ) common diagenetic haloes.

5G 8/1
+ 5Y 6/1 to
10YR 5/1

SMEAR SLIDE SUMMARY (%):

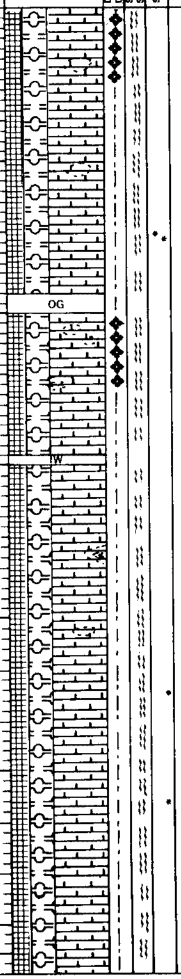
	3, 70	6, 25
	D	D
Texture:		
Sand	5	25
Silt	65	55
Clay	30	20
Composition:		
Clay and silica	23	15
Zeolite	TR	TR
Carbonate unspec.	25	15
Foraminifers	2	10
Calc. nannofossils	15	30
Diatoms	20	15
Radiolarians	5	10
Sponge spicules	10	5

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	37.77	44.70

SITE 613 HOLE CORE 27X CORED INTERVAL 336.2–345.8 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER FORAMINIFERS	FOSSIL CHARACTER NANNOFOSSILS	FOSSIL CHARACTER RADIOLARIANS	FOSSIL CHARACTER DIATOMS	SECTION	METERS
middle Eocene		*T. rohri/G. possagnoensis/G. pomeroli* P11/P12 FC/ M	*Chiasmolithus gigas* Subzone (CP13b)	*Thyrsocyrtis triacantha* Zone A/ MG		1 2 3 4 5 6 7 CC	0.5 1.0



LITHOLOGIC DESCRIPTION

Light greenish gray (5G 8/1) SILICEOUS NANNOFOSSIL CHALK intensely burrowed with pale brown (10YR 6/3) to yellowish brown (10YR 5/4) burrows.

Bioturbation consists of:
unstructured horizontal and oblique flattened burrows;
horizontal and oblique spreiten;
chondrites;
dwelling structures and vertical burrows; and
( ) common diagenetic haloes.

5G 8/1
+ 10YR 6/3
to 10YR 5/4

SMEAR SLIDE SUMMARY (%):

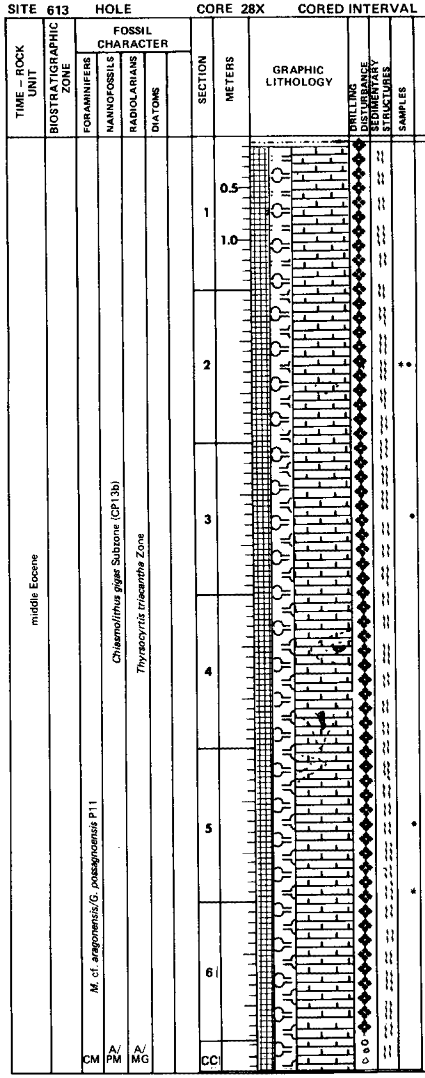
	2, 80	6, 38
	D	D
Texture:		
Sand	5	10
Silt	60	55
Clay	35	35
Composition:		
Clay and silica	27	27
Zeolite	–	TR
Carbonate unspec.	15	15
Foraminifers	3	8
Calc. nannofossils	25	25
Diatoms	10	10
Radiolarians	5	5
Sponge spicules	15	10

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	55.53	57.27

155

SITE 613 HOLE CORE 28X CORED INTERVAL 345.8–355.4 m



LITHOLOGIC DESCRIPTION

Cavings of Miocene

Section 1, 0–10 cm: cavings of grayish green (5G 4/2 to 10G 4/2) Miocene mud.

Light greenish gray (5G 8/1) SILICEOUS NANNOFOSSIL CHALK, intensely burrowed with pale brown (10YR 6/3) to yellowish brown (10YR 5/3) burrows.

Bioturbation consists of:
 unstructured horizontal and oblique flattened burrows;
 horizontal and oblique spreiten;
 chondrites;
 dwelling structures and vertical burrows; and
 ◌ common diagenetic haloes.

5G 8/1
+ 10YR 6/3 to
10YR 5/3

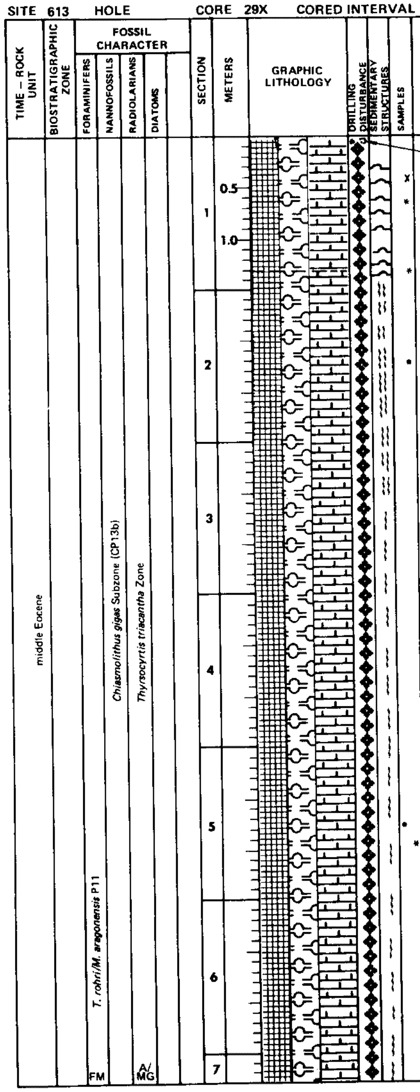
SMEAR SLIDE SUMMARY (%):

	2, 75 D	5, 140 D
Texture:		
Sand	5	2
Silt	55	70
Clay	40	28
Composition:		
Clay and silica	24	19
Pyrite	TR	–
Zeolite	TR	–
Carbonate unspec.	25	15
Foraminifers	1	1
Calc. nannofossils	25	30
Diatoms	10	15
Radiolarians	10	10
Sponge spicules	5	10
Fish remains	TR	–

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76	3, 76
Organic carbon	–	–	–
Carbonate	61.16	42.11	42

SITE 613 HOLE CORE 29X CORED INTERVAL 355.4–364.7 m



LITHOLOGIC DESCRIPTION

Reworked debris (coring)

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5GY 8/1). Slump section of the same facies as below not burrowed. Intensely burrowed with pale brown (10YR 6/3) and yellow brown (10YR 5/4). Varied varieties of burrows with spreiten, chondrites etc.

SMEAR SLIDE SUMMARY (%):

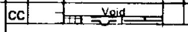
	1, 79	1, 131	5, 97
Texture:			
Sand	2	1	3
Silt	68	70	75
Clay	30	29	22
Composition:			
Quartz	TR	–	–
Clay and silica	20	25	20
Carbonate unspec.	3	3	5
Foraminifers	2	2	5
Calc. nannofossils	45	38	35
Diatoms	20	20	20
Radiolarians Sponge spicules Silicoflagellates	10	12	15

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	56	42

SITE 613 HOLE CORE 30X CORED INTERVAL 364.7–374.0 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	SAMPLES
middle Eocene		FM *M. aragonensis/S. frontosa* P11	AM *Chiasmolithus gigas* Subzone (CP13b)	A/MG *Thyrsocyrtis triacantha* Zone		CC	*



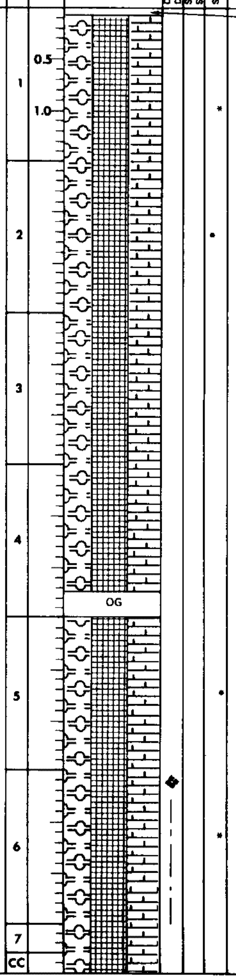
SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1), burrowed by brown (10YR 5/3).

SMEAR SLIDE SUMMARY (%):

	CC, 5
Texture:	
Sand	2
Silt	70
Clay	28
Composition:	
Clay and silica	25
Carbonate unspec.	5
Foraminifers	3
Calc. nannofossils	32
Diatoms	15
Radiolarians Sponge spicules Silicoflagellates	20

SITE 613 HOLE CORE 31X CORED INTERVAL 374.0–383.3 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS
middle Eocene		*T. rohri/M. aragonensis* P11 FP	*Discoaster strictus* Subzone (CP13a) C/MP	*Thyrsocyrtis triacantha* Zone A/MG	



SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1) with burrows of pale brown (10YR 6/3) and yellowish brown (10YR 5/4).

All types of burrows are present. Chondrites, spreiten, etc. Most are horizontal to subhorizontal but vertical burrows are not uncommon.

Diagenetic halos are noted around some burrows (2 or 3 per section). They spread out from 1 to 2.5 cm from the actual burrow. It is not limited to 1 variety of burrow but seems to be most significant around larger burrows.

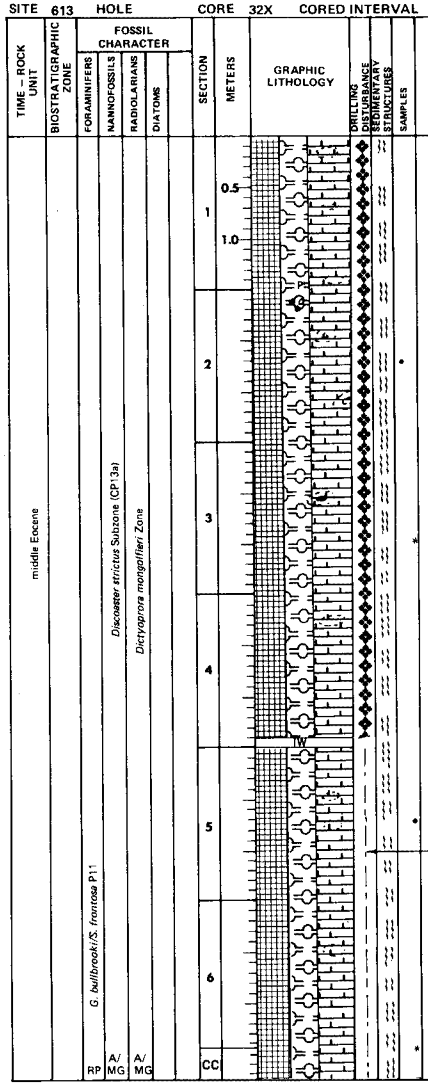
SMEAR SLIDE SUMMARY (%):

	1, 100	6, 118
Texture:		
Sand	2	2
Silt	63	68
Clay	35	30
Composition:		
Clay and silica	35	30
Carbonate unspec.	7	8
Foraminifers	3	2
Calc. nannofossils	25	30
Diatoms	15	15
Radiolarians Sponge spicules Silicoflagellates	15	15

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	41	46

SITE 613 HOLE CORE 32X CORED INTERVAL 383.3–392.7 m



LITHOLOGIC DESCRIPTION

Light greenish gray (5G 8/1) SILICEOUS NANNOFOSSIL CHALK, intensely burrowed with pale brown (10YR 6/3) to yellowish brown (10YR 5/4) burrows.

Bioturbation consists of:
  unstructured horizontal and oblique flattened burrows;
  horizontal and oblique spreiten;
  chondrites;
  dwelling structures and vertical burrows;
  ◌ common diagenetic haloes; and
  sporadic pyritic nodules.

SMEAR SLIDE SUMMARY (%):

	3, 100	CC, 5
	D	D
Texture:		
Sand	2	2
Silt	68	68
Clay	30	30
Composition:		
Clay and silica	30	30
Glauconite	–	TR
Carbonate unspec.	5	5
Foraminifers	2	2
Calc. nannofossils	33	35
Diatoms	15	15
Radiolarians Sponge spicules Silicoflagellates	15	13

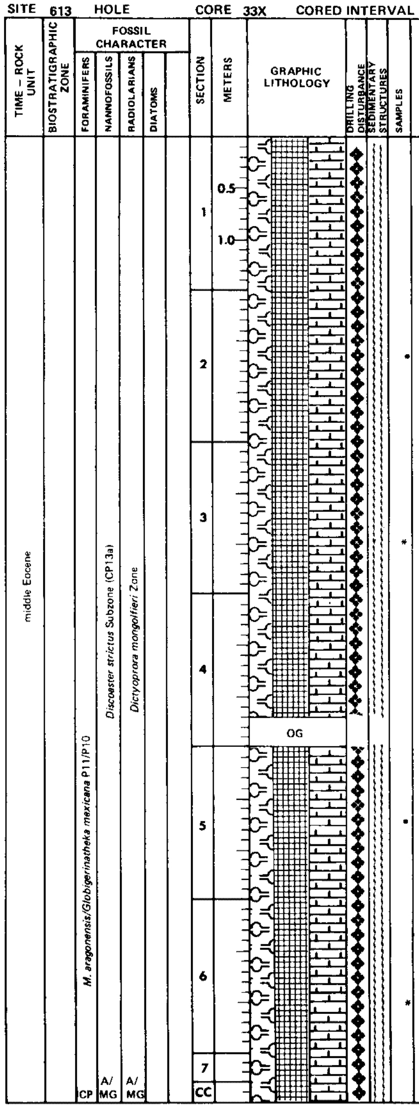
5G 8/1
+ 10YR 6/3
to 10YR 5/4

ORGANIC CARBON AND CARBONATE (%):

	2, 74	5, 76
Organic carbon	–	–
Carbonate	46	50

Moderately fractured

SITE 613 HOLE CORE 33X CORED INTERVAL 392.7–402.1 m



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1). Intensely burrowed, marked by pale brown (10YR 6/3) and yellowish brown (10YR 5/4).

Contains all types of burrows and also alteration halos around some burrows.

SMEAR SLIDE SUMMARY (%):

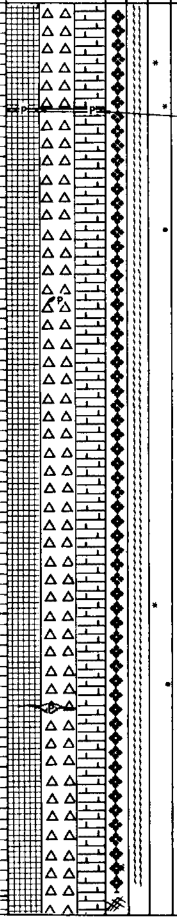
	3, 100	6, 100
Texture:		
Sand	2	2
Silt	58	65
Clay	40	33
Composition:		
Clay and silica	38	30
Carbonate unspec.	10	10
Foraminifers	2	5
Calc. nannofossils	25	30
Diatoms	15	15
Radiolarians Sponge spicules Silicoflagellates	10	10

ORGANIC CARBON AND CARBONATE (%):

	2, 69	5, 73
Organic carbon	—	—
Carbonate	50	51

SITE 613 HOLE CORE 34X CORED INTERVAL 402.1–411.5 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS
middle Eocene		*S. frontosa/M. aragonensis/Globigerinatheka index* P10/P11 CM	*Discoaster strictus* Subzone (CP13a) A/ PM	*Dictyoprora mongolfieri* Zone A/ MG		1 2 3 4 5 6 CC	0.5 1.0



Dark gray volcanic ash (pyrite at lower boundary)

LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, intensely burrowed light greenish gray (5G 8/1) with burrows of pale brown (10YR 6/3) and yellow brown (10YR 5/4).

Many burrows have diagenetic haloes.

SMEAR SLIDE SUMMARY (%):

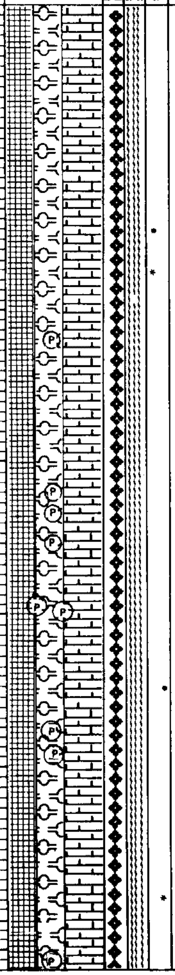
	1, 60	1, 105	4, 145
Texture:			
Sand	10	90	10
Silt	60	10	60
Clay	30	–	30
Composition:			
Quartz	TR	–	–
Mica	–	2	–
Clay and silica	30	–	30
Volcanic glass	–	92	–
Palagonite	–	1	–
Glauconite	TR	–	TR
Pyrite	TR	5	TR
Carbonate unspec.	10	–	10
Foraminifers	TR	–	–
Calc. nannofossils	35	TR	35
Diatoms	15	–	15
Radiolarians	5	–	5
Sponge spicules	5	–	5

ORGANIC CARBON AND CARBONATE (%):

	2, 75	5, 71
Organic carbon	–	–
Carbonate	46	39

SITE 613 HOLE CORE 35X CORED INTERVAL 411.5–421.0 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SECTION	METERS
middle Eocene		*T. rohri/M. aragonensis/S. frontosa* P10 RM	*Discoaster strictus* Subzone (CP13a) AM	*Dictyoprora mongolfieri* Zone A/ MG		1 2 3 4 5 6 7 CC	0.5 1.0



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1) intensely burrowed by pale brown (10YR 6/3) and yellowish brown (10YR 5/4).

Consisting of:

1) abundant horizontal and oblique, slightly flattened;
2) common horizontal spreiten; and
3) rare vertical very dark gray haloes surround a few burrows.

Scattered pyrite nodules; sand-size pyrite often found in slurry between biscuits.

Biscuit deformation throughout; biscuits themselves begin to fracture below the middle of Section 5.

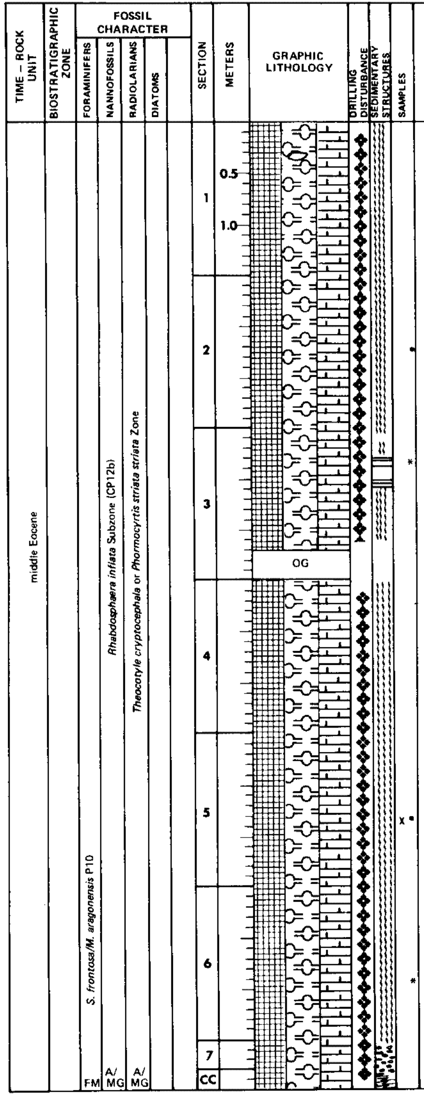
SMEAR SLIDE SUMMARY (%):

	2, 115	6, 130
Texture:		
Sand	10	8
Silt	64	60
Clay	24	32
Composition:		
Quartz	5	3
Clay and silica	24	32
Foraminifers	1	–
Calc. nannofossils	35	35
Diatoms Radiolarians	} 35	} 30

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	37	44

SITE 613 HOLE CORE 36X CORED INTERVAL 421.0–430.5 m



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1) intensely bioturbated with pale brown (10YR 6/3) and yellowish brown (10YR 5/4) in 3 styles: 1) abundant horizontal/oblique; 2) common vertical; and 3) rare spreiten.

Some burrows surrounded by very dark gray haloes. Sand-size pyrite scattered in slurry between biscuits found throughout the core. Clast of Pliocene in Section 1, 30 cm downhole contamination.

Section 3, 10–57 cm: massive to finely laminated; burrows only at top of interval.

Section 7, 7–18 cm: clast-supported mud pebble conglomerate, pebbles only moderately flattened, composed of same material as enclosing sediment.

Core Catcher contains deformed sediment of an apparent slump: irregular burrows and chevron laminae.

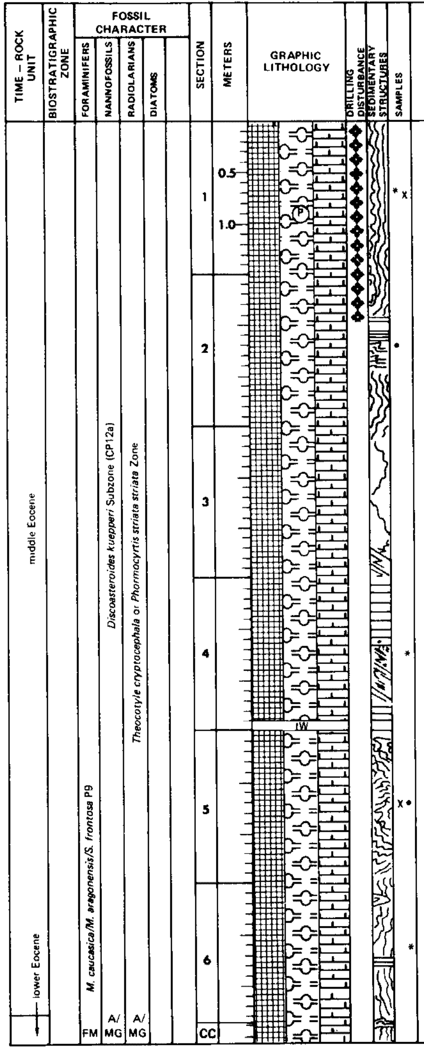
SMEAR SLIDE SUMMARY (%):

	3, 39	6, 92
	M	D
Texture:		
Sand	2	4
Silt	65	64
Clay	33	32
Composition:		
Quartz	2	1
Clay and silica	33	32
Carbonate unspec.	—	2
Calc. nannofossils	30	35
Diatoms } Radiolarians	35	30

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 86
Organic carbon	—	—
Carbonate	43	49

SITE 613 HOLE CORE 37X CORED INTERVAL 430.5–440.0 m



LITHOLOGIC DESCRIPTION

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1) intensely bioturbated with pale brown (10YR 6/3) and yellowish brown (10YR 5/4) versus overlying cores, however, these are almost exclusively horizontal/oblique, and become irregular and deformed towards the top of Section 2.

Below Section 2, 38 cm, all burrows are either severely deformed (both "soft" and "brittle") or totally lacking in massive or laminated intervals, and "biscuit" drilling disturbance is gone; obviously a slump deposit, containing:

1) plasticaly deformed, folded laminae
2) brittle deformed laminae-chevron folds
3) small-offset faults
4) angular chalk intraclasts (few)
5) dewatering structure
6) massive, homogeneous intervals

SMEAR SLIDE SUMMARY (%):

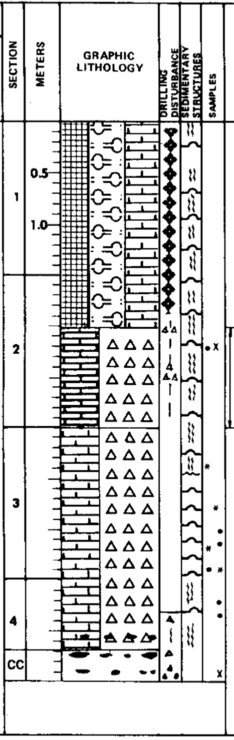
	1, 70	4, 75	6, 65
Texture:			
Sand	3	3	—
Silt	58	63	—
Clay	39	34	29
Composition:			
Quartz	1	—	—
Clay and silica	39	34	29
Micronodules	—	1	—
Carbonate unspec.	2	2	5
Foraminifers	1	—	1
Calc. nannofossils	32	28	30
Diatoms } Radiolarians	25	35	35

ORGANIC CARBON AND CARBONATE (%)

	2, 73	5, 73
Organic carbon	—	—
Carbonate	38	34

SITE 613 HOLE CORE 38X CORED INTERVAL 440.0–449.5 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS
lower Eocene		*M. caucasica/M. aragonensis/S. frontosa* P9 RF/P	*Discoasteroides kuepperi* Subzone (CP12a) A/MG	*Theocotyle cryptocephala* or *Phormocyrtis striata striata* Zone FPI	



LITHOLOGIC DESCRIPTION

5G 8/1 (10YR 5/3 and N6)

Lithified to porcellanitic limestone

10YR 6/2

SILICEOUS NANNOFOSSIL CHALK, light greenish gray (5G 8/1) with numerous flattened burrows brown (10YR 5/3) and medium light gray (N6), giving the sediment a marbled aspect. Sediment deformed to small-scale chevron folds and affected by samll faults. Burrows missing from 40–150 cm in Section 3, sediment here extremely folded by slumping. 40% siliceous organisms disappear completely at 130 cm in Section 3 by dissolution. Hard porcellanitic limestone layers occur in the indicated intervals " ▬ " as porcellanite nodules.

Below Core 38, Section 2, 60 cm: all cores contain an indeterminate mixture of clay and biogenically derived opal C-T.

SMEAR SLIDE SUMMARY (%):

	3, 40	3, 80	3, 120	3, 140
	D	D	D	
Texture:				
Sand	10	20	5	–
Silt	70	60	55	50
Clay	20	20	40	50
Composition:				
Clay	20	20	40	50
Pyrite	1	1	TR	TR
Carbonate unspec.	5	5	5	7
Foraminifers	TR	–	–	3
Calc. nannofossils	49	34	45	39
Diatoms	5	30	TR	–
Radiolarians	15	5	5	TR
Sponge spicules	5	5	5	1
Silicoflagellates	–	TR	–	–

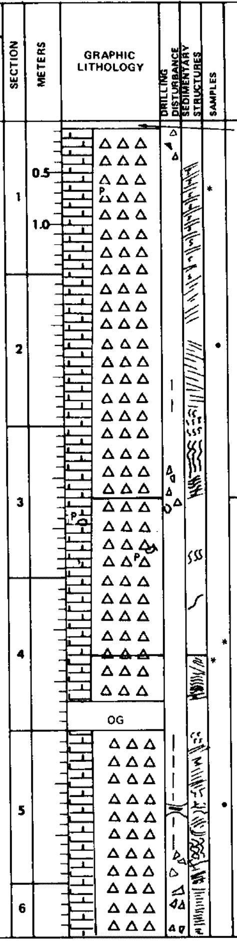
ORGANIC CARBON AND CARBONATE (%):

	2, 76	3, 103	3, 119
Organic carbon	–	–	–
Carbonate	43	41	44

	3, 142	4, 22	4, 39
Organic carbon	–	–	–
Carbonate	36	40	34

SITE 613 HOLE CORE 39X CORED INTERVAL 449.5–459.0 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS
lower Eocene		*M. caucasica/M. aragonensis* P9/P8 FP	*Discoasteroides kuepperi* Subzone (CP12a) A/MP	Indeterminate FP	



LITHOLOGIC DESCRIPTION

Void

10YR 6/2

5G 8/1

10YR 6/3

Chondrites

Large burrow

Cross-bedded
Becomes indurated

10YR 6/1

Soupy

5Y 6/1 very hard, porcellanitic fragment

PORCELLANEOUS NANNOFOSSIL CHALK

Section 1, 7–42 cm: variably lithified with very hard nodules. Section 1, 42–150 cm: 45° bedding with burrows parallel to bedding, brown (10YR 4/3).

Section 2, 0–80 cm: CHALK to LIMESTONE burrowed by brown (10YR 4/3) and light gray (N6). Section 2, some faulting in bedding and heavily burrowed.

Section 3, 0–70 cm: faulted bedding and chevron folded. Section 3, 70–100 cm: light gray (N7) with medium to dark gray (N5, N4) and 10YR 6/2 burrows, less lithified; not folded (weakly indurated).

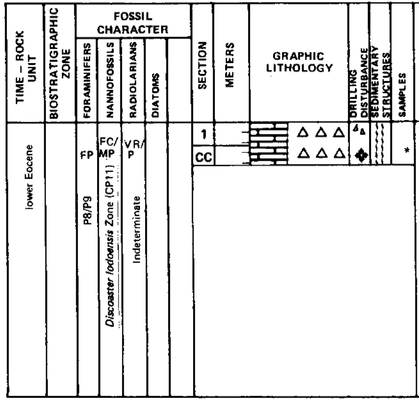
SMEAR SLIDE SUMMARY (%):

	1, 70	4, 68	4, 80
	M	D	D
Texture:			
Silt	62	50	50
Clay	38	50	50
Composition:			
Clay and silica	38	50	50
Pyrite	20	TR	TR
Carbonate unspec.	5	15	20
Foraminifers	5	5	5
Calc. nannofossils	30	30	25
Radiolarians	2	–	–

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	37	40

SITE 613 HOLE CORE 40X CORED INTERVAL 459.0–468.5 m



LITHOLOGIC DESCRIPTION

N7 + 10YR 5/3

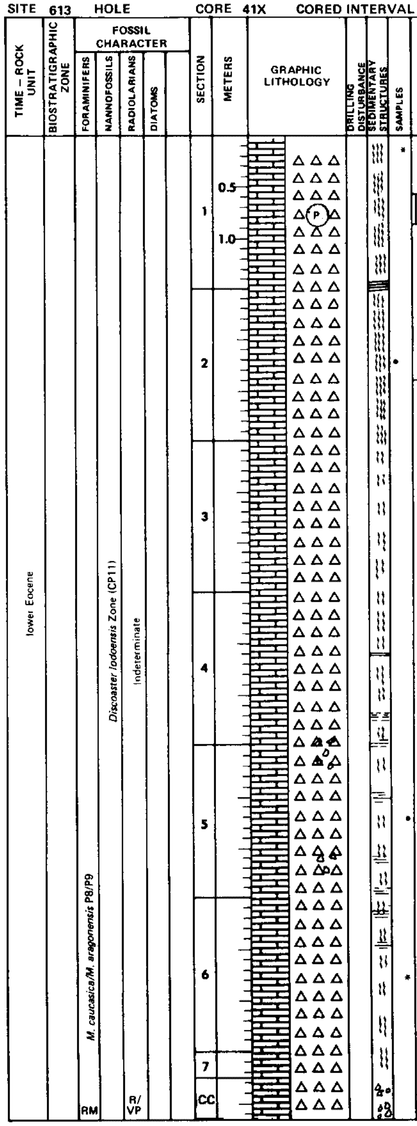
N7 (10YR 5/3)

PORCELLANITIC NANNOFOSSIL LIMESTONE, light gray (N7) with burrows of brown (10YR 5/3). Medium gray specks and streaks with pyrite framboids.

SMEAR SLIDE SUMMARY (%):

	CC, 18
Texture:	
Sand	5
Silt	55
Clay	40
Composition:	
Clay and silica	40
Carbonate unspec.	10
Calc. nannofossils	30
Diatoms	10
Radiolarians	5
Sponge spicules	5

SITE 613 HOLE CORE 41X CORED INTERVAL 468.5–477.8 m



LITHOLOGIC DESCRIPTION

N7
+ 10YR 5/3

10YR 6/1

Porcellanite
N7

5G 8/1
(+ 10YR 4/3
and N5)

PORCELLANITIC NANNOFOSSIL LIMESTONE, light greenish gray (5G 8/1) and light gray (N7 to 10YR 6/1) intensely burrowed. Burrows brown (10YR 4/3). Burrows often surrounded by large bleached haloes with black outer rim of pyrite framboids.

About 10% of sand-sized foraminifera enriched in layers throughout the core.

Many dark gray (N4) specks and thin streaks of pyrite framboids.

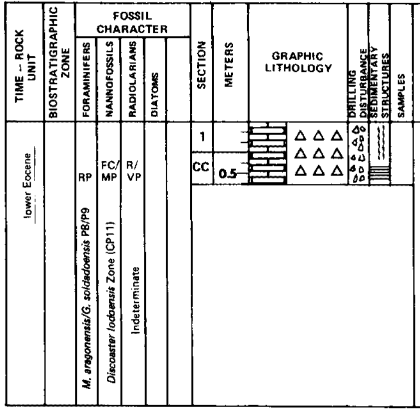
SMEAR SLIDE SUMMARY (%):

	1, 15	6, 80
	D	D
Texture:		
Silt	50	50
Clay	50	50
Composition:		
Clay and silica	50	50
Pyrite	TR	TR
Carbonate unspec.	10	10
Foraminfiers	10	5
Calc. nannofossils	30	34
Radiolarians	TR	1

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	30	35

SITE 613 HOLE CORE 42X CORED INTERVAL 477.8–487.1 m

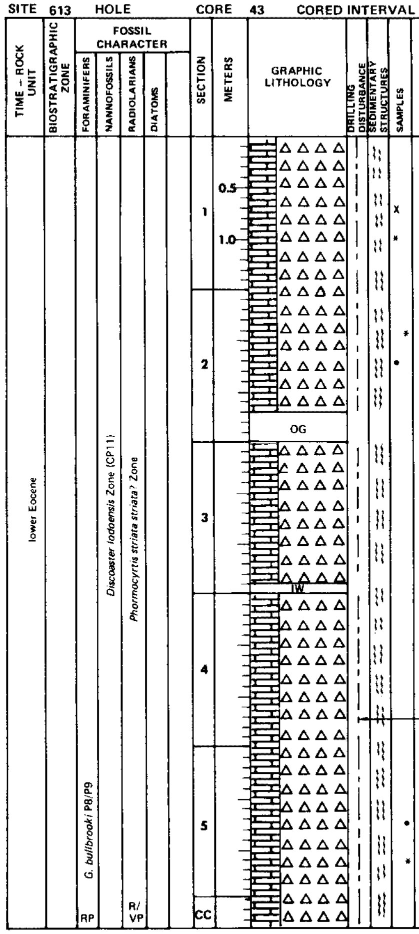


LITHOLOGIC DESCRIPTION

N7 +
10YR 4/3

PORCELLANITIC NANNOFOSSIL LIMESTONE, light gray (N7) with burrows of brown (10YR 4/3) color. Lower part of Core Catcher fissil.

SITE 613 HOLE CORE 43 CORED INTERVAL 487.1–496.4 m



LITHOLOGIC DESCRIPTION

Light greenish gray (5G 8/1) to pale green (5G 7/2) PORCELLANITIC NANNOFOSSIL LIMESTONE to NANNOFOSSIL PORCELLANITIC LIMESTONE, intensely burrowed with brown (10YR 5/3) flattened burrows and common grayish purple (5P 4/2) pyritic specks and diagenetic haloes around the burrows.

Elegant chondrites at Section 4, 16–19 cm and Section 5, 18–20, 30–76, and 110–120 cm.

5G 8/1 to
5G 7/2
+ 10YR 5/3
burrows and
5P 4/2 diagenetic
haloes

SMEAR SLIDE SUMMARY (%):

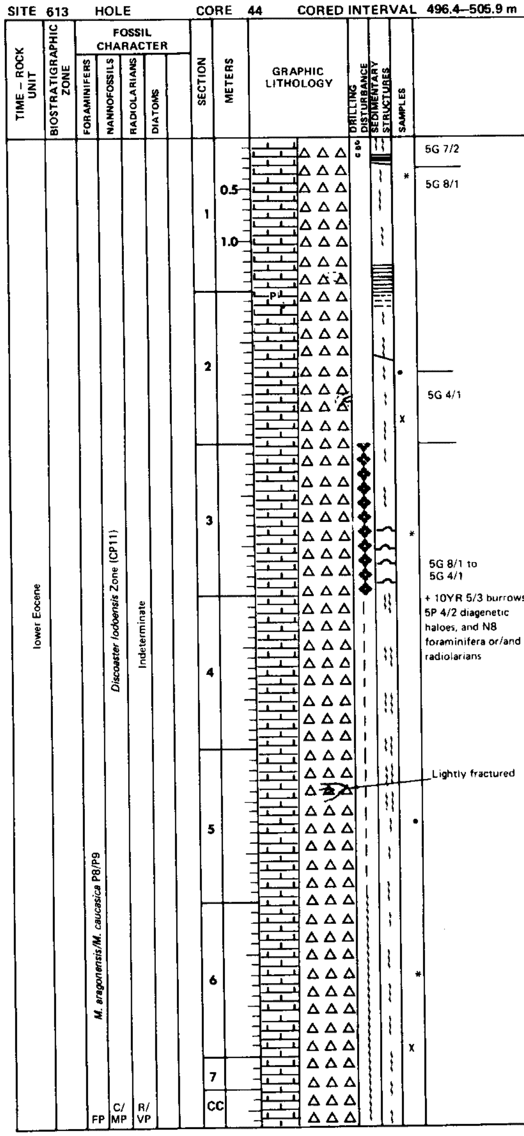
	1, 100	2, 48	5, 117
	D	D	D
Texture:			
Sand	5	5	5
Silt	25	30	25
Clay	70	65	70
Composition:			
Clay and silica	64	62	68
Pyrite	TR	TR	TR
Zeolite	TR	TR	TR
Carbonate unspec.	10	10	5
Foraminifers	TR	TR	–
Calc. nannofossils	25	25	25
Diatoms	–	TR	–
Radiolarians	1	3	2

ORGANIC CARBON AND CARBONATE (%):

	2, 76	5, 76
Organic carbon	–	–
Carbonate	30	20

Lightly to moderately fractured

SITE 613 HOLE CORE 44 CORED INTERVAL 496.4–505.9 m



LITHOLOGIC DESCRIPTION

Light greenish gray (5G 8/1) to pale green (5G 7/2 → 5G 4/1) PORCELLANITIC NANNOFOSSIL CHALK to NANNOFOSSIL PORCELLANITIC CHALK, moderately burrowed with brown (10YR 5/3) flattened burrows.

Common:
- grayish purple (5P 4/2) pyritic? specks, streaks, and haloes
- very light gray (N8) small specks (foraminifera or/and radiolarian) and diffuse mottles
- oblique color boundary Section 1, 29–30 cm and Section 2, 69–70 cm: erosion surface?
- microfolding at Section 3, 90–120 cm, slumps or disharmonic core disturbance

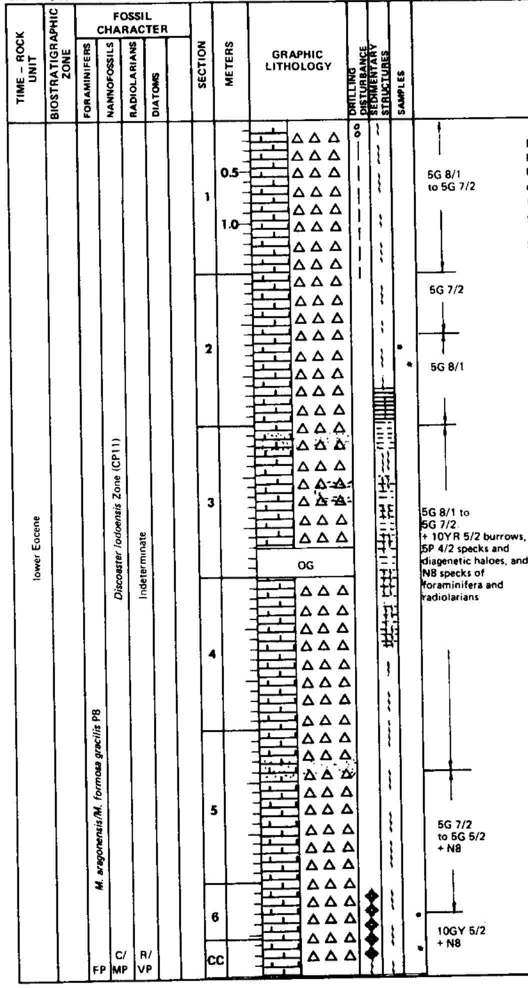
SMEAR SLIDE SUMMARY (%):

	1, 40	3, 90	6, 70
	D	D	D
Texture:			
Sand	15	15	10
Silt	35	25	10
Clay	50	60	50
Composition:			
Quartz	–	TR	–
Clay and silica	50	50	49
Pyrite	TR	TR	TR
Zeolite	TR	TR	1
Carbonate unspec.	15	20	25
Foraminifers	8	TR	5
Calc. nannofossils	25	25	15
Radiolarians	2	5	5
Sponge spicules	TR	TR	–

ORGANIC CARBON AND CARBONATE (%):

	2, 82	5, 76
Organic carbon	–	–
Carbonate	45	41

SITE 613 HOLE CORE 45 CORED INTERVAL 505.9–515.4 m



LITHOLOGIC DESCRIPTION

Light greenish gray (5G 8/1) to pale green (5G 7/2) PORCELLANITIC NANNOFOSSIL CHALK to NANNOFOSSIL PORCELLANITIC CHALK, Section 5, 40 cm–Section 6, 30 cm, pale green (5G 7/2) to grayish green (5G 5/2) and Section 6, 30 cm–Core Catcher, grayish green (10GY 5/2).

Sporadic light brownish gray (10YR 5/2) burrows.
Grayish purple (5P 4/2) specks, thin layers and diagenetic haloes.
Common small very light gray (N8) specks and diffuse mottles.
Sporadic disseminated pyrite Section 3, 15–25 cm and Section 5, 40–45 cm.

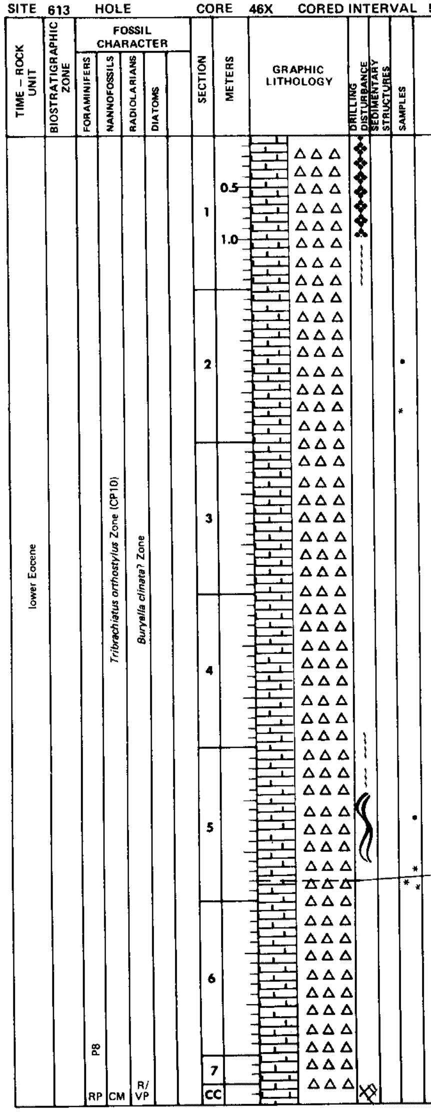
SMEAR SLIDE SUMMARY (%):

	2, 94	CC, 15
	M	D
Texture:		
Sand	5	5
Silt	40	35
Clay	55	60
Composition:		
Clay and silica	55	60
Carbonate unspec.	30	20
Calc. nannofossils	15	20

ORGANIC CARBON AND CARBONATE (%):

	2, 76	6, 33
Organic carbon	–	–
Carbonate	47	33

SITE 613 HOLE CORE 46X CORED INTERVAL 515.4–524.9 m



Thin 1 to 1.5 cm gray silt layer with well preserved radiolarian

LITHOLOGIC DESCRIPTION

NANNOFOSSIL PORCELLANITIC CHALK to PORCELLANITIC NANNOFOSSIL CHALK, pale green (10G 6/2) with burrows colored brown (10YR 5/3) and very dusky purple (5P 2/2). Burrows are variable in . intensity.

SMEAR SLIDE SUMMARY (%):

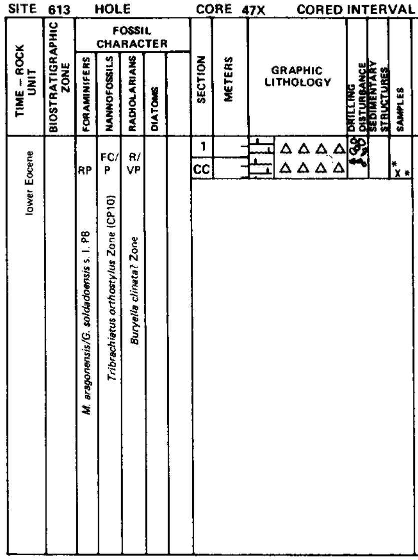
	2, 120	5, 120	5, 132	5, 140
Texture:				
Sand	–	–	1	–
Silt	40	40	49	40
Clay	60	60	50	60
Composition:				
Clay and silica	55	55	50	55
Glauconite	–	–	1	–
Carbonate unspec.	5	4	5	–
Foraminifers	–	1	8	–
Calc. nannofossils	30	30	25	35
Sponge spicules	TR	TR	1	–
Other[a]	10	10	10	10

[a] In Cores 46–52 of Site 613, partially altered (calcified? silicified?) biogenic grains (rads and forams?) are noted as other.

ORGANIC CARBON AND CARBONATE (%):

	2, 75	5, 70
Organic carbon	–	–
Carbonate	27	32

SITE 613 HOLE CORE 47X CORED INTERVAL 524.9–534.4 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL PORCELLANITIC CHALK to CALCAREOUS PORCELLANITE, pale green (10G 6/2), with grayish green (5G 5/2) laminae and scattered dark gray sulfide stains in Core Catcher.

Pale green intervals (dominant facies) expand and develop crenulated fissile structure.

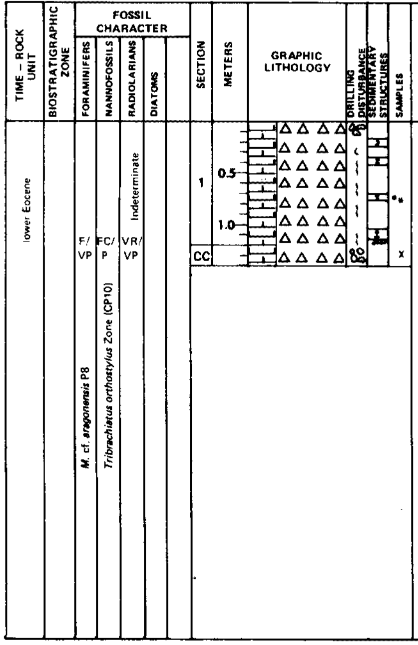
Section 1 totally brecciated.

SMEAR SLIDE SUMMARY (%):

	CC, 15 D	CC, 25 M
Texture:		
Sand	10	10
Silt	23	15
Clay	67	75
Composition:		
Clay and silica	57	65
Pyrite	TR	TR
Carbonate unspec.	15	25
Foraminifers	5	–
Calc. nannofossils	13	–
Silicoflagellates	–	–
Other[a]	10	10

[a] See Core 46.

SITE 613 HOLE CORE 48X CORED INTERVAL 534.4–543.9 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL PORCELLANITIC CHALK, pale green (10G 6/2) with common very dark gray sulfide mottles and rare pale brown burrows.

Several intervals are severely broken up into crenulated fissile laminae due to expansion and/or in situ soft-sediment deformation (sediment creep?).

SMEAR SLIDE SUMMARY (%):

	1, 80 D
Texture:	
Sand	15
Silt	20
Clay	65
Composition:	
Mica	TR
Clay and silica	55
Glauconite	–
Pyrite	1
Carbonate unspec. (calcite crystals)	20
Foraminifers	TR
Calc. nannofossils	12
Sponge spicules	–
Other[a]	12

[a] See Core 46.

ORGANIC CARBON AND CARBONATE (%):

	1, 78
Organic carbon	–
Carbonate	32

SITE 613 HOLE CORE 49X CORED INTERVAL 543.9–553.4 m

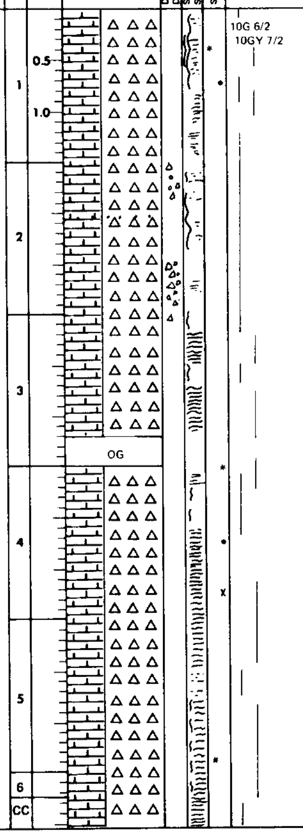
TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS
lower Eocene		CP *M. aragonensis/M. marginodentata* P7/P8	A/MP *Tribrachiatus orthostylus* Zone (CP10)	VR/VP Indeterminate	

LITHOLOGIC DESCRIPTION

Core Catcher only: pale green (10G 6/2) breccia.

SITE 613 HOLE CORE 50X CORED INTERVAL 553.4–562.9 m

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS
lower Eocene		*M. aragonensis/M. marginodentata* P7/P8	*Discoaster binodosus* Zone (CP9b)	*Bekoma bidartensis* Zone R/VP	



LITHOLOGIC DESCRIPTION

NANNOFOSSIL PORCELLANITIC CHALK, pale green (10G 6/2) with flattened burrows of brownish gray (5YR 4/1) to medium dark gray (N4) color. Some purple (5P 2/2) streaks and specks of pyrite framboids. Layerwise ~10% foraminifera.

Larger parts of core have a pale yellowish green (10GY 7/2) color and show a crenulated fissility. Small mm-wide faults appear on slightly deformed burrows.

Structures probably due to in situ creeping of the slightly firm sediment (or drilling disturbance?).

These parts of core are less lithified.

SMEAR SLIDE SUMMARY (%):

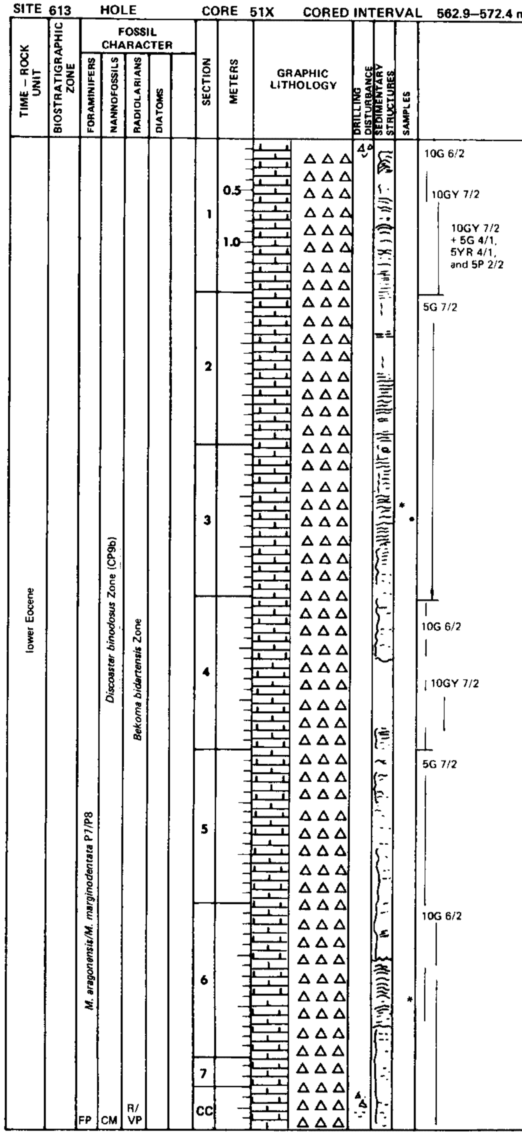
	1, 40	4, 5	5, 140
	D	M	D
Texture:			
Sand	10	20	10
Silt	22	20	23
Clay	68	60	67
Composition:			
Clay and silica	58	50	57
Pyrite	1	TR	1
Carbonate unspec.	20	30	20
Foraminifers	–	TR	1
Calc. nannofossils	11	10	11
Other[a]	10	10	10

[a] See Core 46.

ORGANIC CARBON AND CARBONATE (%):

	1, 76	4, 76
Organic carbon	–	–
Carbonate	39	36

SITE 613 HOLE CORE 51X CORED INTERVAL 562.9–572.4 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL PORCELLANITIC CHALK, pale green (10G 6/2 and 5G 7/2) to pale yellowish green (10GY 7/2) with burrowed layers. Burrows have color of brownish gray (5YR 4/1) and dark greenish gray. Some dark green horizontally thin bedded layers. Throughout the core occasional purplish (5P 2/2) streaks and specks of pyrite framboids.

Large parts of core show crenulated fissile structures, probably due to in situ creep (or to drilling activity?!). In Section 5 chondrites-type burrows.

SMEAR SLIDE SUMMARY (%):

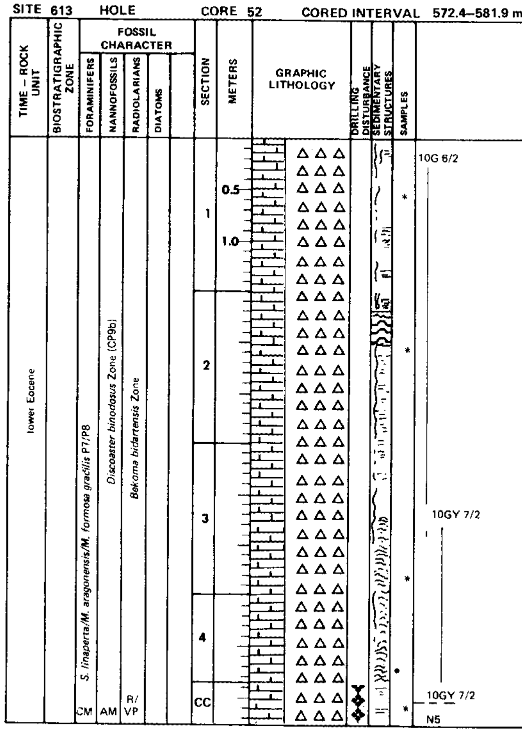
	3, 60	6, 95
	D	D
Texture:		
Sand	10	10
Silt	20	20
Clay	70	70
Composition:		
Quartz	–	TR
Mica	–	TR
Clay and silica	60	60
Pyrite	TR	TR
Carbonate unspec.	19	19
Calc. nannofossils	11	11
Other	10[a]	10[a]

[a] Fragments of organisms. Foraminifera or calcified radiolarians!

ORGANIC CARBON AND CARBONATE (%):

	3, 76
Organic carbon	–
Carbonate	40

SITE 613 HOLE CORE 52 CORED INTERVAL 572.4–581.9 m



LITHOLOGIC DESCRIPTION

NANNOFOSSIL to NANNOFOSSIL-FORAMINIFERA PORCELLANITIC CHALK, pale green (10G 6/2) to pale yellowish green (10GY 7/2) with burrows of brownish gray (5YR 4/1), dark greenish gray (5GY 4/1) and purplish (5P 2/2).

Upper part of core mainly irregularly parallel bedded, bottom shows crenulated fissile structures due to in situ sediment creep (or to drilling activity?!).

Section 2, 25–60 cm is affected by slump movement and shows elegant folds.

SMEAR SLIDE SUMMARY (%):

	2, 60	3, 135	CC, 25
	D	D	D
Texture:			
Sand	–	–	1
Silt	30	40	49
Clay	70	60	50
Composition:			
Quartz	–	5	5
Clay and silica	70	55	50
Glauconite	TR	1	–
Carbonate unspec.	15	14	15
Foraminifers	5	15	15
Calc. nannofossils	10	10	15
Other[a]	TR	TR	–

[a] See Core 46.

ORGANIC CARBON AND CARBONATE (%):

	4, 76
Organic carbon	–
Carbonate	33