INITIAL CORE DESCRIPTIONS

DEEP SEA DRILLING PROJECT

LEG 31

WEST PHILIPPINE BASIN & SEA OF JAPAN

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

UNIVERSITY OF CALIFORNIA, SAN DIEGO

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Dear Colleague:

This document has been printed and distributed by the Deep Sea Drilling Project for the purpose of sample selection by interested earth scientists, sample requests being honored one year after completion of the cruise on which the samples were collected. It is an interim and informal document consisting of site data and sedimentologic and paleontologic data as known six (6) months post-cruise. These data, while completely adequate for almost all sample selection needs, will be subject to possible slight change by the time of issue of the formal cruise report, 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,

N. Terence Edgar
Chief Scientist
Deep Sea Drilling Project

NTE:eb

INITIAL CORE DESCRIPTION (ICD)

DEEP SEA DRILLING PROJECT

LEG 31

JUNE 15, 73 - AUG 4, 73

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

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Rosenstiel School of Marine and Atmospheric Science, University of Miami
Scripps Institution of Oceanography, University of California
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INITIAL CORE DESCRIPTION - LEG 31

INTRODUCTION

This is the fifth Initial Core Description document to be published by the Deep Sea Drilling Project. In addition to the Site Summary Sheets and Core Forms, additional material is presented to provide a clearer understanding of the ICD material.

First, a synopsis of Leg 31. The purpose here is to specify the objectives and to indicate briefly the general nature of the cruise. Secondly, a series of Explanatory Notes. These explanatory notes provide a fuller understanding of the information contained on the Site Summary Sheets and the accompanying core forms, as well as explaining how this information is obtained.

Synopsis of Leg 31

Earth scientists have long been fascinated by the complex of marginal seas, volcanic island arcs, and deep sea trenches rimming the western margin of the Pacific Ocean. In fact, each generation of geologists since the turn of the century has repeatedly recast this trinity of features into various models of mountain building processes and continental accretion. The evolution of this area of extremely complex geology has been attacked with renewed vigor by students of global plate tectonics with the controversy currently centered on the age and origin of marginal seas.

The prime focus of Leg 31 of the Deep Sea Drilling Project was to probe the tectonic, sedimentologic, and biostratigraphic histories of

the West Philippine Sea, and the Sea of Japan, two classic examples of these enigmatic pieces of sea floor displaying many of the geophysical characteristics of deep sea crust, but situated within arcs of transitional to continental character.

The major objectives outlined for Leg 31 were as follows:

(1) Testing of the various proposed origins of the West Philippine Basin and the Sea of Japan.

(2) Dating the major geologic events in and surrounding the Philippine Sea in order to better understand the formation of arc complexes as developed in the western Pacific.

(3) Documentation of Cenozoic (emphasis on the Neogene) planktonic biostratigraphy across 24° of latitude (17° to 41°N) in areas influenced by tropical, transitional, and subarctic water masses.

(4) Analysis of variations in Neogene planktonic biofacies in terms of major paleoceanographic, and paleoclimatological events with emphasis on interplay between the Kuroshio and Oyashio currents in the Pacific, and the Tsushima and Liman-North Korean currents in the Sea of Japan.

(5) Scrutiny of sedimentary processes within marginal basins with a focus on turbidite sedimentation and sediment provenance.

(6) Investigation of volcanogenic processes, and post-depositional sediment alteration which might be operative in marginal basins.

GLOMAR CHALLENGER steamed west from Apra, Guam on 15 June 1973, ultimately covering 4125 nautical miles in 52 days with termination of the cruise in Hakodate, Japan on 4 August 1973 (Figure 1). Twelve holes were drilled at nine sites in the West Philippine Sea including penetration of the Benham Rise, Palau-Kyushu Ridge, and the Nankai Trough. Water depths at these sites averaged over 5000 meters with the maximum water depth on Leg 31 encountered at Site 290 (6062 m). Maximum penetration below the sea floor on this cruise was 1087 meters at Site 296 on the Palau-Kyushu Ridge.

The CHALLENGER passed through the Shimonoseki Straits between Honshu and Kyushu entering the Sea of Japan on 24 July 1973. This passage was particularly noteworthy because a major suspension bridge under construction across this strait allowed only 2 meters clearance for the CHALLENGER's derrick. The final portion of Leg 31 was the drilling of four sites in the Sea of Japan. Ethane gas shows at Sites 299 and 301 caused them to be abandoned before objectives were reached, whereas early abandonment of Site 300 was caused by caving sand. Finally, a medical emergency forced the premature completion of Hole 302 prior to reaching the known Late Paleozoic core of the Yamato Rise.

Coring on Leg 31 recovered a total of 1233.5 meters of sediment and igneous rock. Average percentage of core recovery was 47 percent.

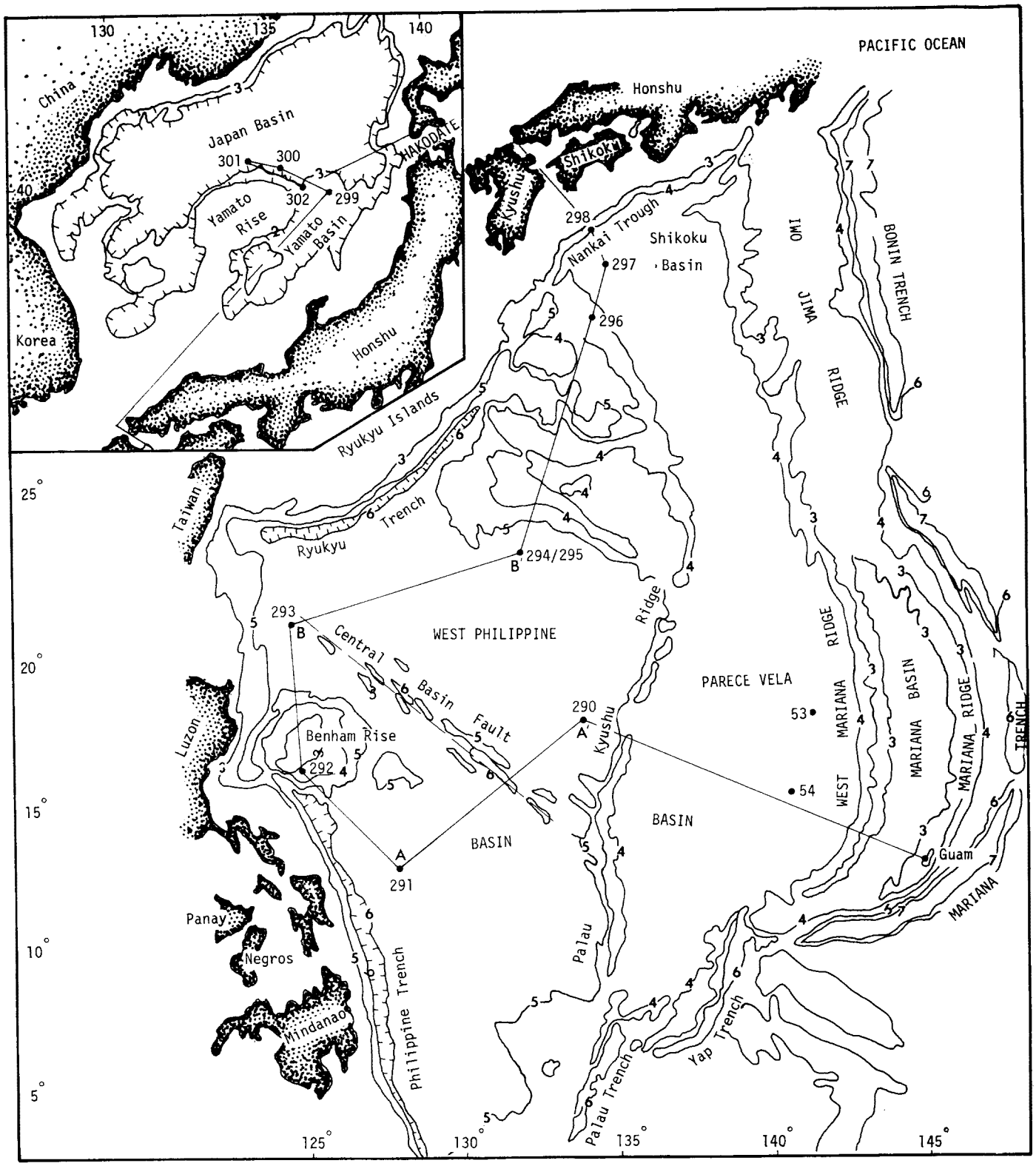


FIGURE 1 Track of the GLOMAR CHALLENGER during DSDP Leg 31 with location of drilling sites in the West Philippine Sea and the Sea of Japan. From map: " Topography of North Pacific", T.E.Chase, H.W.Menard and J. Mammerickx, Institute of Marine Resources, Geol. Data Center, Scripps Institution of Oceanography, 1971. Contour depths in kilometers, scale 1:6,500,000.

EXPLANATORY NOTES

Numbering and Depth Conventions

A site number refers to a single hole or group of holes drilled in essentially the same position using the same acoustic beacon. The first hole at a site is given the number of the site. Second or subsequent holes drilled after withdrawing from the first hole and redrilling were labeled "A", "B", etc. holes (e.g. Hole 290A).

A core is taken by dropping a core barrel down the drill string and coring for 9 meters as measured by lowering of the drill string. The sediment is retained in a plastic liner 9.28 meters long inside the core barrel and in a 0.20 meter long core catcher assembly below the liner. The liner is not normally full.

On recovery the liner is cut into sections of 1.5 meters measured from the lowest point of sediment within the liner. In general the top of the core does not coincide with the top of a section. The sections are labeled from 1 for the top (incomplete) section to a figure as high as 6 for the bottom (complete) section, depending on the total length of core recovered.

By convention, when partial recovery results, the recovered sediment is assumed to represent the top of the cored sequence. The core catcher represents sediment immediately below the lowest section.

An example of accepted convention for a sample number is "31-290-3-1 (10-20 cm)". The sample represents the interval between 10 and 20 centimeters in Section 1 of Core 3, Site 290, Leg 31.

Handling of Cores

After a core section has been cut, sealed, and labeled, it is brought into the core laboratory for processing. The routine procedure listed below was usually followed:

1) Weighing of the core section for mean bulk density measurement.
2) GRAPE analysis for bulk density and porosity.
3) Sonic velocity determination, using a Hamilton Frame.

After the physical measurements are made, the core is cut. One of the split halves is designated a working half. Samples, including those for grain size, X-ray mineralogy, water content, and carbon-carbonate are taken. Larger samples are taken from suitable cores for inorganic and organic geochemical analysis. These samples are generally taken before the core is split.

The working half is then sent to the paleontology laboratory. There, samples for shipboard and shorebased studies of nannoplankton, foraminifera, radiolarians, diatoms, and silicoflagellates or other paleontological studies are taken.

The other half of a split section is designated an archive half. The color, texture, structure, and composition of the various lithologic units within a section are described on standard visual core description sheets (one per section) and any unusual features noted. A smear slide is made, usually at 75 cm if the core was uniform. Otherwise, two or more smear slides are made, each for a sediment of distinct lithology. The smear slides are examined microscopically. The archive half of the core section is then

photographed. Both halves are sent to cold storage on board after they had been processed.

All samples are now deposited in cold storage at the DSDP West Coast Repository at Scripps Institution of Oceanography and are available to investigators.

Sediment Analyses

Carbon-Carbonate

Sediment samples are analyzed on a Leco 70-Second Analyzer following procedures outlined in Volumes 9 and 18 of the Initial Reports of the Deep Sea Drilling Project. Accuracy and precision of the results are as follows:

Total carbon	±0.3% (absolute)
Organic carbon	±0.06% (absolute)
$CaCO_3$	±3% (absolute)

X-ray Mineralogy

Semiquantitative determinations of the mineral composition in bulk samples, 2 to 20μ, and <2μ fractions is performed according to the methods described in the reports of Legs 1 and 2 and in Appendix III of Volume IV, Initial Reports of the Deep Sea Drilling Project. The mineral analyses of the 2 to 20μ and <2μ fractions are performed on $CaCO_3$-free residues.

These are reported and shown on the core forms using a ranked, semiqualitative scale as outlined below:

Trace - (TR)	(<5%); diffraction pattern is weak and identification is made on the basis of two major diagnostic peaks.

Present - (P)	(5-25%); a number of peaks of the mineral are visible in the diffraction pattern.
Abundant - (A)	(25-65%); diffraction peaks of the mineral are prominent in the total diffraction pattern, but the peaks of other minerals are of an equivalent intensity.
Major - (M)	(>65%); the diffraction peaks of the mineral dominate the diffraction pattern.

Although a certain quantity of the unidentified minerals is implied, their concentration is not included in the concentrations of the identified minerals which are summed to 100 percent.

Grain Size

Sand-silt-clay distribution is determined on 10 cc sediment samples collected at the time the cores were split and described.

The sediment classification used here is that of Shepard (1954) with the sand, silt, and clay boundaries based on the Wentworth (1922) scale. Thus the sand, silt, and clay fractions are composed of particles whose diameters range from 2000 to 62.5 microns, 62.5 to 3.91 microns, and less than 3.91 microns, respectively.

Standard sieve and pipette methods were used to determine the grain size distribution. The sand-size fraction was removed by wet sieving using 63-micron sieve, and the silt and clay fractions were analyzed by standard pipette analysis. Sampling depths and volumes

were calculated using equations derived from Stokes setling velocity equation (Krumbein and Pettijohn, 1938, 95-96).

Sediment Classification

A basic sediment classification was devised by O. E. Weser of DSDP and was first used at sea on Leg 18. The system has been reviewed and changed in-house several times, based upon experience gained during utilization at sea.

The complete DSDP sediment classification system follows.

Lithologic Symbols

Accompanying the introduction of the sediment classification to the DSDP volumes is the employment of a set of lithologic symbols (Figure 3). These symbols and their method of employment has continued, with only minor modification, through all volumes subsequent to Volume 18. These symbols have been used on all core and site summary forms. Where complex lithologies occur, each major constituent is represented by a vertical bar. The width of each bar corresponds to the percentage value of the constituent it represents in the manner shown on Figure 2. It will be noted that the class limits of the vertical bars corresponds to those of the sediment classification. With this system of graphical representation, the rich portion of the major constituents and the minor constituents may be shown.

Shipboard Mineralogic-Lithologic Determination

Smear Slides

Smear slides are the basic means of mineral identification

CLASSIFICATION AND NOMENCLATURE RULES

I. Rules for class limits and sequential listing of constituents in a sediment name

A. Major constituents

1. Sediment assumes name of those constituents present in major amounts (major defined as >25%). See example in rule IA3.
2. Where more than one major constituent is present, the one in greatest abundance is listed farthest to the right. In order of decreasing abundance, the remaining major constituents are listed progressively farther to the left.
3. Class limits when two or more major constituents are present in a sediment are based on 25% intervals, thusly: 0-25, 25-50, 50-75, 75-100.
   Example illustrating rules IA and IB and the resulting sediment names:

% Clay	% Nannos		
0-25	75-100	=	Nanno ooze
25-50	50-75	=	Clayey nanno ooze
50-75	25-50	=	Nanno clay
75-100	0-25	=	Clay

B. Minor constituents

1. At the discretion of the geologist, constituents present in amounts of 10-25% may be prefixed to the sediment name by the term **rich.**
   Example: 50% nannofossils, 30% radiolarians, 20% zeolites would be called a **zeolite-rich rad nanno ooze.**
2. At the discretion of the geologist, constituents present in amounts of 2-10% may be prefixed to the sediment name by the term **bearing.**
   Example: 50% nannofossils, 40% radiolarians, 10% zeolites would be called a **zeolite-bearing rad nanno ooze.**

C. Trace constituents. Constituents present in amounts of <2% may follow the sediment name with addition of the word **trace.** This again is at the discretion of the geologist.

II. Specific rules for calcareous and siliceous tests

A. Nannofossil is applied only to the calcareous tests of coccolithophorids, discoasters, etc.

B. The term **calcareous** or **siliceous**, depending on skeletal composition is applied where no attempt is made to distinguish fossils as to major subgroup. Thus, if no percent estimate is made, a mixture of radiolarians, diatoms, and silicoflagellates would be called **siliceous ooze.** Where this distinction is made, the appropriate fossil name is used.

C. Fossil tests are not qualified by a textural term unless very obviously redeposited.

D. Abbreviations, as nanno for nannofossil, rad for radiolarian, etc., may be used in the sediment name.

E. The term **ooze** follows a microfossil taxonomic group whenever it is the dominant sediment constituent.

F. Usage of the terms **marl** and **chalk** to designate amounts of microfossils, 30-60% and >60% respectively, as used by Olausson (1960) and others, is dropped. The term **chalk** is retained to designate a compacted calcareous ooze.

III. Clastic sediments

A. Clastic constituents, whether detrital, volcanic, biogenous or authigenic, are given a textural designation. When detrital[2] grains are the sole clastic constituents of a sediment, a simple textural term suffices for its name. The appropriate term is derived from Shepard's triangle diagram (see Figure 3). The textural term can be preceded by a mineralogical term when this seems warranted. Such mineralogical terms are applied as per rules IA and B.

[2]Detrital = all clastic grains derived from the erosion of preexisting rocks except for those of biogenous, authigenic, or volcanic origin.

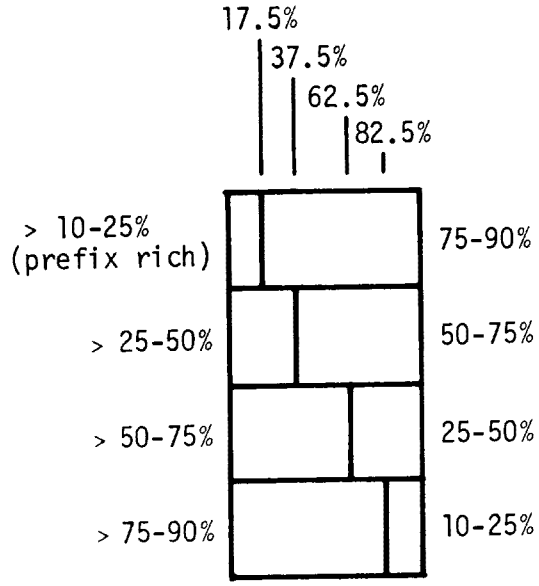


FIGURE 2 Vertical bar width representation of class limits.

B. When the tests of a fossil biocoenosis or authigenic and detrital grains occur together, the fossil or authigenic material is not given a textural designation (as per rule IIC). However, the detrital material is classified texturally by recalculating its size components to 100%. With the presence of other constituents in the sediment, the detrital fraction now requires a compositional term.

C. Clastic volcanics
Redeposited pyroclastics also become a clastic component. They are again recognized by the term **volcanic** and receive a textural term such as **gravel, sand, silt,** etc. It is particularly difficult at times to differentiate between **volcanic sand** (i.e., transported by tractive mechanisms) and **crystal ash** (i.e., direct outfall resulting from explosion of a volcano).

D. Clastic authigenic constituents
Where authigenic minerals are recognized as being a redeposited constituent, they are given a textural designation in addition to their mineral names.

IV. Volcanic and authigenic constituents

A. Volcanic constituents
Pyroclastics are given textural designations already established in the literature. Thus, **volcanic breccia** = >32 mm, **volcanic lapilli** = <32 mm to >4 mm, and **volcanic ash** = <4 mm. It is at times useful to further refine the textural designations by using such modifiers as **coarse** or **fine.** An ash wholly, or almost wholly, of glass shards is termed **vitric ash.**

B. Authigenic constituents

1. Authigenic minerals enter the sediment name in a fashion similar to that outlined under rules IA and B. Normally, as with a fossil biocoenosis, the authigenic minerals are not given a textural designation and texture.
2. The terms **ooze** and **chalk** are applied to carbonate minerals of all types using the same rules that apply to biogenous constituents.

V. Color

A. Color is not formally part of the sediment name. However, its employment for sediment description is important particularly as it provides one of the criteria used to distinguish **pelagic** and **terrigenous** sediments.

B. Common usage dictates that it is no longer expedient to employ the term **red** for sediments (*usually* pelagic) which are various shades of red, yellow, and brown. The proper color designation should be used.

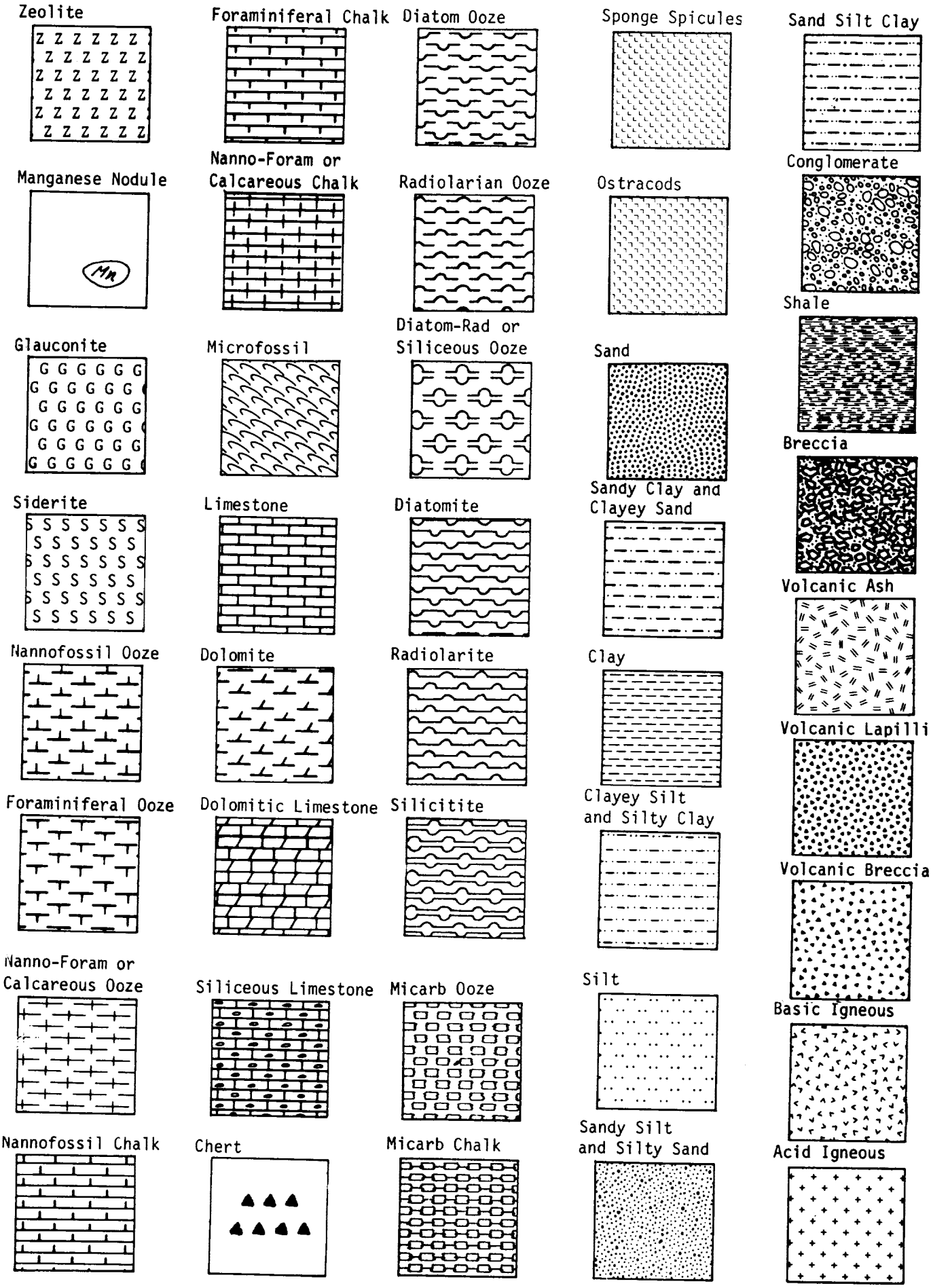


FIGURE 3 LITHOLOGIC SYMBOLS

on shipboard. The shipboard party tried to be as specific as possible with regard to mineral identifications.

Smear slide estimates of mineral abundances were based on area of the smear slide covered by each component. Specific mineral identification and quantification was attempted for sands, but for silts and clays, only the textural categories were really quantified. Past experience has shown that accuracy may approach a percent or so for very distinctive minor constituents but that, for major constituents, accuracy of ±10 to 20% is considered very good. Of more importance to the geologist than absolute accuracy are relative changes in component abundances.

Core Forms

The basic lithologic data are contained on core summary forms. As far as possible the data are presented in the following order:

Sediment name

Color name and Munsell or GSA number

The reader is advised that colors recorded in core barrel summaries were determined during shipboard examination immediately after splitting core sections. Experience with carbonate sediments shows that many of the colors will fade or disappear with time after opening and storage. Colors particularly susceptible to rapid fading are purple, light and medium tints of blue, light bluish gray, dark greenish black, light tints of green, and pale tints of orange. These colors change to white or yellowish white or pale tan.

Composition

Structure(s)

X-ray, grain size, and carbon-carbonate data

Many cores contain minor important lithologies as well as a basic lithology. The description of the basic lithology is so indicated in most cases, however, descriptive information for minor lithologies is included wherever possible. X-ray data are those generated by the DSDP X-ray mineralogy laboratory at the University of California, Riverside. Grain size and carbon-carbonate results are from the DSDP laboratory at Scripps unless otherwise noted.

A sample core form precedes the site-by-site presentation of the cores (Figure 4). On this sample core form is contained all legend and explanatory notes for an understanding of the core forms.

Drilling Deformation

Four degrees of drilling deformation were recognized as follows: the symbols are on the sample core form. Slightly deformed cores exhibit a slight bending of bedding contacts; extreme bending defines moderate deformation. In highly deformed cores, injected bedding planes may approach the vertical. In extreme cases, bedding may be completely disrupted to produce a "drilling breccia". Watery intervals generally have lost any bedding characteristics originally available.

Downhole Contamination

Downhole contamination is a serious problem. Hard objects (manganese nodules, chert, lithic fragments, and pebbles) are often washed or dragged hundreds of meters downhole. They commonly are lodged in the top of cores or will become incorporated into the middle of cores at levels far below their proper stratigraphic position. Displaced manganese nodules can usually be recognized. However, displaced chert, lithic fragments, and pebbles are more difficult to recognize. This information is recorded on the core forms.

BIOSTRATIGRAPHY

General

As of this writing biostratigraphic studies of Leg 31 cores are still in progress. Consequently, biostratigraphic boundaries given in this report are necessarily tentative. Although no major changes in age assignments are anticipated, adjustments of some boundaries are likely to be made prior to issuing of the Initial Report Volume for Leg 31. Abundance and preservation of both calcareous and siliceous microfossils vary significantly at Leg 31 sites as a function of the wide spectrum of depths encountered, and low to high latitudes traversed. Two excellent mid to late Tertiary calcareous sequences are present at Sites 292 and 296 containing abundant and well-preserved calcareous nannofossils and planktonic foraminifera; radiolarians are present in the late early and mid Tertiary portions of these sediments, but are absent in younger

sediments. Good to excellent late Neogene siliceous sequences rich in diatoms and good to fair silicoflagellates and radiolarians were recovered at Sites 301 and 302. Marginal to good calcareous assemblages were found only in the Pleistocene portion of these sections. Other sites on Leg 31 offer only adequate to poor paleontologic control although ongoing work on fish teeth may provide some control in sequences otherwise barren of microfossils in the Philippine Sea.

It is important to note that only two fossil groups were used in assigning ages on the following Leg 31 core descriptions to facilitate ease of definition during preliminary analysis as detailed below. However, data from all microfossil groups will be integrated for each site in the Initial Report Volume.

Philippine Sea Area; Sites 290 to 298.

Ages and biostratigraphic boundaries indicated herein for Sites 290 through 298 represent definitions established almost solely on the basis of calcareous nannofossils following the zonation present by Bukry (1973c). Key species used in establishing major boundaries are given in Table 1. Rare apparently reworked Cretaceous and Paleocene planktonic foraminifera appear in sediments of Holes 290, 293, 295, and 298.

Sea of Japan Area; Sites 299 to 302.

Diatom zonation provides the sole basis for age determinations presented herein for Sites 299 through 302 following the high to middle latitude zonation established by Koizumi (1973a; 1973b). Critical boundaries and key paleontologic datum levels are given in Table 2.

Table 1. Calcareous nannofossil datum levels, epoch boundaries and subdivisions, Philippine Sea[1,2]

Epoch Boundary or Subdivision		Calcareous Nannofossil Datum
Pleistocene/Pliocene	-	top *Discoaster brouweri*
Late Pliocene/Early Pliocene	-	top *Reticulofenestra pseudoumbilica* and *Sphenolithus abies*
Early Pliocene/Late Miocene	-	top *Triquetrorhabdulus rugosus* and base *Ceratolithus acutus*
Late Miocene/Mid Miocene	-	top *Discoaster hamatus*
Mid Miocene/Early Miocene	-	top *Helicopontosphaera ampliaperta*
Early Miocene/Late Oligocene	-	top *Cyclicargolithus abisectus*
Late Oligocene/Early Oligocene	-	base *Sphenolithus distentus*
Early Oligocene/Late Eocene	-	top *Discoaster barbadiensis* and *D. saipanensis*
Late Eocene/Mid Eocene	-	top *Chiasmolithus grandis*

[1]Also used in Sea of Japan area where calcareous material is present.
[2]Boundaries follow Bukry (1973c).

Table 2. Diatom datum levels, epoch boundaries and subdivisions, Sea of Japan[1]

Epoch Boundary or Subdivision		Diatom Datum
Pleistocene/Pliocene	-	top *Thalassiosira antiqua*
Late/Early Pliocene	-	top *Denticula kamtschatica*
Pliocene/Miocene	-	base *Denticula seminae*
Late/Mid Miocene	-	top *Denticula lauta*

[1]Boundaries follow Koizumi (1973a; 1973b).

sample-distribution policy

Distribution of Deep Sea Drilling samples will be undertaken in order to (1) provide supplementary data for inclusion in the appropriate Initial Report to support *Glomar Challenger* scientists in achieving the scientific objectives of their particular cruise, and (2) provide individual investigators with material to conduct detailed studies beyond the scope of the Initial Reports.

The National Science Foundation has established a Sample Distribution Panel to advise on distribution of core material. 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 core and related materials. Funding for the proposed research is handled separately by the investigator, not through the Deep Sea Drilling Project.

Distribution of samples for contributions to Initial Reports

Any investigator who wishes to contribute a paper to a given volume of the Initial Reports may write to the Curator, Deep Sea Drilling Project, Scripps Institution of Oceanography, University of California at San Diego, La Jolla, 92037, requesting samples from a forthcoming cruise. The request should include the nature of the study, and type, size, number of samples, particular sampling techniques or equipment that might be required, and an estimate of the time required to complete the study. The requests will be reviewed by shipboard scientists, and, if they are deemed suitable and pertinent to the objectives of the leg, and shipboard workload permits, the requested samples will be taken during the cruise (provided, of course, material suitable to the investigation is obtained during the drilling). In the case of multiple requests to perform the same investigation, selection of investigator will be made by the shipboard scientific party.

Proposals should be of a scope appropriate to complete the sampling and study in time for publication in the Initial Reports. Studies deemed acceptable will be referred to the Curator who will, with the consent of the NSF Sample Distribution Panel, authorize distribution of the samples. The Sample Distribution Panel and the Deep Sea Drilling Project will strive to ensure a reasonable degree of continuity in the investigations among the various cruises, that the studies are pertinent to goals of the cruise, and that they are consistent with the publication policy for the Initial Reports. Subject to these same provisions, the shipboard scientific party may elect to have special studies of selected core samples of its recently completed cruise made by other investigators.

Investigations not completed in time for inclusion in the Initial Report may not be published in other journals until publication of the Initial Report for which it was intended.

Distribution of samples for publication other than in Initial Reports

1. Researchers intending to request samples for studies beyond the scope of the Initial Reports should first obtain a sample request form from the Curator. Requests should specify the quantities and intervals of the core required, a statement of the proposed research, the possibility of returning residue to the Curator, the estimated time required to complete and publish the results, and the availability or need of funding and availability of equipment and space foreseen for the research.

In order to ensure that requests for highly desirable but limited samples can all be considered, approval of requests and distribution of samples will not be made prior to 12 months after date of completion of the cruise that collected the cores. Prior to publication of an Initial Report, requests for samples from a cruise can be based on the preliminary shipboard core logs. Copies of these logs will be kept on open file at Scripps and other designated institutions. The only exceptions will be for specific instances involving ephemeral properties.

Requests for samples from researchers in industrial laboratories will be handled in the same manner as those from academic organizations, and there will be the same obligation to publish results promptly. Requests from foreign scientists or organizations will also be considered.

2. The Curator has the responsibility for distributing samples, controlling quality of samples, and preserving core material. He also has the responsibility for maintaining a record of requests for samples that have been processed and filled indicating the investigator and subjects to be studied. This record will be available to investigators.

The distribution of samples will be made directly from the two repositories at Lamont-Doherty Geological Observatory and Scripps by the Curator or his designated representative.

3. (a) Samples up to 10 cc/m of core length can be automatically distributed by the Curator, Deep Sea Drilling Project or his authorized representative to any qualified investigator who requests them. The Curator will refrain from making automatic distribution of any parts of the cores which appear to be in particularly high demand, and any requests for these parts of the cores will be referred to the Sample Distribution Panel for review. Requests for samples from thin layers or important stratigraphic boundaries will generally require Panel review.

(b) All requests for samples in excess of 3(a) above will be referred to the Sample Distribution Panel.

(c) If, in the opinion of scientific investigators, certain properties they wish to study may deteriorate prior to the normal availability of the samples, such investigators may request that the normal waiting period not apply. All such requests must be approved by the Sample Distribution Panel.

4. 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 1). If a sample request is dependent, either wholly or in part, on proposed funding, the Curator will 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.

5. Investigators receiving samples are responsible for:

i) promptly publishing significant results.

ii) acknowledging, in publications, that samples were supplied through the assistance of the National Science Foundation.

iii) submitting 4 copies of all reprints of published results to the Curator.

iv) notifying the Curator of any work done on the samples that is additional to that stated in the original request for samples.

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

6. Cores will be made available at repositories for investigators to examine and specify exact samples in such instances as this may be necessary for the scientific purposes of the sampling, subject to the limitations of 3 (a), (b), (c), and 5, above, and with the specific permission of the Curator or his delegate.

7. Cores of igneous and metamorphic rocks will also remain at the repositories where they will be available for observation and description and where selected samples may be taken for thin-section preparation and other work.

8. The Deep Sea Drilling Project routinely processes by computer most of the quantitative data presented in the Initial Reports. Space limits in the Initial Reports preclude 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.

Magnetics, seismic-reflection and bathymetric data collected under way by the *Glomar Challenger* will also be available for distribution 12 months after completion of the cruise.

Requests for these data may be made to the Chief Scientific Editor of the Deep Sea Drilling Project, at Scripps.

A charge will be made to recover the expenses of responding to individual requests. Estimated charges can be furnished before the request is processed, if required.

9. This policy has the approval of the National Science Foundation and is designed to help ensure that the greatest possible scientific benefit is gained from the materials obtained, and that samples will be made widely available to interested geologists.

(Slightly condensed from the official sample distribution policy of the Deep Sea Drilling Project.)

REFERENCES

Addicott, W. O., 1969. Tertiary climatic changes in the marginal northeastern Pacific Ocean, Science, v. 165, p. 583.

Asano, K., Ingle, J. C., Jr., and Takayanagi, Y., 1969. Neogene planktonic foraminiferal sequence in northeastern Japan; Proc. First Intern. Conf. Planktonic Microfossils (Geneva), v. 1, p. 14-25.

Berger, W. H., 1973. Cenozoic sedimentation in the Eastern Tropical Pacific; Geol. Soc. Amer. Bull., v. 84, p. 1941-1954.

Berggren, W., 1972. A Cenozoic time-scale - some implications for regional geology and paleobiogeography, Lethia, v. 5, p. 195.

_____, in press. Biostratigraphy and biochronology of the Late Miocene (Messinian and Tortonian) of the Mediterranean.

Blow, Walter H., 1969. Late Middle Eocene to Recent planktonic foraminiferal biostratigraphy. First Planktonic Conf. Proc., p. 299.

Bolli, H. M., 1966. Zonation of Cretaceous to Pliocene marine sediments based on planktonic foraminifera: Inform. Assoc. Venezolana Geologia, Min., Petrol., Bol., v. 9, p. 3-32.

Bukry, D., 1971. Cenozoic calcareous nannofossils from the Pacific Ocean: San Diego Soc. Nat. Hist. Trans., v. 16 (14), p. 303-328.

_____ , 1973a. Coccolith stratigraphy, Leg 10 Deep Sea Drilling Project, In Worzel, J. L., Bryant, W., et al., Initial Reports of the Deep Sea Drilling Project, v. X, Washington (U. S. Government Printing Office), p. 385.

_____, 1973b. Coccolith stratigraphy, eastern equatorial Pacific, Leg 16, Deep Sea Drilling Project, In van Andel, T. H., Heath, G. R., et al., Initial Reports of the Deep Sea Drilling Project, v. XVI, Washington (U. S. Government Printing Office), p. 653.

_____, 1973c. Low-latitude coccolith biostratigraphic zonation, In Edgar, N. T., Saunders, J. B., et al., Initial Reports of the Deep Sea Drilling Project, v. XV, Washington (U. S. Government Printing Office), Chapter 17.

Burckle, L. H., 1972. Late Cenozoic planktonic diatom zones from the eastern Equatorial Pacific; Beih. Nova Hed., Heft 39, p. 217-246.

Eames, F. E., Banner, F. T., Blow, W. H., and Clarke, W. J., 1962. Fundamentals of Mid-Tertiary stratigraphical correlation, Cambridge Univ. Press, p. 151.

Hays, J. D., Saito, T., Opdyke, N. D., and Burckle, L. H., 1969. Pliocene-Pleistocene sediments of the equatorial Pacific: Their paleomagnetic, biostratigraphic, and climatic record, Geol. Soc. America, Bull., v. 80, p. 1481-1514.

Heath, G. R., 1969. Carbonate sedimentation in the abyssal equatorial Pacific during the past 50 million years, Geol. Soc. Amer., Bull., v. 80, p. 689.

Hilde, T. W. C., Wageman, J. M., and Hammond, W. T., 1969. The structure of the Tosa Terrace and Nankai Trough off south-eastern Japan; Deep-Sea Research, v. 16, p. 67-75.

Ingle, J. C., Jr., 1967. Foraminiferal biofacies and the Miocene-Pliocene boundary in southern California, Bull. Amer. Paleo., v. 52 (No. 236), p. 211.

_____, 1973. Neogene foraminifera from the northeastern Pacific; Leg 18, Deep Sea Drilling Project, In Kulm, L. D., and von Huene, R., Initial Reports of the Deep Sea Drilling Project, v. XVIII, Washington, U. S. Government Printing Office.

Iwabuchi, Y., 1968. Submarine geology of the southeastern part of the Japan Sea; Tohoku Univ., Inst. Geol. Pal., Contrib. No. 66, p. 1-76.

Kaseno, Y., 1971. Geological Features of the Japan Sea floor: a review of recent studies; Pacific Geology, v. 4, p. 91-111.

_____, 1972. On the origin of the Japan Sea basin; Proc. 24th Intern. Geol. Congress (Montreal), Sec. 8, p. 37-42.

Karig, D., 1971a. Origin and development of marginal basins in the western Pacific, Amer. Geophys. Union, Bull., v. 76, p. 2542-2560.

_____, 1971b. Structural history of the Mariana Island Arc System; Geol. Soc. American Bulletin, v. 82, p. 323-344.

Koizumi, I., 1973a. The stratigraphic ranges of marine planktonic diatoms and diatom biostratigraphy in Japan; Geol. Soc. Japan, Mem., No. 8, p. 35-44.

_____, 1973b. The late Cenozoic diatoms of Sites 183-193, Leg 19, Deep Sea Drilling Project, Leg 19, In Creager, J. S., Scholl, D. W., et al., 1973, Initial Reports of the Deep Sea Drilling Project, v. XIX, Washington (U. S. Government Printing Office), p. 805-856.

Krumbein, W. C. and Pettijohn, F. J., 1938. Manual of Sedimentary Petrography. New York (Appleton-Century).

Ling, H. Y., 1971. Silicoflagellates and ebridians from the Shinzan diatomaceous mudstone member of the Onnagawa Formation (Miocene), Northeast Japan, Proc. II Planktonic Conf., Roma 1970, Farinacci, E. A. (Ed.), v. II, p. 689-703.

Martini, E., 1971. Standard Tertiary and Quaternary calcareous nannoplankton zonation. Second Planktonic Conf. Proc., p. 739-785.

Moore, J. C., 1973. Complex deformation of Cretaceous trench deposits, southwestern Alaska; Bull. Geol. Soc. Amer., v. 84, p. 2005-2020.

Moore, T., 1971. Radiolaria; In Tracey, J. I., Jr., Sutton, G. H., et al., Initial Reports of the Deep Sea Drilling Project, v. VIII, Washington (U. S. Government Printing Office), p. 727-775.

Perch-Nielsen, K., 1972. Remarks on Late Cretaceous to Pleistocene coccoliths from the North Atlantic, In Laughton, A. S., Berggren, W. A., et al., Initial Reports of the Deep Sea Drilling Project, v. XII, Washington (U. S. Government Printing Office), p. 1003.

Riedel, W. R. and Sanfilippo, Annika, 1971. Cenozoic Radiolaria from Western Tropical Pacific, Leg 7, In Winterer, E. L., Ewing, J. I., et al., Initial Reports of the Deep Sea Drilling Project, v. VII, p. 1529-1683.

Sanfilippo, Annika and Riedel, W. W., 1973. Cenozoic Radiolaria (exclusive of Theoperids, Artostrobiids and Amphipyndacids) from the Gulf of Mexico, Deep Sea Drilling Project Leg 10. In Worzel, J. L., Bryant, W., et al., 1973, Initial Reports of the Deep Sea Drilling Project, v. X, Washington (U. S. Government Printing Office), p. 475.

Shepard, F. P., 1954. Nomenclature based on sand-silt-clay ratios: J. Sed. Petro., v. 24, (3), p. 151-158.

Ujiie, H. and Miura, M., 1970. Planktonic foraminiferal analysis of a calcareous ooze core from the Philippine Sea, Proc. II Planktonic Conf., Roma, 1970, p. 1231-1249.

Ujiie, H. and Ichikura, M., 1973. Holocene to Uppermost Pleistocene foraminifera in a piston core from off San'in district, Sea of Japan, Trans. Proc. Paleont. Soc. Japan, N. S., No. 71.

Williams, H., Turner, F. J., and Gilbert, C. M., 1954. Petrography, an introduction to the study of rocks in thin sections: San Francisco, (W. H. Freeman and Co.), p. 406.

Winterer, E. L., 1973. Sedimentary facies and plate tectonics of equatorial Pacific, Amer. Assoc. Petrol. Geologists Bull., v. 57 (2), p. 265.

Site Hole Core Cored Interval: Meters below sea floor

AGE	ZONE	FOSSIL CHARACTER	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
Foraminifera Zones Nannofossil Zones Radiolarian and/or Diatom Zones		See Notes* (lower portion of this sample form)	1 2 3 4 5 6 Core Catcher	0.5 1.0	See Explanatory Notes	Drilling Breccia oooo Intense Deformation ~~~ Moderate Deformation — — — — Slight Deformation ———	Smear Slide depth in centimeters in a section.	Area of General Description: general lithology, colors, deformation, and specific characteristics. Smear Slide Descriptions (Note: "Clay mineral" in composition column may designate unresolvable, fine clay-size material) Lithology. (Major and Minor included) Smear: by section and depth (cm) Texture in % Composition in % (Specific characteristics of smear slides may follow the basic listing) X-ray, Carbon-carbonate, Grain Size Analyses. X-ray 6 - 107 (bulk fraction) Sec. cm Composition in %: components have abbreviated names. Carbon-carbonate 6 - 107 (Total C, Org. C, $CaCO_3$) Sec. cm Grain Size 6 - 107 (Sand %, Silt %, Clay %) Sec. cm *Notes 1. Fossil character = fossil name (Nannos, Forams, Rads, Diatoms, Silicoflagellates, etc.). a. Small marks (-) in column under FOSSIL CHARACTER show the location of the sample. b. First letter near the small mark designates "Abundance" in capital letters. A = Abundant (flood; many species and specimens) C = Common (many species; easy to make age determinations) R = Rare (enough for age assignment) T = Trace (few species and specimens) c. The second letter designates "Preservation" and is written in small letters to distinguish from "Abundance" designation. e = excellent (no dissolution or abrasion) g = good (very little dissolution or abrasion) f = fair (dissolution and/or abrasion and/or recrystallization very noticeable) p = poor (substantial or very strong evidence of dissolution and/or abrasion and/or recrystallization) d. In "ZONE" column, imagine three vertical columns in the space provided. Foram zone closest to the left, the Nannoplankton zone in the middle, and the Rad. zone on the right. Example(s): Ae Cg

Explanatory notes in chapter 1

Figure 4 - Sample Core Form and Legends

DEEP SEA DRILLING PROJECT

LEG 31 SITE 290

SITE SUMMARY SHEET

POSITION: Latitude: 290-17°44.85'N / 290A-17°45.05'N Longitude: 290-133°28.08'E / 290A-133°28.44'E

Water depth (from sea level): 6062.5 corrected meters (Echo sounding)

Bottom felt at: 6071 meters (drill pipe) Penetration: 290-255 m / 290A-140 m

Number of Holes: 2 Number of Cores: 290-9 and 290A-2

Total length of cored section: 290-80 m / 290A-19 m Total core recovered: 290-38.9 m / 290A-1.9 m

Percentage of core recovery: 290-48.6% and 290A-10%

OLDEST SEDIMENT CORED:

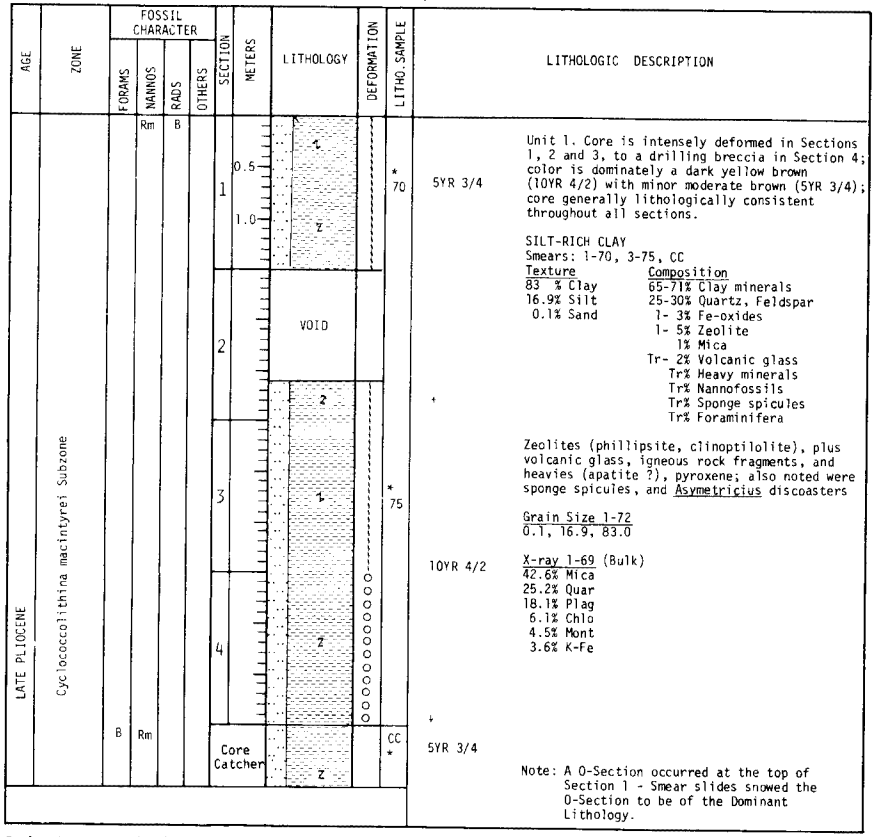
Depth below sea floor: 255 meters Nature: Volcanic conglomerate and breccia

Age: early Oligocene or late Eocene Measured Velocity: 3.8 km/sec horizontal / 4.21 km/sec vertical

PRINCIPAL RESULTS:

The stratigraphic sequence in Hole 290 consists of 90 meters of Quaternary to late Oligocene brown silt-rich clays overlying 49 meters of late Oligocene nannofossil ooze. This transition dates the subsidence of this part of the West Philippine Basin through the CCD. Beneath these units lie more than 80 meters of early Oligocene or late Eocene volcanic silts forming the distal edge of a large sedimentary apron lying west of the Palau Kyushu Ridge. Apron formation probably extended from the late Eocene to early Oligocene. The basal sediment unit is a late Eocene or very early Oligocene volcanic breccia, over 30 meters thick, formed by slumping from a local topographic high. Basalt fragments and nannofossils in clasts suggest that the basement, which was not reached, is of late Eocene age.

Site 290 Hole Core 1 Cored Interval: 23.0-32.5 m



Unit 1. Core is intensely deformed in Sections 1, 2 and 3, to a drilling breccia in Section 4; color is dominately a dark yellow brown (10YR 4/2) with minor moderate brown (5YR 3/4); core generally lithologically consistent throughout all sections.

SILT-RICH CLAY
Smears: 1-70, 3-75, CC

Texture	Composition
83 % Clay	65-71% Clay minerals
16.9% Silt	25-30% Quartz, Feldspar
0.1% Sand	1- 3% Fe-oxides
	1- 5% Zeolite
	1% Mica
	Tr- 2% Volcanic glass
	Tr% Heavy minerals
	Tr% Nannofossils
	Tr% Sponge spicules
	Tr% Foraminifera

Zeolites (phillipsite, clinoptilolite), plus volcanic glass, igneous rock fragments, and heavies (apatite ?), pyroxene; also noted were sponge spicules, and Asymetricius discoasters

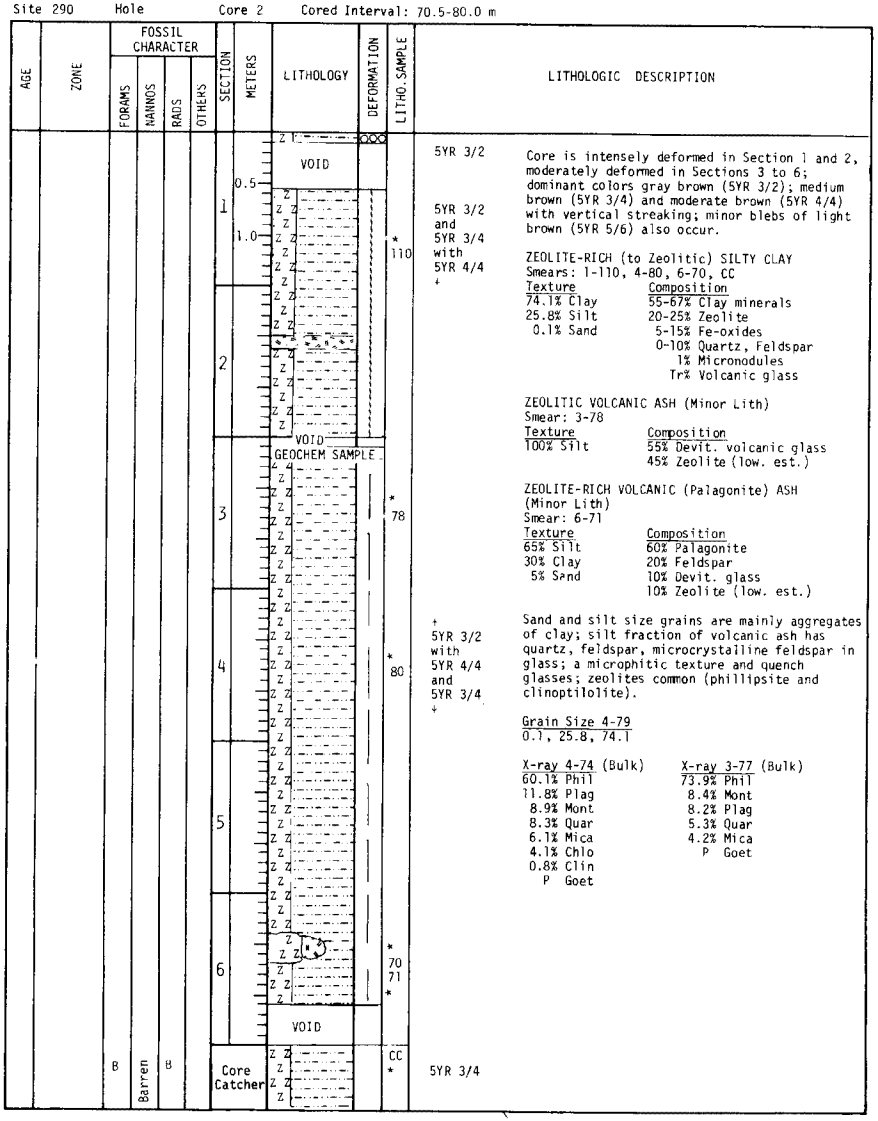
Grain Size 1-72
0.1, 16.9, 83.0

X-ray 1-69 (Bulk)
42.6% Mica
25.2% Quar
18.1% Plag
6.1% Chlo
4.5% Mont
3.6% K-Fe

Note: A 0-Section occurred at the top of Section 1 - Smear slides snowed the 0-Section to be of the Dominant Lithology.

Explanatory notes in chapter 1

Site 290 Hole Core 2 Cored Interval: 70.5-80.0 m



Core is intensely deformed in Section 1 and 2, moderately deformed in Sections 3 to 6; dominant colors gray brown (5YR 3/2); medium brown (5YR 3/4) and moderate brown (5YR 4/4) with vertical streaking; minor blebs of light brown (5YR 5/6) also occur.

ZEOLITE-RICH (to Zeolitic) SILTY CLAY
Smears: 1-110, 4-80, 6-70, CC

Texture	Composition
74.1% Clay	55-67% Clay minerals
25.8% Silt	20-25% Zeolite
0.1% Sand	5-15% Fe-oxides
	0-10% Quartz, Feldspar
	1% Micronodules
	Tr% Volcanic glass

ZEOLITIC VOLCANIC ASH (Minor Lith)
Smear: 3-78

Texture	Composition
100% Silt	55% Devit. volcanic glass
	45% Zeolite (low. est.)

ZEOLITE-RICH VOLCANIC (Palagonite) ASH (Minor Lith)
Smear: 6-71

Texture	Composition
65% Silt	60% Palagonite
30% Clay	20% Feldspar
5% Sand	10% Devit. glass
	10% Zeolite (low. est.)

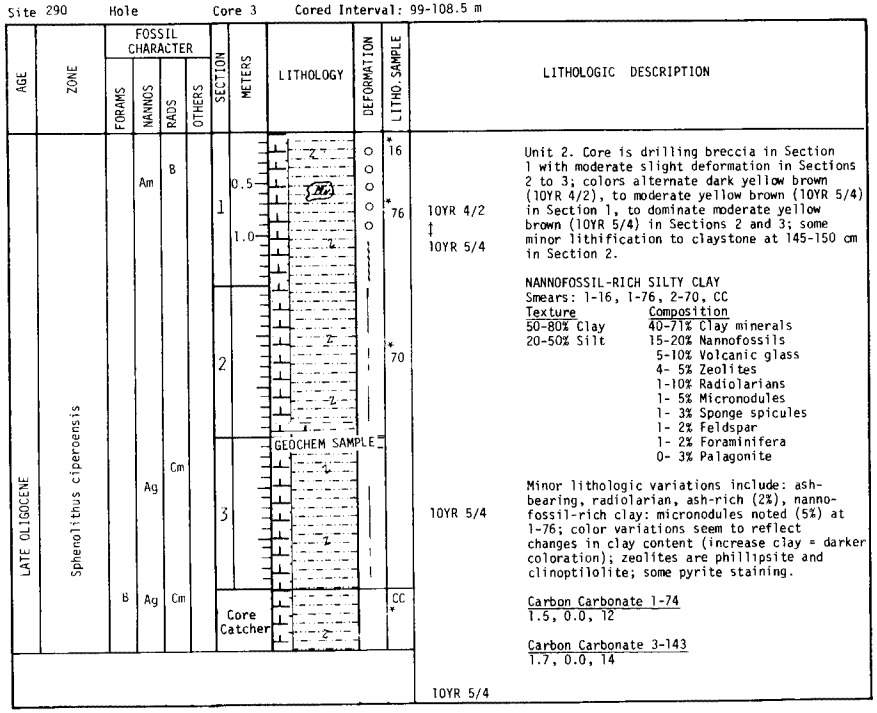
Sand and silt size grains are mainly aggregates of clay; silt fraction of volcanic ash has quartz, feldspar, microcrystalline feldspar in glass; a microphitic texture and quench glasses; zeolites common (phillipsite and clinoptilolite).

Grain Size 4-79
0.1, 25.8, 74.1

X-ray 4-74 (Bulk)	X-ray 3-77 (Bulk)
60.1% Phil	73.9% Phil
11.8% Plag	8.4% Mont
8.9% Mont	8.2% Plag
8.3% Quar	5.3% Quar
6.1% Mica	4.2% Mica
4.1% Chlo	P Goet
0.8% Clin	
P Goet	

Explanatory notes in chapter 1

Site 290 Hole Core 3 Cored Interval: 99-108.5 m



LITHOLOGIC DESCRIPTION

10YR 4/2 ↕ 10YR 5/4

Unit 2. Core is drilling breccia in Section 1 with moderate slight deformation in Sections 2 to 3; colors alternate dark yellow brown (10YR 4/2), to moderate yellow brown (10YR 5/4) in Section 1, to dominate moderate yellow brown (10YR 5/4) in Sections 2 and 3; some minor lithification to claystone at 145-150 cm in Section 2.

NANNOFOSSIL-RICH SILTY CLAY
Smears: 1-16, 1-76, 2-70, CC

Texture	Composition
50-80% Clay	40-71% Clay minerals
20-50% Silt	15-20% Nannofossils
	5-10% Volcanic glass
	4- 5% Zeolites
	1-10% Radiolarians
	1- 5% Micronodules
	1- 3% Sponge spicules
	1- 2% Feldspar
	1- 2% Foraminifera
	0- 3% Palagonite

10YR 5/4

Minor lithologic variations include: ash-bearing, radiolarian, ash-rich (2%), nannofossil-rich clay: micronodules noted (5%) at 1-76; color variations seem to reflect changes in clay content (increase clay = darker coloration); zeolites are phillipsite and clinoptilolite; some pyrite staining.

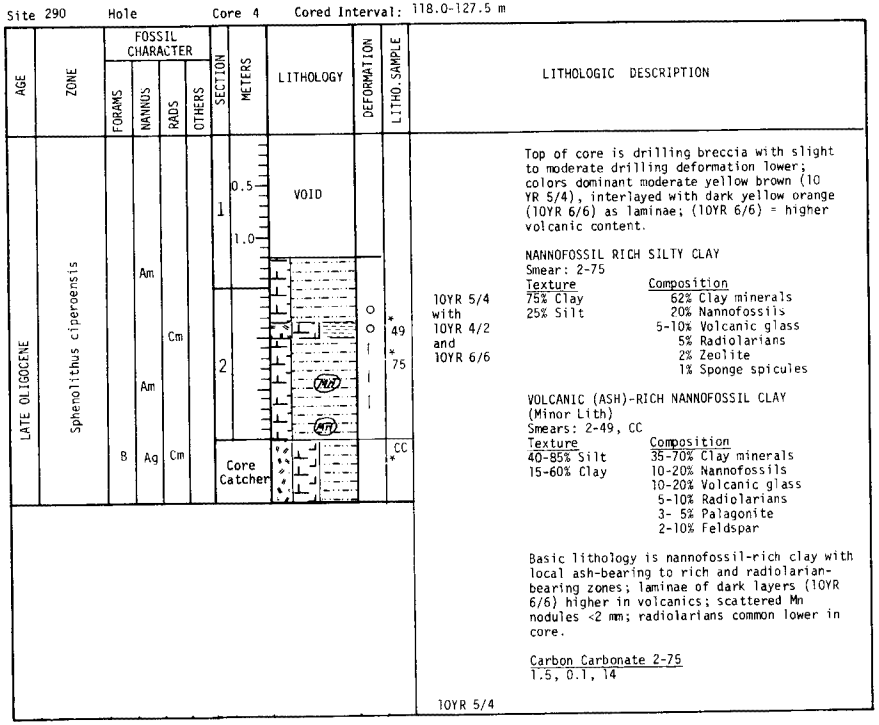
Carbon Carbonate 1-74
1.5, 0.0, 12

Carbon Carbonate 3-143
1.7, 0.0, 14

10YR 5/4

Explanatory notes in chapter 1

Site 290 Hole Core 4 Cored Interval: 118.0-127.5 m



LITHOLOGIC DESCRIPTION

10YR 5/4 with 10YR 4/2 and 10YR 6/6

Top of core is drilling breccia with slight to moderate drilling deformation lower; colors dominant moderate yellow brown (10 YR 5/4), interlayed with dark yellow orange (10YR 6/6) as laminae; (10YR 6/6) = higher volcanic content.

NANNOFOSSIL RICH SILTY CLAY
Smear: 2-75

Texture	Composition
75% Clay	62% Clay minerals
25% Silt	20% Nannofossils
	5-10% Volcanic glass
	5% Radiolarians
	2% Zeolite
	1% Sponge spicules

VOLCANIC (ASH)-RICH NANNOFOSSIL CLAY
(Minor Lith)
Smears: 2-49, CC

Texture	Composition
40-85% Silt	35-70% Clay minerals
15-60% Clay	10-20% Nannofossils
	10-20% Volcanic glass
	5-10% Radiolarians
	3- 5% Palagonite
	2-10% Feldspar

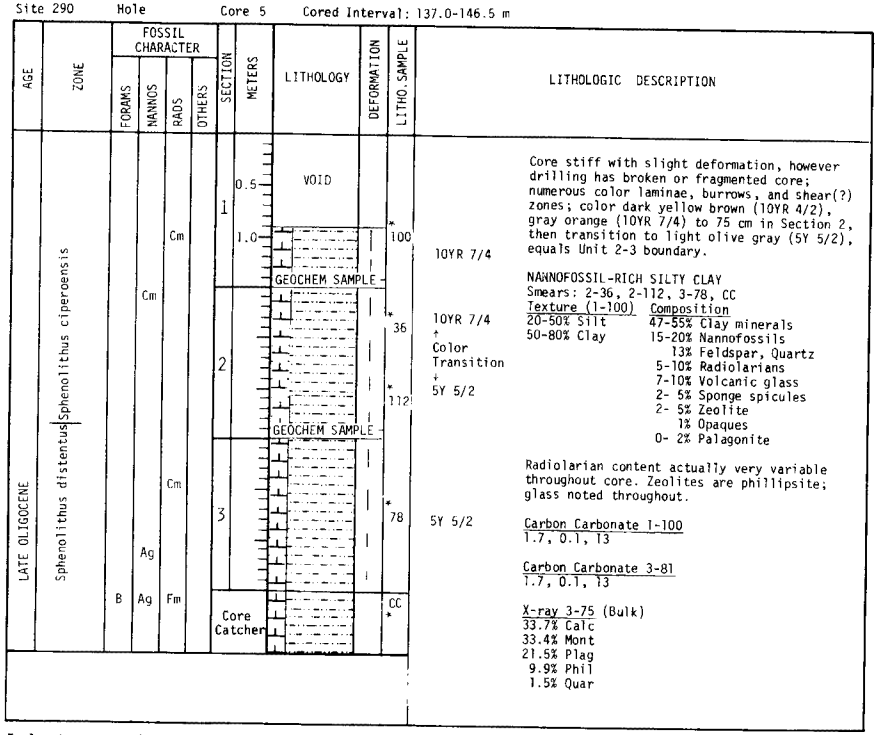
Basic lithology is nannofossil-rich clay with local ash-bearing to rich and radiolarian-bearing zones; laminae of dark layers (10YR 6/6) higher in volcanics; scattered Mn nodules <2 mm; radiolarians common lower in core.

Carbon Carbonate 2-75
1.5, 0.1, 14

10YR 5/4

Explanatory notes in chapter 1

Site 290 Hole Core 5 Cored Interval: 137.0-146.5 m



LITHOLOGIC DESCRIPTION

Core stiff with slight deformation, however drilling has broken or fragmented core; numerous color laminae, burrows, and shear(?) zones; color dark yellow brown (10YR 4/2), gray orange (10YR 7/4) to 75 cm in Section 2, then transition to light olive gray (5Y 5/2), equals Unit 2-3 boundary.

NANNOFOSSIL-RICH SILTY CLAY
Smears: 2-36, 2-112, 3-78, CC

Texture (1-100)	Composition
20-50% Silt	47-55% Clay minerals
50-80% Clay	15-20% Nannofossils
	13% Feldspar, Quartz
	5-10% Radiolarians
	7-10% Volcanic glass
	2- 5% Sponge spicules
	2- 5% Zeolite
	1% Opaques
	0- 2% Palagonite

Radiolarian content actually very variable throughout core. Zeolites are phillipsite; glass noted throughout.

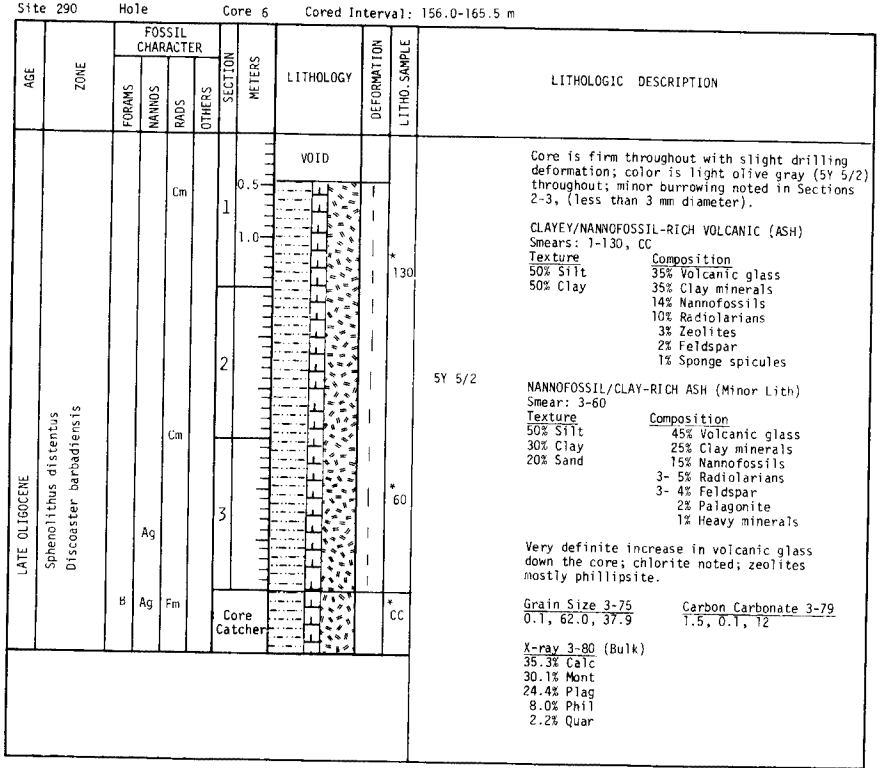
Carbon Carbonate 1-100
1.7, 0.1, 13

Carbon Carbonate 3-81
1.7, 0.1, 13

X-ray 3-75 (Bulk)
33.7% Calc
33.4% Mont
21.5% Plag
9.9% Phil
1.5% Quar

Explanatory notes in chapter 1

Site 290 Hole Core 6 Cored Interval: 156.0-165.5 m



LITHOLOGIC DESCRIPTION

Core is firm throughout with slight drilling deformation; color is light olive gray (5Y 5/2) throughout; minor burrowing noted in Sections 2-3, (less than 3 mm diameter).

CLAYEY/NANNOFOSSIL-RICH VOLCANIC (ASH)
Smears: 1-130, CC

Texture	Composition
50% Silt	35% Volcanic glass
50% Clay	35% Clay minerals
	14% Nannofossils
	10% Radiolarians
	3% Zeolites
	2% Feldspar
	1% Sponge spicules

NANNOFOSSIL/CLAY-RICH ASH (Minor Lith)
Smear: 3-60

Texture	Composition
50% Silt	45% Volcanic glass
30% Clay	25% Clay minerals
20% Sand	15% Nannofossils
	3- 5% Radiolarians
	3- 4% Feldspar
	2% Palagonite
	1% Heavy minerals

Very definite increase in volcanic glass down the core; chlorite noted; zeolites mostly phillipsite.

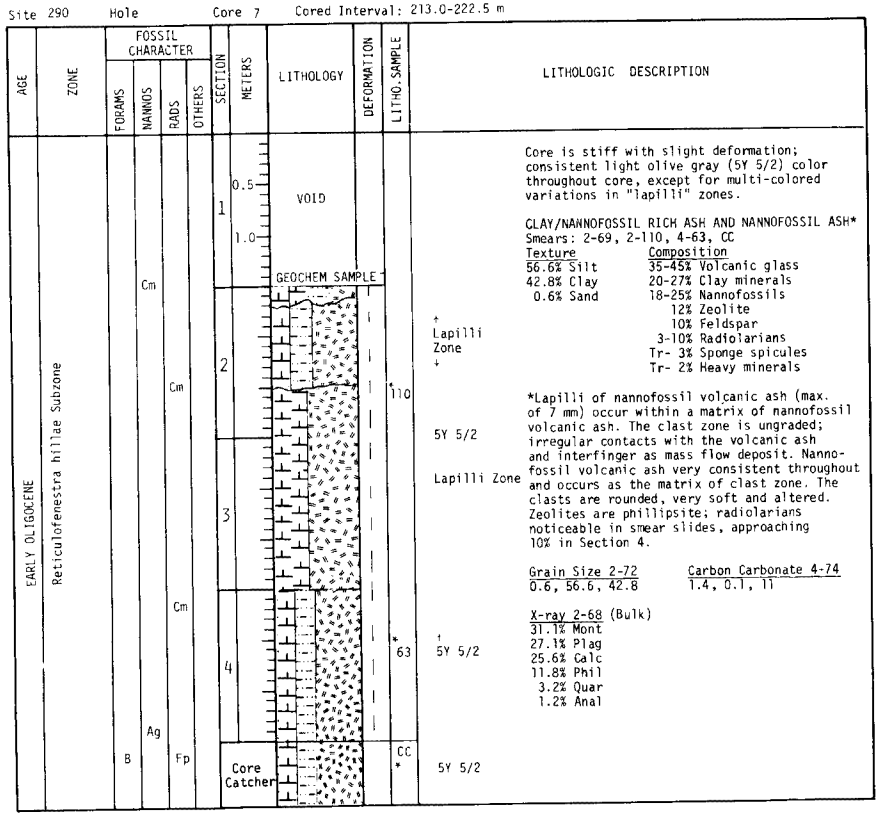
Grain Size 3-75
0.1, 62.0, 37.9

Carbon Carbonate 3-79
1.5, 0.1, 12

X-ray 3-80 (Bulk)
35.3% Calc
30.1% Mont
24.4% Plag
8.0% Phil
2.2% Quar

Explanatory notes in chapter 1

Site 290 Hole Core 7 Cored Interval: 213.0-222.5 m



Core is stiff with slight deformation; consistent light olive gray (5Y 5/2) color throughout core, except for multi-colored variations in "lapilli" zones.

CLAY/NANNOFOSSIL RICH ASH AND NANNOFOSSIL ASH*
Smears: 2-69, 2-110, 4-63, CC

Texture	Composition
56.6% Silt	35-45% Volcanic glass
42.8% Clay	20-27% Clay minerals
0.6% Sand	18-25% Nannofossils
	12% Zeolite
	10% Feldspar
	3-10% Radiolarians
	Tr- 3% Sponge spicules
	Tr- 2% Heavy minerals

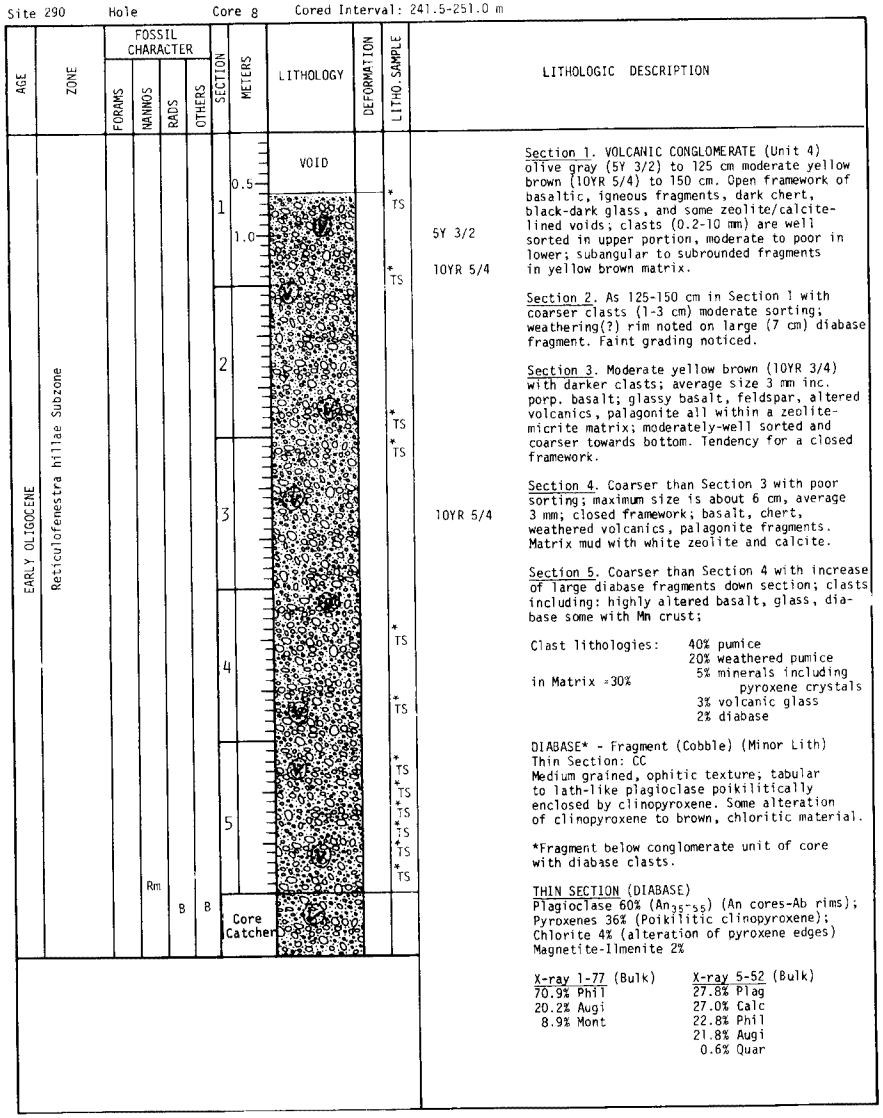
*Lapilli of nannofossil volcanic ash (max. of 7 mm) occur within a matrix of nannofossil volcanic ash. The clast zone is ungraded; irregular contacts with the volcanic ash and interfinger as mass flow deposit. Nannofossil volcanic ash very consistent throughout and occurs as the matrix of clast zone. The clasts are rounded, very soft and altered. Zeolites are phillipsite; radiolarians noticeable in smear slides, approaching 10% in Section 4.

Grain Size 2-72	Carbon Carbonate 4-74
0.6, 56.6, 42.8	1.4, 0.1, 11

X-ray 2-68 (Bulk)
31.1% Mont
27.1% Plag
25.6% Calc
11.8% Phil
3.2% Quar
1.2% Anal

Explanatory notes in chapter 1

Site 290 Hole Core 8 Cored Interval: 241.5-251.0 m



Section 1. VOLCANIC CONGLOMERATE (Unit 4) olive gray (5Y 3/2) to 125 cm moderate yellow brown (10YR 5/4) to 150 cm. Open framework of basaltic, igneous fragments, dark chert, black-dark glass, and some zeolite/calcite-lined voids; clasts (0.2-10 mm) are well sorted in upper portion, moderate to poor in lower; subangular to subrounded fragments in yellow brown matrix.

Section 2. As 125-150 cm in Section 1 with coarser clasts (1-3 cm) moderate sorting; weathering(?) rim noted on large (7 cm) diabase fragment. Faint grading noticed.

Section 3. Moderate yellow brown (10YR 3/4) with darker clasts; average size 3 mm inc. porp. basalt; glassy basalt, feldspar, altered volcanics, palagonite all within a zeolite-micrite matrix; moderately-well sorted and coarser towards bottom. Tendency for a closed framework.

Section 4. Coarser than Section 3 with poor sorting; maximum size is about 6 cm, average 3 mm; closed framework; basalt, chert, weathered volcanics, palagonite fragments. Matrix mud with white zeolite and calcite.

Section 5. Coarser than Section 4 with increase of large diabase fragments down section; clasts including: highly altered basalt, glass, diabase some with Mn crust;

Clast lithologies: 40% pumice
20% weathered pumice
5% minerals including pyroxene crystals
3% volcanic glass
2% diabase
in Matrix =30%

DIABASE* - Fragment (Cobble) (Minor Lith)
Thin Section: CC
Medium grained, ophitic texture; tabular to lath-like plagioclase poikilitically enclosed by clinopyroxene. Some alteration of clinopyroxene to brown, chloritic material.

*Fragment below conglomerate unit of core with diabase clasts.

THIN SECTION (DIABASE)
Plagioclase 60% (An_{35-55}) (An cores-Ab rims);
Pyroxenes 36% (Poikilitic clinopyroxene);
Chlorite 4% (alteration of pyroxene edges)
Magnetite-Ilmenite 2%

X-ray 1-77 (Bulk)	X-ray 5-52 (Bulk)
70.9% Phil	27.8% Plag
20.2% Augi	27.0% Calc
8.9% Mont	22.8% Phil
	21.8% Augi
	0.6% Quar

Explanatory notes in chapter 1

Site 290 Hole Core 9 Cored Interval: 251.0-255.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
EARLY OLIGOCENE OR LATE EOCENE	Helicopontosphaera reticulata or Discoaster barbadiensis	B	Fm	B		Core Catcher				CC *	5YR 3/4

Five sections of moderate brown (5YR 3/4) SILT-BEARING CLAY. Very soupy and flowed from liner upon retrival. Core apparently represents caving sediment representative of Core 1 - Hole abandoned due to collapse, after Core 9 was taken.

SILT-RICH CLAY
Smear: CC

Texture	Composition
86% clay	84% Clay minerals
14% Silt	7-10% Zeolite
	5% Quartz, Feldspar
	1- 2% Nannofossils
	1- 2% Fe-oxides

5 additional smears show: SILT-BEARING/RICH CLAY

Texture	Composition
85-98% Clay	77-86% Iron stained clay minerals
2-15% Silt	12-17% Zeolites (clinoptilolite and phillipsite)
	1- 4% Nannofossils
	1- 2% Quartz, Feldspar

PALEONTOLOGY: Mixture of upper Eocene nannofossils.

Explanatory notes in chapter 1

Site 290 Hole A Core 1 Cored Interval: 108.5-118.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	Sphenolithus ciperoensis	B	Aq Am	Fm Am Am		1	0.5 1.0	VOID			5YR 4/4 to 5YR 3/4
						2				* 110	
						Core Catcher				CC *	

Lithologic material is firm but is drilling breccia occurs within sections; colors are moderate brown (5YR 4/4) to moderate brown (5YR 3/4) and generally uniform. No structures are apparent in the core. Similar to Unit 2 in Hole 290 Core 3.

ASH/NANNOFOSSIL-BEARING SILTY CLAY
Smears: 2-110, CC

Texture	Composition
40-50% Silt	41-45% Clay minerals
50-60% Clay	25% Quartz, Feldspar
	10-12% Zeolites
	8-10% Nannofossils
	6-10% Volcanic glass
	5% Heavy minerals
	3- 6% Sponge spicules
	2% Fe-oxides

The zeolites are phillipsite: some discoasters present. May locally be ash-rich, and zeolite-rich.

Carbon Carbonate 2-104
1.0, 0.1, 8

X-ray 2-112 (Bulk)
29.8% Calc
27.4% Plag
19.1% Mont
13.5% Phil
6.9% Augi
3.4% Quar

Explanatory notes in chapter 1

Site 290 Hole A Core 2 Cored Interval: 130.5-140.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	Sphenolithus ciperoensis	B	Am	Rp		Core Catcher					10YR 5/4

VOLCANIC CONGLOMERATE

Color moderate yellow brown (10YR 5/4); clasts average 3 mm (up to 2-3 cm) including: basalt, glass, chert(?), altered volcanics, palagonite fragments; subangular to subrounded in a matrix of, dolomitized(?) calcite(?), zeolite mud. Unit equivalent to Unit 4 in Core 8 Hole 290.

Explanatory notes in chapter 1

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DEEP SEA DRILLING PROJECT

LEG 31 SITE 291

SITE SUMMARY SHEET

POSITION: Latitude: 291-12°48.43'N / 291A-12°48.45'N Longitude: 291-127°49.85'E / 291A-127°49.98'E

Water depth (from sea level): 5217 corrected meters (Echo sounding)

Bottom felt at: 5237.5 meters (drill pipe) Penetration: 291-126.5 m / 291A-114.5 m

Number of Holes: 2 Number of Cores: 291-5 and 291A-2

Total length of cored section: 291-41.0 m / 291A-16.5 m Total core recovered: 291-10.0 m / 291A-1.4 m

Percentage of core recovery: 291-24.4% and 291A-8.5%

OLDEST SEDIMENT CORED:

Depth below sea floor: 120.9 meters Nature: Compact brown clay

Age: late Eocene

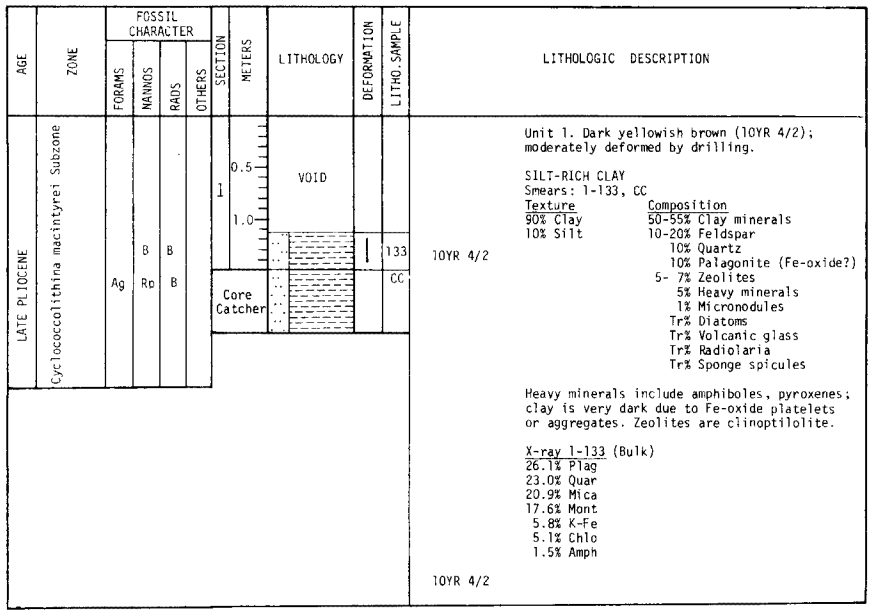
BASEMENT:

Depth below sea floor: 121 meters (drilled) Nature: Basalt

PRINCIPAL RESULTS:

Site 291 was located on a N20-30W trending bench near the crest of the outer swell of the Philippine Trench. The stratigraphic section encountered consists of brown clay with increasingly frequent nannofossil and radiolarian interbeds below 50 meters based on seismic records, or 69 meters where first cored. This section is Recent to late Eocene age with the nannofossil beds ending in early late Oligocene or later. From 101 to 118 meters is a dark brown ferruginous, and zeolite clay with nannofossil and radiolarian rich beds of late middle to late Eocene age. Both 291 and 291A bottomed in extrusive basalt with a glassy to very fine grained surface, in which high torques limited penetration to 5.5 meters. Major questions arise concerning the interpretation of the late Eocene to late Oligocene calcareous section, and the noncalcareous, nonvolcanic section immediately above basalt.

Site 291 Hole Core 1 Cored Interval: 0.0-3.0 m



LITHOLOGIC DESCRIPTION

Unit 1. Dark yellowish brown (10YR 4/2); moderately deformed by drilling.

SILT-RICH CLAY
Smears: 1-133, CC

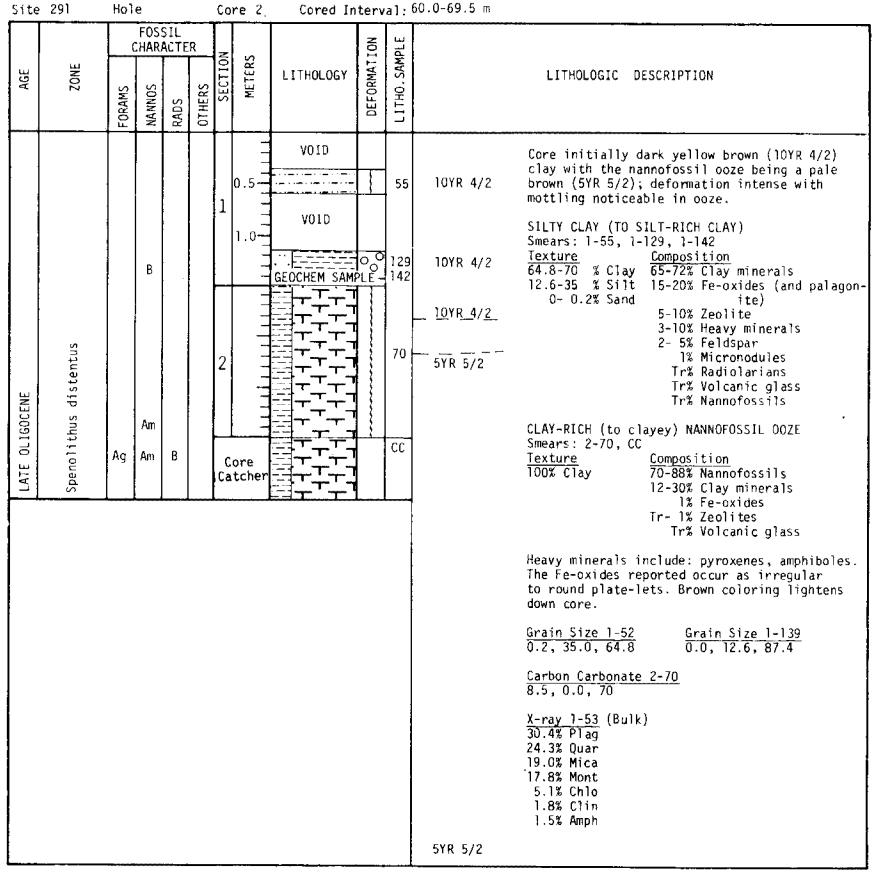
Texture	Composition
90% Clay	50-55% Clay minerals
10% Silt	10-20% Feldspar
	10% Quartz
	10% Palagonite (Fe-oxide?)
	5- 7% Zeolites
	5% Heavy minerals
	1% Micronodules
	Tr% Diatoms
	Tr% Volcanic glass
	Tr% Radiolaria
	Tr% Sponge spicules

Heavy minerals include amphiboles, pyroxenes; clay is very dark due to Fe-oxide platelets or aggregates. Zeolites are clinoptilolite.

X-ray 1-133 (Bulk)
26.1% Plag
23.0% Quar
20.9% Mica
17.6% Mont
5.8% K-Fe
5.1% Chlo
1.5% Amph

Explanatory notes in chapter 1

Site 291 Hole Core 2 Cored Interval: 60.0-69.5 m



LITHOLOGIC DESCRIPTION

Core initially dark yellow brown (10YR 4/2) clay with the nannofossil ooze being a pale brown (5YR 5/2); deformation intense with mottling noticeable in ooze.

SILTY CLAY (TO SILT-RICH CLAY)
Smears: 1-55, 1-129, 1-142

Texture		Composition
64.8-70	% Clay	65-72% Clay minerals
12.6-35	% Silt	15-20% Fe-oxides (and palagonite)
0- 0.2%	Sand	5-10% Zeolite
		3-10% Heavy minerals
		2- 5% Feldspar
		1% Micronodules
		Tr% Radiolarians
		Tr% Volcanic glass
		Tr% Nannofossils

CLAY-RICH (to clayey) NANNOFOSSIL OOZE
Smears: 2-70, CC

Texture	Composition
100% Clay	70-88% Nannofossils
	12-30% Clay minerals
	1% Fe-oxides
	Tr- 1% Zeolites
	Tr% Volcanic glass

Heavy minerals include: pyroxenes, amphiboles. The Fe-oxides reported occur as irregular to round plate-lets. Brown coloring lightens down core.

Grain Size 1-52
0.2, 35.0, 64.8

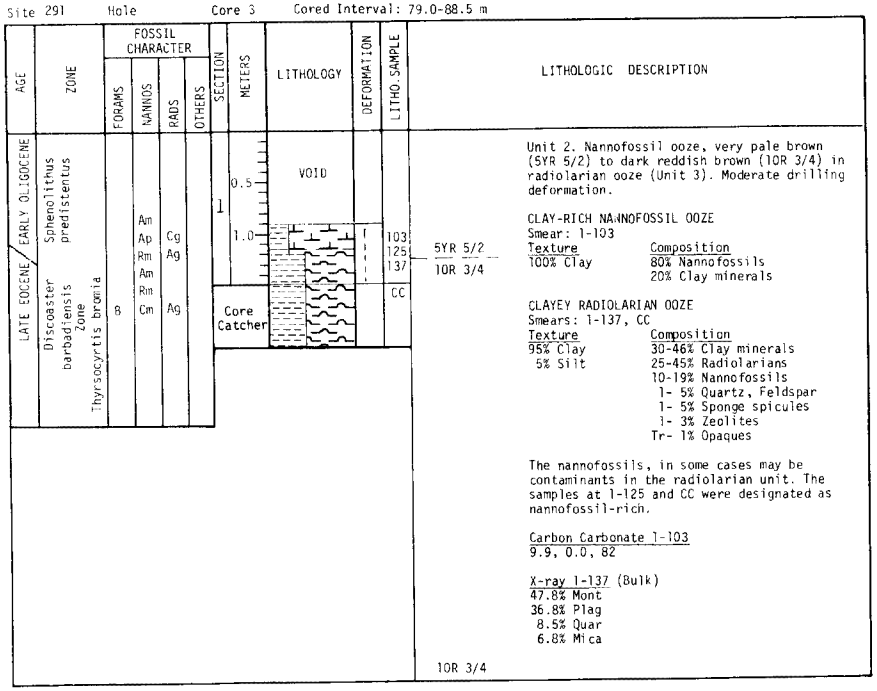
Grain Size 1-139
0.0, 12.6, 87.4

Carbon Carbonate 2-70
8.5, 0.0, 70

X-ray 1-53 (Bulk)
30.4% Plag
24.3% Quar
19.0% Mica
17.8% Mont
5.1% Chlo
1.8% Clin
1.5% Amph

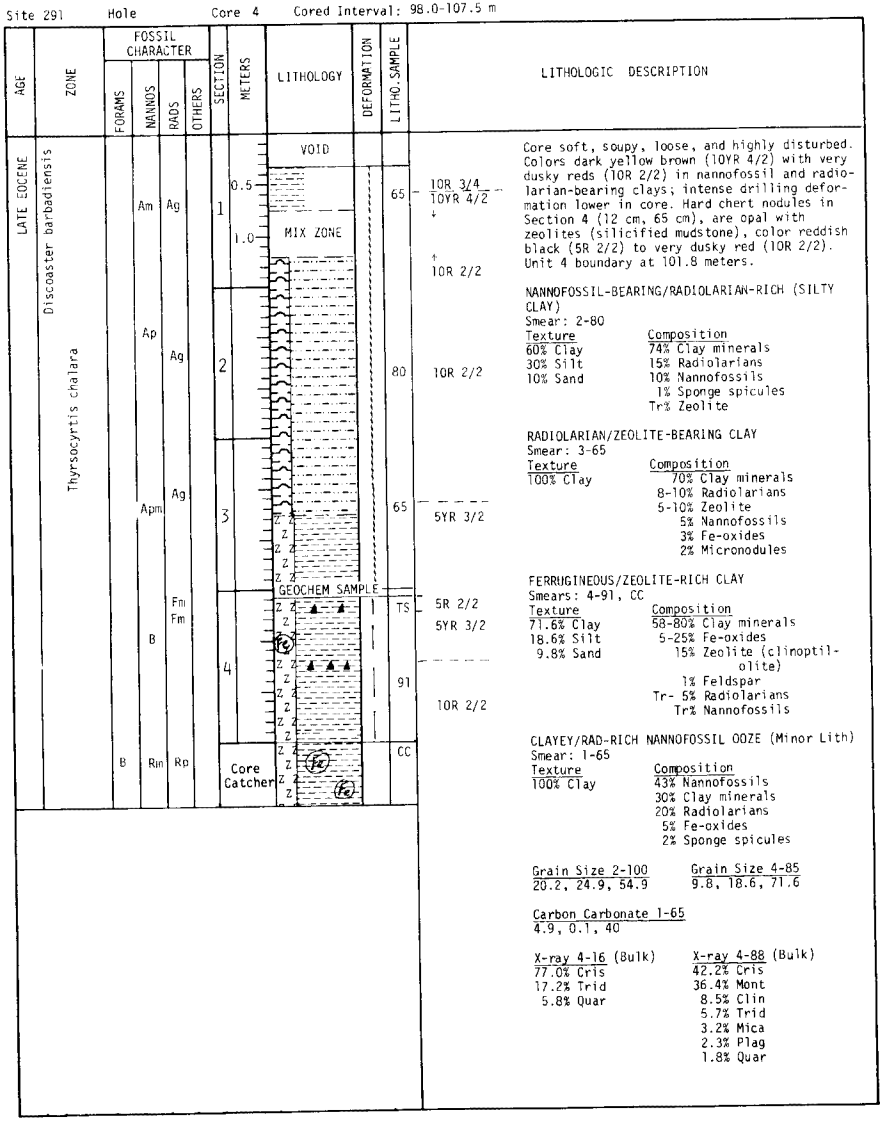
Explanatory notes in chapter 1

Site 291 Hole Core 3 Cored Interval: 79.0-88.5 m



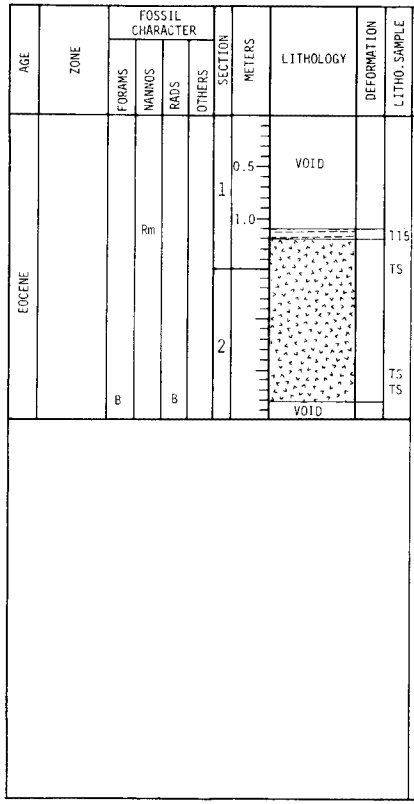
Explanatory notes in chapter 1

Site 291 Hole Core 4 Cored Interval: 98.0-107.5 m



Explanatory notes in chapter 1

Site 291 Hole Core 5 Cored Interval: 117.0-126.5 m



LITHOLOGIC DESCRIPTION

5YR 4/4

Unit 5. Core is basalt with two small fragments of mildly-indurated ferrugineous/zeolite-bearing clays at 113-121 cm; moderate brown (5YR 4/4) color.

BASALT: Tabular to acicular plagioclase in fine-grained groundmass of pyroxene; calcite veinlets.

Composition (Ranges) from thin sections
60-65% Groundmass
23-60% Plagioclase
35-56% Pyroxene
2- 8% Opaques
5-40% Glass
35-40% Phenocrysts
35-40% Plagioclase

FERRUGINEOUS/ZEOLITE-BEARING CLAY (MINOR LITH)
Smear: 1-115

Texture	Composition
95% Clay	87% Clay minerals
5% Silt	5% Fe-oxides
	5% Zeolite
	1% Heavy minerals
	1% Micronodules
	1% Feldspar

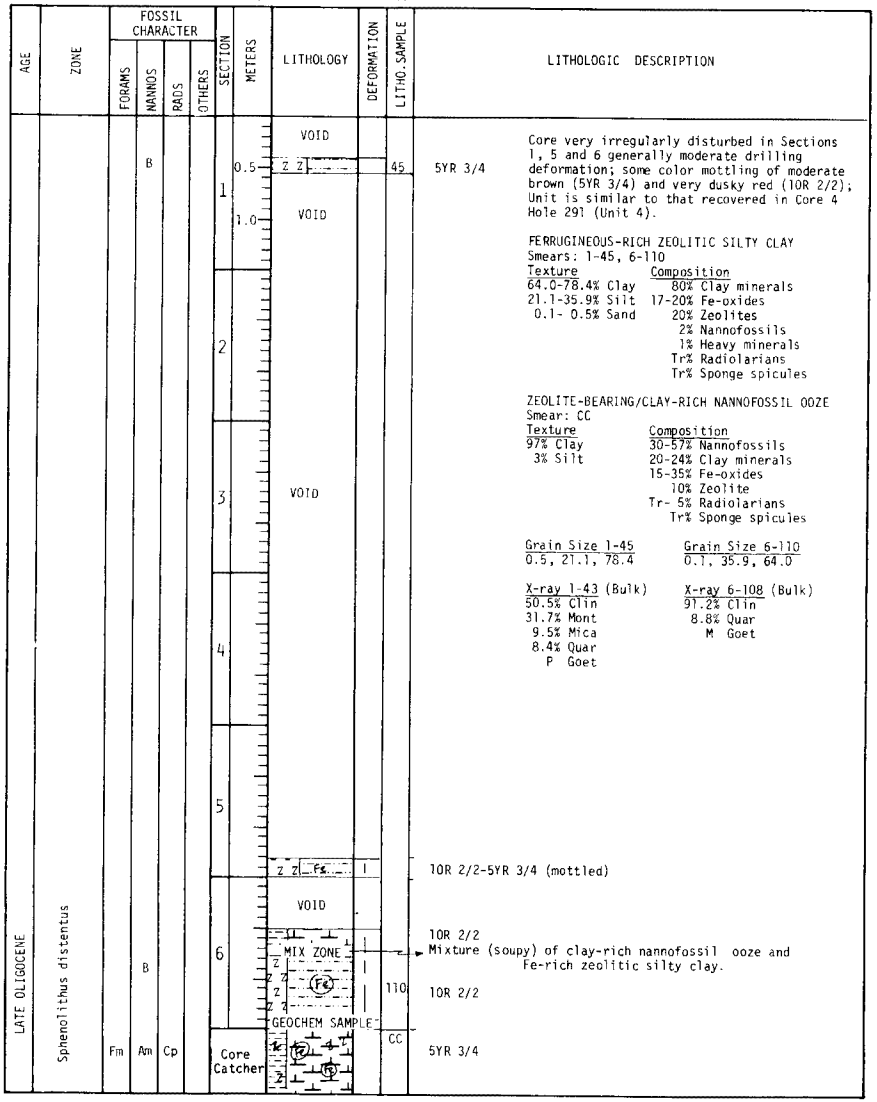
*After Core 5 had been taken a quantity of material was recovered from the core barrel after pipe had been pulled, and even though a new coring interval had not occurred. The sample designated Sample 5A contained four pieces of basalt and some moderate brown (5YR 4/4) nannofossil-rich ferrugineous clay.

NANNOFOSSIL-RICH FERRUGINEOUS SILTY CLAY
Smear: 5A

Texture	Composition
60% Clay	45% Clay minerals
40% Silt	25% Fe-oxides
	20% Nannofossils
	5% Zeolites
	4% Feldspar
	2% Heavies
	Tr% Volcanic glass

Explanatory notes in chapter 1

Site 291 Hole A Core 1 Cored Interval: 98.0-107.5 m



LITHOLOGIC DESCRIPTION

5YR 3/4

Core very irregularly disturbed in Sections 1, 5 and 6 generally moderate drilling deformation; some color mottling of moderate brown (5YR 3/4) and very dusky red (10R 2/2); Unit is similar to that recovered in Core 4 Hole 291 (Unit 4).

FERRUGINEOUS-RICH ZEOLITIC SILTY CLAY
Smears: 1-45, 6-110

Texture	Composition
64.0-78.4% Clay	80% Clay minerals
21.1-35.9% Silt	17-20% Fe-oxides
0.1- 0.5% Sand	20% Zeolites
	2% Nannofossils
	1% Heavy minerals
	Tr% Radiolarians
	Tr% Sponge spicules

ZEOLITE-BEARING/CLAY-RICH NANNOFOSSIL OOZE
Smear: CC

Texture	Composition
97% Clay	30-57% Nannofossils
3% Silt	20-24% Clay minerals
	15-35% Fe-oxides
	10% Zeolite
	Tr- 5% Radiolarians
	Tr% Sponge spicules

Grain Size 1-45	Grain Size 6-110
0.5, 21.1, 78.4	0.1, 35.9, 64.0

X-ray 1-43 (Bulk)	X-ray 6-108 (Bulk)
50.5% Clin	91.2% Clin
31.7% Mont	8.8% Quar
9.5% Mica	M Goet
8.4% Quar	
P Goet	

10R 2/2-5YR 3/4 (mottled)

10R 2/2
Mixture (soupy) of clay-rich nannofossil ooze and Fe-rich zeolitic silty clay.

10R 2/2

5YR 3/4

Explanatory notes in chapter 1

Site 291 Hole A Core 2 Cored Interval: 107.5-114.5 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	FOSSIL CHARACTER: NANNOS	FOSSIL CHARACTER: RADS	FOSSIL CHARACTER: OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
LATE EOCENE	D. barbadiensis	Fg	Rm	Rp		Core Catcher					10R 2/2 and 5YR 4/4 — Core catcher sample contained mixture of clay = (Fe-rich), clay-rich nannofossil oozes, and basalt fragments. *After drill pipe was brought on deck upon hole termination the core barrel contained basalt fragments, with minor amounts of moderate brown (5YR 4/4) clay-rich nannofossil ooze. Sample was designated as Sample 2A for Hole 291A.

Explanatory notes in chapter 1

DEEP SEA DRILLING PROJECT

LEG 31 SITE 292

SITE SUMMARY SHEET

POSITION: Latitude: 15°49.11'N Longitude: 124°39.05'E

Water depth (from sea level): 2943 corrected meters (Echo sounding)

Bottom felt at: 2937 meters (drill pipe) Penetration: 443.5 meters

Number of Holes: 1 Number of Cores: 47

Total length of cored section: 443.5 m Total core recovered: 242.7 m

Percentage of core recovery: 55%

OLDEST SEDIMENT CORED:

Depth below sea floor: 367.5 meters Nature: Nannofossil chalk-ooze

Age: late Eocene Measured Velocity: 2.09-4.41 km/sec

BASEMENT:

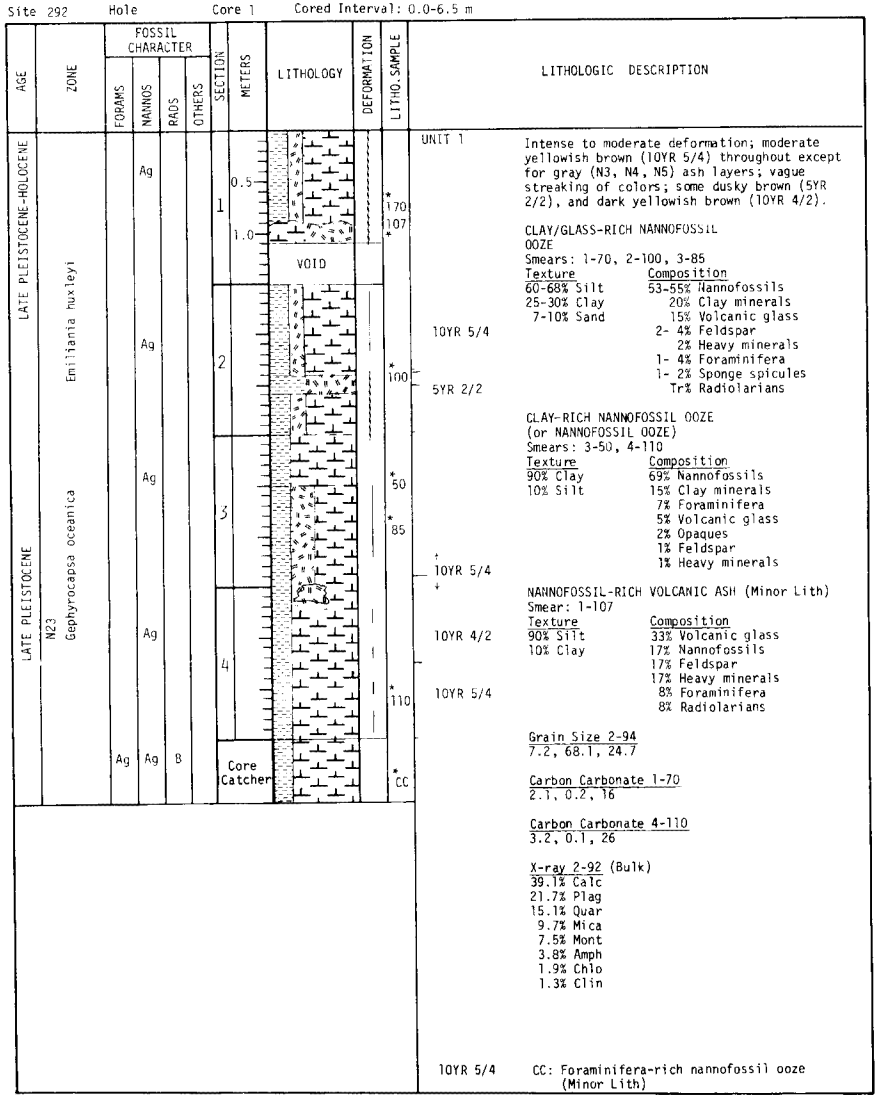
Depth below sea floor: 367.5-443.5 meters (drilled)

Inferred velocity to basement: 4.02 km/sec at top Nature: Basalt

PRINCIPAL RESULTS:

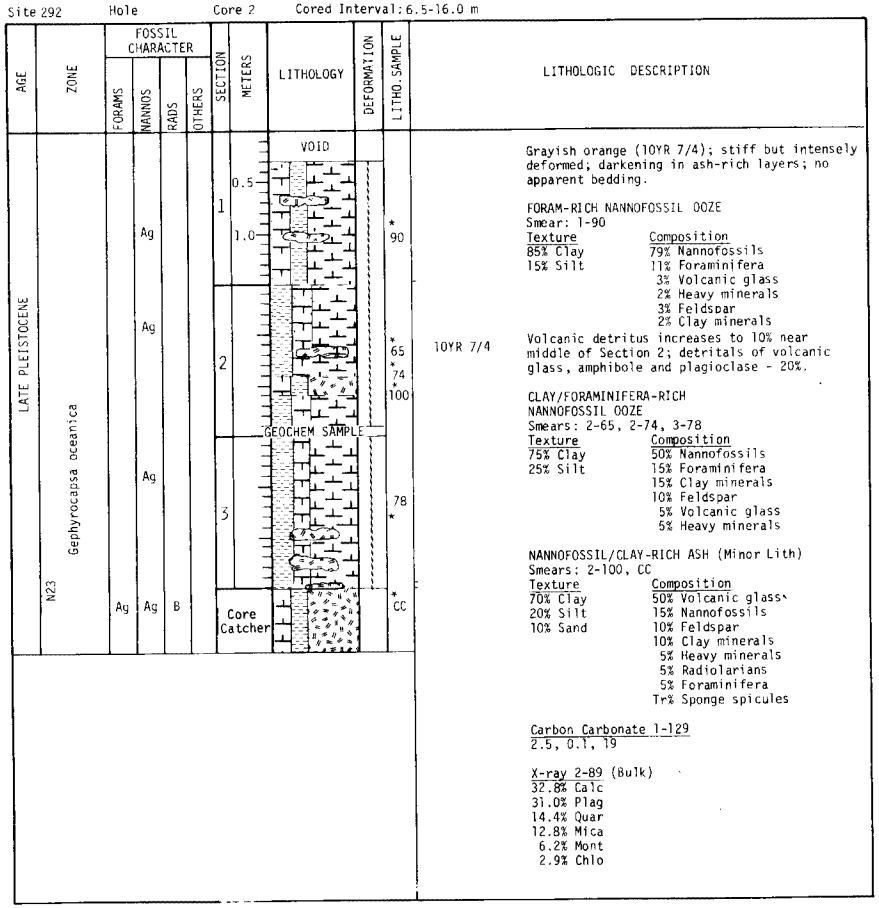
An excellent biostratigraphic reference section was penetrated on the southeastern flank of Benham Rise consisting of 154 meters of Pleistocene-late Oligocene nannofossil ooze, 71 meters of late to early Oligocene nannofossil ooze and chalk, and 142.5 meters of early Oligocene-late Eocene ooze, chalk, and minor chert underlain by basalt. Basalt was penetrated from 367.5 to 443.5 meters below the sea floor. A significant seismic reflector is correlated with a possible paleontologic hiatus at 101.5 meters marked by the apparent absence of planktonic foraminiferal zones N11 through N6 apparently related to a period of intermitant of erosion or nondeposition across the rise in early to mid Miocene time. Another minor hiatus is also indicated at 108.3 meters by the absence of the Helicopontosphaera ampliaperta Zone. Vugular basalt and displaced Eocene-Oligocene fossils indicate a history of subsidence for the rise after its formation in the mid to late Eocene.

Site 292 Hole Core 1 Cored Interval: 0.0-6.5 m



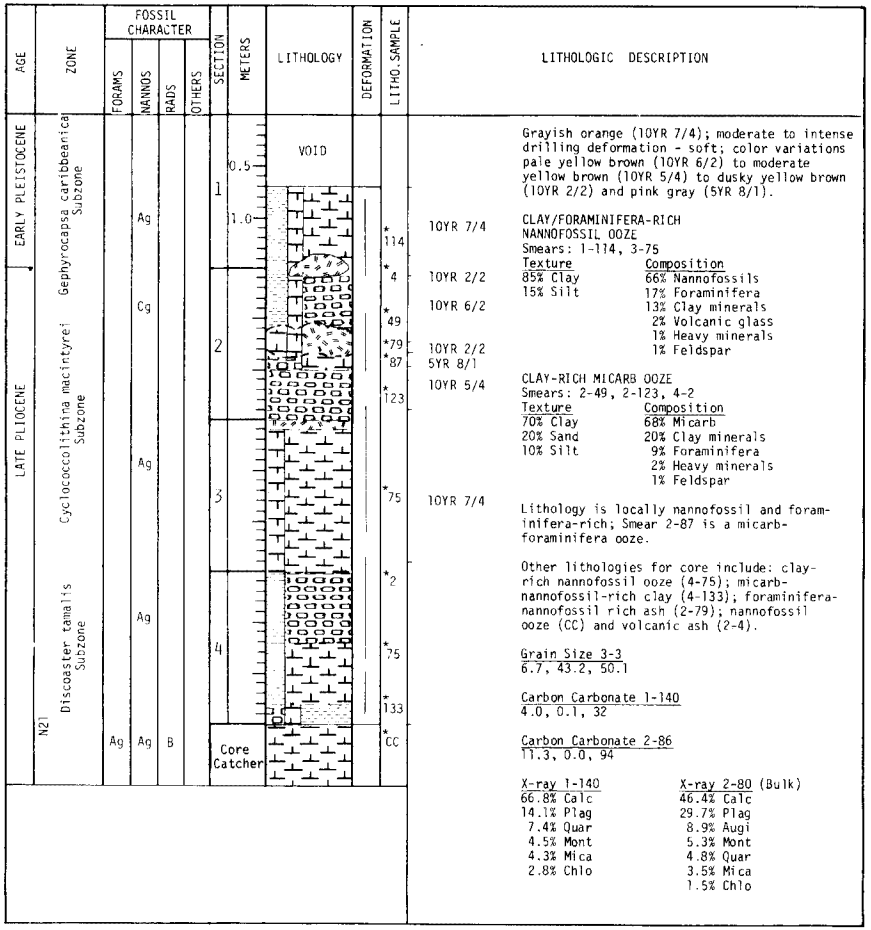
Explanatory notes in chapter 1

Site 292 Hole Core 2 Cored Interval: 6.5-16.0 m



Explanatory notes in chapter 1

Site 292 Hole Core 3 Cored Interval: 16.0-25.5 m



Grayish orange (10YR 7/4); moderate to intense drilling deformation - soft; color variations pale yellow brown (10YR 6/2) to moderate yellow brown (10YR 5/4) to dusky yellow brown (10YR 2/2) and pink gray (5YR 8/1).

CLAY/FORAMINIFERA-RICH NANNOFOSSIL OOZE
Smears: 1-114, 3-75

Texture	Composition
85% Clay	66% Nannofossils
15% Silt	17% Foraminifera
	13% Clay minerals
	2% Volcanic glass
	1% Heavy minerals
	1% Feldspar

CLAY-RICH MICARB OOZE
Smears: 2-49, 2-123, 4-2

Texture	Composition
70% Clay	68% Micarb
20% Sand	20% Clay minerals
10% Silt	9% Foraminifera
	2% Heavy minerals
	1% Feldspar

Lithology is locally nannofossil and foraminifera-rich; Smear 2-87 is a micarb-foraminifera ooze.

Other lithologies for core include: clay-rich nannofossil ooze (4-75); micarb-nannofossil-rich clay (4-133); foraminifera-nannofossil rich ash (2-79); nannofossil ooze (CC) and volcanic ash (2-4).

Grain Size 3-3
6.7, 43.2, 50.1

Carbon Carbonate 1-140
4.0, 0.1, 32

Carbon Carbonate 2-86
11.3, 0.0, 94

X-ray 1-140

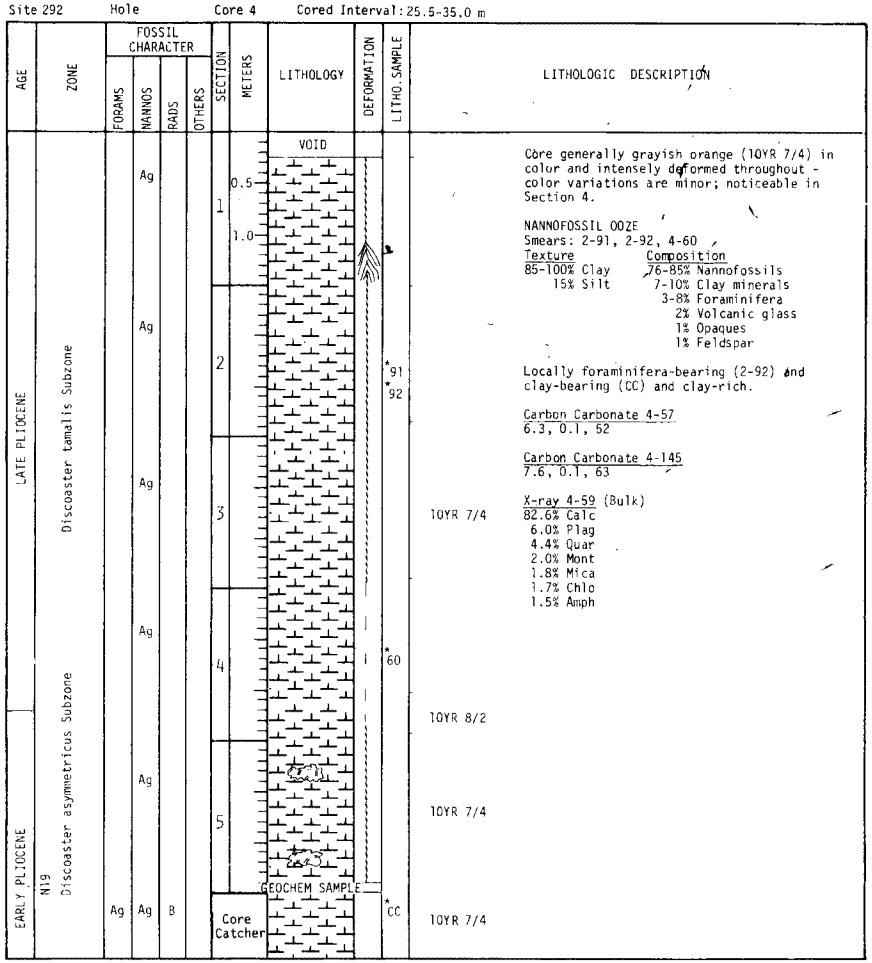
66.8% Calc	
14.1% Plag	
7.4% Quar	
4.5% Mont	
4.3% Mica	
2.8% Chlo	

X-ray 2-80 (Bulk)

46.4% Calc	
29.7% Plag	
8.9% Augi	
5.3% Mont	
4.8% Quar	
3.5% Mica	
1.5% Chlo	

Explanatory notes in chapter 1

Site 292 Hole Core 4 Cored Interval: 25.5-35.0 m



Core generally grayish orange (10YR 7/4) in color and intensely deformed throughout - color variations are minor; noticeable in Section 4.

NANNOFOSSIL OOZE
Smears: 2-91, 2-92, 4-60

Texture	Composition
85-100% Clay	76-85% Nannofossils
15% Silt	7-10% Clay minerals
	3-8% Foraminifera
	2% Volcanic glass
	1% Opaques
	1% Feldspar

Locally foraminifera-bearing (2-92) and clay-bearing (CC) and clay-rich.

Carbon Carbonate 4-57
6.3, 0.1, 52

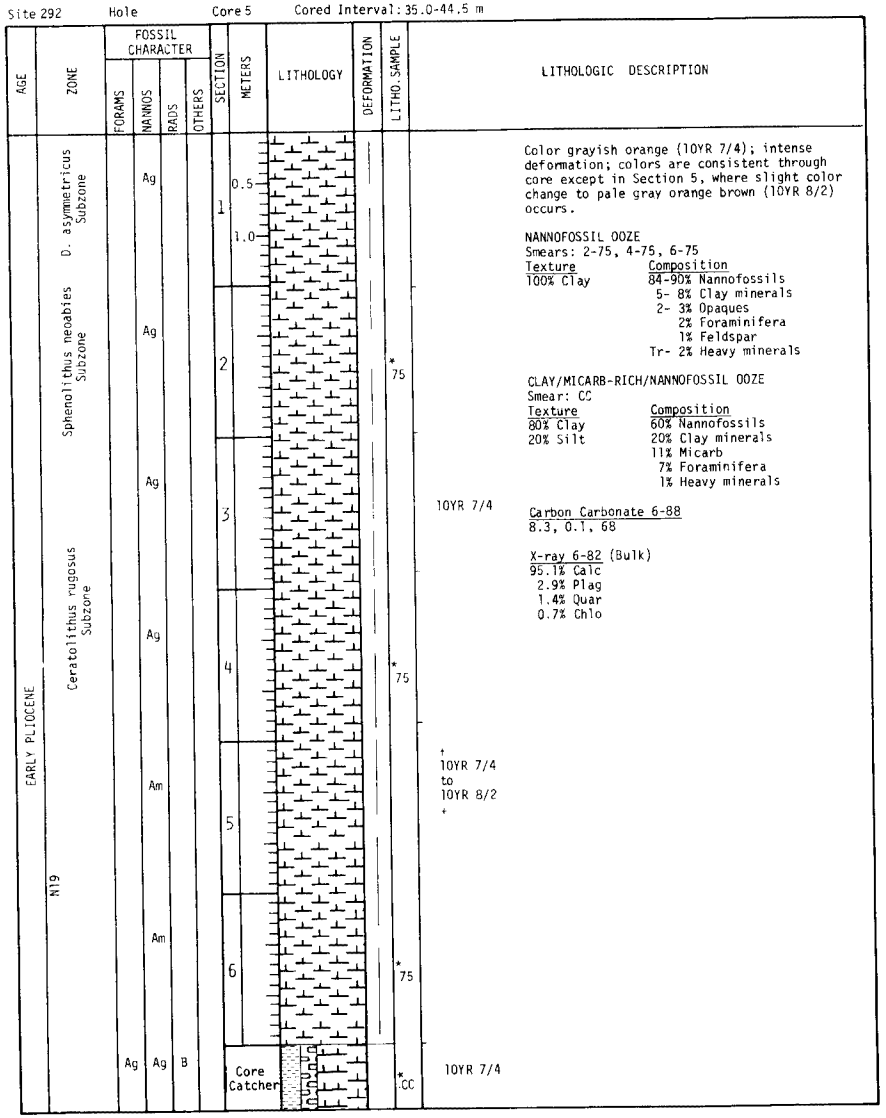
Carbon Carbonate 4-145
7.6, 0.1, 63

X-ray 4-59 (Bulk)

82.6% Calc
6.0% Plag
4.4% Quar
2.0% Mont
1.8% Mica
1.7% Chlo
1.5% Amph

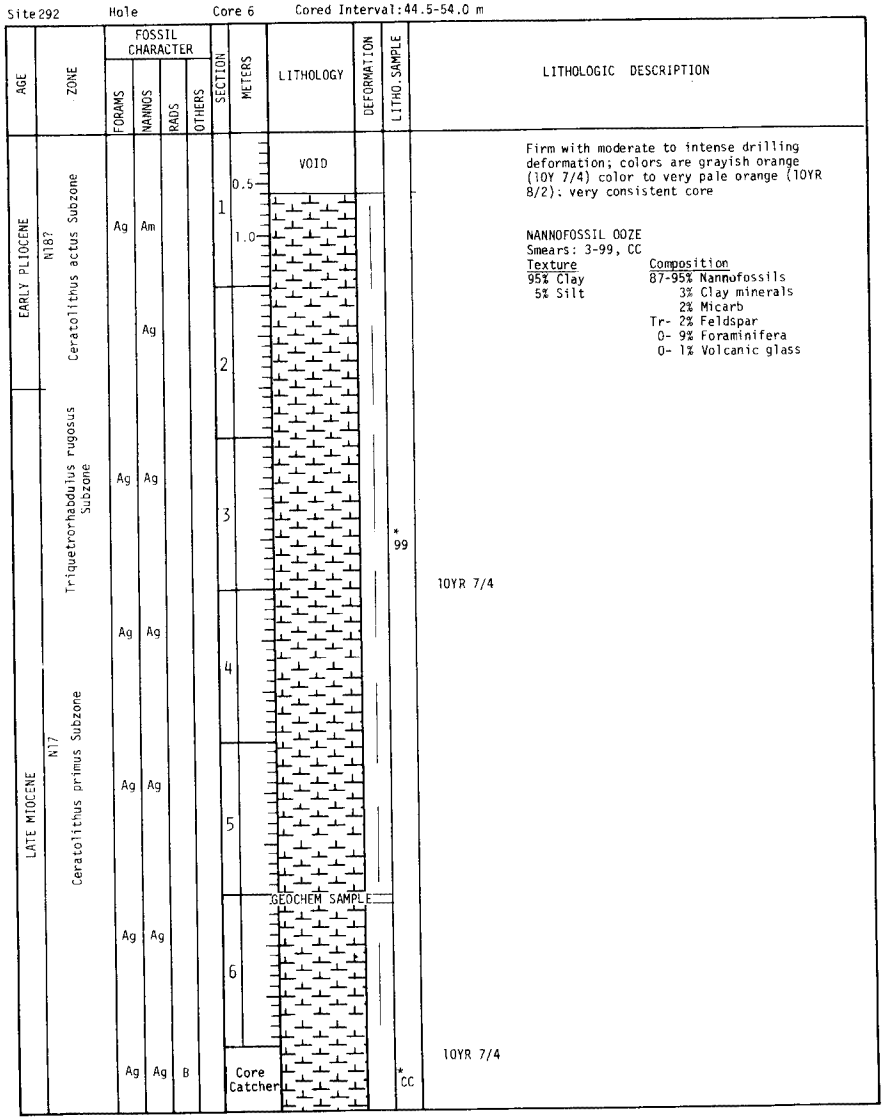
Explanatory notes in chapter 1

Site 292 Hole Core 5 Cored Interval: 35.0-44.5 m



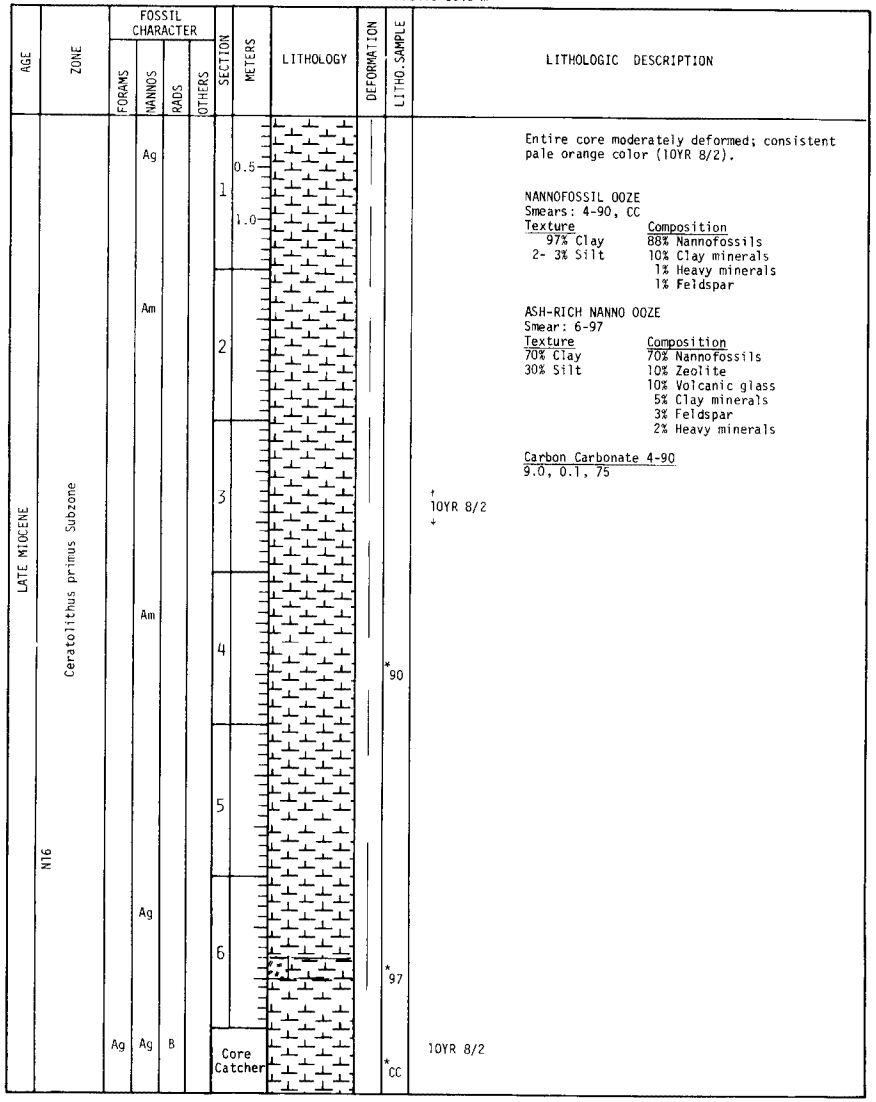
Explanatory notes in chapter 1

Site 292 Hole Core 6 Cored Interval: 44.5-54.0 m



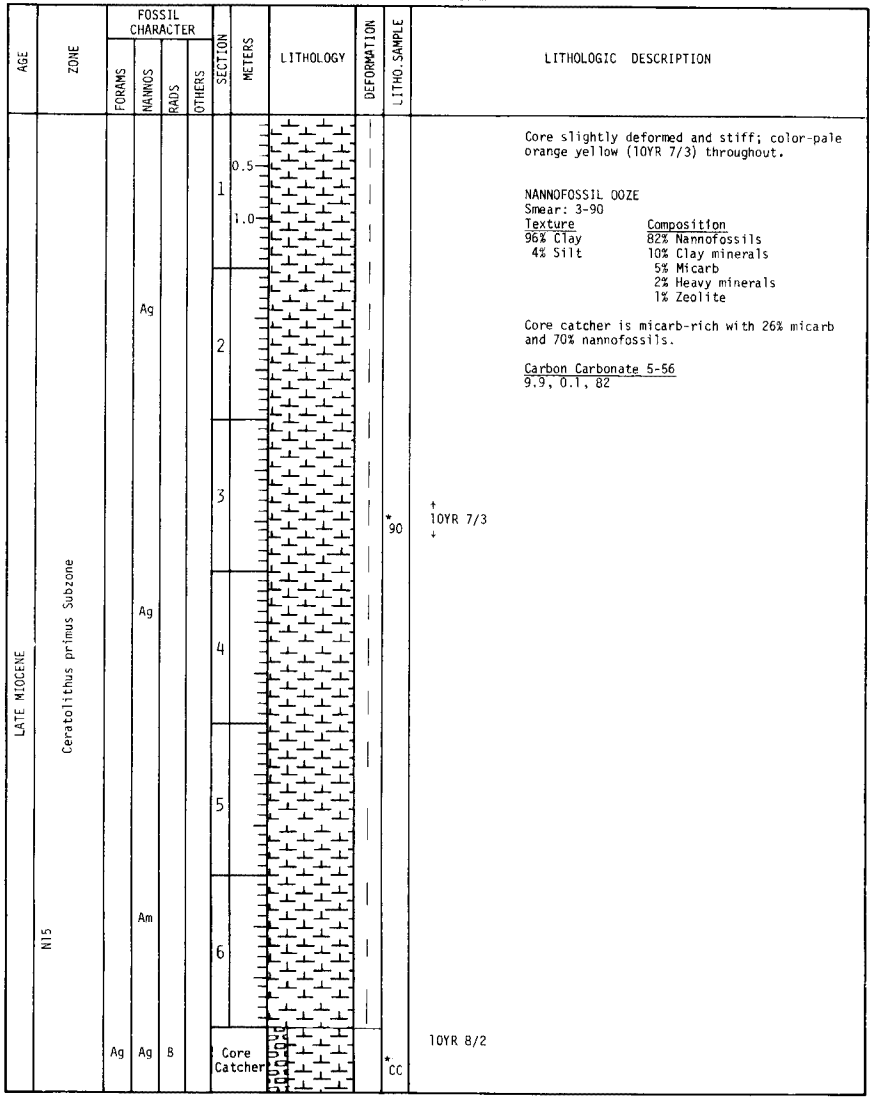
Explanatory notes in chapter 1

Site 292 Hole Core 7 Cored Interval: 54.0-63.5 m



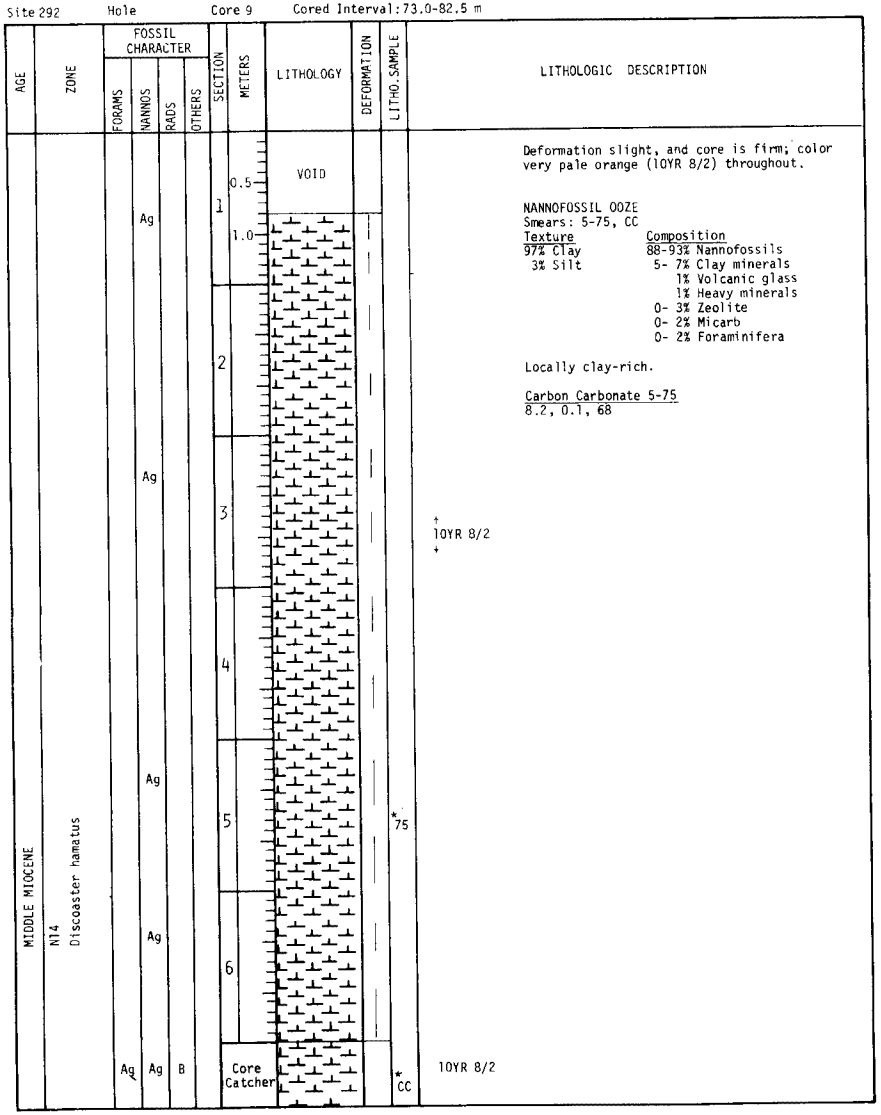
Explanatory notes in chapter 1

Site 292 Hole Core 8 Cored Interval: 63.5-73.0 m



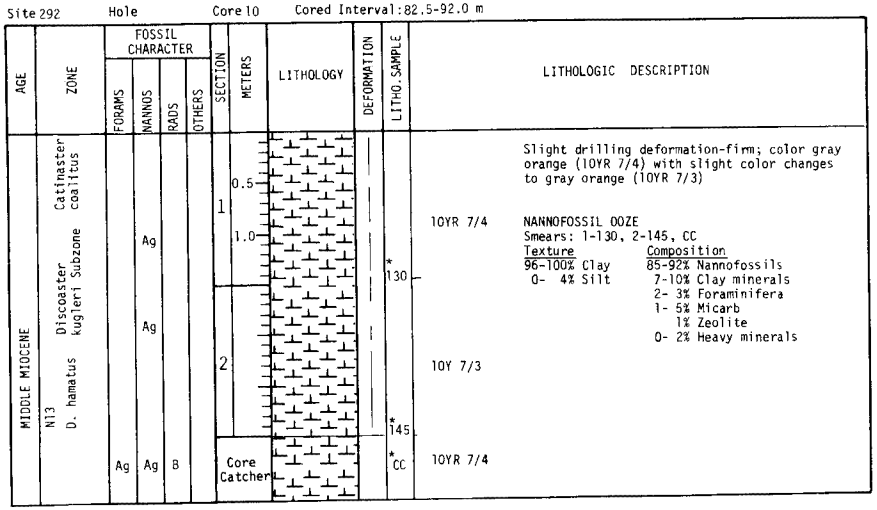
Explanatory notes in chapter 1

Site 292 Hole Core 9 Cored Interval: 73.0-82.5 m



Explanatory notes in chapter 1

Site 292 Hole Core 10 Cored Interval: 82.5-92.0 m



Explanatory notes in chapter 1

Site 292 Hole Core 11 Cored Interval: 92.0-101.5 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE MIOCENE	N12 Sphenolithus heteromorphus / Coccolithus miopelagicus Subzone	Ag	Ap			1	0.5				Slight deformation; color gray orange (10YR 7/4) except ash beds; burrow mottling and vague, thick (10-14 cm) bedding which is alternation of homogeneous and burrow-mottled beds
							1.0			* 95 * 122	10YR 6/2
			Ap			2				* 75	NANNOFOSSIL OOZE Smear: 2-75 Texture: 100% Clay Composition: 76% Nannofossils, 10% Clay minerals, 10% Foraminifera, 2% Micarb, 1% Zeolite (Clinoptilolite), 1% Volcanic glass
		Ag	Ap			3					VOLCANIC ASH (Minor Lith) Smear: 1-122 Texture: 87% Clay, 10% Silt, 3% Sand Composition: 82% Clay, Volcanic ash, 10% Quartz, Feldspar, 5% Heavy minerals, 2% Micarb, 1% Nannofossils
			Am			4					NANNOFOSSIL ASH (Minor Lith) Smear: 1-95 Texture: 89% Clay, 10% Silt, 1% Sand Composition: 50% Clay, Volcanic ash, 38% Nannofossils, 4% Quartz, Feldspar, 3% Zeolite, 2% Heavy minerals, 2% Foraminifera, 1% Micarb
											10YR 7/4
		Ag	Ap			5		GEOCHEM SAMPLE			Carbon Carbonate 2-75 7.2, 0.1, 59
		Ag	Ap			6					
		Ag	Ag	B		Core Catcher					10YR 7/4

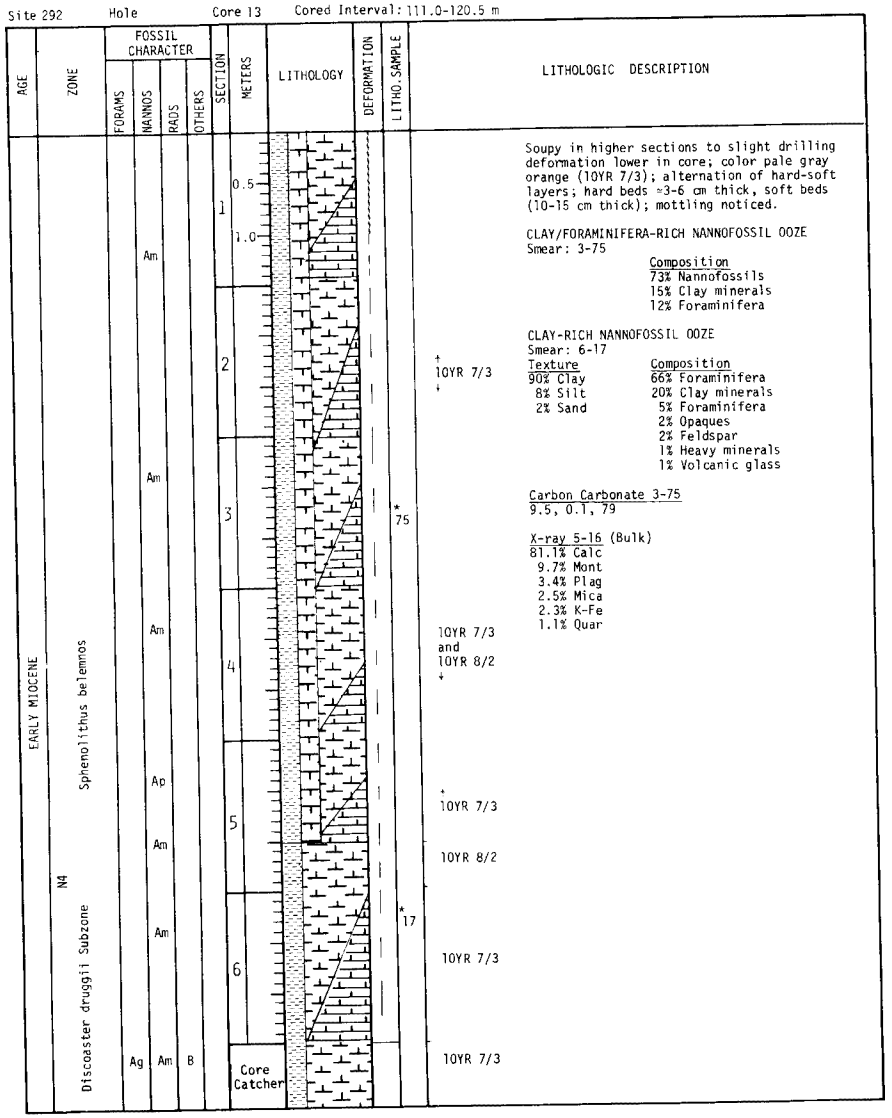
Explanatory notes in chapter 1

Site 292 Hole Core 12 Cored Interval: 101.5-111.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
EARLY MIOCENE (FORAM)	N5 Sphenolithus heteromorphus					1	0.5	VOID			Slight deformed-stiff; color pale gray orange (10YR 7/4) with some pale yellow brown (10YR 6/2) and very pale orange (10YR 8/2); some vague bedding (7-11 cm thick) and slight color mottling; semilithification to chalk increases with depth.
							1.0				FORAMINIFERA-RICH NANNOFOSSIL OOZE Smear: 2-110 Texture: 90% Clay, 10% Silt Composition: 79% Nannofossils, 12% Foraminifera, 9% Clay mineral, Tr% Volcanic glass
		Ag	Ap			2		VOID		* 110	Volcanic ash beds at 35-40 cm (Section 2) and 120-150 cm (Section 3).
			Ap								CLAY AND FORAMINIFERA-RICH NANNOFOSSIL OOZE Smear: 4-30 Texture: 90% Clay, 10% Silt Composition: 69% Nannofossil, 15% Clay minerals, 15% Foraminifera, 1% Quartz, Feldspar, Tr% Zeolite
		Ag	Am			3					10YR 7/3
											Carbon Carbonate 2-110 10.1, 0.1, 84
			Am			4				* 30	Carbon Carbonate 4-130 9.2, 0.1, 76
											10YR 6/2
											10YR 8/2
			Am			5					↑ 10YR 7/4
											10YR 7/3
EARLY MIOCENE	N4 Sphenolithus belemnos	Ag	Ag	B		Core Catcher					10YR 7/3

Explanatory notes in chapter 1

Site 292 Hole Core 13 Cored Interval: 111.0-120.5 m



Soupy in higher sections to slight drilling deformation lower in core; color pale gray orange (10YR 7/3); alternation of hard-soft layers; hard beds ≈3-6 cm thick, soft beds (10-15 cm thick); mottling noticed.

CLAY/FORAMINIFERA-RICH NANNOFOSSIL OOZE
Smear: 3-75

Composition
73% Nannofossils
15% Clay minerals
12% Foraminifera

CLAY-RICH NANNOFOSSIL OOZE
Smear: 6-17

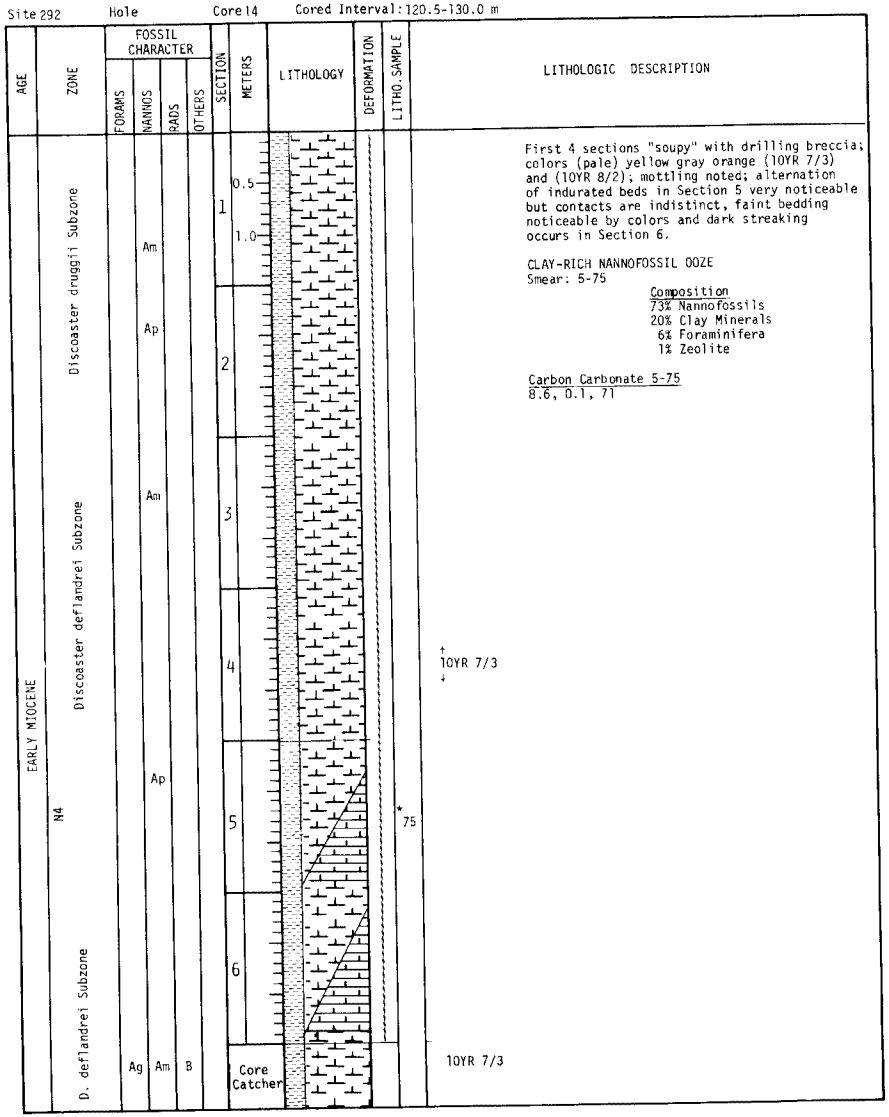
Texture	Composition
90% Clay	66% Foraminifera
8% Silt	20% Clay minerals
2% Sand	5% Foraminifera
	2% Opaques
	2% Feldspar
	1% Heavy minerals
	1% Volcanic glass

Carbon Carbonate 3-75
9.5, 0.1, 79

X-ray 5-16 (Bulk)
81.1% Calc
9.7% Mont
3.4% Plag
2.5% Mica
2.3% K-Fe
1.1% Quar

Explanatory notes in chapter 1

Site 292 Hole Core 14 Cored Interval: 120.5-130.0 m



First 4 sections "soupy" with drilling breccia; colors (pale) yellow gray orange (10YR 7/3) and (10YR 8/2); mottling noted; alternation of indurated beds in Section 5 very noticeable but contacts are indistinct, faint bedding noticeable by colors and dark streaking occurs in Section 6.

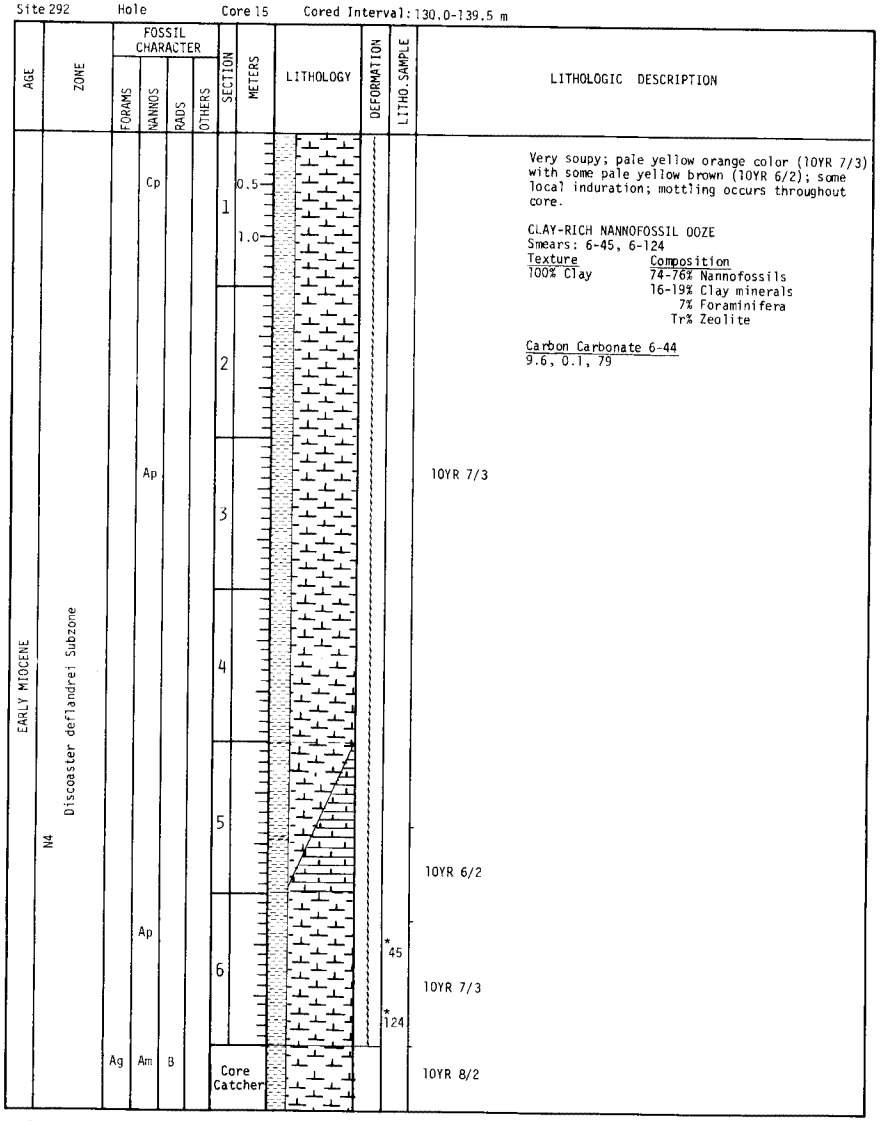
CLAY-RICH NANNOFOSSIL OOZE
Smear: 5-75

Composition
73% Nannofossils
20% Clay Minerals
6% Foraminifera
1% Zeolite

Carbon Carbonate 5-75
8.6, 0.1, 71

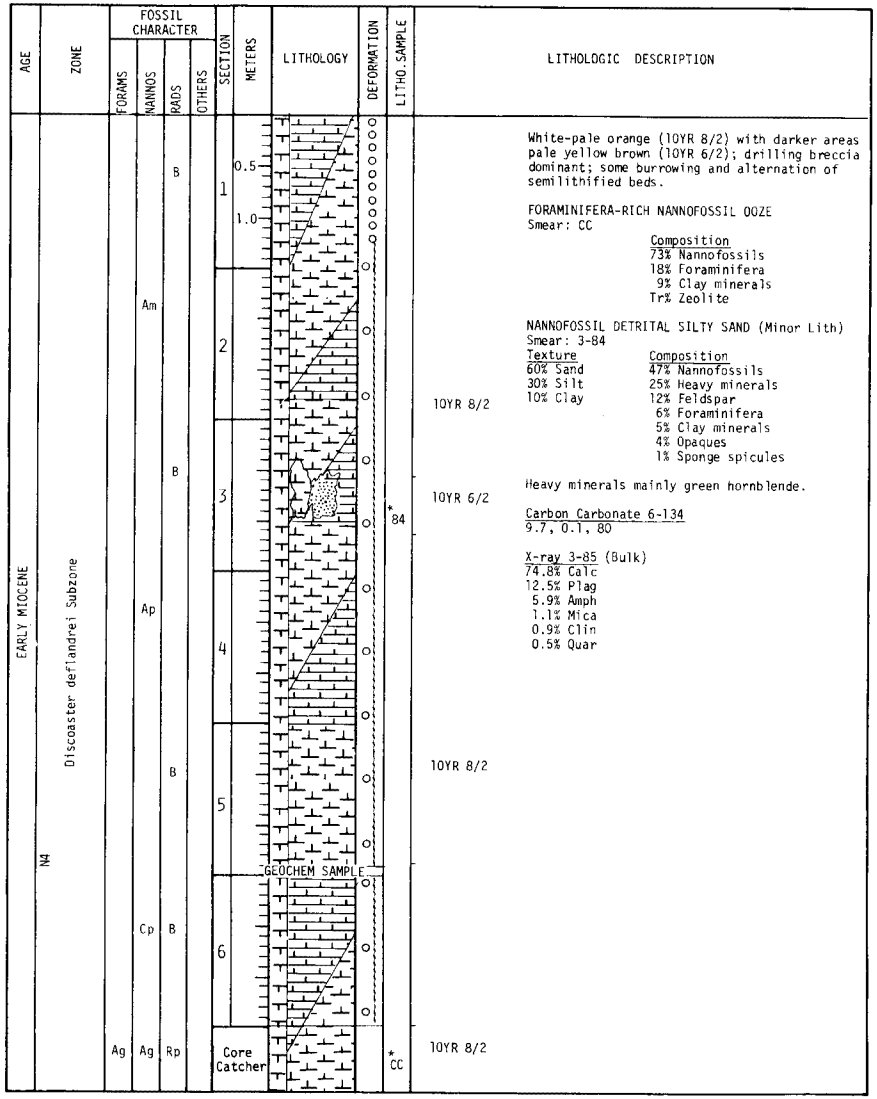
Explanatory notes in chapter 1

Site 292 Hole Core 15 Cored Interval: 130.0-139.5 m



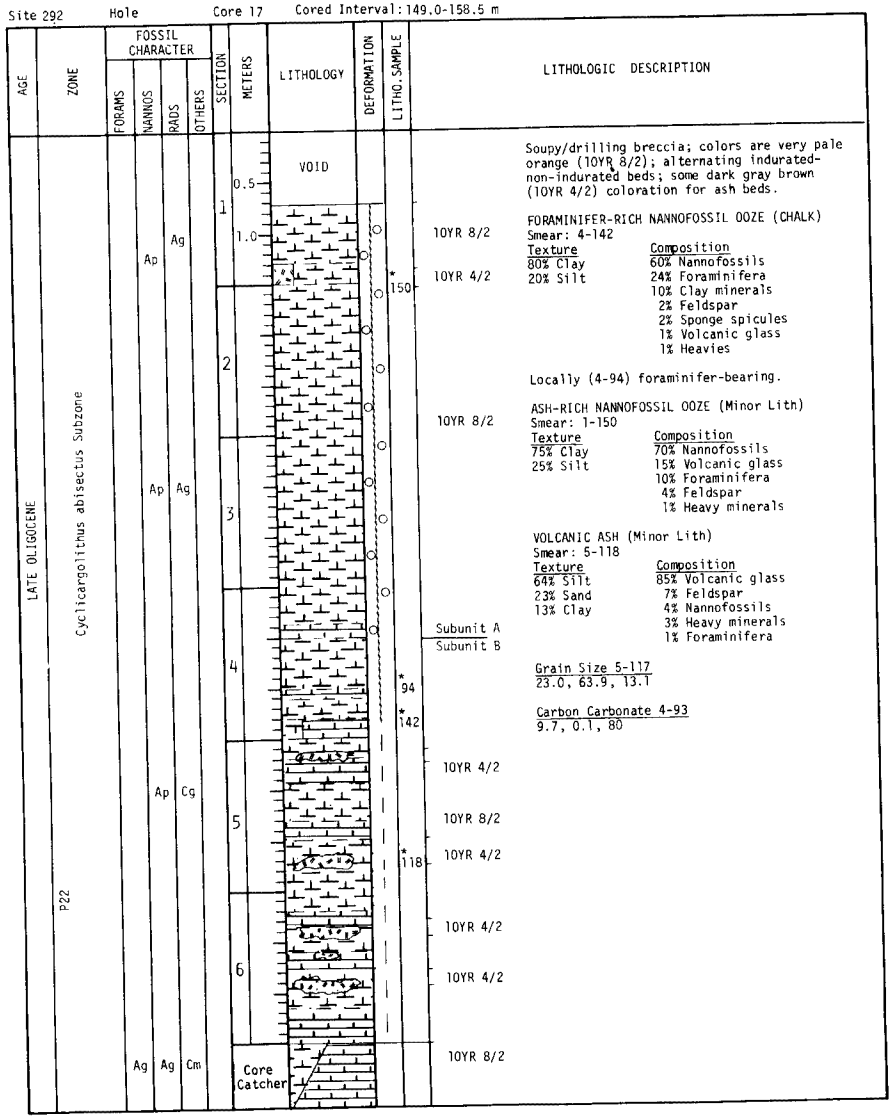
Explanatory notes in chapter 1

Site 292 Hole Core 16 Cored Interval: 139.5-149.0 m



Explanatory notes in chapter 1

Site 292 Hole Core 17 Cored Interval: 149.0-158.5 m



Soupy/drilling breccia; colors are very pale orange (10YR 8/2); alternating indurated-non-indurated beds; some dark gray brown (10YR 4/2) coloration for ash beds.

FORAMINIFER-RICH NANNOFOSSIL OOZE (CHALK)
Smear: 4-142

Texture	Composition
80% Clay	60% Nannofossils
20% Silt	24% Foraminifera
	10% Clay minerals
	2% Feldspar
	2% Sponge spicules
	1% Volcanic glass
	1% Heavies

Locally (4-94) foraminifer-bearing.

ASH-RICH NANNOFOSSIL OOZE (Minor Lith)
Smear: 1-150

Texture	Composition
75% Clay	70% Nannofossils
25% Silt	15% Volcanic glass
	10% Foraminifera
	4% Feldspar
	1% Heavy minerals

VOLCANIC ASH (Minor Lith)
Smear: 5-118

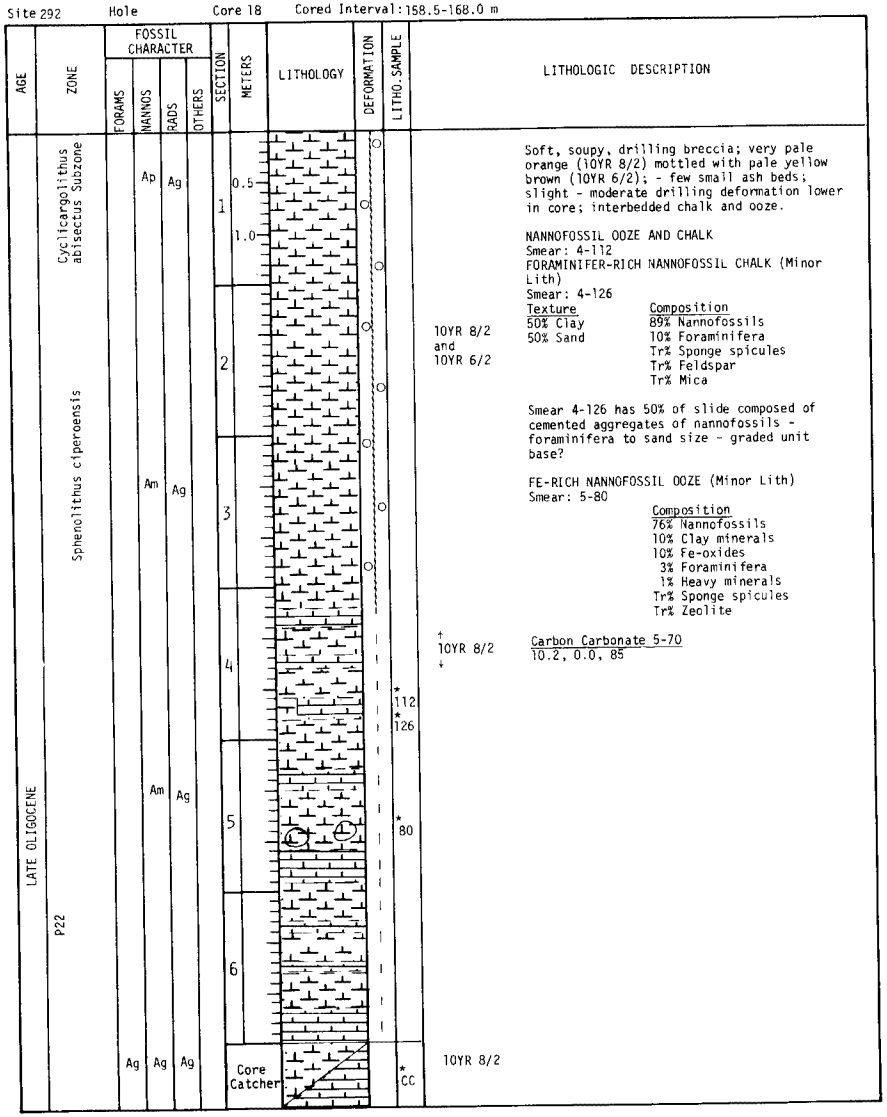
Texture	Composition
64% Silt	85% Volcanic glass
23% Sand	7% Feldspar
13% Clay	4% Nannofossils
	3% Heavy minerals
	1% Foraminifera

Grain Size 5-117
23.0, 63.9, 13.1

Carbon Carbonate 4-93
9.7, 0.1, 80

Explanatory notes in chapter 1

Site 292 Hole Core 18 Cored Interval: 158.5-168.0 m



Soft, soupy, drilling breccia; very pale orange (10YR 8/2) mottled with pale yellow brown (10YR 6/2); - few small ash beds; slight - moderate drilling deformation lower in core; interbedded chalk and ooze.

NANNOFOSSIL OOZE AND CHALK
Smear: 4-112

FORAMINIFER-RICH NANNOFOSSIL CHALK (Minor Lith)
Smear: 4-126

Texture	Composition
50% Clay	89% Nannofossils
50% Sand	10% Foraminifera
	Tr% Sponge spicules
	Tr% Feldspar
	Tr% Mica

Smear 4-126 has 50% of slide composed of cemented aggregates of nannofossils - foraminifera to sand size - graded unit base?

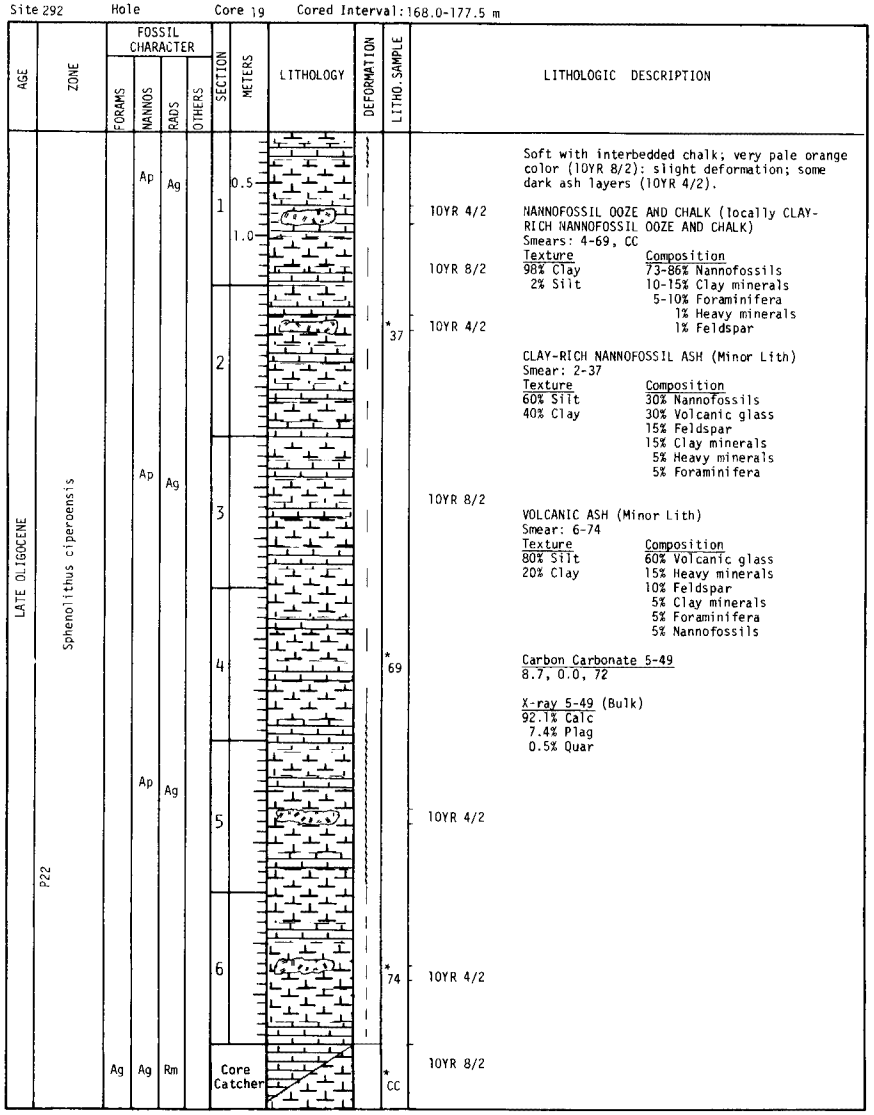
FE-RICH NANNOFOSSIL OOZE (Minor Lith)
Smear: 5-80

Composition
76% Nannofossils
10% Clay minerals
10% Fe-oxides
3% Foraminifera
1% Heavy minerals
Tr% Sponge spicules
Tr% Zeolite

Carbon Carbonate 5-70
10.2, 0.0, 85

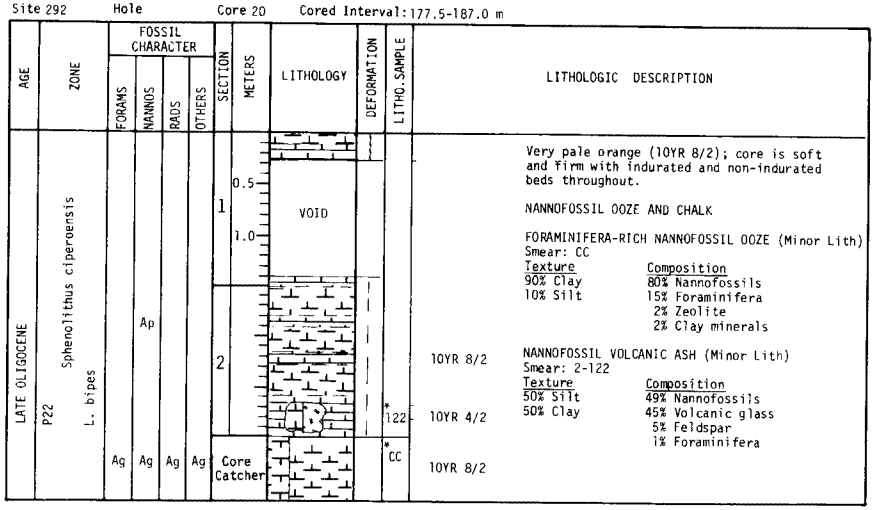
Explanatory notes in chapter 1

Site 292 Hole Core 19 Cored Interval: 168.0-177.5 m



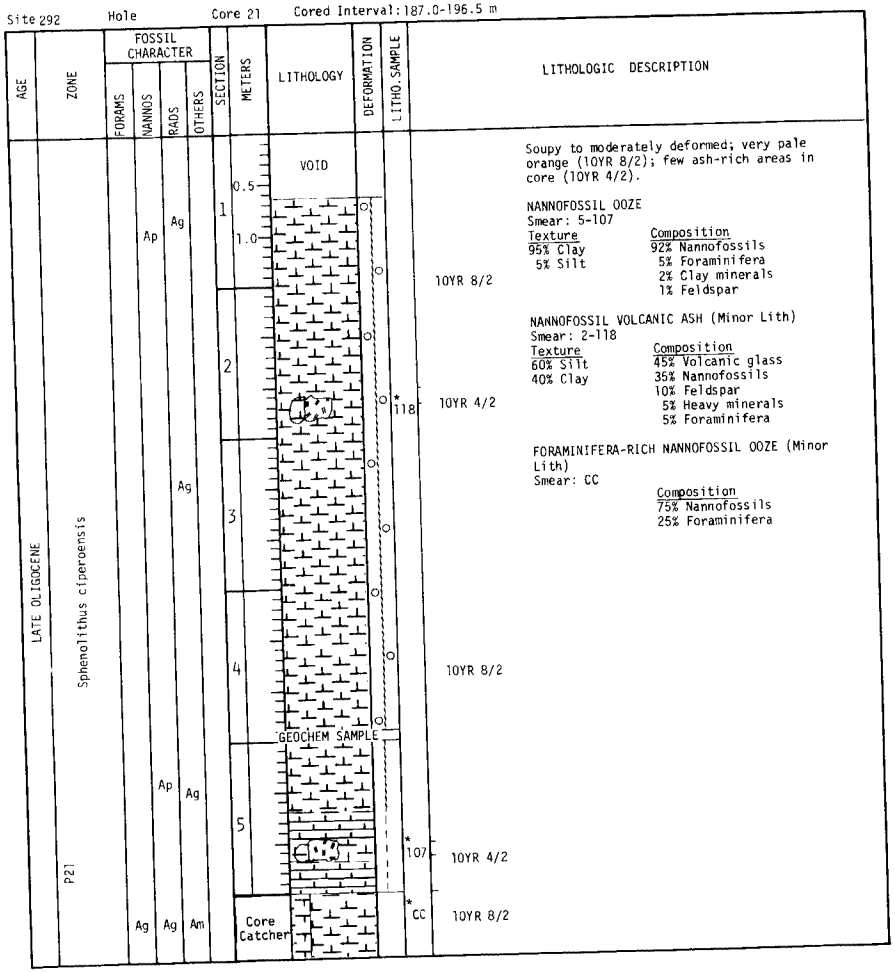
Explanatory notes in chapter 1

Site 292 Hole Core 20 Cored Interval: 177.5-187.0 m



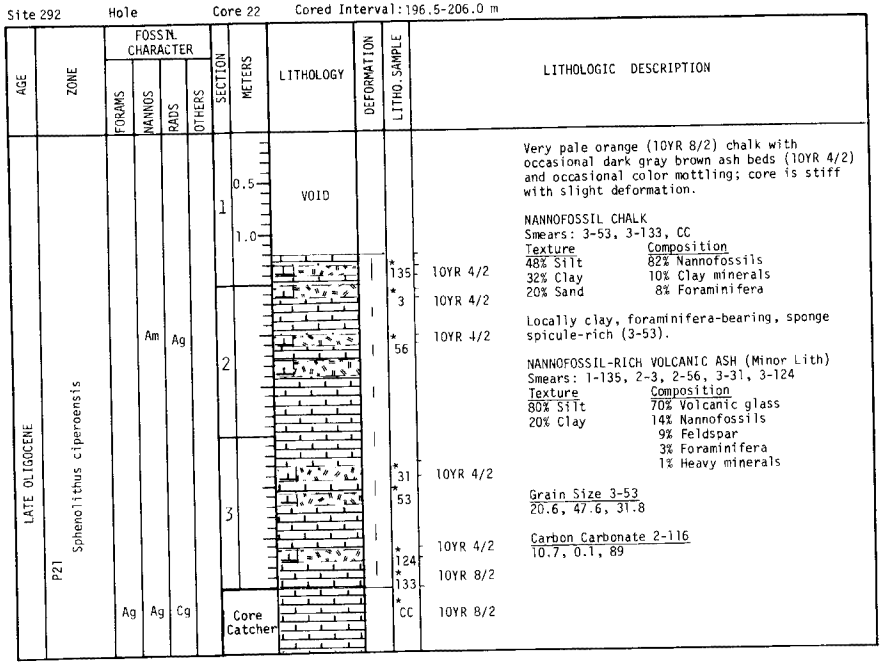
Explanatory notes in chapter 1

Site 292 Hole Core 21 Cored Interval: 187.0-196.5 m

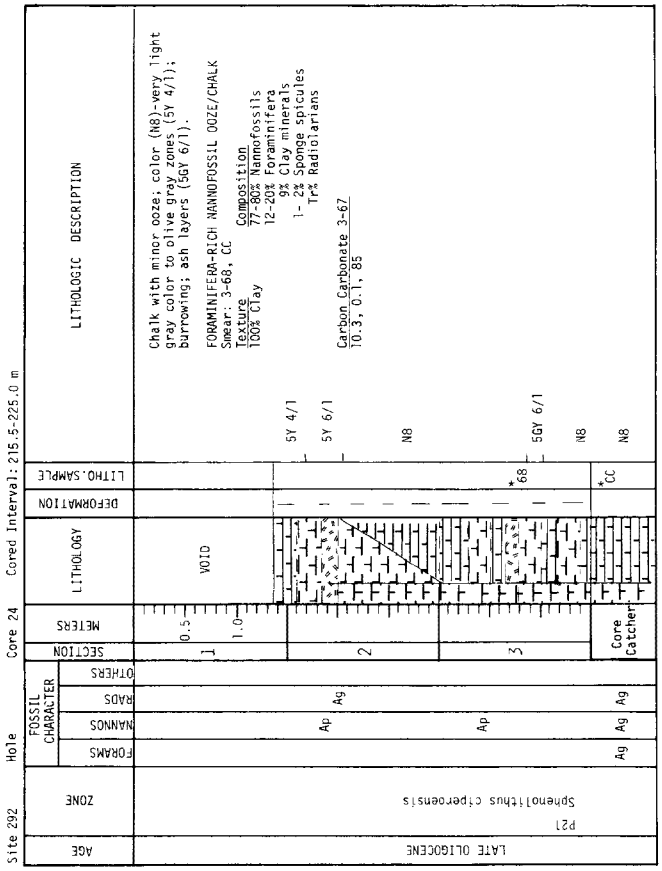


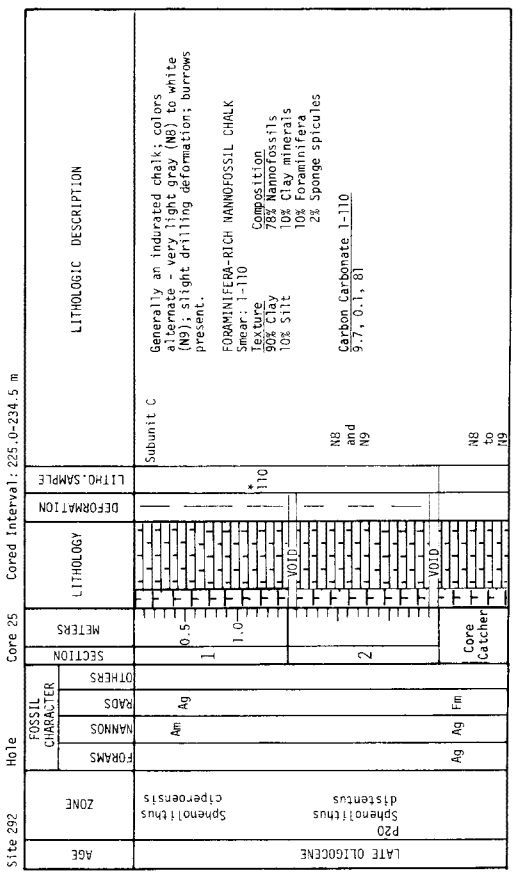
Explanatory notes in chapter 1

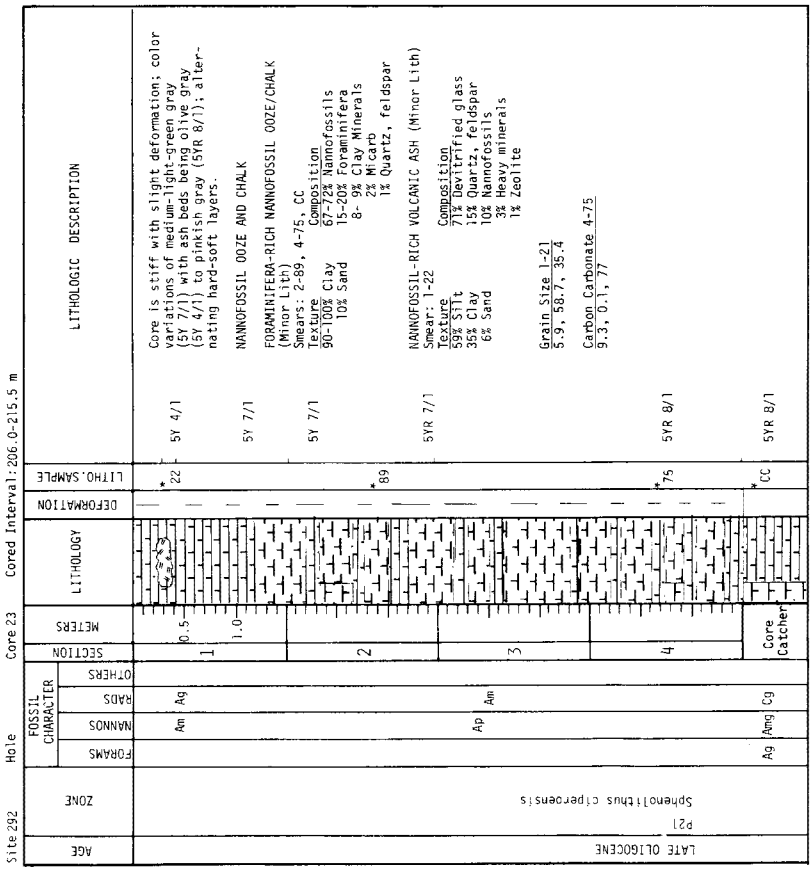
Site 292 Hole Core 22 Cored Interval: 196.5-206.0 m



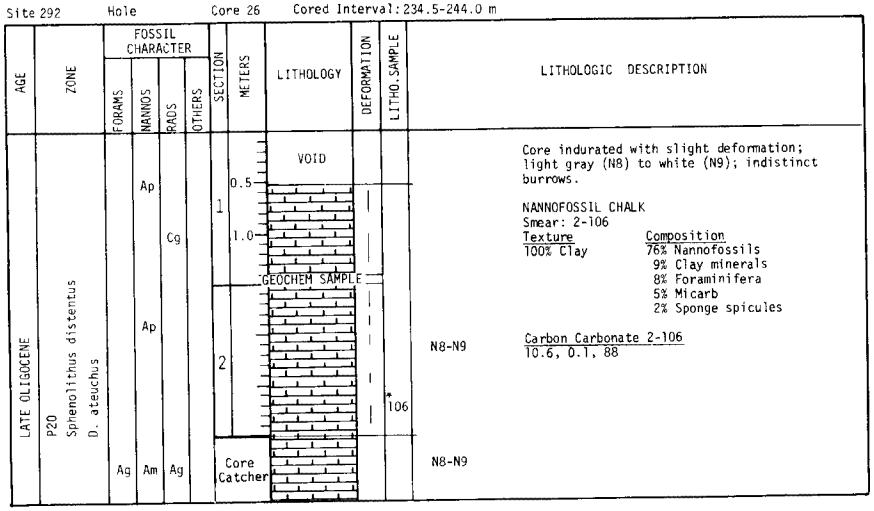
Explanatory notes in chapter 1


Site 292 Hole Core 24 Cored Interval: 215.5-225.0 m
AGE
ZONE
FOSSIL CHARACTER
FORAMS
NANNOS
RADS
OTHERS
SECTION
METERS
LITHOLOGY
DEFORMATION
LITHO.SAMPLE
LITHOLOGIC DESCRIPTION
LATE OLIGOCENE
P21
Sphenolithus ciperoensis
VOID
Chalk with minor ooze; color (N8)-very light gray color to olive gray zones (5Y 4/1); burrowing; ash layers (5GY 6/1).
FORAMINIFERA-RICH NANNOFOSSIL OOZE/CHALK
Smear: 3-68, CC
Texture
100% Clay
Composition
77-80% Nannofossils
12-20% Foraminifera
9% Clay minerals
1- 2% Sponge spicules
Tr% Radiolarians
Carbon Carbonate 3-67
10.3, 0.1, 85
5Y 4/1
5Y 6/1
N8
5GY 6/1
N8
N8
68
CC
Explanatory notes in chapter 1


Site 292 Hole Core 25 Cored Interval: 225.0-234.5 m
AGE
ZONE
FOSSIL CHARACTER
FORAMS
NANNOS
RADS
OTHERS
SECTION
METERS
LITHOLOGY
DEFORMATION
LITHO.SAMPLE
LITHOLOGIC DESCRIPTION
LATE OLIGOCENE
P20
Sphenolithus distentus
Sphenolithus ciperoensis
Subunit C
Generally an indurated chalk; colors alternate - very light gray (N8) to white (N9); slight drilling deformation; burrows present.
FORAMINIFERA-RICH NANNOFOSSIL CHALK
Smear: 1-110
Texture
90% Clay
10% Silt
Composition
78% Nannofossils
10% Clay minerals
10% Foraminifera
2% Sponge spicules
Carbon Carbonate 1-110
9.7, 0.1, 81
VOID
VOID
110
N8 and N9
N8 to N9
Explanatory notes in chapter 1

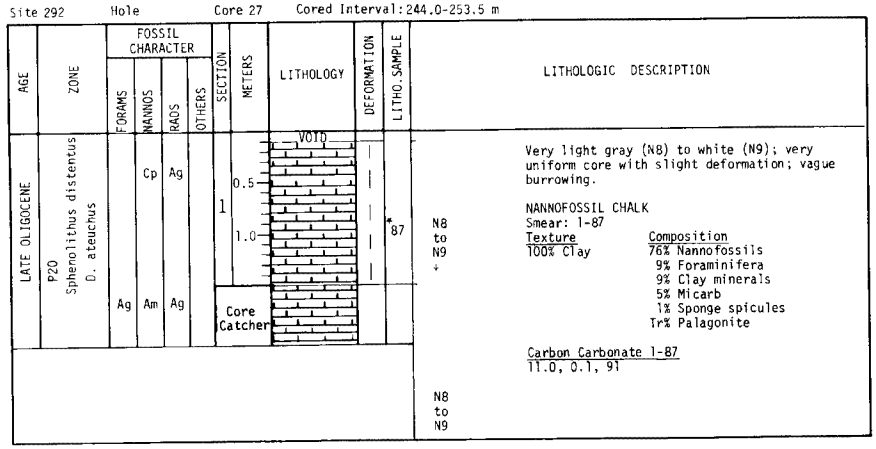

Site 292 Hole Core 23 Cored Interval: 206.0-215.5 m
AGE
ZONE
FOSSIL CHARACTER
FORAMS
NANNOS
RADS
OTHERS
SECTION
METERS
LITHOLOGY
DEFORMATION
LITHO.SAMPLE
LITHOLOGIC DESCRIPTION
LATE OLIGOCENE
P21
Sphenolithus ciperoensis
Core is stiff with slight deformation; color variations of medium-light-green gray (5Y 7/1) with ash beds being olive gray (5Y 4/1) to pinkish gray (5YR 8/1); alternating hard-soft layers.
5Y 4/1
NANNOFOSSIL OOZE AND CHALK
5Y 7/1
FORAMINIFERA-RICH NANNOFOSSIL OOZE/CHALK (Minor Lith)
Smears: 2-89, 4-75, CC
Texture
90-100% Clay
10% Sand
Composition
67-72% Nannofossils
15-20% Foraminifera
8- 9% Clay Minerals
2% Micarb
1% Quartz, feldspar
5Y 7/1
NANNOFOSSIL-RICH VOLCANIC ASH (Minor Lith)
Smear: 1-22
Texture
59% Silt
35% Clay
6% Sand
Composition
71% Devitrified glass
15% Quartz, feldspar
10% Nannofossils
3% Heavy minerals
1% Zeolite
5YR 7/1
Grain Size 1-21
5.9, 58.7, 35.4
Carbon Carbonate 4-75
9.3, 0.1, 77
5YR 8/1
5YR 8/1
22
89
75
CC
Explanatory notes in chapter 1

Site 292 Hole Core 26 Cored Interval: 234.5-244.0 m



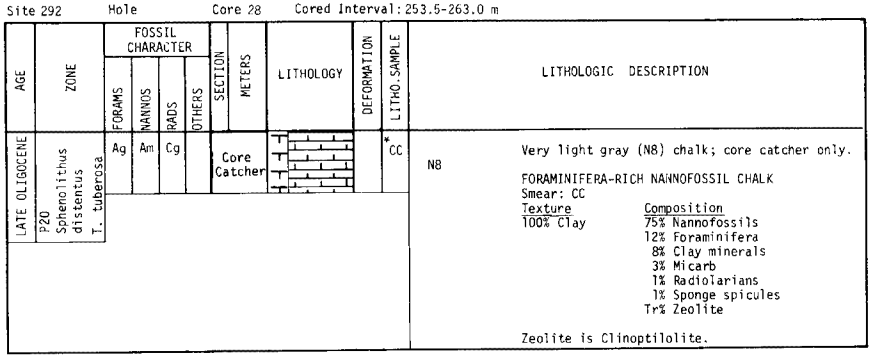
Explanatory notes in chapter 1

Site 292 Hole Core 27 Cored Interval: 244.0-253.5 m



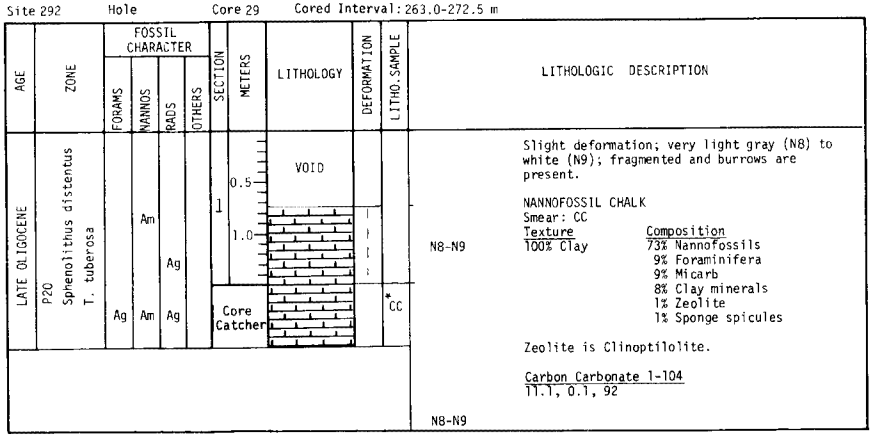
Explanatory notes in chapter 1

Site 292 Hole Core 28 Cored Interval: 253.5-263.0 m



Explanatory notes in chapter 1

Site 292 Hole Core 29 Cored Interval: 263.0-272.5 m



Explanatory notes in chapter 1

Site 292 Hole Core 30 Cored Interval: 272.5-282.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	P20 Sphenolithus distentus	Ag	Am	Ag	Cg	1	0.5	VOID			Slight deformation; color very light gray (N8) to white (N9); chalk with brown black (5YR 2/1) streaks; burrows; also olive black (5Y 2/1) streaks.
							1.0			* 102	NANNOFOSSIL CHALK Smear: 1-102 Texture: 100% Clay Composition: 75% Nannofossils, 9% Clay minerals, 7% Foraminifera, 6% Micarb, 2% Sponge spicules, 1% Zeolite, Tr% Radiolarians
						2		VOID			N8-N9 Carbon Carbonate 1-101 11.1, 0.1, 92
						Core Catcher					N8-N9

Explanatory notes in chapter 1

Site 292 Hole Core 31 Cored Interval: 282.0-291.5 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	P19 Sphenolithus distentus	Ag	Am	Ag	Cg	1	0.5	VOID			Chalk; light gray (N8) to white (N9); slight deformation; burrowing common with dark colors; fragmental at base of Section 2.
							1.0				CLAY-RICH NANNOFOSSIL CHALK Smears: 2-57, CC Texture: 100% Clay Composition: 65-71% Nannofossils, 6-8% Clay minerals, 10-12% Foraminifera, 1% Radiolarians, 0-5% Sponge spicules, 0-3% Volcanic glass, 0-1% Heavy minerals
								GEOCHEM SAMPLE			
						2				* 28 * 57	N8-N9 May be locally foraminifera-rich.
						Core Catcher				* CC	MICARB-RICH NANNOFOSSIL CHALK (Minor Lith) Smear: 2-28 Texture: 100% Clay Composition: 78% Nannofossils, 20% Micarb, 2% Radiolarians, Tr% Volcanic glass, Tr% Feldspar Carbon Carbonate 2-56 8.5, 0.1, 70

Explanatory notes in chapter 1

Site 292 Hole Core 32 Cored Interval: 291.5-301.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	Sphenolithus distentus		Ap	Cg		1	0.5	VOID			Very light gray (N8); slight deformation, indistinct burrowing, 5 mm diameter.
EARLY OLIGOCENE	P19-P18 Sphenolithus predistentus						1.0				NANNOFOSSIL CHALK Smear: CC Composition: 95% Nannofossils, 5% Foraminifera
		Ag	Ag	Cm		Core Catcher					N8 N8

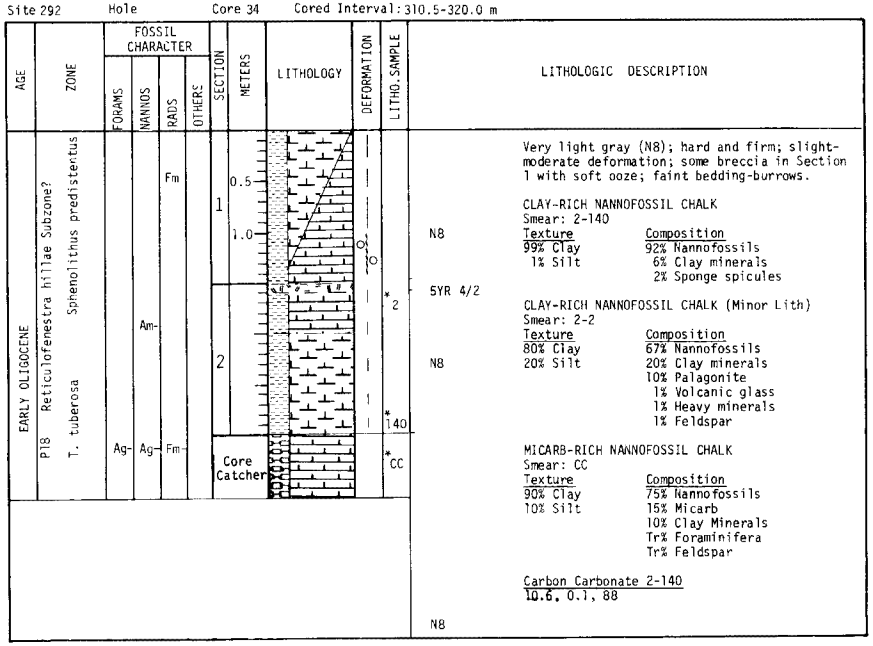
Explanatory notes in chapter 1

Site 292 Hole Core 33 Cored Interval: 301.0-310.5 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
EARLY OLIGOCENE	P18 Sphenolithus predistentus		Rp	Cm		1	0.5	VOID			N8 Chalk, slight deformation; very light gray (N8) to white (N9); burrows are irregular; some pink gray color (5YR 8/1) in Section 2; fragmental in Section 2 with some soft-ooze areas.
							1.0				NANNOFOSSIL CHALK Smears: 2-65, 2-121 Texture: 100% Clay Composition: 80-90% Nannofossils, 10% Clay minerals, 5% Foraminifera, 4- 8% Sponge spicules, 1- 3% Volcanic glass, 1% Radiolarians, 1% Feldspar, 1% Heavy minerals
						2				* 65 * 121	N8 5Y 8/1
		Ag	Ag	Fm		Core Catcher					N8 Carbon Carbonate 2-66 10.8, 0.1, 90

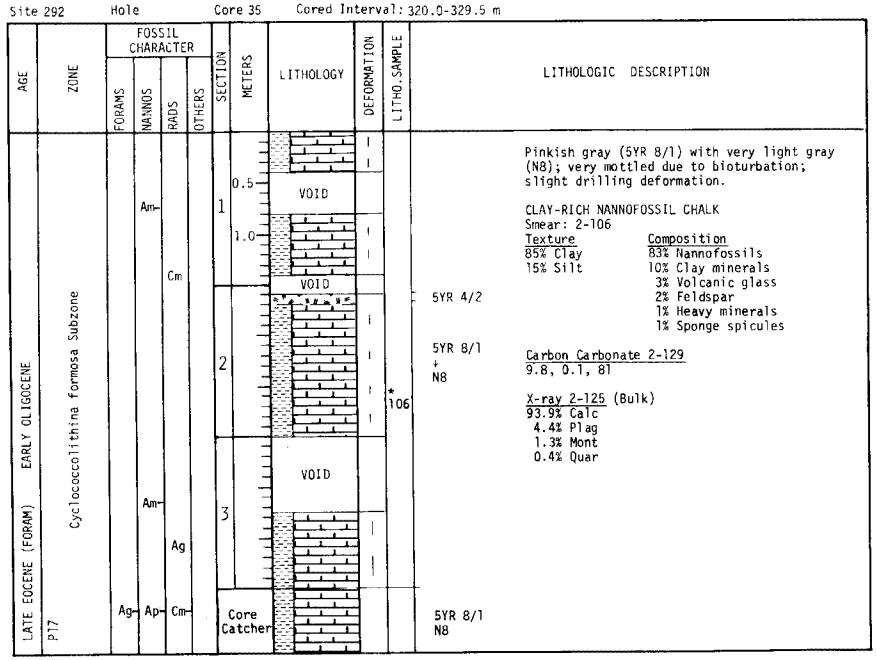
Explanatory notes in chapter 1

Site 292 Hole Core 34 Cored Interval: 310.5-320.0 m



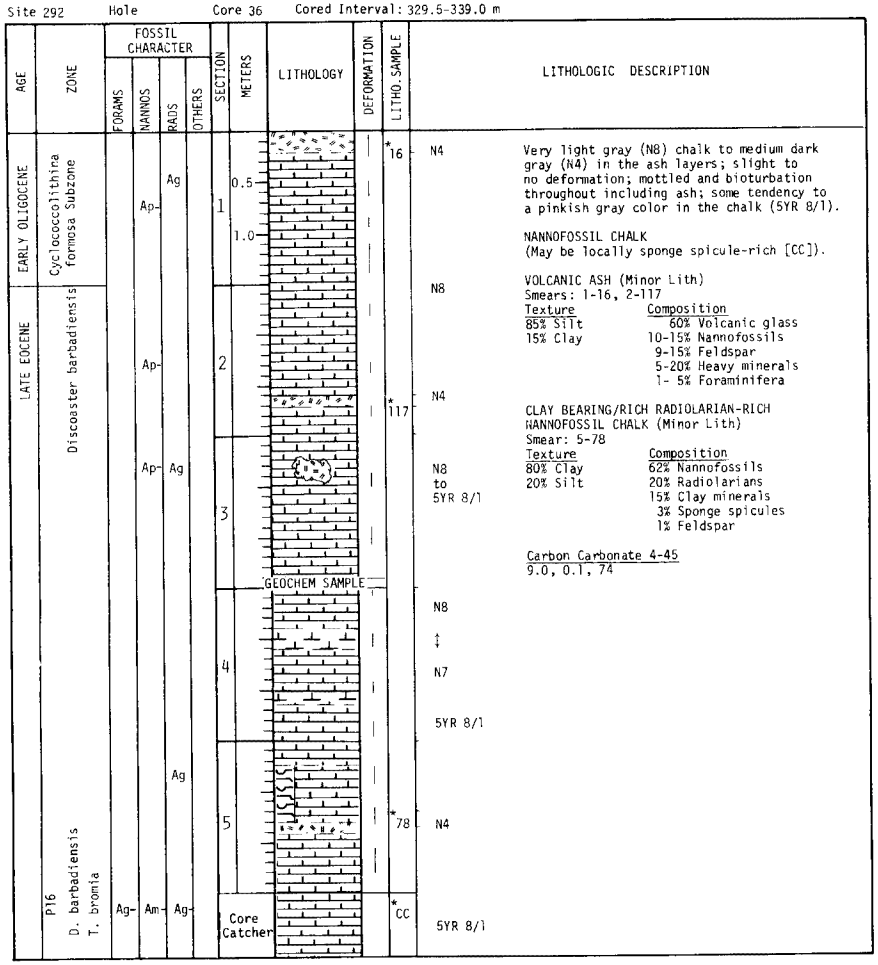
Explanatory notes in chapter 1

Site 292 Hole Core 35 Cored Interval: 320.0-329.5 m



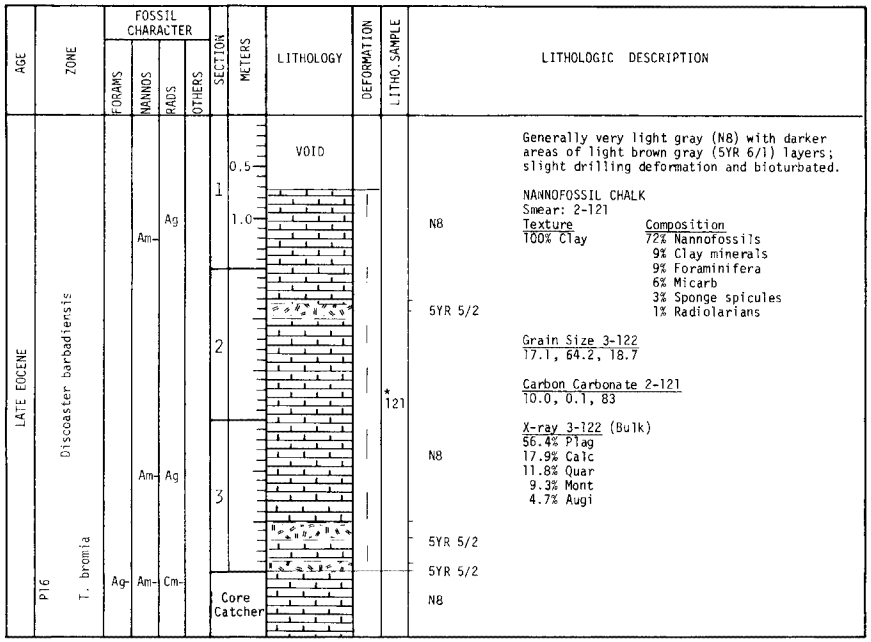
Explanatory notes in chapter 1

Site 292 Hole Core 36 Cored Interval: 329.5-339.0 m



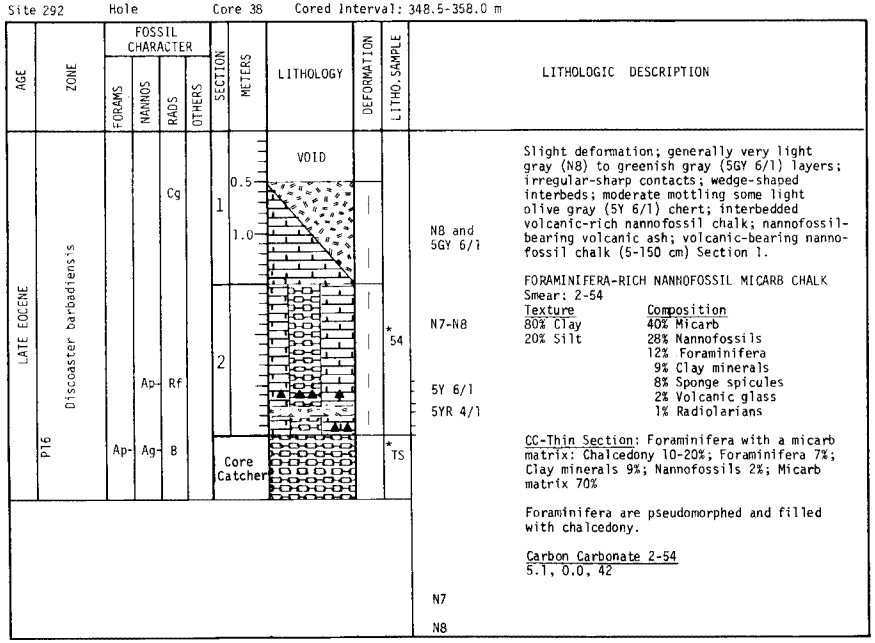
Explanatory notes in chapter 1

Site 292 Hole Core 37 Cored Interval: 339.0-348.5 m



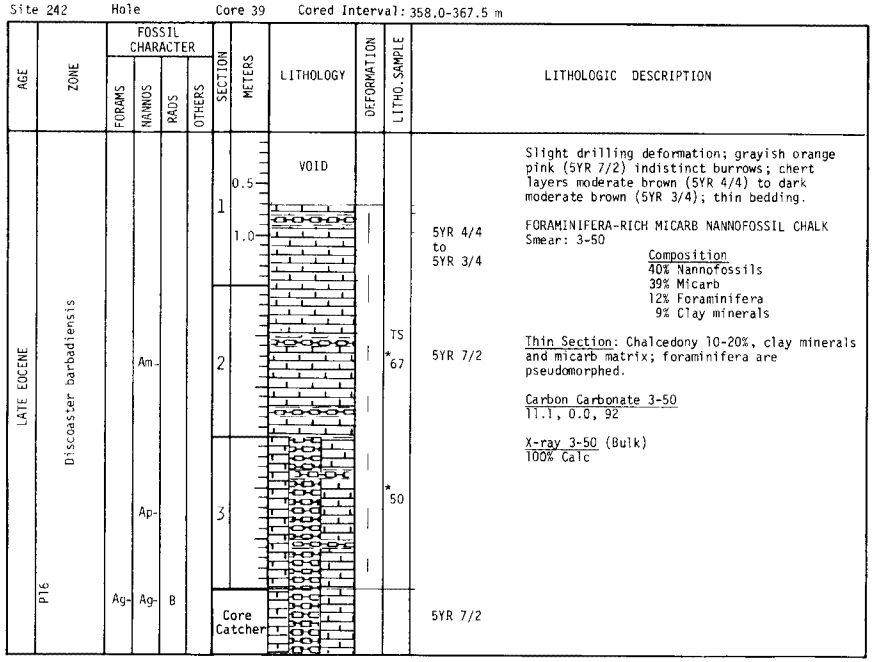
Explanatory notes in chapter 1

Site 292 Hole Core 38 Cored Interval: 348.5-358.0 m



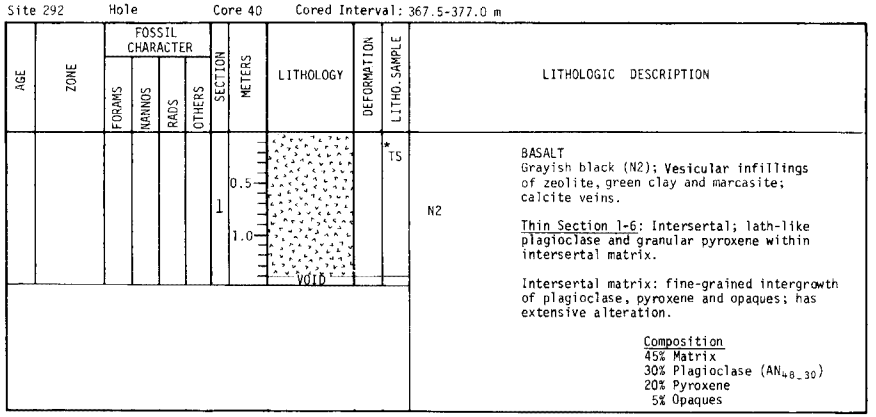
Explanatory notes in chapter 1

Site 292 Hole Core 39 Cored Interval: 358.0-367.5 m



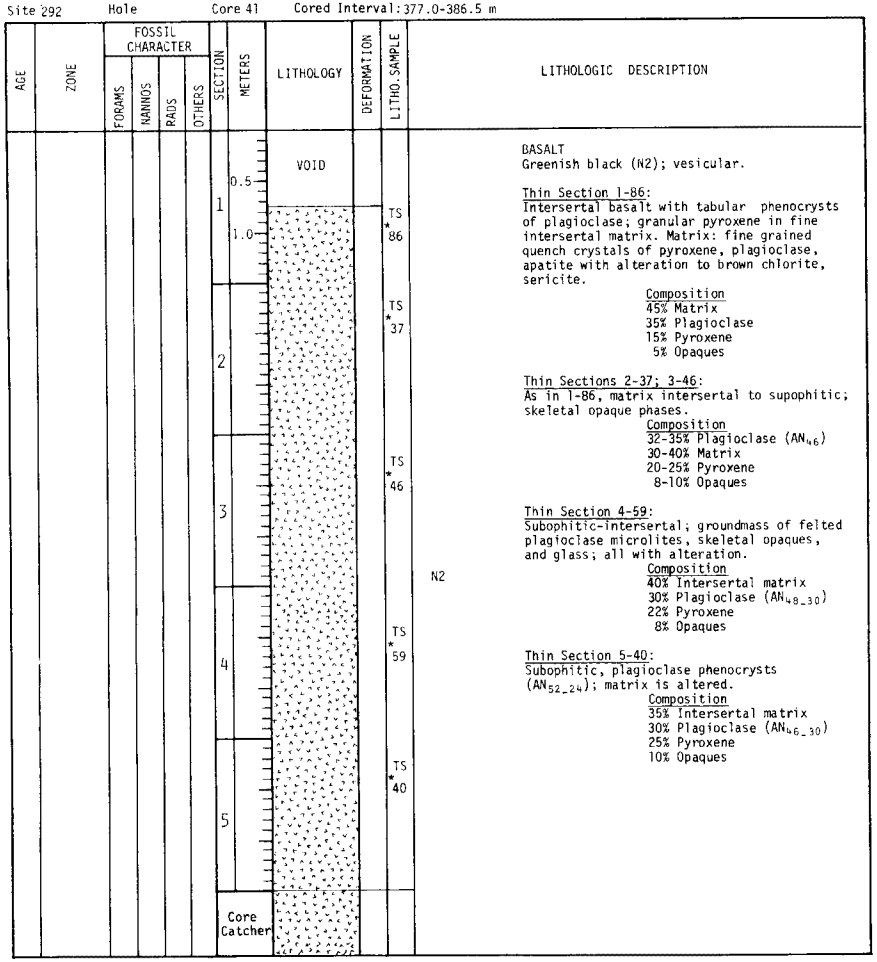
Explanatory notes in chapter 1

Site 292 Hole Core 40 Cored Interval: 367.5-377.0 m



Explanatory notes in chapter 1

Site 292 Hole Core 41 Cored Interval: 377.0-386.5 m



LITHOLOGIC DESCRIPTION

BASALT
Greenish black (N2); vesicular.

Thin Section 1-86:
Intersertal basalt with tabular phenocrysts of plagioclase; granular pyroxene in fine intersertal matrix. Matrix: fine grained quench crystals of pyroxene, plagioclase, apatite with alteration to brown chlorite, sericite.

Composition
45% Matrix
35% Plagioclase
15% Pyroxene
5% Opaques

Thin Sections 2-37; 3-46:
As in 1-86, matrix intersertal to supophitic; skeletal opaque phases.

Composition
32-35% Plagioclase (AN_{46})
30-40% Matrix
20-25% Pyroxene
8-10% Opaques

Thin Section 4-59:
Subophitic-intersertal; groundmass of felted plagioclase microlites, skeletal opaques, and glass; all with alteration.

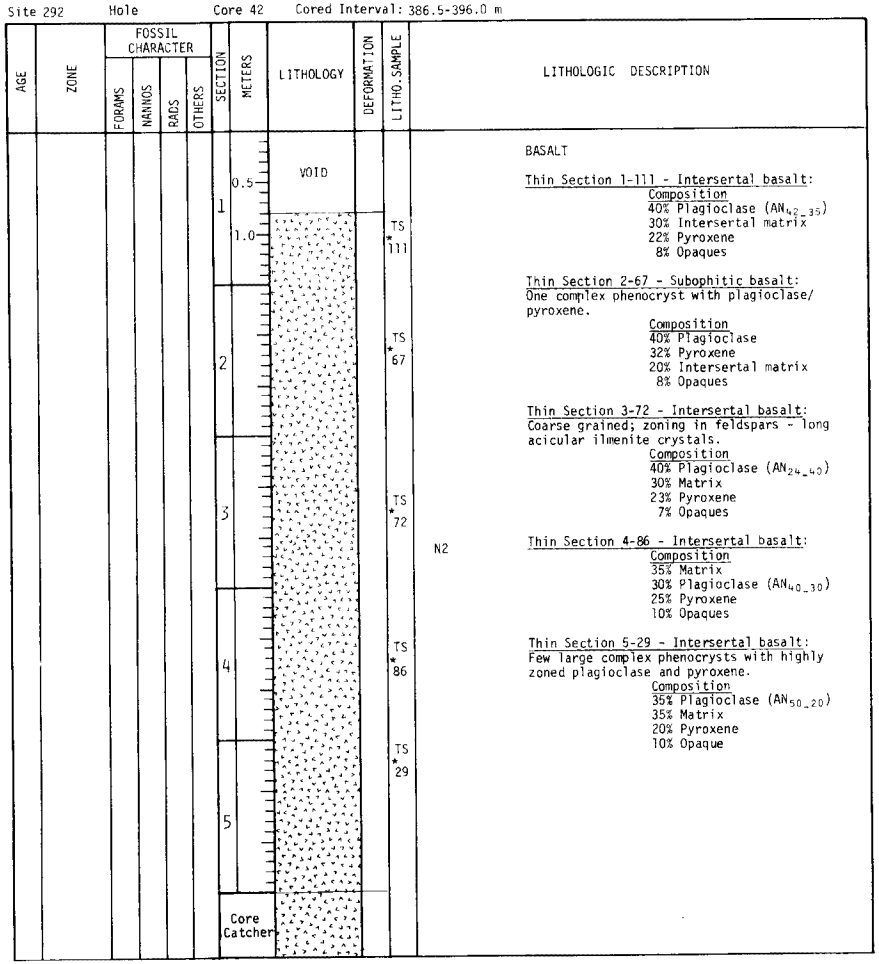
Composition
40% Intersertal matrix
30% Plagioclase (AN_{48_30})
22% Pyroxene
8% Opaques

Thin Section 5-40:
Subophitic, plagioclase phenocrysts (AN_{52_24}); matrix is altered.

Composition
35% Intersertal matrix
30% Plagioclase (AN_{46_30})
25% Pyroxene
10% Opaques

Explanatory notes in chapter 1

Site 292 Hole Core 42 Cored Interval: 386.5-396.0 m



LITHOLOGIC DESCRIPTION

BASALT

Thin Section 1-111 - Intersertal basalt:

Composition
40% Plagioclase (AN_{42_35})
30% Intersertal matrix
22% Pyroxene
8% Opaques

Thin Section 2-67 - Subophitic basalt:
One complex phenocryst with plagioclase/ pyroxene.

Composition
40% Plagioclase
32% Pyroxene
20% Intersertal matrix
8% Opaques

Thin Section 3-72 - Intersertal basalt:
Coarse grained; zoning in feldspars - long acicular ilmenite crystals.

Composition
40% Plagioclase (AN_{24_40})
30% Matrix
23% Pyroxene
7% Opaques

Thin Section 4-86 - Intersertal basalt:

Composition
35% Matrix
30% Plagioclase (AN_{40_30})
25% Pyroxene
10% Opaques

Thin Section 5-29 - Intersertal basalt:
Few large complex phenocrysts with highly zoned plagioclase and pyroxene.

Composition
35% Plagioclase (AN_{50_20})
35% Matrix
20% Pyroxene
10% Opaque

Explanatory notes in chapter 1

Site 292 Hole Core 43 Cored Interval: 396.0-405.5 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						1	0.5	VOID		TS * 139	BASALT Thin Sections 1-139, 2-111, 4-40 - Intersertal basalt: Composition 35-45% Interstitial 25-35% Plagioclase (AN_{40-25}) 19-22% Pyroxene 6-10% Opaques Thin Section 3-45 - Intersertal basalt: Large plagioclase (AN_{42-25}) phenocryst Composition 35% Plagioclase 35% Interstitial 24% Pyroxene 6% Opaque Thin Section CC - Intersertal to subophitic basalt: Composition 40% Interstitial 30% Plagioclase (AN_{40-20}) 20% Pyroxene 10% Opaques
						2	1.0			TS * 111	
						3				TS * 45	N2
						4				TS * 40	
						Core Catcher				TS * CC	

Explanatory notes in chapter 1

Site 292 Hole Core 44 Cored Interval: 405.5-415.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						1	0.5	VOID		TS * 133	BASALT Color grayish black (N2), pyrite veinlets (100-130 cm - Section 2). Some vesicules in Section 5. Thin Section 5-69 - Subophitic basalt Thin Sections 1-133, 2-69, 3-107, 4-48, CC - Intersertal basalt
						2	1.0			TS * 69	N2
						3				TS * 107	N2
						4				TS * 48	
						5				TS * 69	N2
						Core Catcher				TS * CC	N2

Explanatory notes in chapter 1

Site 292 Hole Core 45 Cored Interval: 415.0-424.5 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						1	0.5, 1.0			TS * 109	BASALT Color grayish black (N2). Thin Sections 1-109, 2-48 - Intersertal basalt: Intersertal basalt; some matrix less altered than rest (Section 2); some with complex phenocrysts of pyroxene and plagioclase.
						2				TS * 48	N2
						3					
						Core Catcher					N2

Explanatory notes in chapter 1

Site 292 Hole Core 46 Cored Interval: 424.5-434.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						1	0.5, 1.0			TS * 120	BASALT Grayish black (N2) in unaltered areas to greenish black (5GY 2/1) in altered zones; some vertical weathering zones. Thin Section 1-120 - Subophitic basalt Thin Section 2-64 - Intersertal to Subophitic basalt Thin Section 2-72 - Intersertal basalt: Intersertal basalt - large complex phenocrysts of plagioclase-pyroxene. Intersertal areas altered to green serpentine-like mineral; CO_3 present; some fresh plagioclase. Composition 50% Interstitial 26% Plagioclase (AN_{42-30}) 18% Pyroxene 6% Opaques
						2				TS * 64 * 72	
						Core Catcher				TS * CC	Thin Section CC - Subophitic basalt: Vertical veinlets of alteration in interstitial areas.

Explanatory notes in chapter 1

Site 292 Hole Core 47 Cored Interval: 434.0-443.5 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						1	0.5, 1.0			TS * 51	BASALT (N5) Thin Section 1-51 - Intersertal basalt: Intersertal basalt with pyroxene plagioclase phenocrysts. Thin Section 2-73 - Intersertal to Subophitic basalt: Intersertal to Subophitic basalt; pyroxene and plagioclase phenocrysts. Composition 38% Plagioclase 25% Pyroxene 25% Interstitial 12% Opaques
						2				TS * 73	N5
						Core Catcher					N5

Explanatory notes in chapter 1

DEEP SEA DRILLING PROJECT

LEG 31 SITE 293

SITE SUMMARY SHEET

POSITION: Latitude: 20°21.25'N Longitude: 124°05.65'E

Water depth (from sea level): 5599 corrected meters (Echo sounding)

Bottom felt at: 5626 meters (drill pipe) Penetration: 563.5 meters

Number of Holes: 1 Number of Cores: 23

Total length of cored section: 202.5 m Total core recovered: 78.6 m

Percentage of core recovery: 38.9%

OLDEST SEDIMENT CORED:

Depth below sea floor: 517-547 meters plus Nature: Basaltic breccia

Age: late mid Miocene

PRINCIPAL RESULTS:

Hole 293 was drilled into a thick apron of sediment lying north and east of Luzon and immediately west of Central Basin Fault zone in West Philippine Basin. The stratigraphic column consists of 244 meters of late Pliocene-Pleistocene sand-silt turbidites, 156 meters of Pliocene distal mudstone turbidites, 29 meters of brown mudstone with reworked late mid Eocene nannofossils overlying 46.5 meters (or more) of Miocene basaltic breccia. This breccia is probably associated with mid plate faulting within the West Philippine Basin between the latest Eocene(?) and mid Miocene.

Site 293 Hole Core 1 Cored Interval: 0.0-3.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
PLEISTOCENE/HOLOCENE	N23	Rq	Fp	B		Core Catcher				CC *	Subunit 1A 5YR 4/1 Color brownish gray (5YR 4/1); material caught between liners of punch core. VOLCANIC SAND-RICH SILT Smear: CC Texture: 80% Silt, 18% Sand, 2% Clay Composition: 40% Feldspar, 30% Heavy minerals, 20% Opaques, 9% Volcanic glass, 1% Foraminifera, Tr% Nannofossils Foraminifera are redeposited; heavy minerals include: green and brown (basaltic) hornblende, chlorite, and pyroxene.

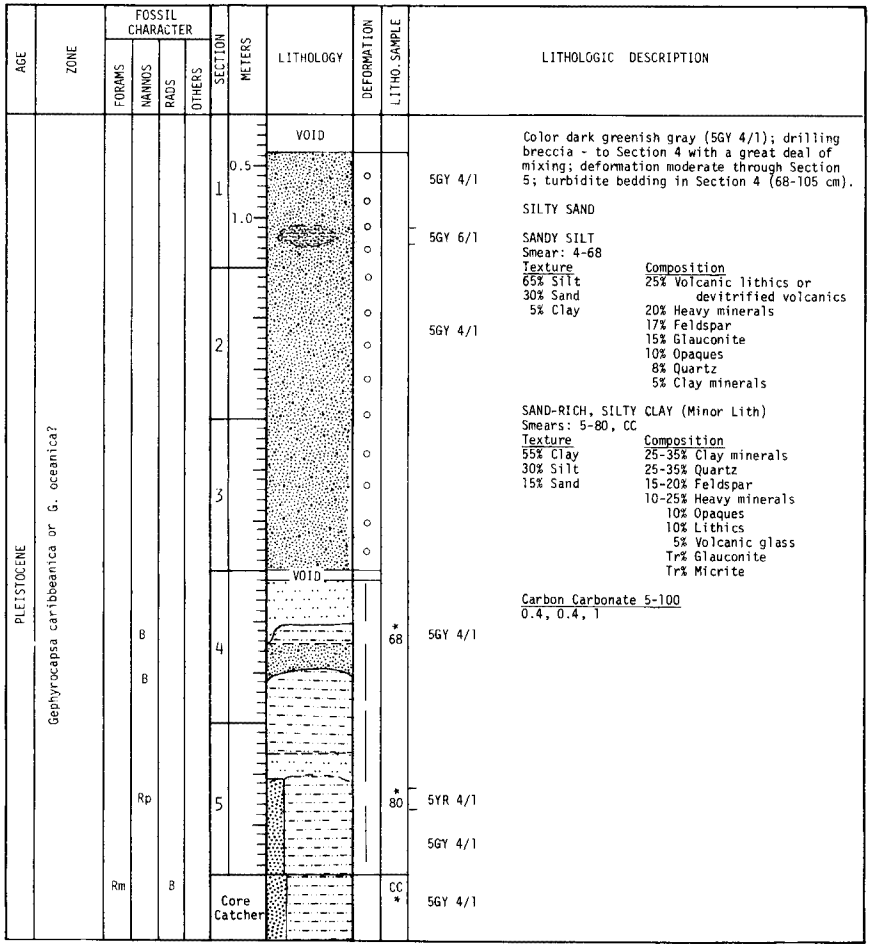
Explanatory notes in chapter 1

Site 293 Hole Core 2 Cored Interval: 88.5-98.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						1	0.5 1.0	VOID			Subunit 1B Core dominately dark gray (N3) to medium dark gray (N4); soupy in Sections 1-4 to firm with slight to intense deformation in Section 5; some dark greenish gray areas (5G 4/1 - 5GY 3/1) in Section 5; burrowing(?) or mottling in Section 5.
						2				* 140	N3 + N4 CLAYEY SAND Smear: 2-140 Texture: 57% Sand, 26% Clay, 17% Silt Composition: 40% Feldspar, 32% Clay minerals, 18% Quartz, 5% Heavy minerals, 5% Opaques, Tr% Nannofossils Heavy minerals mainly amphibole; sand-bearing in Sections 1, 2, 3, and 4.
						3		VOID			SANDY SILT (Minor Lith) Smear: 5-59 Texture: 74% Silt, 18% Sand, 8% Clay Composition: 35% Volcanic lithics, 15% Feldspar, 15% Heavy minerals, 12% Quartz, 11% Clay minerals, 7% Opaques, 5% Glauconite
						4		GEOCHEM AND CONSOLIDAT. SAMPLES			Clayey silt / Silty clay contact Indistinct graded bedding; amphiboles are the common heavy mineral; some gradation to silty sand. N3-N4 CLAYEY SILT Smear: CC Texture: 50% Silt, 40% Clay, 10% Sand Composition: 50% Feldspar, 15% Clay minerals, 10% Quartz, 10% Heavy minerals, 10% Opaques, Tr% Nannofossils
						5				* 59	5GY 4/1 5G 4/1 + Grain Size 2-140: 57.3, 16.5, 26.2 Grain Size 5-27: 11.7, 79.3, 8.9 Grain Size 5-47: 1.5, 86.8, 11.7 Grain Size 5-59: 18.4, 73.8, 7.8 Grain Size 5-64: 1.6, 50.8, 47.6 Carbon Carbonate 2-142: 0.3, 0.2, 0
		Fg		B		Core Catcher				* CC	X-ray 2-135 (Bulk) 39.4% Plag 20.2% Mont 18.5% Quar 14.1% Mica 3.6% Chlo 2.8% Amph 1.4% Calc N3 + N4

Explanatory notes in chapter 1

Site 293 Hole Core 3 Cored Interval: 98.0-107.5 m



LITHOLOGIC DESCRIPTION

Color dark greenish gray (5GY 4/1); drilling breccia - to Section 4 with a great deal of mixing; deformation moderate through Section 5; turbidite bedding in Section 4 (68-105 cm).

SILTY SAND

SANDY SILT
Smear: 4-68

Texture	Composition
65% Silt	25% Volcanic lithics or devitrified volcanics
30% Sand	20% Heavy minerals
5% Clay	17% Feldspar
	15% Glauconite
	10% Opaques
	8% Quartz
	5% Clay minerals

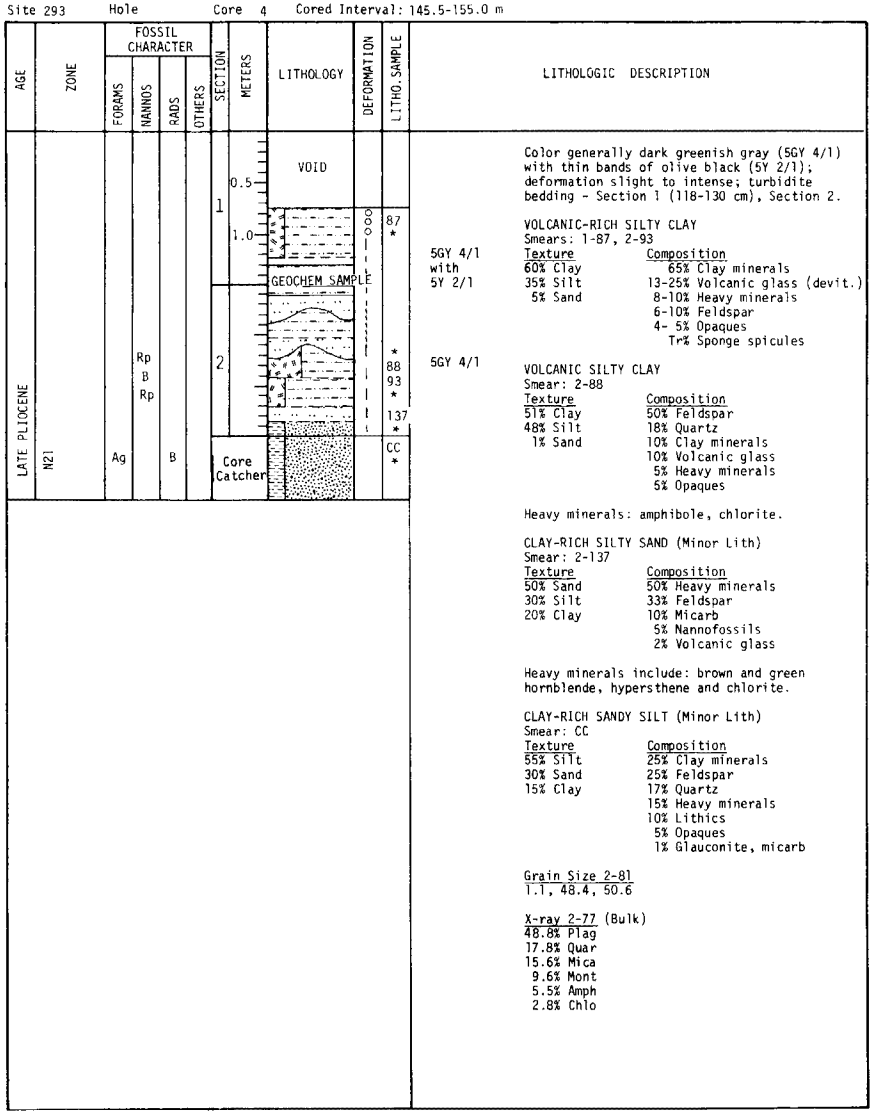
SAND-RICH, SILTY CLAY (Minor Lith)
Smears: 5-80, CC

Texture	Composition
55% Clay	25-35% Clay minerals
30% Silt	25-35% Quartz
15% Sand	15-20% Feldspar
	10-25% Heavy minerals
	10% Opaques
	10% Lithics
	5% Volcanic glass
	Tr% Glauconite
	Tr% Micrite

Carbon Carbonate 5-100
0.4, 0.4, 1

Explanatory notes in chapter 1

Site 293 Hole Core 4 Cored Interval: 145.5-155.0 m



LITHOLOGIC DESCRIPTION

Color generally dark greenish gray (5GY 4/1) with thin bands of olive black (5Y 2/1); deformation slight to intense; turbidite bedding - Section 1 (118-130 cm), Section 2.

VOLCANIC-RICH SILTY CLAY
Smears: 1-87, 2-93

Texture	Composition
60% Clay	65% Clay minerals
35% Silt	13-25% Volcanic glass (devit.)
5% Sand	8-10% Heavy minerals
	6-10% Feldspar
	4- 5% Opaques
	Tr% Sponge spicules

VOLCANIC SILTY CLAY
Smear: 2-88

Texture	Composition
51% Clay	50% Feldspar
48% Silt	18% Quartz
1% Sand	10% Clay minerals
	10% Volcanic glass
	5% Heavy minerals
	5% Opaques

Heavy minerals: amphibole, chlorite.

CLAY-RICH SILTY SAND (Minor Lith)
Smear: 2-137

Texture	Composition
50% Sand	50% Heavy minerals
30% Silt	33% Feldspar
20% Clay	10% Micarb
	5% Nannofossils
	2% Volcanic glass

Heavy minerals include: brown and green hornblende, hypersthene and chlorite.

CLAY-RICH SANDY SILT (Minor Lith)
Smear: CC

Texture	Composition
55% Silt	25% Clay minerals
30% Sand	25% Feldspar
15% Clay	17% Quartz
	15% Heavy minerals
	10% Lithics
	5% Opaques
	1% Glauconite, micarb

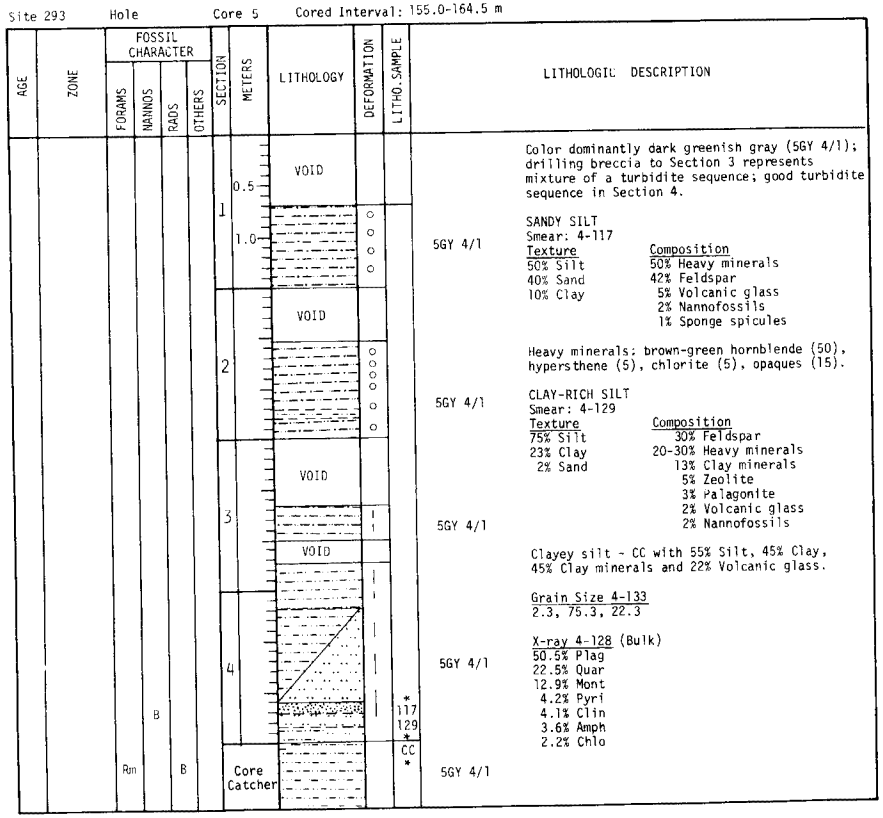
Grain Size 2-81
1.1, 48.4, 50.6

X-ray 2-77 (Bulk)

48.8%	Plag
17.8%	Quar
15.6%	Mica
9.6%	Mont
5.5%	Amph
2.8%	Chlo

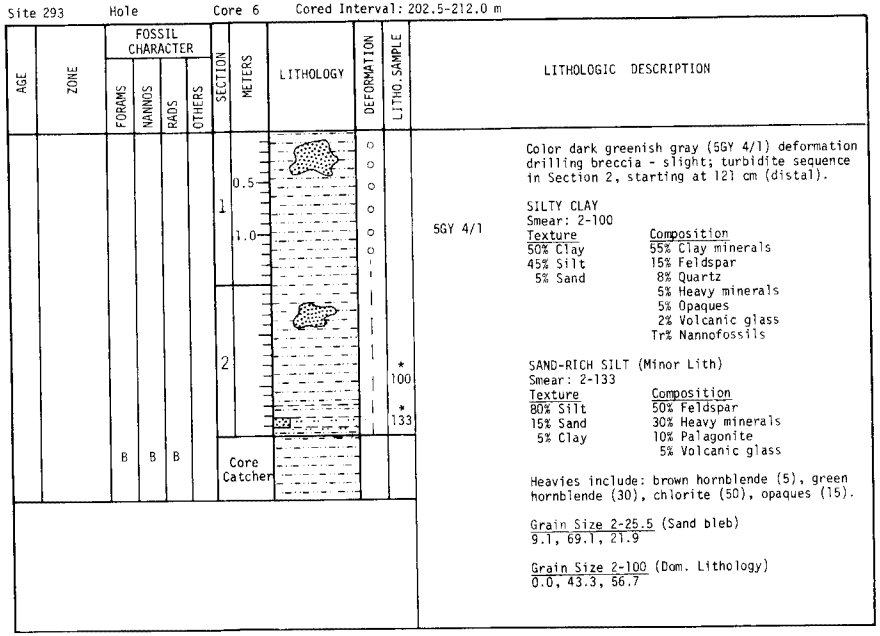
Explanatory notes in chapter 1

Site 293 Hole Core 5 Cored Interval: 155.0-164.5 m



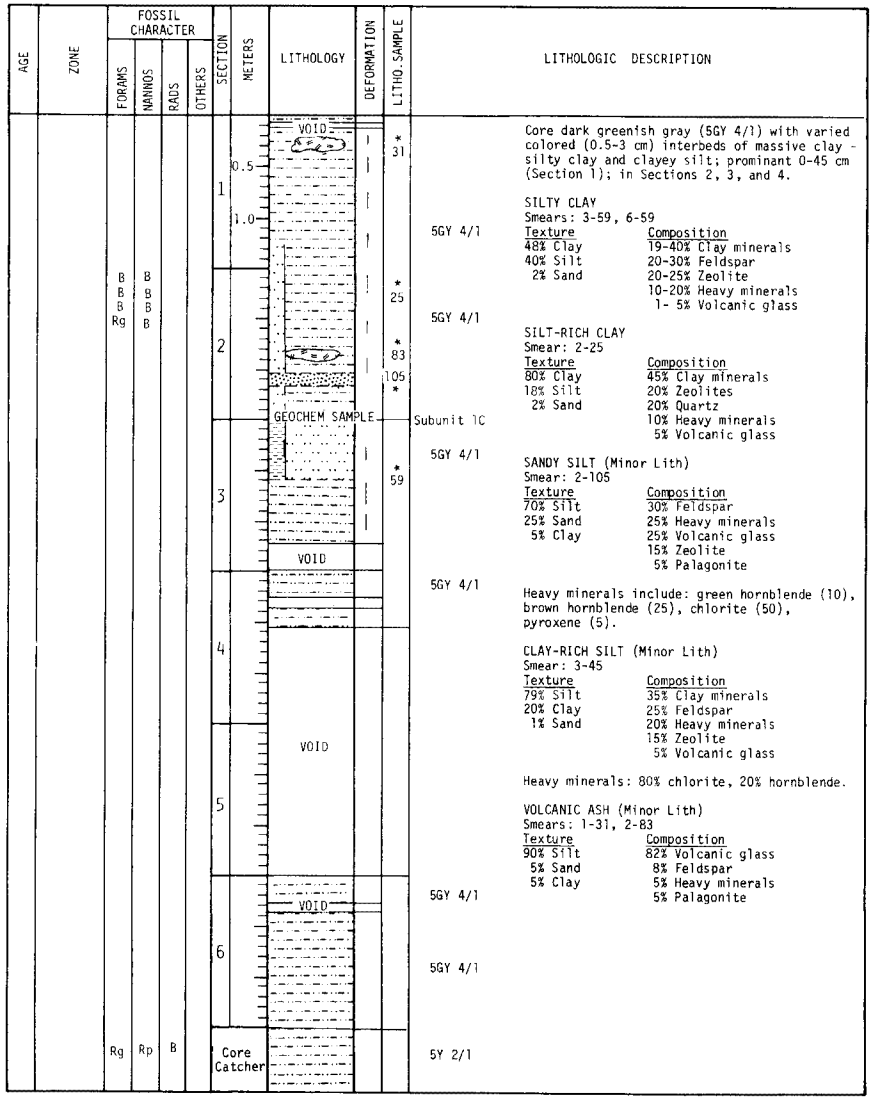
Explanatory notes in chapter 1

Site 293 Hole Core 6 Cored Interval: 202.5-212.0 m



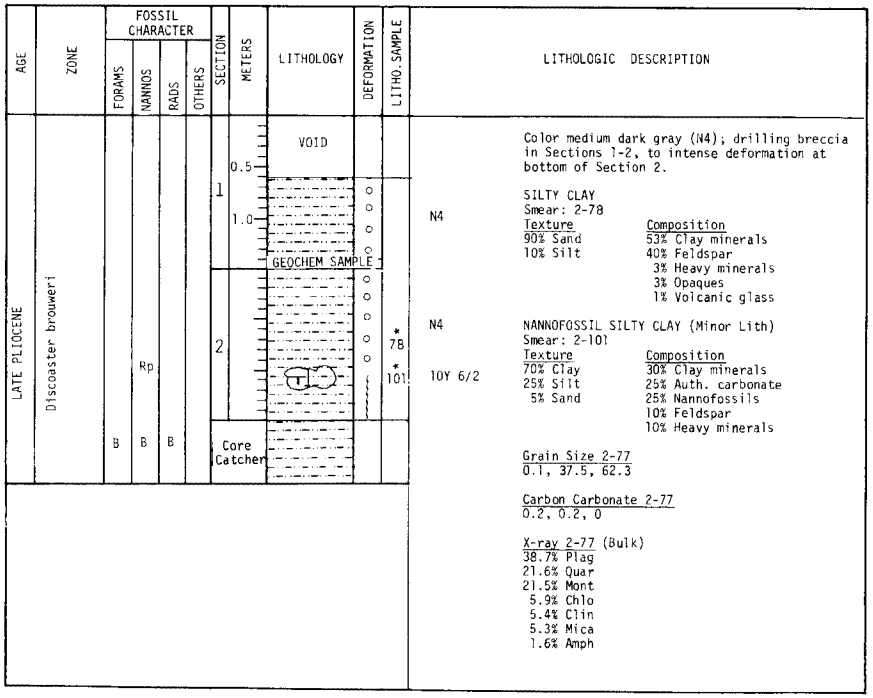
Explanatory notes in chapter 1

Site 293 Hole Core 7 Cored Interval: 212.0-221.5 m



Explanatory notes in chapter 1

Site 293 Hole Core 8 Cored Interval: 259.5-269.0 m



Explanatory notes in chapter 1

Site 293 Hole Core 9 Cored Interval: 269.0-278.5 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
LATE PLIOCENE	Discoaster brouweri		Rm	Fg	B	1	0.5	VOID			Generally a medium dark gray (N4) with minor purple-blue hues throughout i.e. green (5GY 4/1) purple (5P 3/2) with purple-green (5YR 3/1); *Clay bedding: 1) green: hard - 1-3 cm thick } vague contacts 2) purple: clay-crumbly } between (cyclicity) 3) purple-green: silty, decrease upward = base cycle
							1.0				
						2					CLAY Smear: 3-30 Texture: 82% Clay, 10% Silt, 8% Sand. Composition: 64% Clay minerals, 20% Feldspar, 9% Auth. Carbonate, 5% Heavy minerals, 1% Quartz, 1% Opaques
						3				* 30	N4 (with variations noted above) 5GY 4/1 SILT-RICH CLAY Smears: 6-23, 6-35, 6-38 Texture: 75-80% Clay, 15-25% Silt, 0- 5% Sand. Composition: 45-70% Clay minerals, 25-30% Feldspar, 12-20% Quartz, 2- 5% Heavy minerals, 2% Opaques, 1- 2% Zeolite, 1% Auth. carbonate, Tr% Nannofossils
						4		VOID			SILTY CLAY Smears: 6-31, CC Texture: 50-70% Clay, 30-40% Silt, 0-10% Sand. Composition: 33-55% Clay minerals, 25-35% Feldspar, 5-20% Heavy minerals, 17-20% Quartz, 2- 5% Opaques, 2- 5% Zeolites, 1% Volcanic glass
						5					X-ray 6-105 (Bulk) (purple clay): 33.8% Plag, 23.9% Mont, 22.2% Quar, 8.6% Mica, 6.5% Chlo, 3.3% Clin, 1.8% Amph. N4 (with variations noted above)
						6				* 23 * 31 * 35 * 38	X-ray 6-110 (Bulk) (green clay): 50.5% Plag, 22.0% Quar, 17.3% Mont, 4.2% Clin, 2.6% Mica, 2.1% Chlo, 1.3% Amph. N4 (with variations noted above)
						Core Catcher				CC *	5Y 2/1

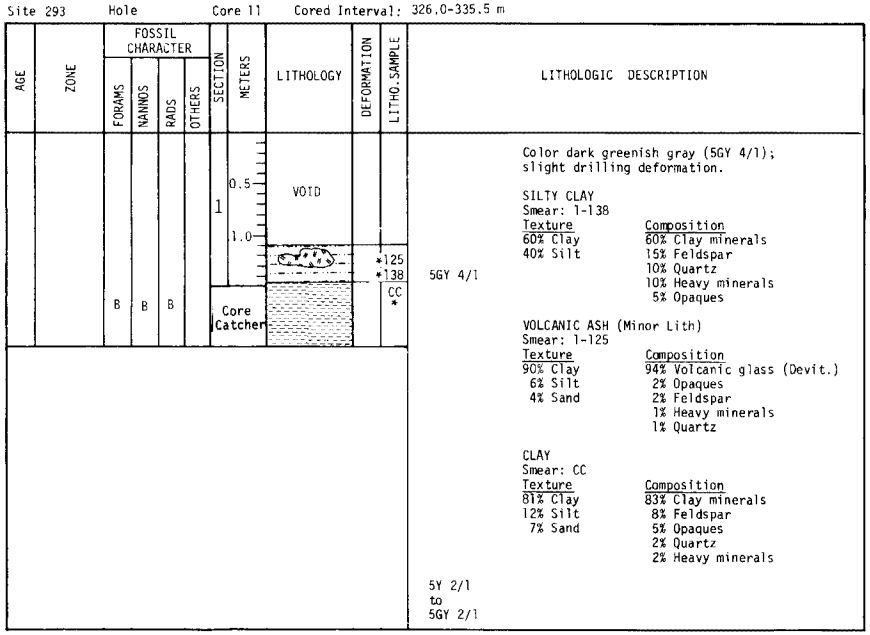
Explanatory notes in chapter 1

Site 293 Hole Core 10 Cored Interval: 297.5-307.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						1	0.5	VOID			Dominate color dark green gray (5GY 4/1); slight deformation; some burrowing; layering noted as follows: 1) (5Y 2/1) olive black-purple=silty clay=hemipelagic 2) (5GY 4/1) dark green gray=silty clay distal 3) (5Y 3/1) olive gray-black=clayey silt turbidite Above interbedded (2-5 cm) thick sequences.
							1.0				
						2				* 132	5GY 4/1 – 5GY 5/1 CLAYEY SILT Smear: 2-70 Texture: 75% Silt, 25% Clay. Composition: 65% Clay minerals, 20% Feldspar, 10% Heavy minerals, 5% Quartz
						3				* 70	5GY 4/1 with interbeds VOLCANIC ASH (Minor Lith) Smear: 1-132 Texture: 90% Clay, 10% Silt. Composition: 90% Devit. ash, 6% Feldspar, 2% Opaques, 2% Heavy minerals
								GEOCHEM SAMPLE			CLAY (Minor Lith) Smear: CC 5GY 4/1 with interbeds Texture: 85% Clay, 10% Silt, 5% Sand. Composition: 60% Clay minerals, 15% Feldspar, 10% Fe-oxides, 5% Quartz, 3% Heavy minerals, 2% Opaques
			B	Rp	B	Core Catcher				CC *	Grain Size 2-69: 0.4, 75.0, 24.6. Carbon Carbonate 3-44: 0.7, 0.6, 1. 5Y 2/1

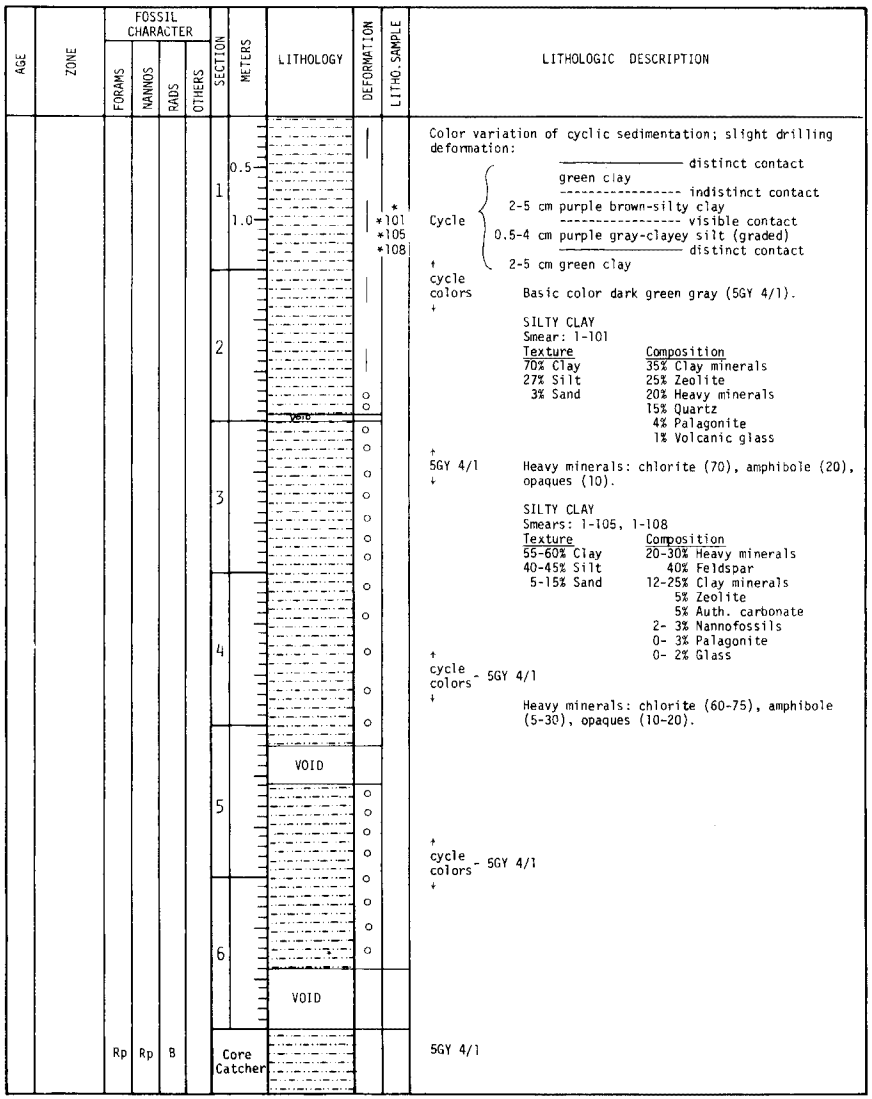
Explanatory notes in chapter 1

Site 293 Hole Core 11 Cored Interval: 326.0-335.5 m



Explanatory notes in chapter 1

Site 293 Hole Core 12 Cored Interval: 354.5-364.0 m



Explanatory notes in chapter 1

Site 293 Hole Core 13 Cored Interval: 383.0-392.5 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						1	0.5, 1.0	VOID			Color variations: green, purple brown, green. Purple gray = cyclic with green black (5G 2/1) as basic color. Drilling deformation breccia to slight. SILTY CLAY
								GEOCHEM SAMPLE			cycle colors
						2		VOID		1	var. colors of cycle 5G 2/1
		B	Rp	B		Core Catcher					5G 2/1

Site 293 Hole Core 14 Cored Interval: 411.5-421.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
										Subunit 1D	Generally olive gray (5Y 3/2) with cyclic colors as noted; drilling breccia: approaching claystone induration.
						1	0.5, 1.0	VOID			SILT-RICH CLAY Smear: 1-123 Texture: 72% Clay, 18% Silt, 10% Sand Composition: 72% Clay minerals, 18% Feldspar, 7% Heavy minerals, 3% Opaques, Tr% Nannofossils
										* 123	5Y 3/2
		B	B	B		Core Catcher					5Y 2/1

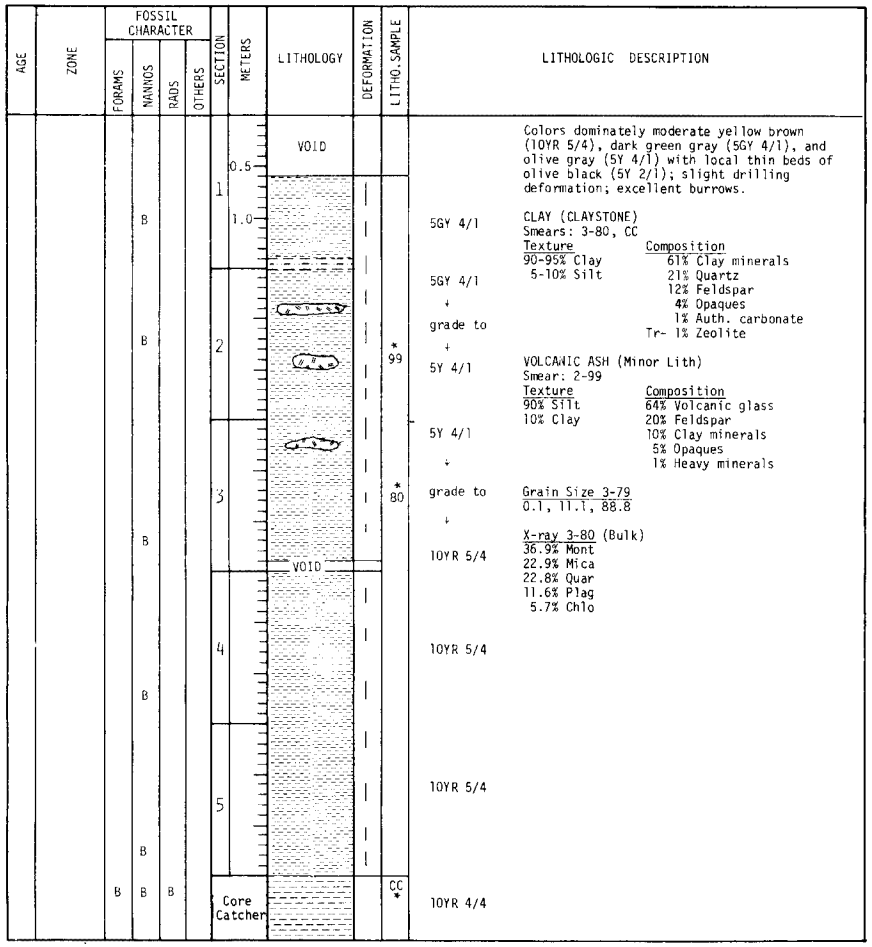
Explanatory notes in chapter 1

Site 293 Hole Core 15 Cored Interval: 440.0-449.5 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						1	0.5, 1.0			* 33	Colors variable-bluish gray (5B 4/1), olive gray (5Y 5/1), with areas moderate yellow brown (10YR 5/4), dark green gray (5GY 4/1); laminae and burrows present - very firm.
			B							* 103	5B 4/1 and 5Y 5/1 CLAY (CLAYSTONE) Smears: 1-130, 2-145, 3-90 Texture: 95% Clay, 5% Silt Composition: 9-33% Feldspar, 7-30% Quartz, 5-60% Zeolite, 2-45% Clay minerals, 1-40% Volcanic glass, 1-10% Auth. carbonate, 1- 2% Heavy minerals, opaques
			B			2				130 *	10YR 5/4
											+ scattered green spotting Smear 1-33 clay with 20% authigenic carbonate.
										* 145	5Y 5/1 ZEOLITIC CLAY (Minor Lith) Smear: 1-103 Texture: 80% Clay, 15% Silt, 5% Sand Composition: 50% Clay minerals, 35% Zeolite, 5% Quartz, feldspar, 1% Heavy minerals, 1% Volcanic glass
			B			3				* 90	10YR 5/4
								GEOCHEM SAMPLE			5BG 4/2 Textures of other smear slides (Sd, St, Cl) 1-33 (3, 28, 69) 2-45 (30, 70) 1-103 (3, 47, 50) 3-90 (4, 35, 61) 1-130 (0, 23, 77) Grain Size 1-27: 0.5, 27.7, 71.8 Grain Size 1-101: 0.9, 48.6, 50.5
			B			4					5GY 4/1 Grain Size 1-130: 0.2, 23.2, 76.6
		B	B	B		Core Catcher					graded beds D-E sequence Carbon Carbonate 1-101: 0.6, 0.1, 4 Carbon Carbonate 1-130: 0.1, 0.1, 0 X-ray 1-27 (Bulk): 29.2% Plag, 26.5% Quar, 21.2% Mica, 17.8% Mont, 5.5% Chlo X-ray 1-101 (Bulk): 60.3% Phil, 19.6% Mont, 9.0% Plag, 7.1% Quar, 4.0% Mica X-ray 1-130 (Bulk): 32.8% Plag, 25.4% Mont, 20.6% Quar, 16.6% Mica, 3.3% Chlo, 1.3% Clin

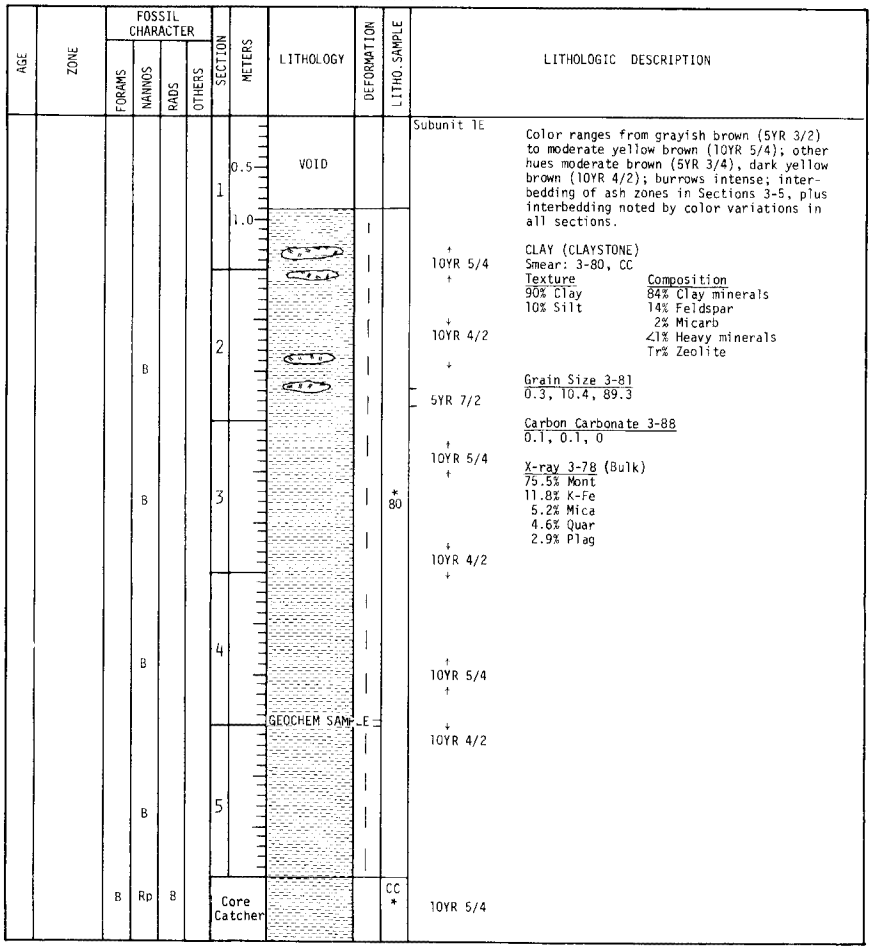
Explanatory notes in chapter 1

Site 293 Hole Core 16 Cored Interval: 468.5-478.0 m



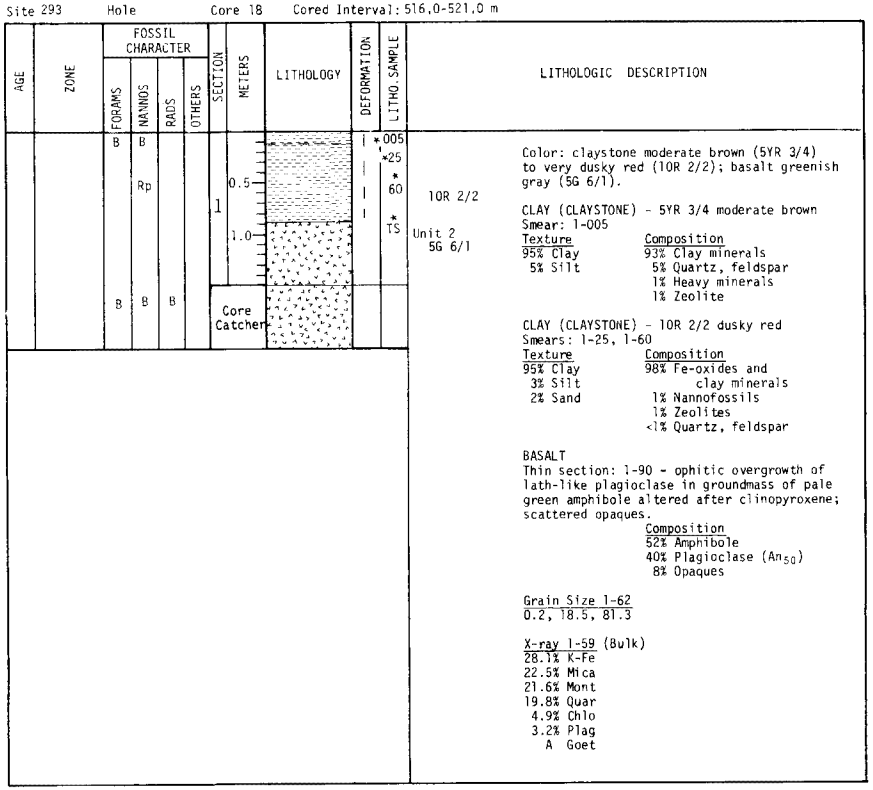
Explanatory notes in chapter 1

Site 293 Hole Core 17 Cored Interval: 497.0-506.5 m



Explanatory notes in chapter 1

Site 293 Hole Core 18 Cored Interval: 516.0-521.0 m



Color: claystone moderate brown (5YR 3/4) to very dusky red (10R 2/2); basalt greenish gray (5G 6/1).

CLAY (CLAYSTONE) - 5YR 3/4 moderate brown
Smear: 1-005

Texture	Composition
95% Clay	93% Clay minerals
5% Silt	5% Quartz, feldspar
	1% Heavy minerals
	1% Zeolite

CLAY (CLAYSTONE) - 10R 2/2 dusky red
Smears: 1-25, 1-60

Texture	Composition
95% Clay	98% Fe-oxides and clay minerals
3% Silt	1% Nannofossils
2% Sand	1% Zeolites
	<1% Quartz, feldspar

BASALT
Thin section: 1-90 - ophitic overgrowth of lath-like plagioclase in groundmass of pale green amphibole altered after clinopyroxene; scattered opaques.

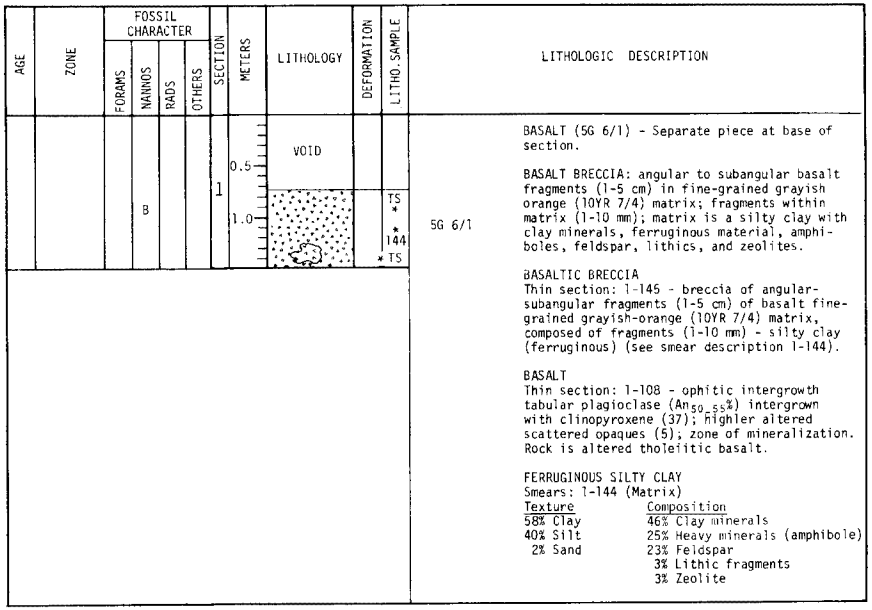
Composition
52% Amphibole
40% Plagioclase (An_{50})
8% Opaques

Grain Size 1-62
0.2, 18.5, 81.3

X-ray 1-59 (Bulk)
28.1% K-Fe
22.5% Mica
21.6% Mont
19.8% Quar
4.9% Chlo
3.2% Plag
A Goet

Explanatory notes in chapter 1

Site 293 Hole Core 19 Cored Interval: 521.0-525.5 m



BASALT (5G 6/1) - Separate piece at base of section.

BASALT BRECCIA: angular to subangular basalt fragments (1-5 cm) in fine-grained grayish orange (10YR 7/4) matrix; fragments within matrix (1-10 mm); matrix is a silty clay with clay minerals, ferruginous material, amphiboles, feldspar, lithics, and zeolites.

BASALTIC BRECCIA
Thin section: 1-145 - breccia of angular-subangular fragments (1-5 cm) of basalt fine-grained grayish-orange (10YR 7/4) matrix, composed of fragments (1-10 mm) - silty clay (ferruginous) (see smear description 1-144).

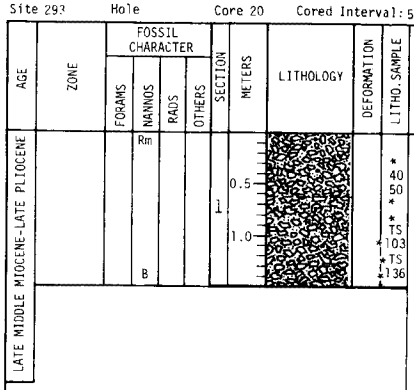
BASALT
Thin section: 1-108 - ophitic intergrowth tabular plagioclase (An_{50-55}%) intergrown with clinopyroxene (37); highler altered scattered opaques (5); zone of mineralization. Rock is altered tholeiitic basalt.

FERRUGINOUS SILTY CLAY
Smears: 1-144 (Matrix)

Texture	Composition
58% Clay	46% Clay minerals
40% Silt	25% Heavy minerals (amphibole)
2% Sand	23% Feldspar
	3% Lithic fragments
	3% Zeolite

Explanatory notes in chapter 1

Site 293 Hole Core 20 Cored Interval: 525.5-535.0 m



LITHOLOGIC DESCRIPTION

IGNEOUS BRECCIA
Four units within core:
i) 0-25 cm - breccia with angular to subangular basalt fragments (up to 10 cm);
ii) 25-61 cm - angular clasts (2-4 cm) in fine-grained matrix; matrix is bimodal with grains (0.2 to 0.8 cm) in fine silty clay; color is moderate red brown (10R 4/6); clast are basalt (angular and micrograbbro);
iii) 61-145 cm - clasts (4-15 cm) of anorthosite gabbro in fine-grained, light greenish gray matrix - matrix is bimodal; and
iv) 145-150 cm - greenish gray (5GY 6/1) basalt fragment.

BRECCIA
ii - clasts of greenschist facies schists of deformed gabbros - in clay size matrix of amphibole, oxide, plagioclase, carbonate and goethite.

iii - coarse gabbro (plagioclase-40, clinopyroxene-30, orthopyroxene-20, amphibole-10) in clay size matrix of carbonate, amphibole, clinopyroxene.

BRECCIA FRAGMENTS
i - Microgabbro
Thin section: 1-103 - euhedral, subhedral plagioclase in groundmass of interstitial clinopyroxene, now altered to amphibole.

Composition
45% Plagioclase (An_{52})
20% Clinopyroxene
35% Amphibole

ii - Gabbro
Thin section: 1-136 - subhedral-anhedral plagioclase intergrown with interstitial clinopyroxene; plagioclase-twinned, zoned; clinopyroxene shows exsolution, partial alteration to amphibole.

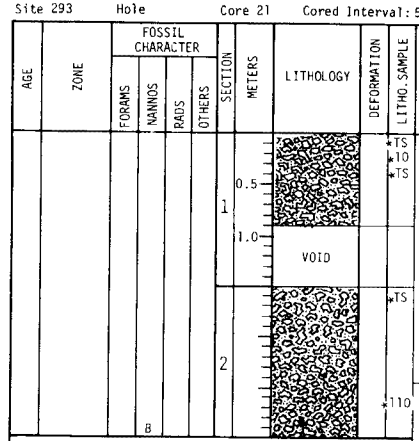
Composition
60% Plagioclase
32% Pyroxene
5% Amphibole
3% Opaques

SANDY SILT MATRIX MATERIAL
Smears: 1-40, 1-50

Texture	Composition
50-60% Silt	40-50% Feldspar
30% Sand	16-55% Heavy minerals (amphibole)
10-20% Clay	20% Fe-oxides
	10-20% Clay minerals
	2- 3% Opaques
	1- 3% Auth. carbonate

Explanatory notes in chapter 1

Site 293 Hole Core 21 Cored Interval: 535.0-544.4 m



LITHOLOGIC DESCRIPTION

IGNEOUS BRECCIA

10YR 8/6

Section 1:
Large (up to 13 cm) clasts of gabbro, angular-subangular anorthosite gabbro, variolitic basalt, hornblende plagioclase schists, and gabbro altered to greenschist
Additional descriptions in Lithology Report-Site 293.
Matrix: color yellowish orange (10YR 8/6) with composition and texture as follows:

10YR 6/6

SILTY SAND
Smear: 1-10

Texture	Composition
50% Sand	54% Feldspar
40% Silt	32% Heavy minerals
10% Clay	10% Clay minerals
	2% Opaques
	2% Auth. carbonate
	Tr% Zeolite

5YR 3/2

Heavy minerals: amphiboles, clinopyroxenes.

Section 2:
0-40 cm: coarse grained angular gabbro clasts (1-15 cm) in dark yellow orange (10YR 6/6) matrix

40-80 cm: finer grained (1-3 cm) gabbro clasts in dark yellowish orange matrix

80-89 cm: fine grained gabbro and pyroxene diorite gneiss clasts in grayish brown (5YR 3/2) matrix (clay size) of chlorite

5GY 8/1

89-150 cm: angular to subangular gabbro clasts (1-5 cm) in light greenish gray (5GY 8/1) matrix of chloritic, serpentine, authigenic carbonate

Additional descriptions in Lithology Report - Site 293.

Matrix: color light greenish gray (5GY 8/1)
SAND-RICH SILT
Smear: 2-110

Texture	Composition
85% Silt	45% Feldspar
10% Sand	40% Heavy minerals
5% Clay	10% Altered pyroxene
	5% Auth. carbonate

Explanatory notes in chapter 1

Site 293 Hole Core 22 Cored Interval: 544.5-554.0 m

AGE	ZONE	FOSSIL CHARACTER				SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
		FORAMS	NANNOS	RADS	OTHERS						
				B							PALEO: A few sediment chips retained on inner lining of core catcher were found to contain few poorly preserved nannofossils.

Explanatory notes in chapter 1

Site 293 Hole Core 23 Cored Interval: 554.0-563.5 m

AGE	ZONE	FOSSIL CHARACTER				SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
		FORAMS	NANNOS	RADS	OTHERS						
LATE MIDDLE MIOCENE-LATE PLIOCENE				B							PALEO: A few sediment chips retained on inner lining of core catcher were found to contain rare moderate to well preserved nannofossils.

Explanatory notes in chapter 1

DEEP SEA DRILLING PROJECT

LEG 31 SITE 294

SITE SUMMARY SHEET

POSITION: Latitude: 22°34.74'N Longitude: 131°23.13'E

Water depth (from sea level): 5784 corrected meters (Echo sounding)

Bottom felt at: 5820 meters (drill pipe) Penetration: 118 meters

Number of Holes: 1 Number of Cores: 7

Total length of cored section: 51.5 m Total core recovered: 23.2 m

Percentage of core recovery: 45%

OLDEST SEDIMENT CORED:

Depth below sea floor: 112 meters Nature: Brown mud

Age: Eocene or Paleocene(?)

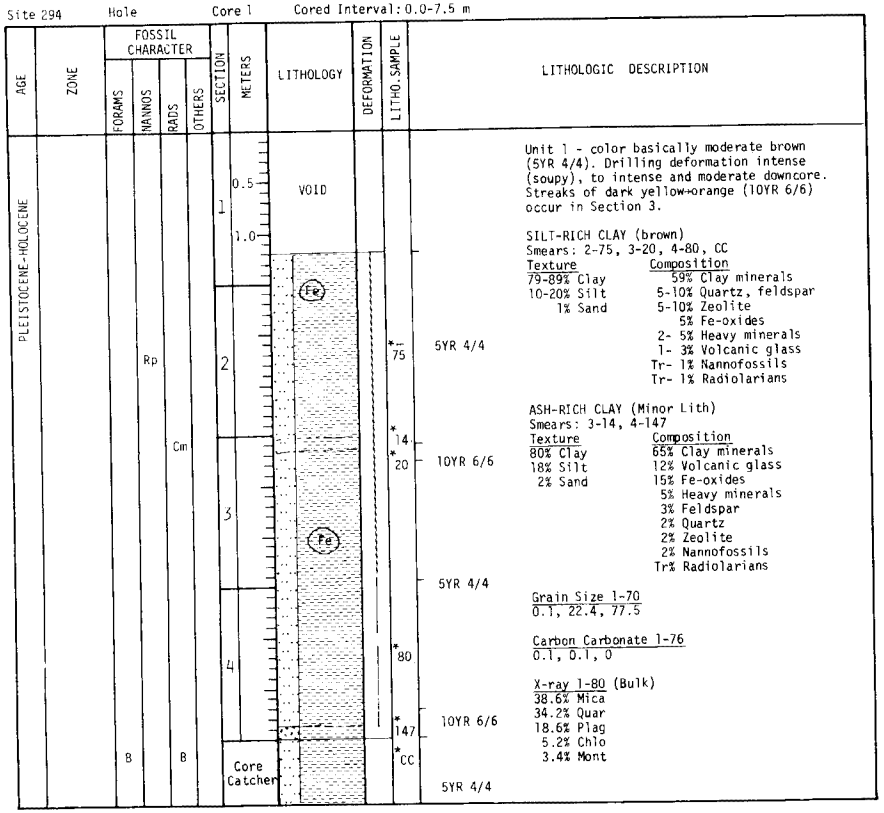
BASEMENT:

Depth below sea floor: 112-118 meters (drilled) Nature: Basalt

PRINCIPAL RESULTS:

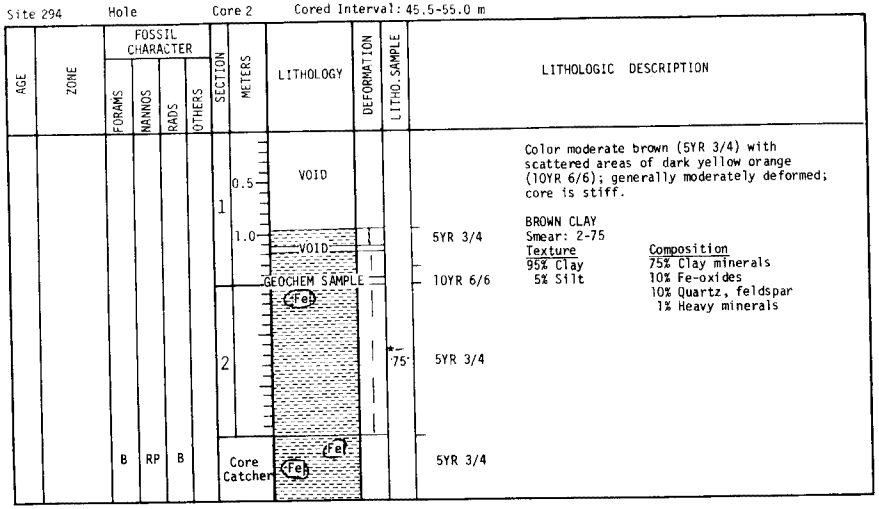
Hole 294 penetrated a thin sediment blanket covering the deeper portions of the West Philippine Basin northeast of the Central Basin Fault in an attempt to obtain another basement age and sediment history. The stratigraphic column consists of 112 meters of brown ferruginous pelagic silt-rich, silty clays and clays, barren of identifiable microfossils except fish teeth, overlying a fine grained titanium-rich basalt. Estimated rate of sedimentation for brown clay of (2-3 m/m.y.) suggests an Eocene to Paleocene basement age.

Site 294 Hole Core 1 Cored Interval: 0.0-7.5 m



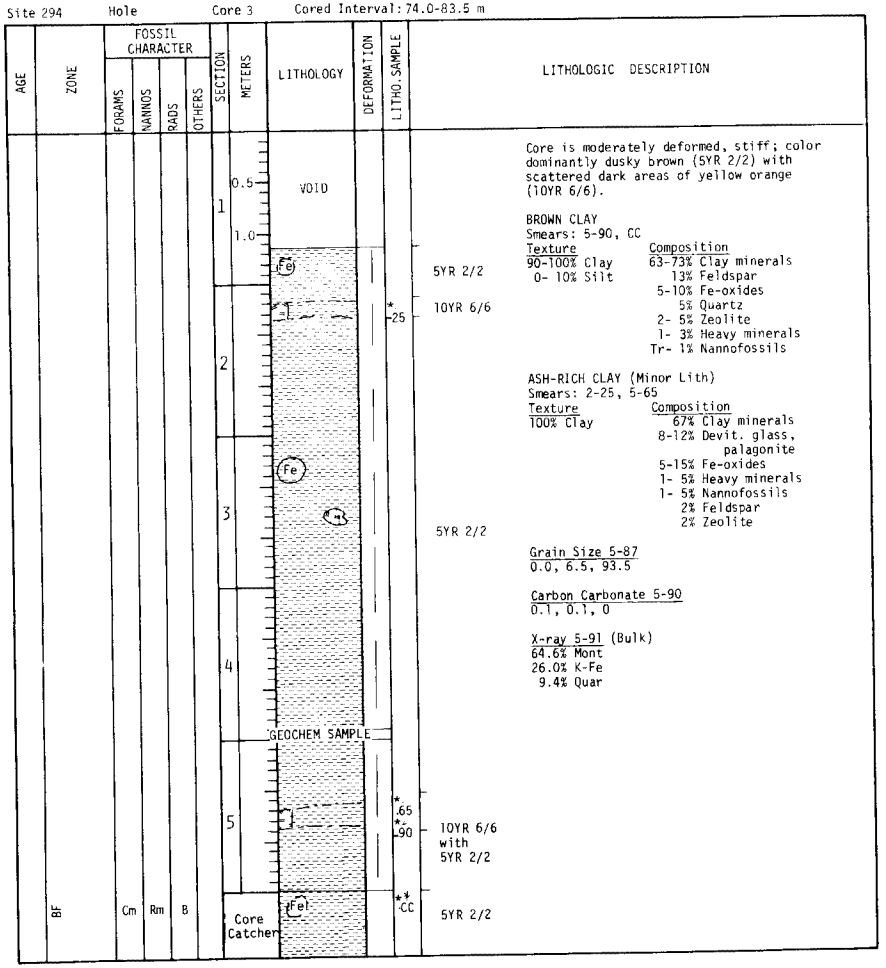
Explanatory notes in chapter 1

Site 294 Hole Core 2 Cored Interval: 45.5-55.0 m



Explanatory notes in chapter 1

Site 294 Hole Core 3 Cored Interval: 74.0-83.5 m



Explanatory notes in chapter 1

Site 294 Hole Core 4 Cored Interval: 93.0-102.5 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
						1	0.5	VOID			Core has drilling breccia in Section 1. Moderate - some intense deformation thereafter; color is dusky brown (5YR 2/2) with scattered moderate brown (5YR 3/4) to section 4 (Unit 2) where color is a dominant blackish red (5R 2/2) with some scattered dark yellow orange (10YR 6/6); some mottling noticed through core.
							1.0				FERRUGINOUS SILT-RICH CLAY Smears: 4-150, 5-20, CC Texture: 80% Clay, 20% Silt Composition: 39-56% Clay minerals, 30-35% Fe-oxides, 12% Feldspar, 6% Opaques, 1-2% Zeolite, Tr% Nannofossils, Tr% Foraminifera 5YR 2/2
						2		(Fe)		65	5YR 3/2
											Some low Fe content clay at 2-65.
						3					5YR 2/2 PALAGONITE ASH (Minor Lith) Smear: 4-100 Texture: 100% Clay Composition: 85% Palagonite, 5% Clay minerals, 5% Heavy minerals, 3% Mica, 2% Feldspar, Tr% Nannofossils
								VOID			
						4		(Fe)			10YR 6/6 Grain Size 3-78: 0.0, 19.7, 80.3 Grain Size 4-146: 0.1, 21.0, 78.9 5R 2/2 Carbon Carbonate 4-146: 0.1, 0.0, 0
										100	10YR 6/6 X-ray 3-80 (Bulk): 41.1% K-Fe, 24.7% Mont, 21.1% Quar, 9.9% Mica, 3.1% Clin, M Goet
								(Fe)		150	
						5				20	5R 2/2 X-ray 4-148 (Bulk): 34.2% Hema, 28.1% Mont, 24.8% K-Fe, 7.1% Plag, 5.9% Quar, P Goet
								GEOCHEM. SAMPLE (Fe)			
						6		(Fe)			
								VOID			
								(Fe)			5YR 2/2 with 5R 2/2 (mixed)
		B	RP	B		Core Catcher		(Fe)		CC	5YR 2/2

Explanatory notes in chapter 1

Site 294 Hole Core 5 Cored Interval: 102.5-105.5 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
		B		B		Core Catcher					Trace amount of FERRUGINOUS SILT-RICH CLAY in core catcher. Foraminifera and radiolarians noted.

Explanatory notes in chapter 1

Site 294 Hole Core 6 Cored Interval: 105.5-112.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
						1	0.5	VOID			Section 1 is alternating drilling breccia - intensely deformed; dominant color is blackish red (5R 2/2), with small scattered light brown (5YR 5/6) areas; areas also mottled with dark reddish brown (10R 3/4).
							1.0	(Fe)			mixed colors
								(Fe)			5R 2/2 FERRUGINOUS SILT-RICH CLAY Smears: 1-141, CC Texture: 80% Clay, 20% Silt Composition: 60% Clay minerals, 40% Fe-oxides, Tr% Nannofossils, Tr% Quartz
		B	Fm	B		Core Catcher		(Fe)		141 CC	BASALT (Unit 3) Intersertal-tholeiitic basalt; felted network of lath-like plagioclase (An_{52}) in groundmass of fine grained interstitial Ti-augite needles in brown altered glass; calcite and serpentine alteration material; scattered euhedral opaques. Composition: 55% Plagioclase, 20% Pyroxene, 10% Oxides, 10% Interstitial, 5% Calcite Grain Size 1-62: 1.1, 21.0, 77.9 Carbon Carbonate 1-65: 0.1, 0.1, 0 X-ray 1-139 (Bulk): 69.8% Hema, 28.9% Mont, 1.3% Quar 5Y 4/1

Explanatory notes in chapter 1

Site 294 Hole Core 7 Cored Interval: 112.0-118.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	OTHERS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
						1	0.5	VOID			BASALT Intersertal tholeiitic basalt; lath-like plagioclase (An_{54}) in groundmass of fine-grained interstitial material of Ti-augite needles in altered glassy material; scattered euhedral opaques with small skeletal crystals in groundmass. Composition: 43% Interstitial, 40% Plagioclase, 8% Oxides, 5% Pyroxene, 4% Calcite; 57% Plagioclase, 45% Pyroxene, 8% Opaques
							1.0			TS	
		B		B		Core Catcher					5Y 4/1

Explanatory notes in chapter 1

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DEEP SEA DRILLING PROJECT

LEG 31 SITE 295

SITE SUMMARY SHEET

POSITION: Latitude: 22°33.76'N Longitude: 131°22.04'E

Water depth (from sea level): 5808 corrected meters (Echo sounding)

Bottom felt at: 5812 meters (drill pipe) Penetration: 158 meters

Number of Holes: 1 Number of Cores: 3

Total length of cored section: 28.5 m Total core recovered: 19.8 m

Percentage of core recovery: 69%

OLDEST SEDIMENT CORED:

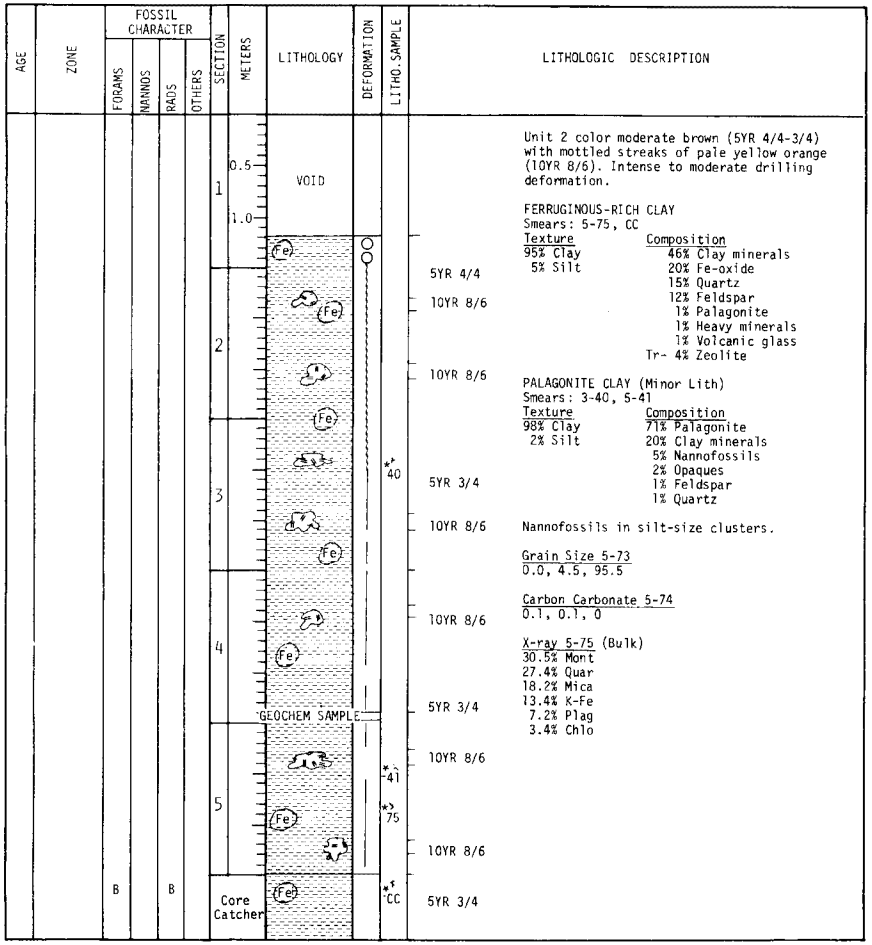
Depth below sea floor: 158 meters Nature: Brown clay

Age: Eocene(?)

PRINCIPAL RESULTS:

Hole 295 was drilled in a local basin 1.6 km west of Site 294 in an attempt to obtain a fossiliferous sediment-basement contact in the northeastern West Philippine Basin. It penetrated 158 meters of brown ferruginous silty clay, and clay. Reworked and poorly preserved Eocene nannofossils, and well preserved mid Paleocene planktonic foraminifera were found in a mixed sample at the base of Hole 295 indicating either a Paleocene basement age or that sediment of that age were being transported from the Oki-Daito Ridge to the northeast. This age is compatible with age based on rate of sedimentation of brown clay.

Site 295 Hole Core 1 Cored Interval: 101.0-110.5 m



Unit 2 color moderate brown (5YR 4/4-3/4) with mottled streaks of pale yellow orange (10YR 8/6). Intense to moderate drilling deformation.

FERRUGINOUS-RICH CLAY
Smears: 5-75, CC

Texture	Composition
95% Clay	46% Clay minerals
5% Silt	20% Fe-oxide
	15% Quartz
	12% Feldspar
	1% Palagonite
	1% Heavy minerals
	1% Volcanic glass
	Tr- 4% Zeolite

PALAGONITE CLAY (Minor Lith)
Smears: 3-40, 5-41

Texture	Composition
98% Clay	71% Palagonite
2% Silt	20% Clay minerals
	5% Nannofossils
	2% Opaques
	1% Feldspar
	1% Quartz

Nannofossils in silt-size clusters.

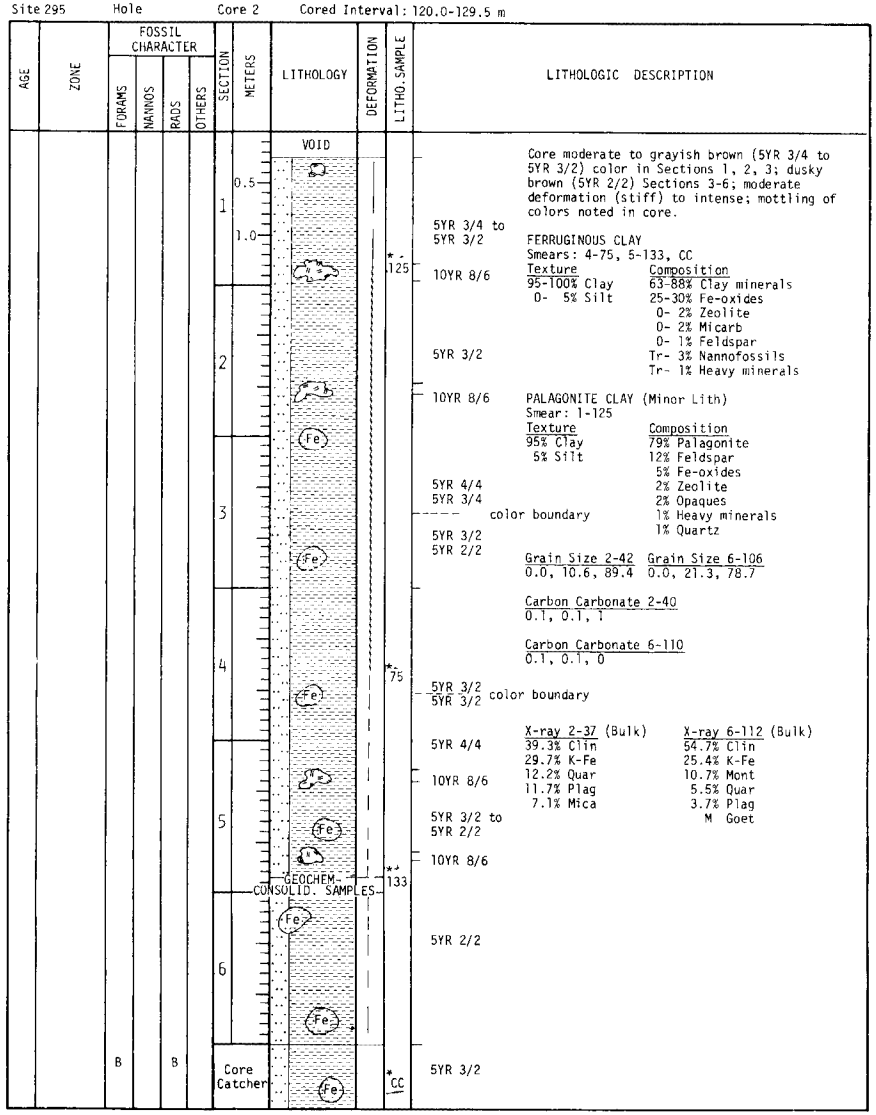
Grain Size 5-73
0.0, 4.5, 95.5

Carbon Carbonate 5-74
0.1, 0.1, 0

X-ray 5-75 (Bulk)
30.5% Mont
27.4% Quar
18.2% Mica
13.4% K-Fe
7.2% Plag
3.4% Chlo

Explanatory notes in chapter 1

Site 295 Hole Core 2 Cored Interval: 120.0-129.5 m



Core moderate to grayish brown (5YR 3/4 to 5YR 3/2) color in Sections 1, 2, 3; dusky brown (5YR 2/2) Sections 3-6; moderate deformation (stiff) to intense; mottling of colors noted in core.

FERRUGINOUS CLAY
Smears: 4-75, 5-133, CC

Texture	Composition
95-100% Clay	63-88% Clay minerals
0- 5% Silt	25-30% Fe-oxides
	0- 2% Zeolite
	0- 2% Micarb
	0- 1% Feldspar
	Tr- 3% Nannofossils
	Tr- 1% Heavy minerals

PALAGONITE CLAY (Minor Lith)
Smear: 1-125

Texture	Composition
95% Clay	79% Palagonite
5% Silt	12% Feldspar
	5% Fe-oxides
	2% Zeolite
	2% Opaques
	1% Heavy minerals
	1% Quartz

Grain Size 2-42: 0.0, 10.6, 89.4
Grain Size 6-106: 0.0, 21.3, 78.7

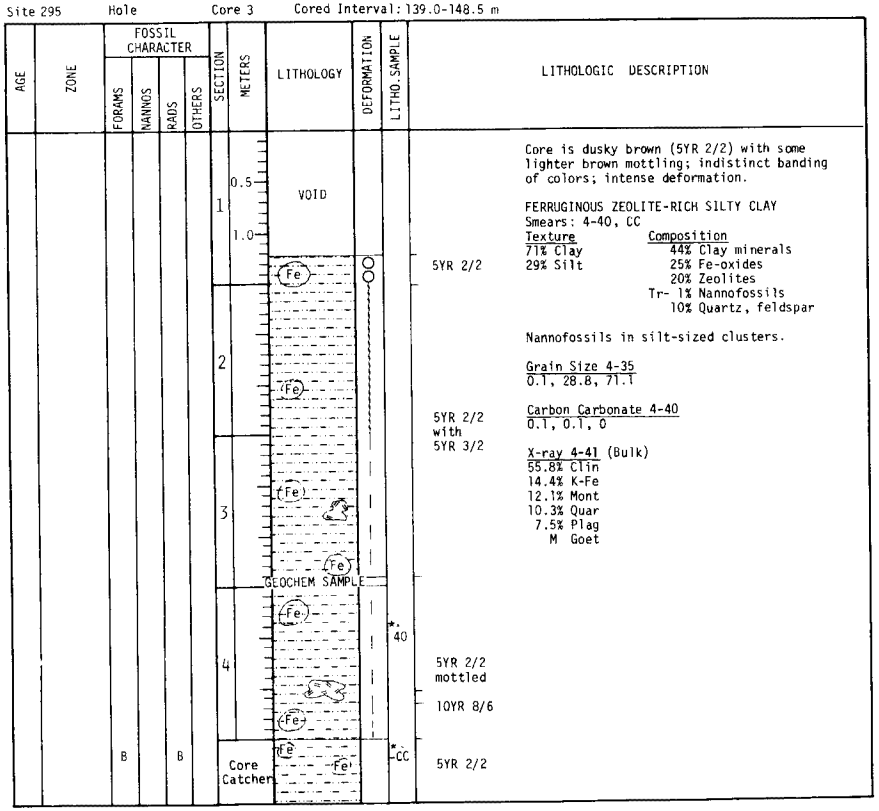
Carbon Carbonate 2-40
0.1, 0.1, 1

Carbon Carbonate 6-110
0.1, 0.1, 0

X-ray 2-37 (Bulk)	X-ray 6-112 (Bulk)
39.3% Clin	54.7% Clin
29.7% K-Fe	25.4% K-Fe
12.2% Quar	10.7% Mont
11.7% Plag	5.5% Quar
7.1% Mica	3.7% Plag
	M Goet

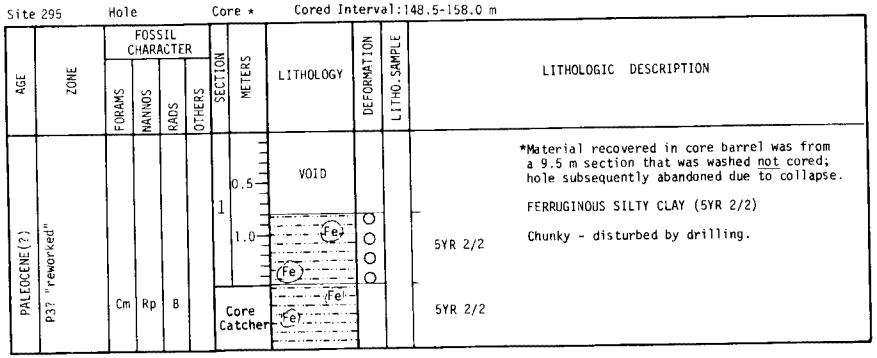
Explanatory notes in chapter 1

Site 295 Hole Core 3 Cored Interval: 139.0-148.5 m



Explanatory notes in chapter 1

Site 295 Hole Core * Cored Interval: 148.5-158.0 m



Explanatory notes in chapter 1

DEEP SEA DRILLING PROJECT

LEG 31 SITE 296

SITE SUMMARY SHEET

POSITION: Latitude: 29°20.41'N Longitude: 133°31.52'E

Water depth (from sea level): 2920 corrected meters (Echo sounding)

Bottom felt at: 2958 meters (drill pipe) Penetration: 1087 meters

Number of Holes: 1 Number of Cores: 65

Total length of cored section: 612 m Total core recovered: 312.1 m

Percentage of core recovery: 51%

OLDEST SEDIMENT CORED:

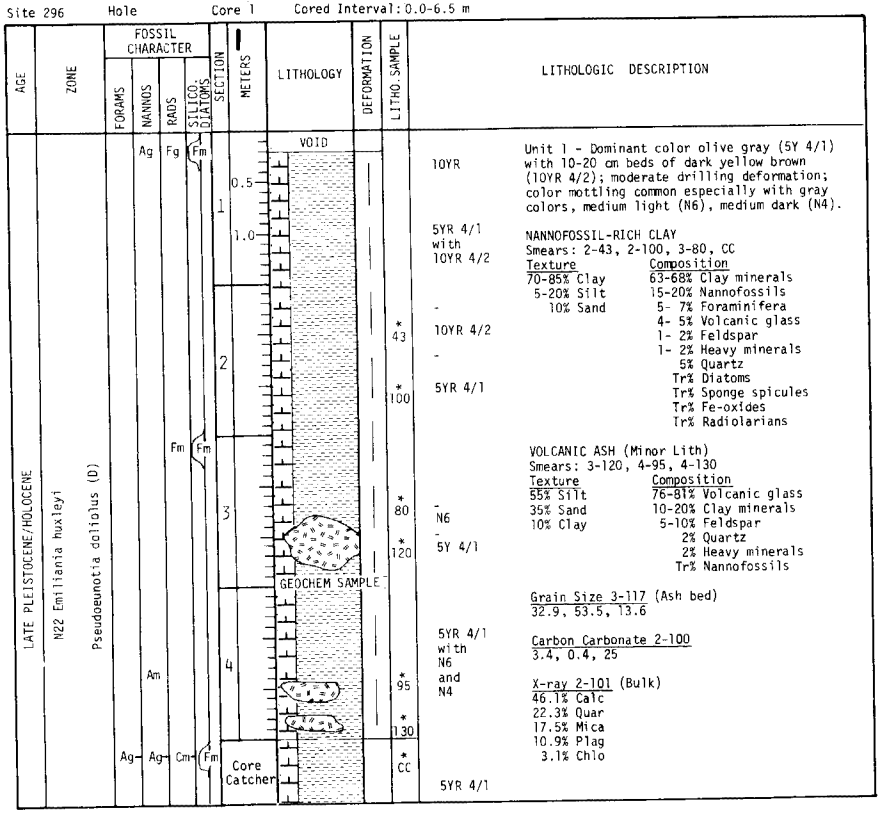
Depth below sea floor: 1087 meters Nature: Volcanic tuff and conglomerate

Age: early Oligocene(?) Measured Velocity: 2.7 km/sec

PRINCIPAL RESULTS:

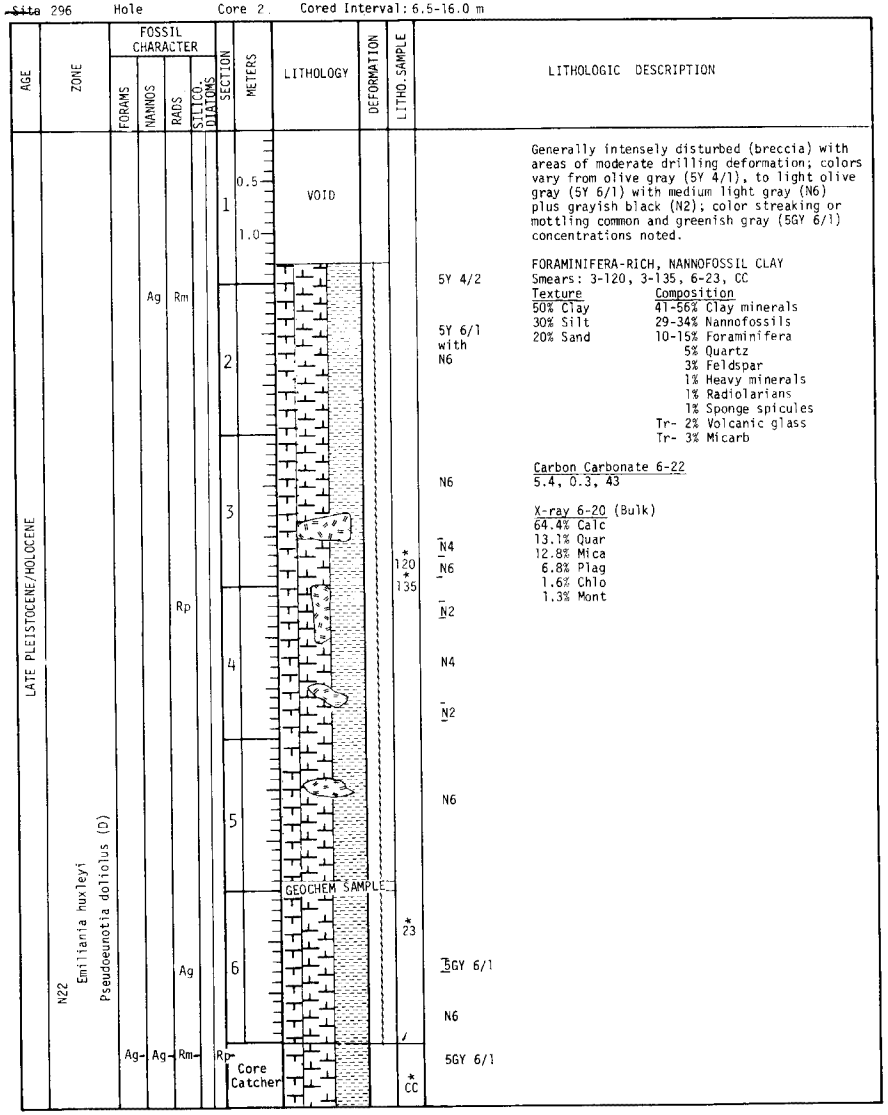
Site 296 was drilled on a sediment covered terrace high on the west flank of the Palau-Kyushu Ridge. The stratigraphic sequence consists of 453 meters of late Oligocene to Pleistocene ash-bearing, clay-rich, and clayey nannofossil oozes/chalks overlying more than 634 meters of early to late Oligocene volcaniclastics in which the hole bottomed (terminated). The clayey chalk-ooze interval provides an excellent biostratigraphic reference section, and record of Neogene planktonic events beneath the Kuroshio Current. Displaced littoral foraminifera indicate that portions of the ridge were at or near sea level during the late Oligocene, whereas Neogene bathyal species document later subsidence of the ridge. The boundary between Oligocene volcaniclastics and younger chalks may coincide with rifting of the ridge after initial opening of the Parece Vela Basin in the late Oligocene.

Site 296 Hole Core 1 Cored Interval: 0.0-6.5 m



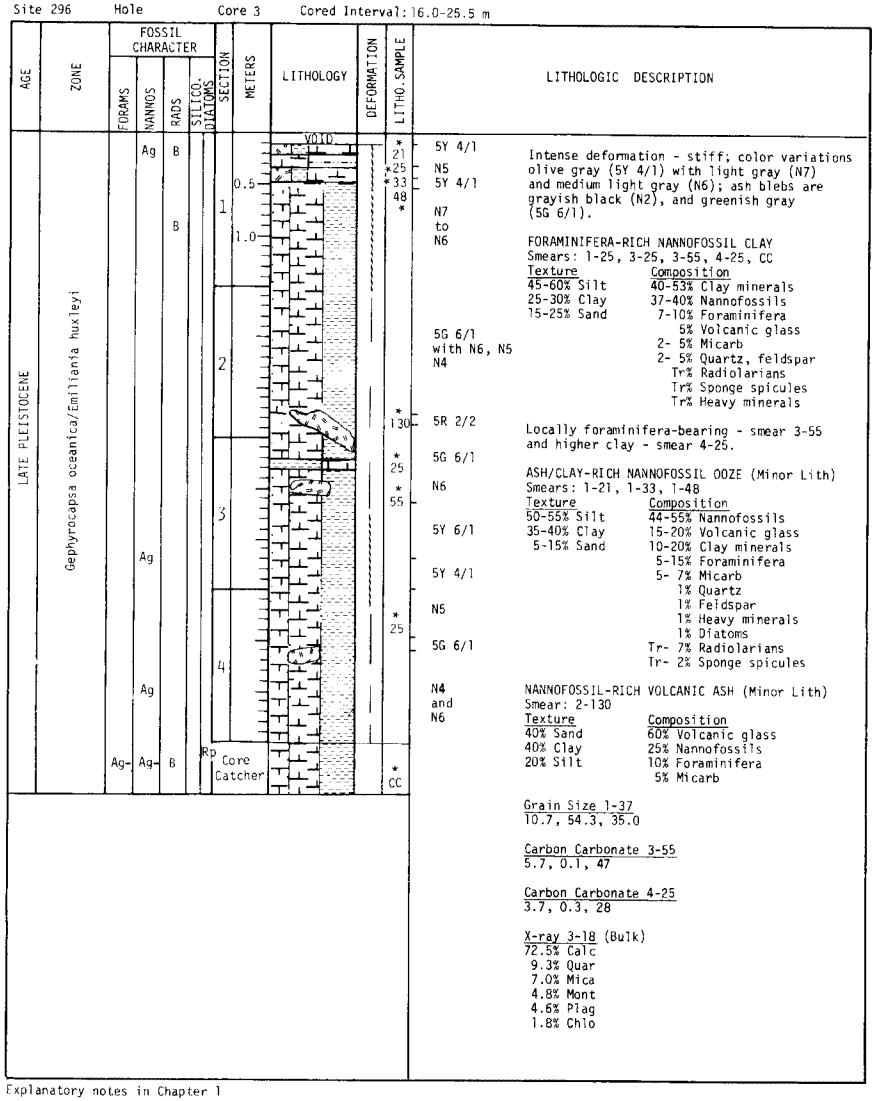
Explanatory notes in chapter 1

Site 296 Hole Core 2 Cored Interval: 6.5-16.0 m



Explanatory notes in chapter 1

Site 296 Hole Core 3 Cored Interval: 16.0-25.5 m



LITHOLOGIC DESCRIPTION

5Y 4/1
N5
5Y 4/1
N7
to
N6

Intense deformation - stiff; color variations olive gray (5Y 4/1) with light gray (N7) and medium light gray (N6); ash blebs are grayish black (N2), and greenish gray (5G 6/1).

FORAMINIFERA-RICH NANNOFOSSIL CLAY
Smears: 1-25, 3-25, 3-55, 4-25, CC

Texture	Composition
45-60% Silt	40-53% Clay minerals
25-30% Clay	37-40% Nannofossils
15-25% Sand	7-10% Foraminifera
	5% Volcanic glass
	2- 5% Micarb
	2- 5% Quartz, feldspar
	Tr% Radiolarians
	Tr% Sponge spicules
	Tr% Heavy minerals

5G 6/1 with N6, N5 N4

5R 2/2

Locally foraminifera-bearing - smear 3-55 and higher clay - smear 4-25.

5G 6/1
N6
5Y 6/1
5Y 4/1
N5
5G 6/1

ASH/CLAY-RICH NANNOFOSSIL OOZE (Minor Lith)
Smears: 1-21, 1-33, 1-48

Texture	Composition
50-55% Silt	44-55% Nannofossils
35-40% Clay	15-20% Volcanic glass
5-15% Sand	10-20% Clay minerals
	5-15% Foraminifera
	5- 7% Micarb
	1% Quartz
	1% Feldspar
	1% Heavy minerals
	1% Diatoms
	Tr- 7% Radiolarians
	Tr- 2% Sponge spicules

N4 and N6

NANNOFOSSIL-RICH VOLCANIC ASH (Minor Lith)
Smear: 2-130

Texture	Composition
40% Sand	60% Volcanic glass
40% Clay	25% Nannofossils
20% Silt	10% Foraminifera
	5% Micarb

Grain Size 1-37
10.7, 54.3, 35.0

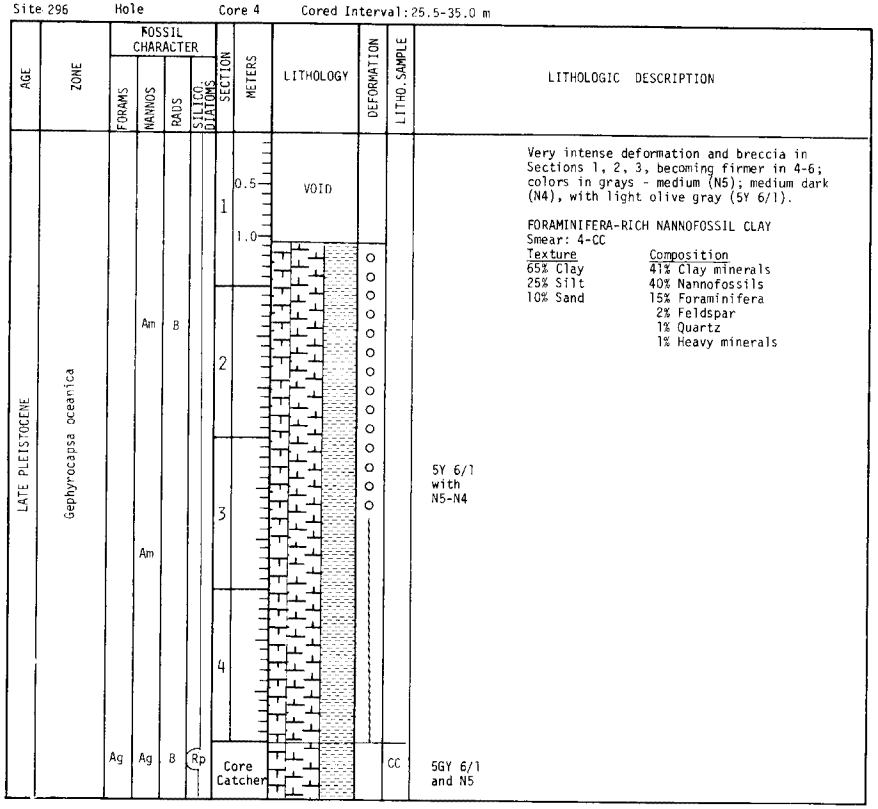
Carbon Carbonate 3-55
5.7, 0.1, 47

Carbon Carbonate 4-25
3.7, 0.3, 28

X-ray 3-18 (Bulk)
72.5% Calc
9.3% Quar
7.0% Mica
4.8% Mont
4.6% Plag
1.8% Chlo

Explanatory notes in Chapter 1

Site 296 Hole Core 4 Cored Interval: 25.5-35.0 m



LITHOLOGIC DESCRIPTION

Very intense deformation and breccia in Sections 1, 2, 3, becoming firmer in 4-6; colors in grays - medium (N5); medium dark (N4), with light olive gray (5Y 6/1).

FORAMINIFERA-RICH NANNOFOSSIL CLAY
Smear: 4-CC

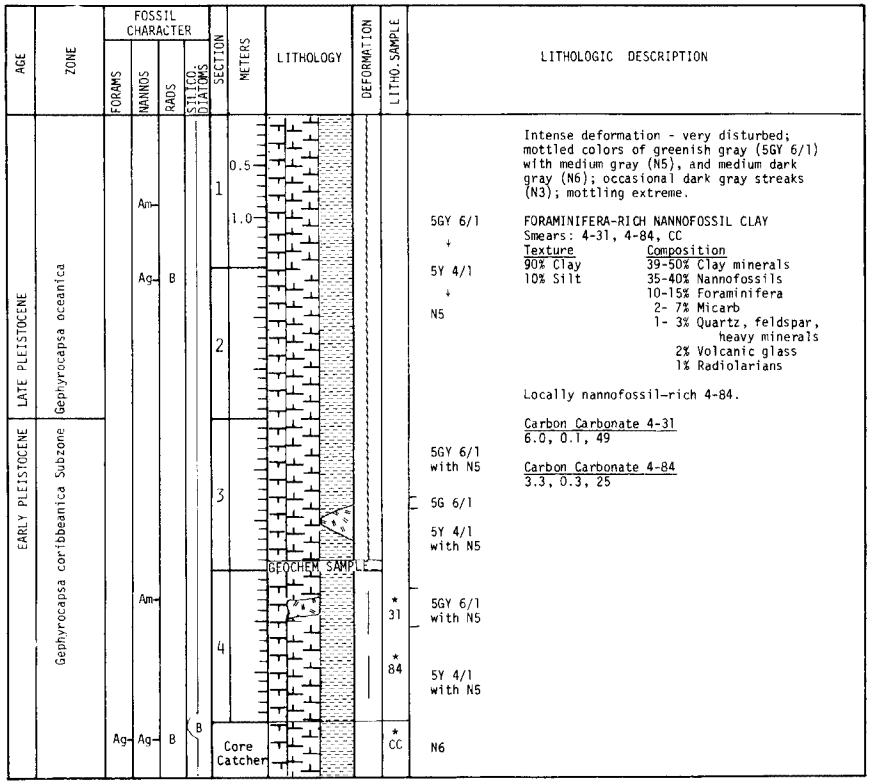
Texture	Composition
65% Clay	41% Clay minerals
25% Silt	40% Nannofossils
10% Sand	15% Foraminifera
	2% Feldspar
	1% Quartz
	1% Heavy minerals

5Y 6/1 with N5-N4

5GY 6/1 and N5

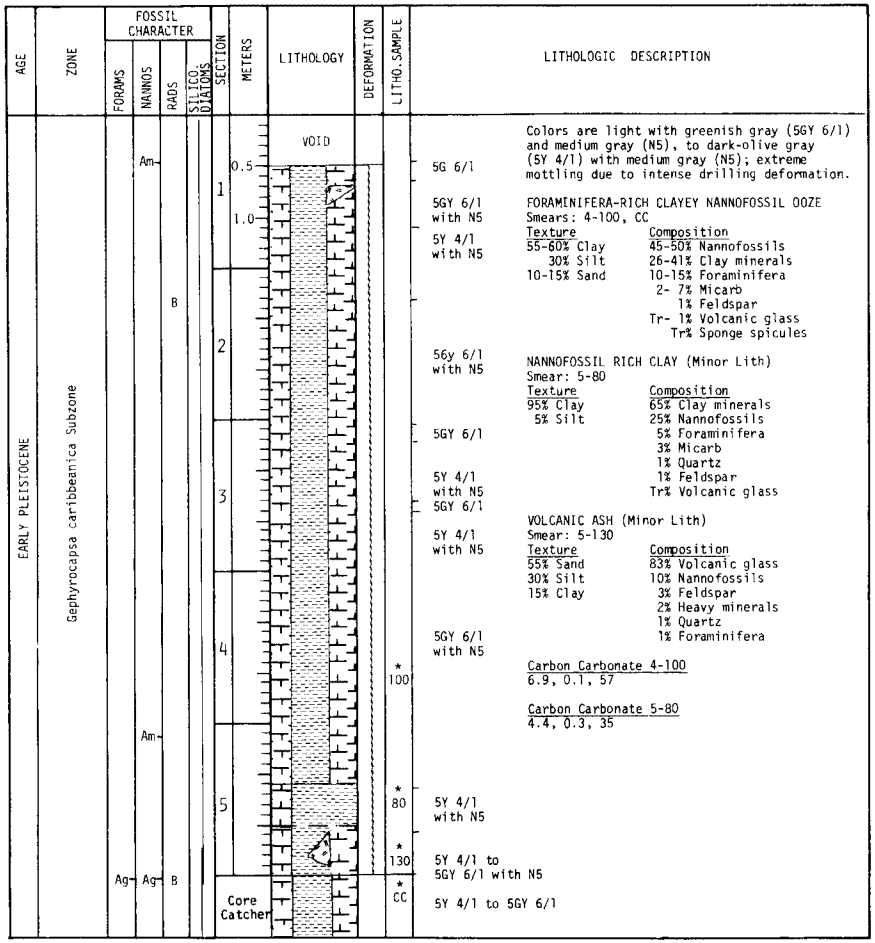
Explanatory notes in chapter 1

Site 296 Hole Core 5 Cored Interval: 35.0-44.5 m



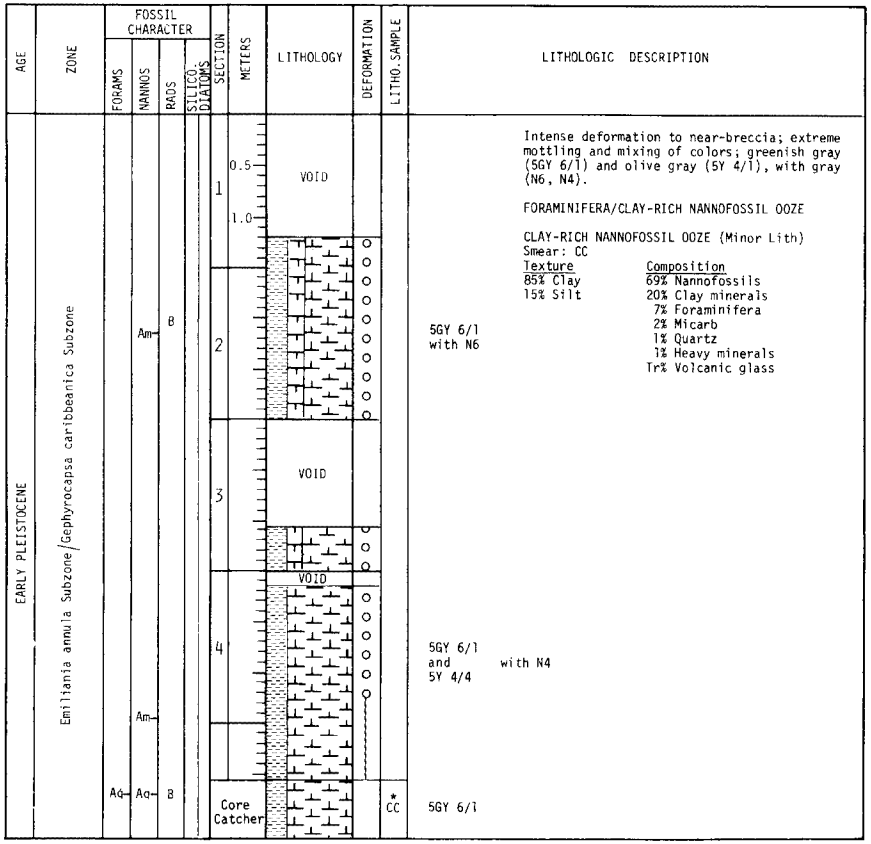
Explanatory notes in chapter 1

Site 296 Hole Core 6 Cored Interval: 44.5-54.0 m



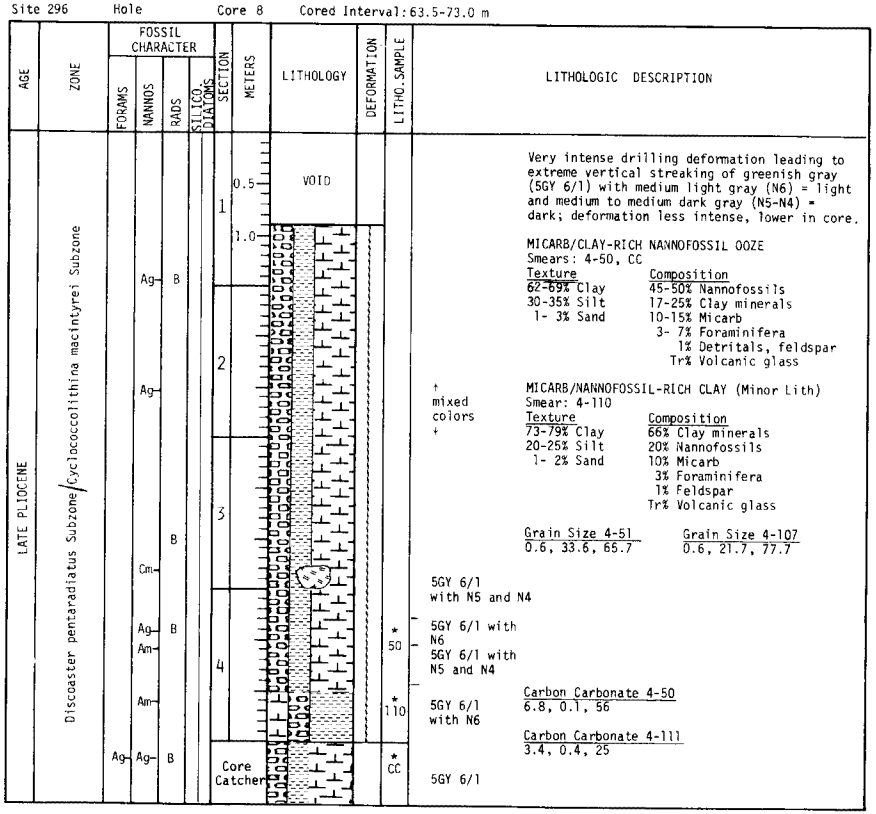
Explanatory notes in chapter 1

Site 296 Hole Core 7 Cored Interval: 54.0-63.5 m



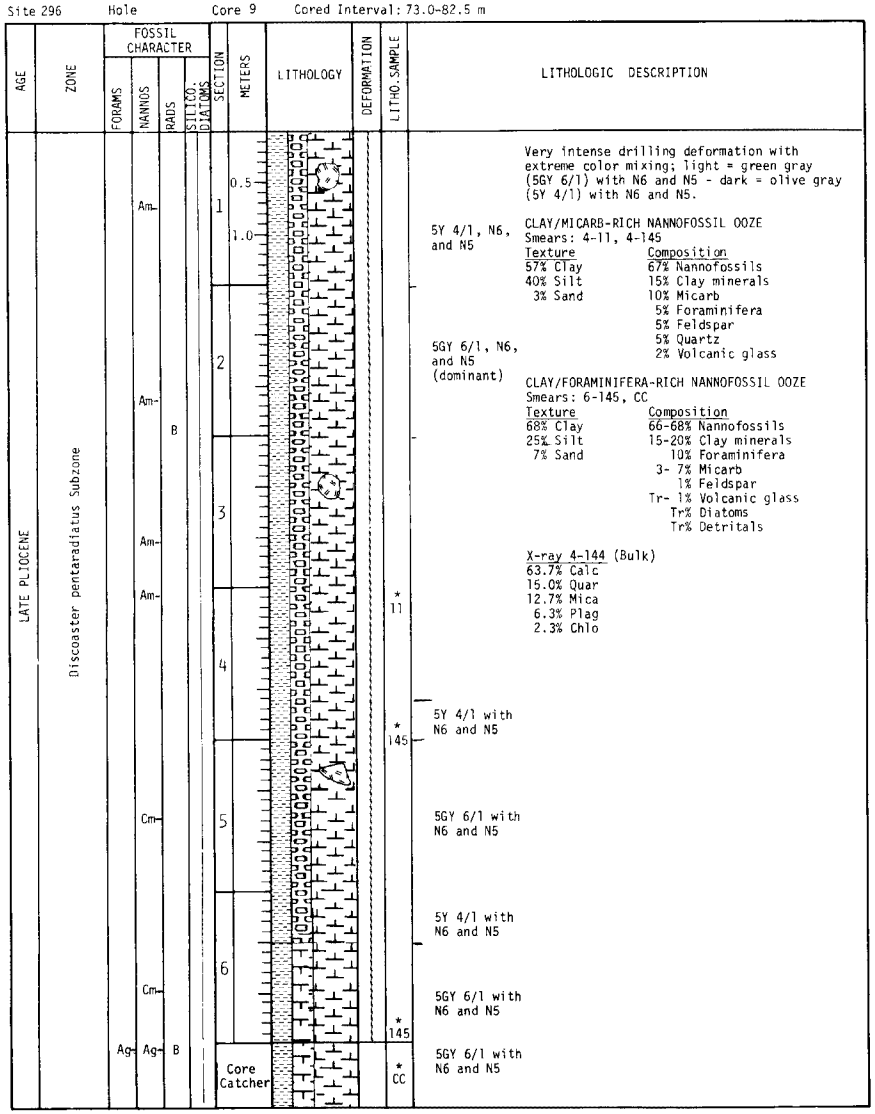
Explanatory notes in chapter 1

Site 296 Hole Core 8 Cored Interval: 63.5-73.0 m



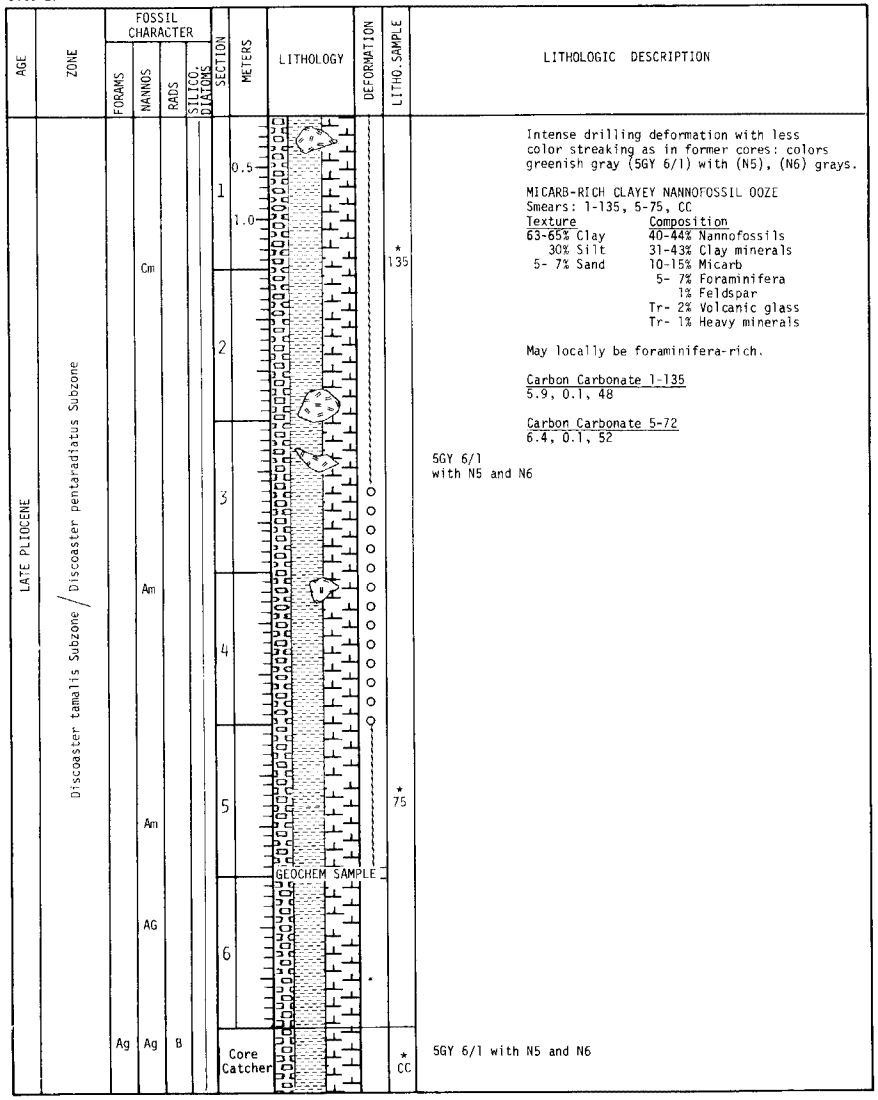
Explanatory notes in chapter 1

Site 296 Hole Core 9 Cored Interval: 73.0-82.5 m



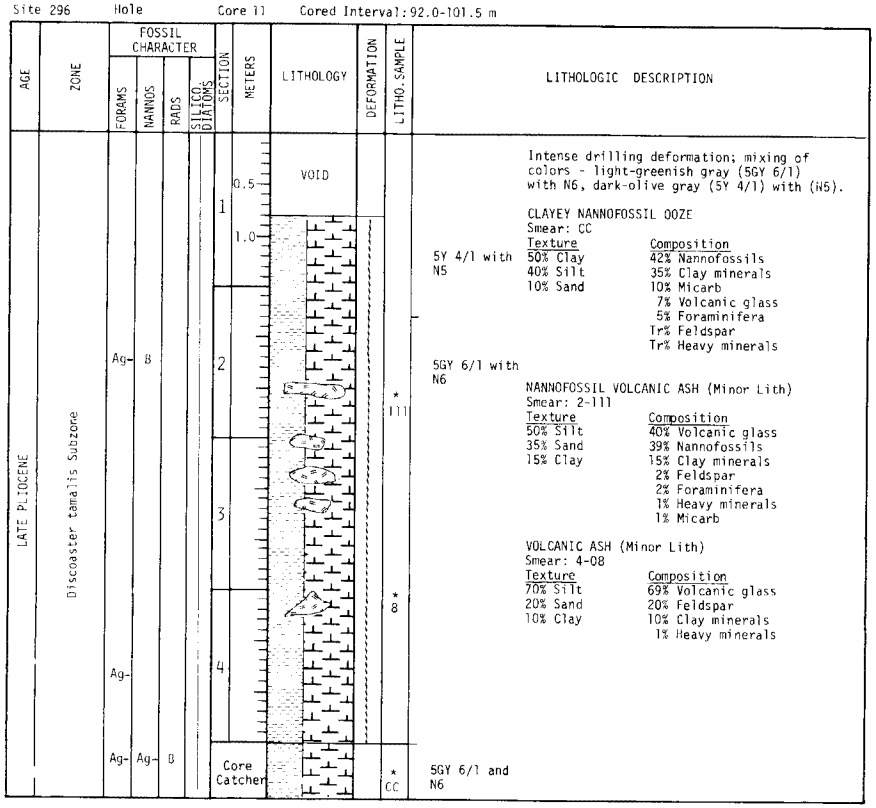
Explanatory notes in chapter 1

Site 296 Hole Core 10 Cored Interval: 82.5-92.0 m



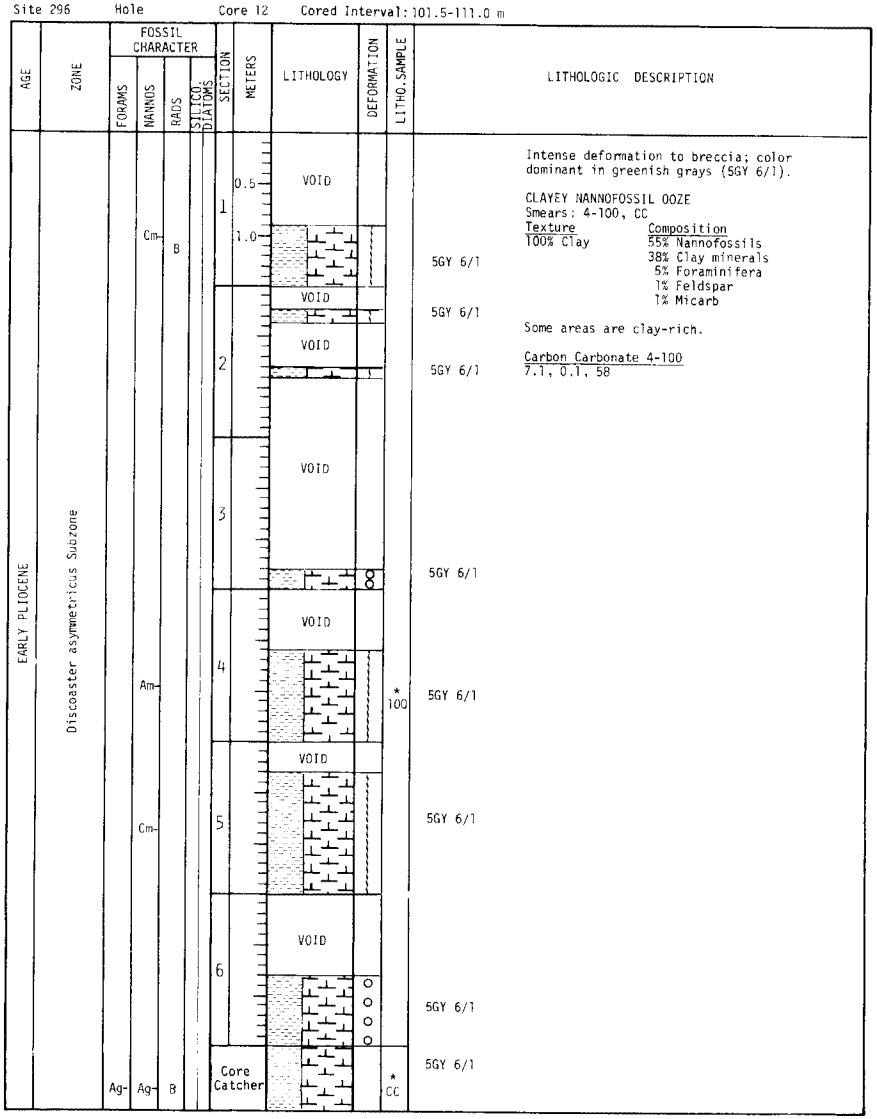
Explanatory notes in chapter 1

Site 296 Hole Core 11 Cored Interval: 92.0-101.5 m



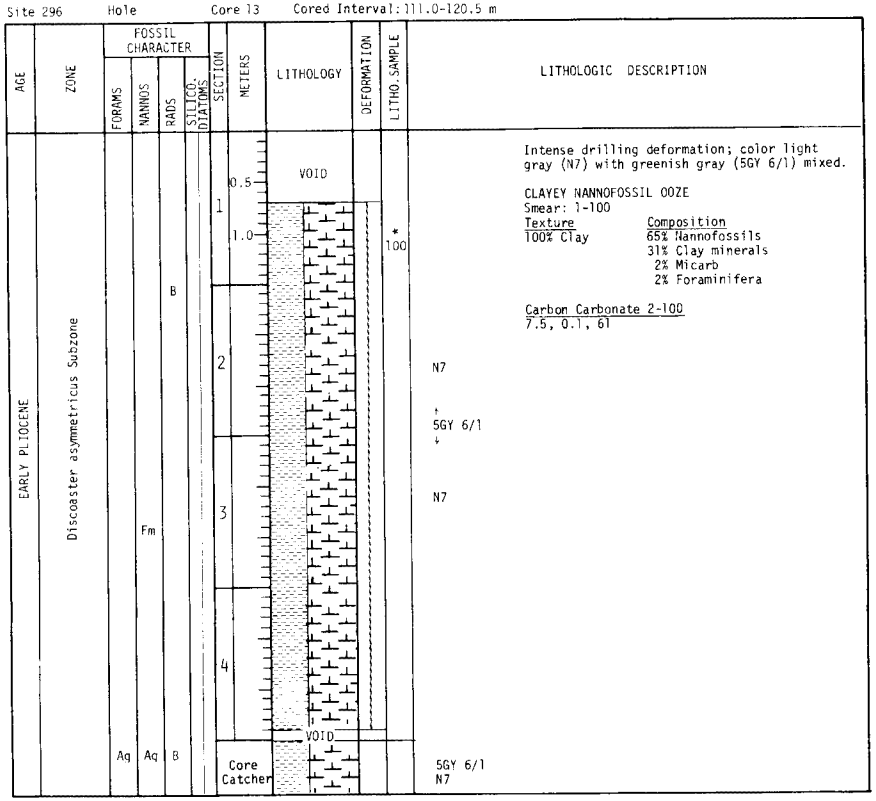
Explanatory notes in chapter 1

Site 296 Hole Core 12 Cored Interval: 101.5-111.0 m



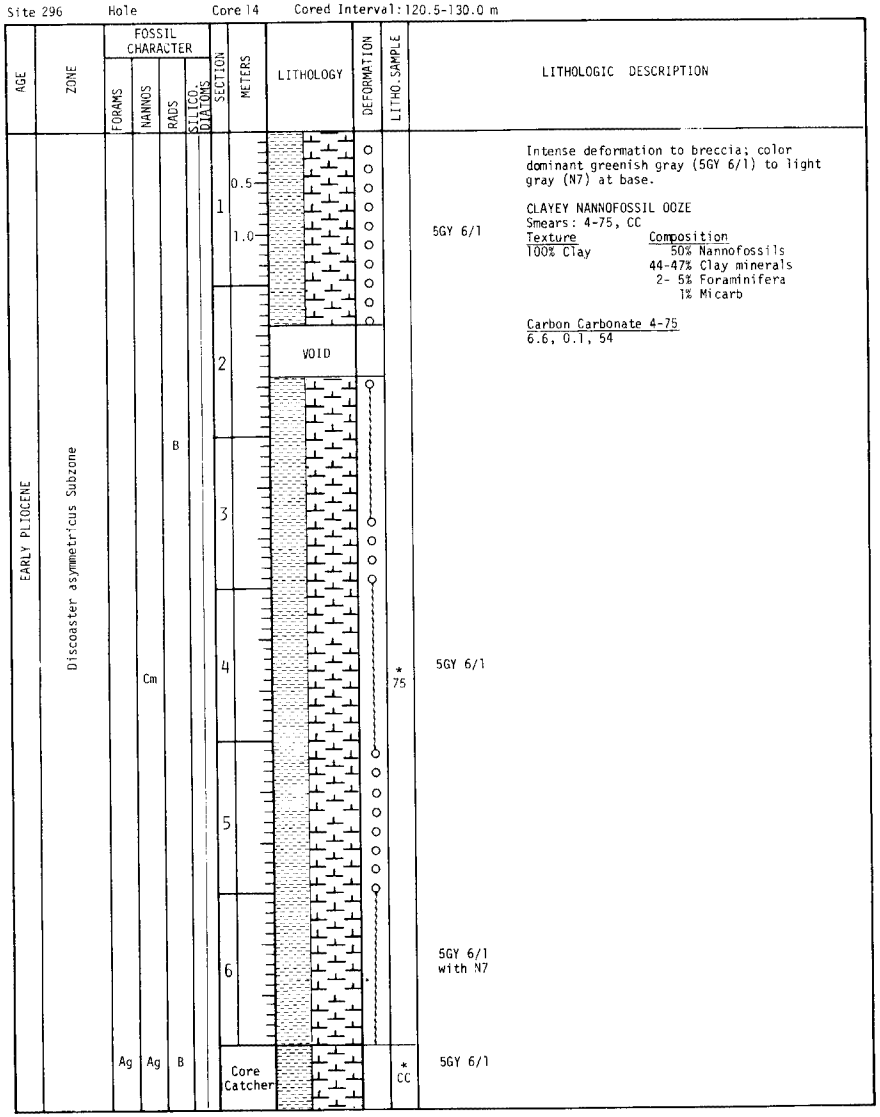
Explanatory notes in chapter 1

Site 296 Hole Core 13 Cored Interval: 111.0-120.5 m



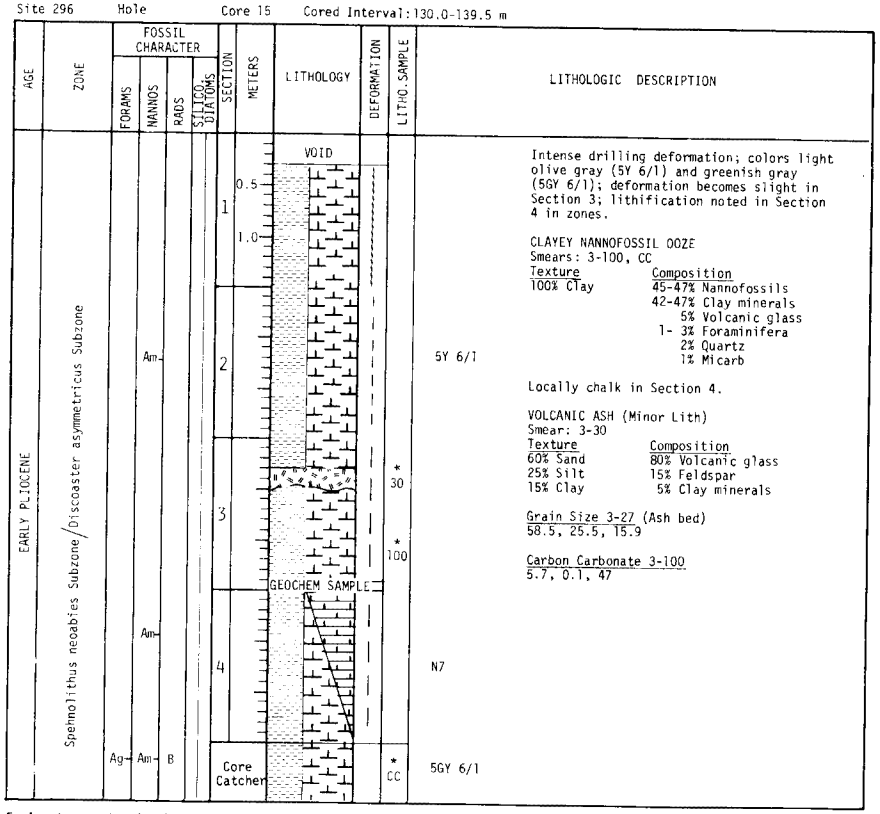
Explanatory notes in chapter 1

Site 296 Hole Core 14 Cored Interval: 120.5-130.0 m



Explanatory notes in chapter 1

Site 296 Hole Core 15 Cored Interval: 130.0-139.5 m



Intense drilling deformation; colors light olive gray (5Y 6/1) and greenish gray (5GY 6/1); deformation becomes slight in Section 3; lithification noted in Section 4 in zones.

CLAYEY NANNOFOSSIL OOZE
Smears: 3-100, CC

Texture	Composition
100% Clay	45-47% Nannofossils
	42-47% Clay minerals
	5% Volcanic glass
	1- 3% Foraminifera
	2% Quartz
	1% Micarb

Locally chalk in Section 4.

VOLCANIC ASH (Minor Lith)
Smear: 3-30

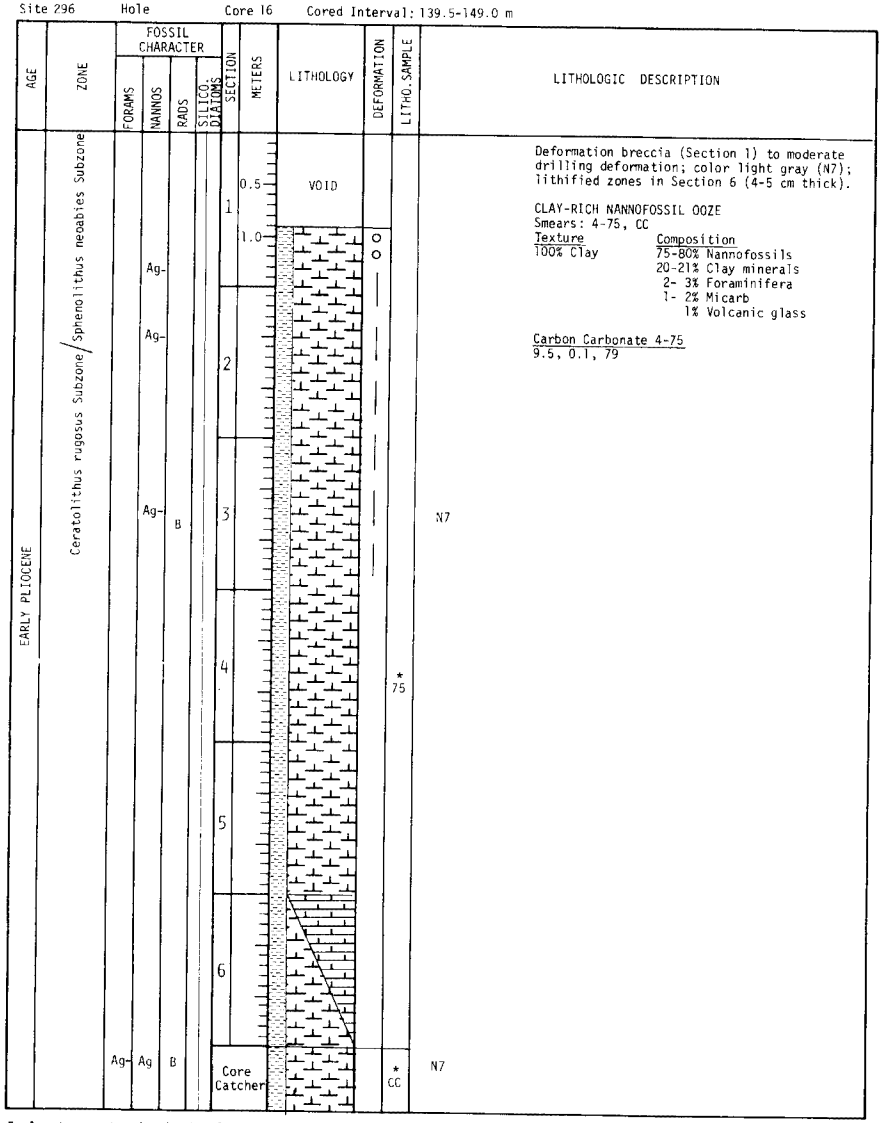
Texture	Composition
60% Sand	80% Volcanic glass
25% Silt	15% Feldspar
15% Clay	5% Clay minerals

Grain Size 3-27 (Ash bed)
58.5, 25.5, 15.9

Carbon Carbonate 3-100
5.7, 0.1, 47

Explanatory notes in chapter 1

Site 296 Hole Core 16 Cored Interval: 139.5-149.0 m



Deformation breccia (Section 1) to moderate drilling deformation; color light gray (N7); lithified zones in Section 6 (4-5 cm thick).

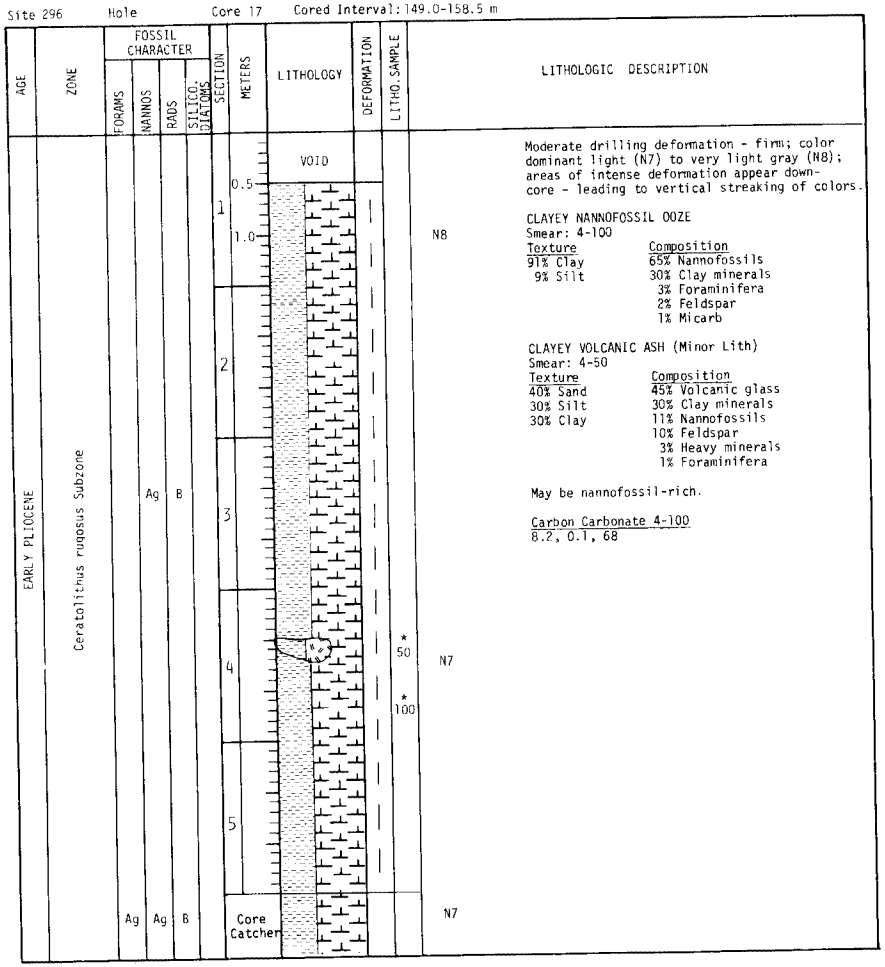
CLAY-RICH NANNOFOSSIL OOZE
Smears: 4-75, CC

Texture	Composition
100% Clay	75-80% Nannofossils
	20-21% Clay minerals
	2- 3% Foraminifera
	1- 2% Micarb
	1% Volcanic glass

Carbon Carbonate 4-75
9.5, 0.1, 79

Explanatory notes in chapter 1

Site 296 Hole Core 17 Cored Interval: 149.0-158.5 m



Moderate drilling deformation - firm; color dominant light (N7) to very light gray (N8); areas of intense deformation appear down-core - leading to vertical streaking of colors.

CLAYEY NANNOFOSSIL OOZE
Smear: 4-100

Texture	Composition
91% Clay	65% Nannofossils
9% Silt	30% Clay minerals
	3% Foraminifera
	2% Feldspar
	1% Micarb

CLAYEY VOLCANIC ASH (Minor Lith)
Smear: 4-50

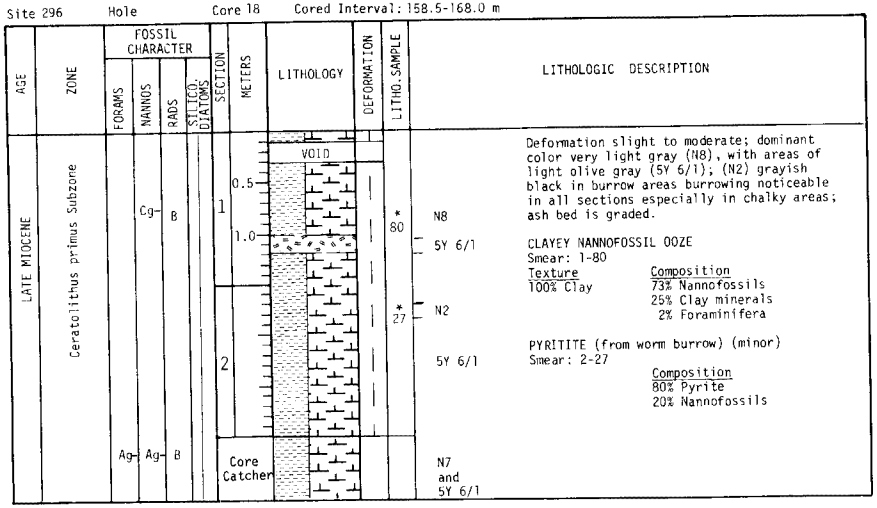
Texture	Composition
40% Sand	45% Volcanic glass
30% Silt	30% Clay minerals
30% Clay	11% Nannofossils
	10% Feldspar
	3% Heavy minerals
	1% Foraminifera

May be nannofossil-rich.

Carbon Carbonate 4-100
8.2, 0.1, 68

Explanatory notes in chapter 1

Site 296 Hole Core 18 Cored Interval: 158.5-168.0 m



Deformation slight to moderate; dominant color very light gray (N8), with areas of light olive gray (5Y 6/1); (N2) grayish black in burrow areas burrowing noticeable in all sections especially in chalky areas; ash bed is graded.

CLAYEY NANNOFOSSIL OOZE
Smear: 1-80

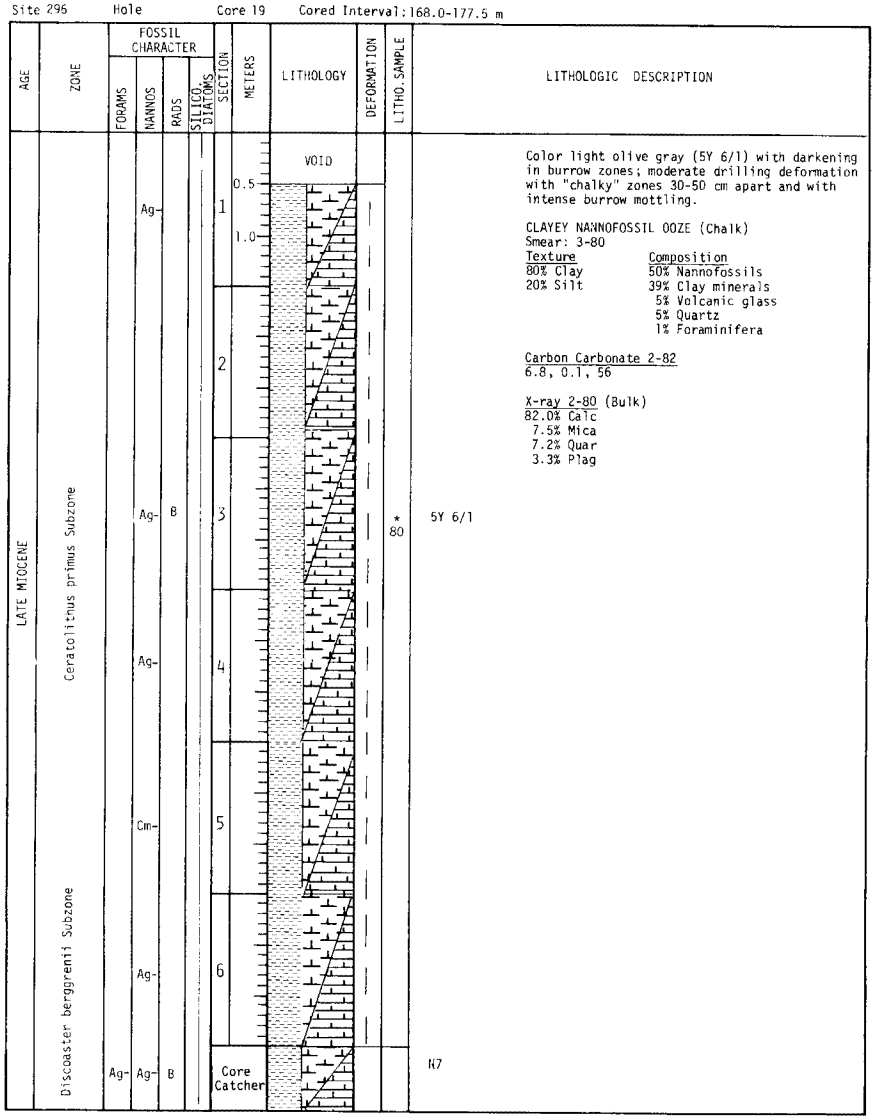
Texture	Composition
100% Clay	73% Nannofossils
	25% Clay minerals
	2% Foraminifera

PYRITITE (from worm burrow) (minor)
Smear: 2-27

Composition
80% Pyrite
20% Nannofossils

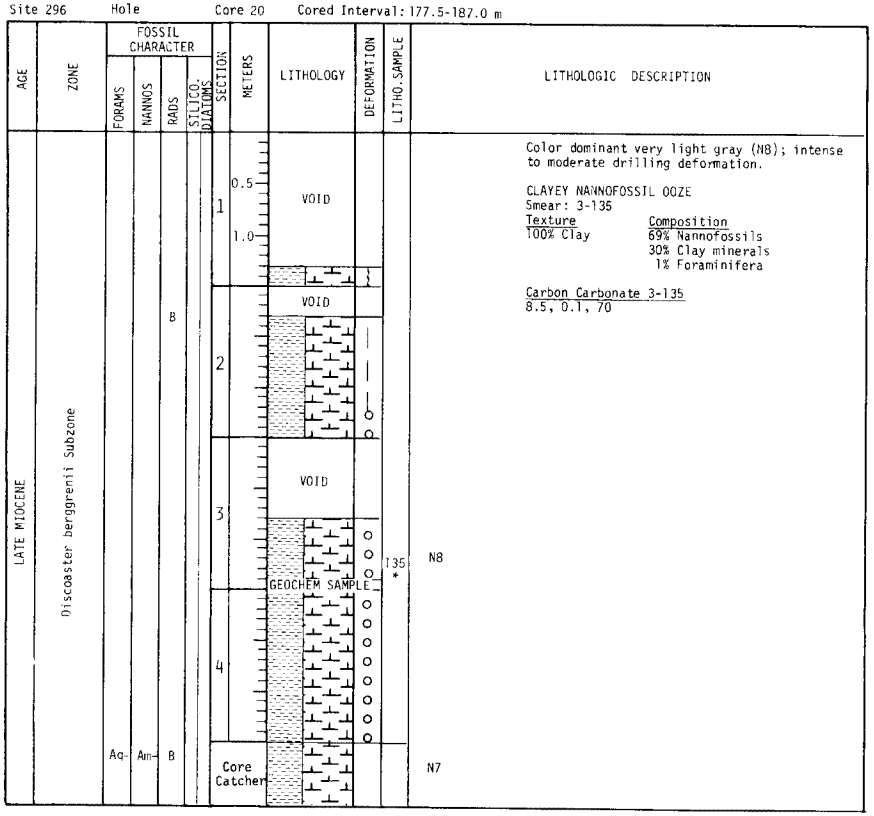
Explanatory notes in chapter 1

Site 296 Hole Core 19 Cored Interval: 168.0-177.5 m



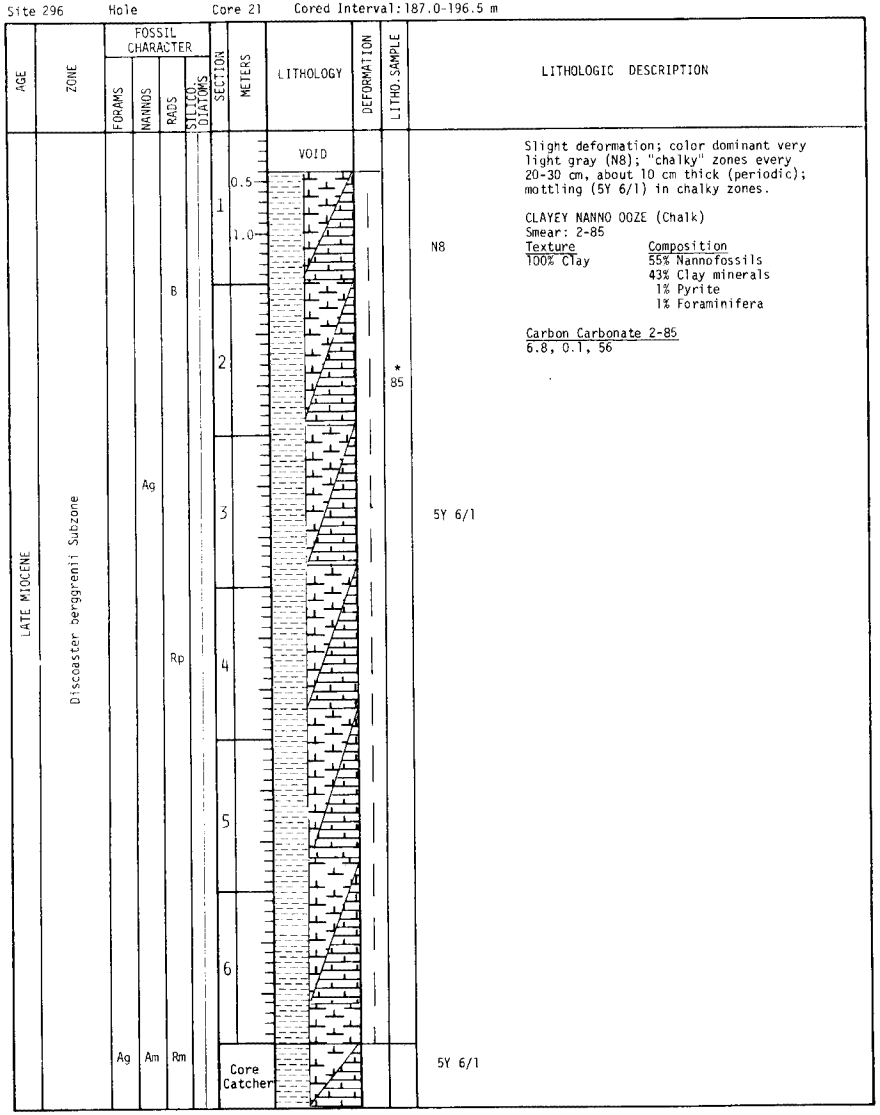
Explanatory notes in chapter 1

Site 296 Hole Core 20 Cored Interval: 177.5-187.0 m



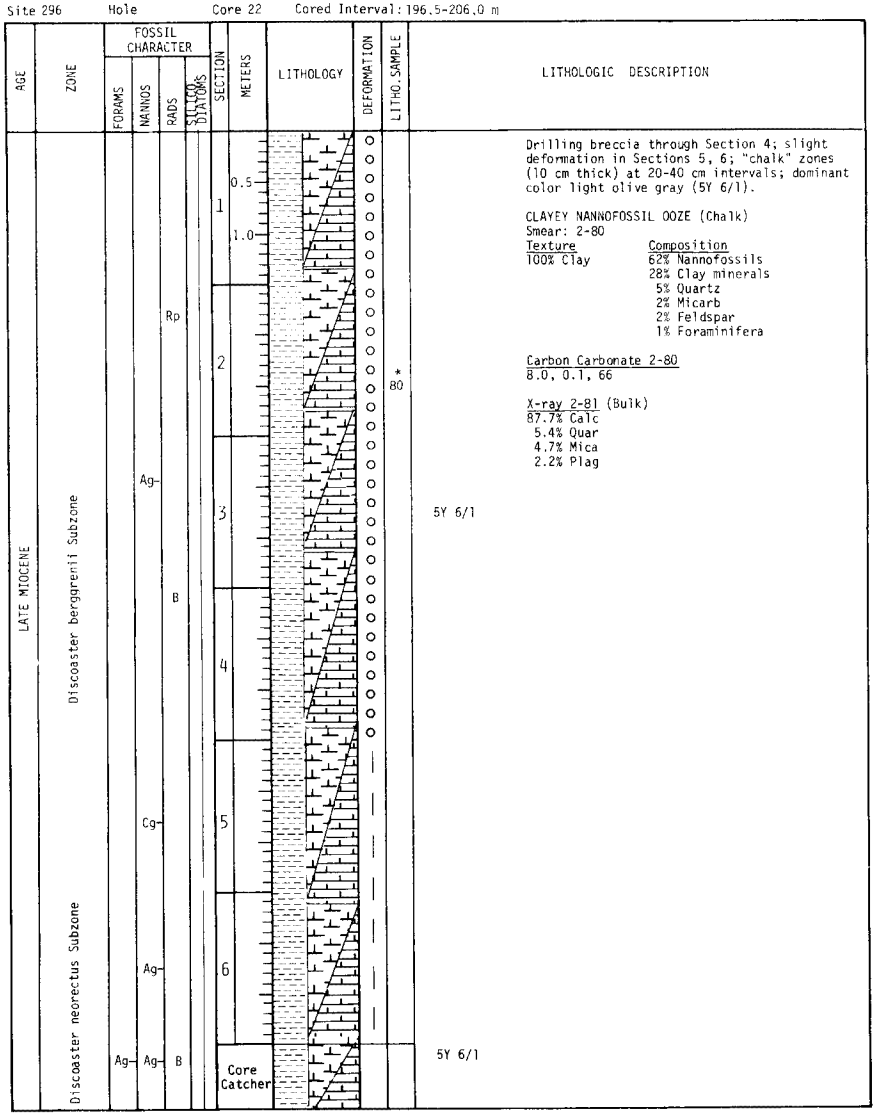
Explanatory notes in chapter 1

Site 296 Hole Core 21 Cored Interval: 187.0-196.5 m



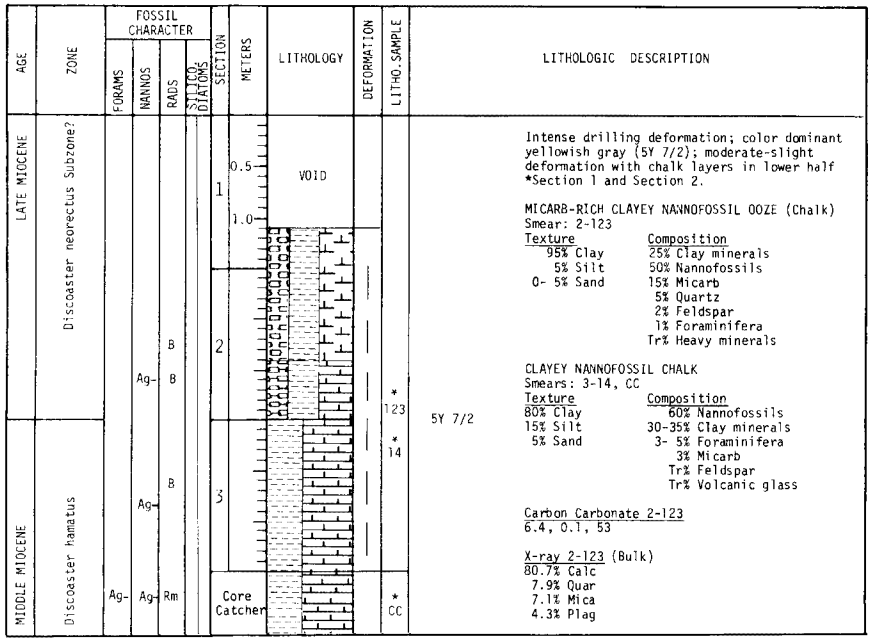
Explanatory notes in chapter 1

Site 296 Hole Core 22 Cored Interval: 196.5-206.0 m



Explanatory notes in chapter 1

Site 296 Hole Core 23 Cored Interval: 206.0-215.5 m



LITHOLOGIC DESCRIPTION

Intense drilling deformation; color dominant yellowish gray (5Y 7/2); moderate-slight deformation with chalk layers in lower half
*Section 1 and Section 2.

MICARB-RICH CLAYEY NANNOFOSSIL OOZE (Chalk)
Smear: 2-123

Texture	Composition
95% Clay	25% Clay minerals
5% Silt	50% Nannofossils
0- 5% Sand	15% Micarb
	5% Quartz
	2% Feldspar
	1% Foraminifera
	Tr% Heavy minerals

CLAYEY NANNOFOSSIL CHALK
Smears: 3-14, CC

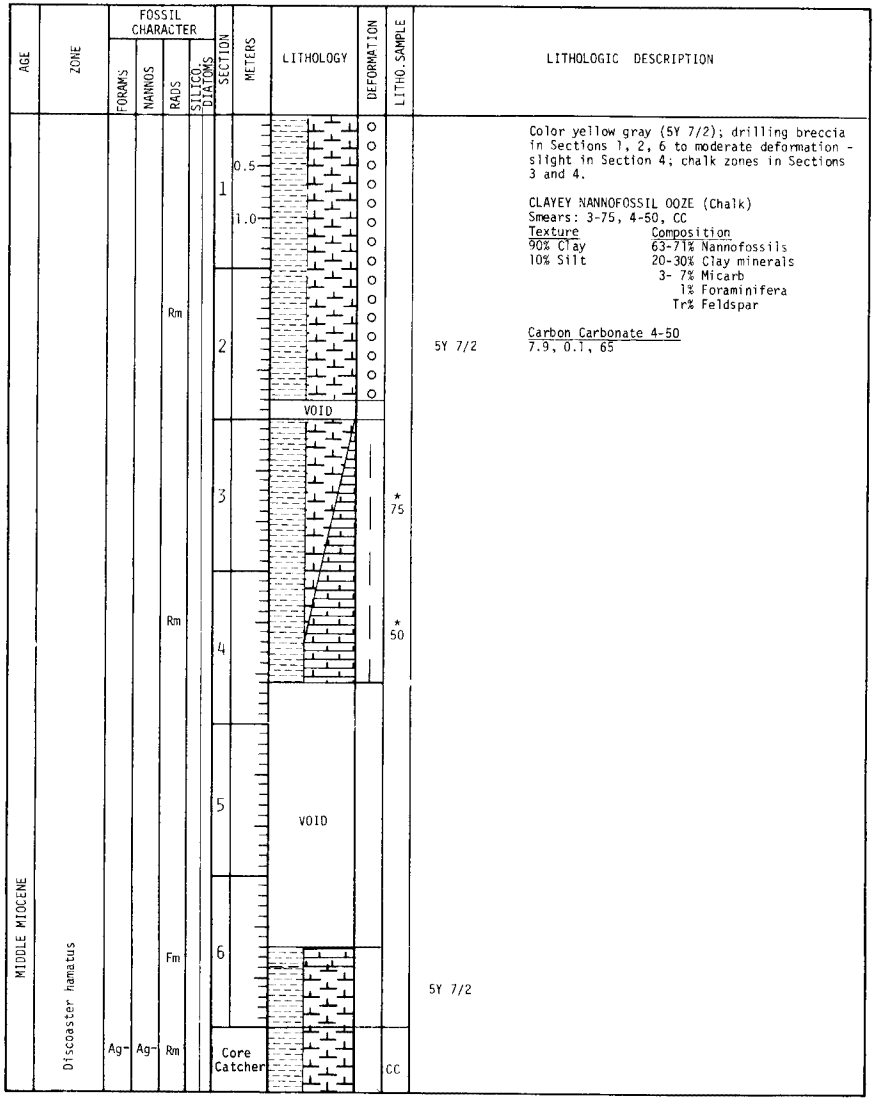
Texture	Composition
80% Clay	60% Nannofossils
15% Silt	30-35% Clay minerals
5% Sand	3- 5% Foraminifera
	3% Micarb
	Tr% Feldspar
	Tr% Volcanic glass

Carbon Carbonate 2-123
6.4, 0.1, 53

X-ray 2-123 (Bulk)
80.7% Calc
7.9% Quar
7.1% Mica
4.3% Plag

Explanatory notes in chapter 1

Site 296 Hole Core 24 Cored Interval: 215.5-225.0 m



LITHOLOGIC DESCRIPTION

Color yellow gray (5Y 7/2); drilling breccia in Sections 1, 2, 6 to moderate deformation - slight in Section 4; chalk zones in Sections 3 and 4.

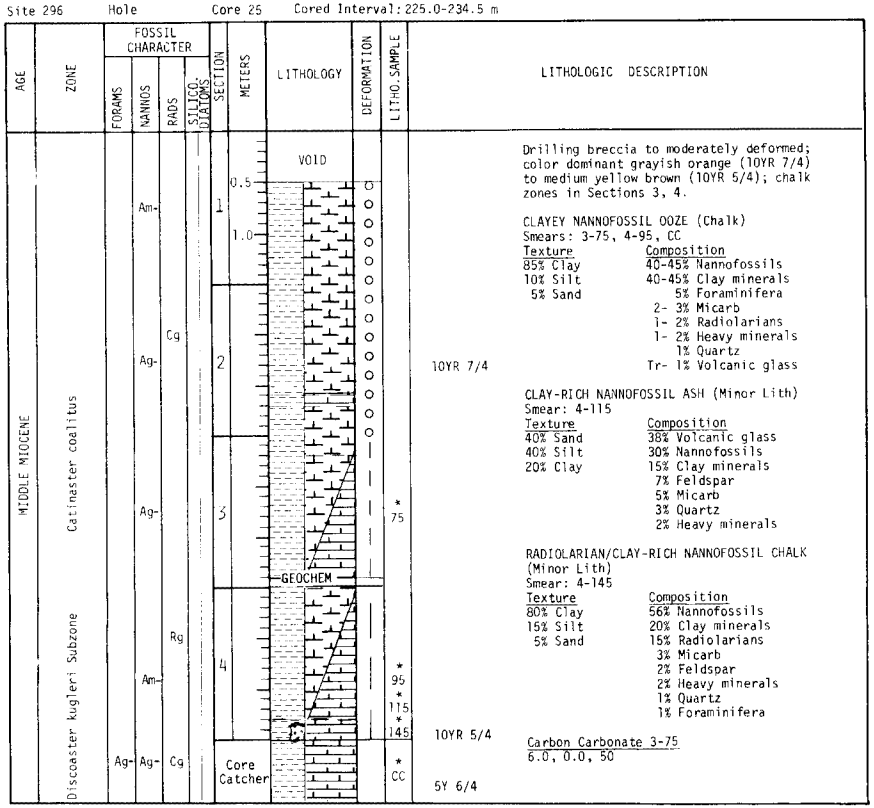
CLAYEY NANNOFOSSIL OOZE (Chalk)
Smears: 3-75, 4-50, CC

Texture	Composition
90% Clay	63-71% Nannofossils
10% Silt	20-30% Clay minerals
	3- 7% Micarb
	1% Foraminifera
	Tr% Feldspar

Carbon Carbonate 4-50
7.9, 0.1, 65

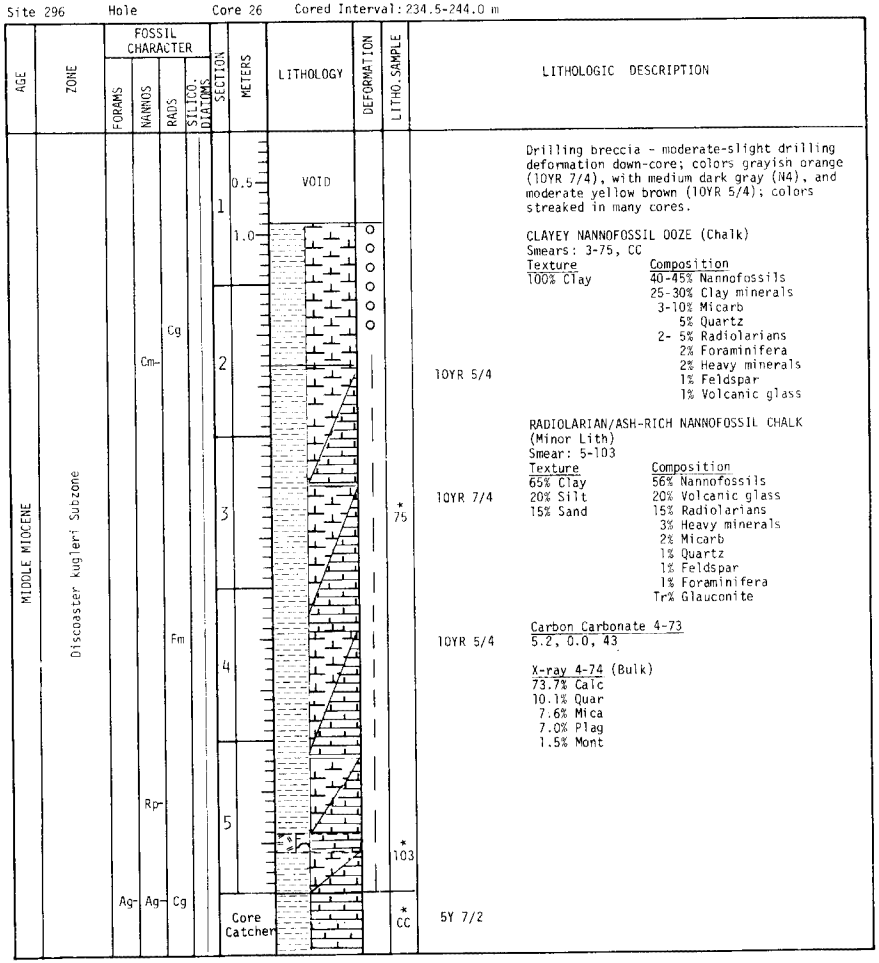
Explanatory notes in chapter 1

Site 296 Hole Core 25 Cored Interval: 225.0-234.5 m



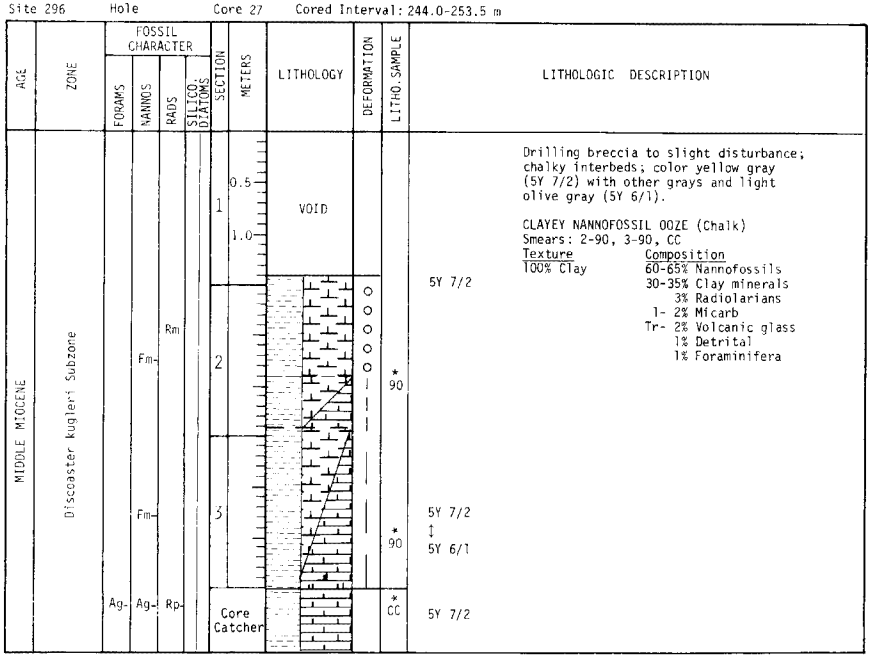
Explanatory notes in chapter 1

Site 296 Hole Core 26 Cored Interval: 234.5-244.0 m



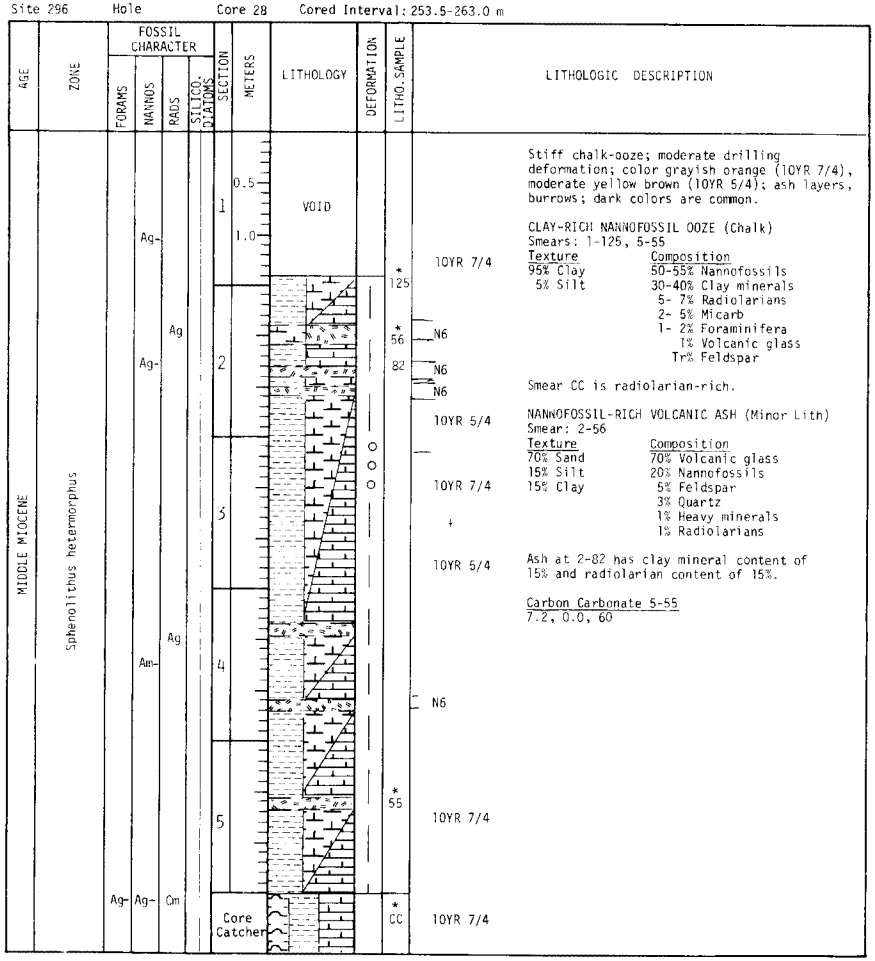
Explanatory notes in chapter 1

Site 296 Hole Core 27 Cored Interval: 244.0-253.5 m



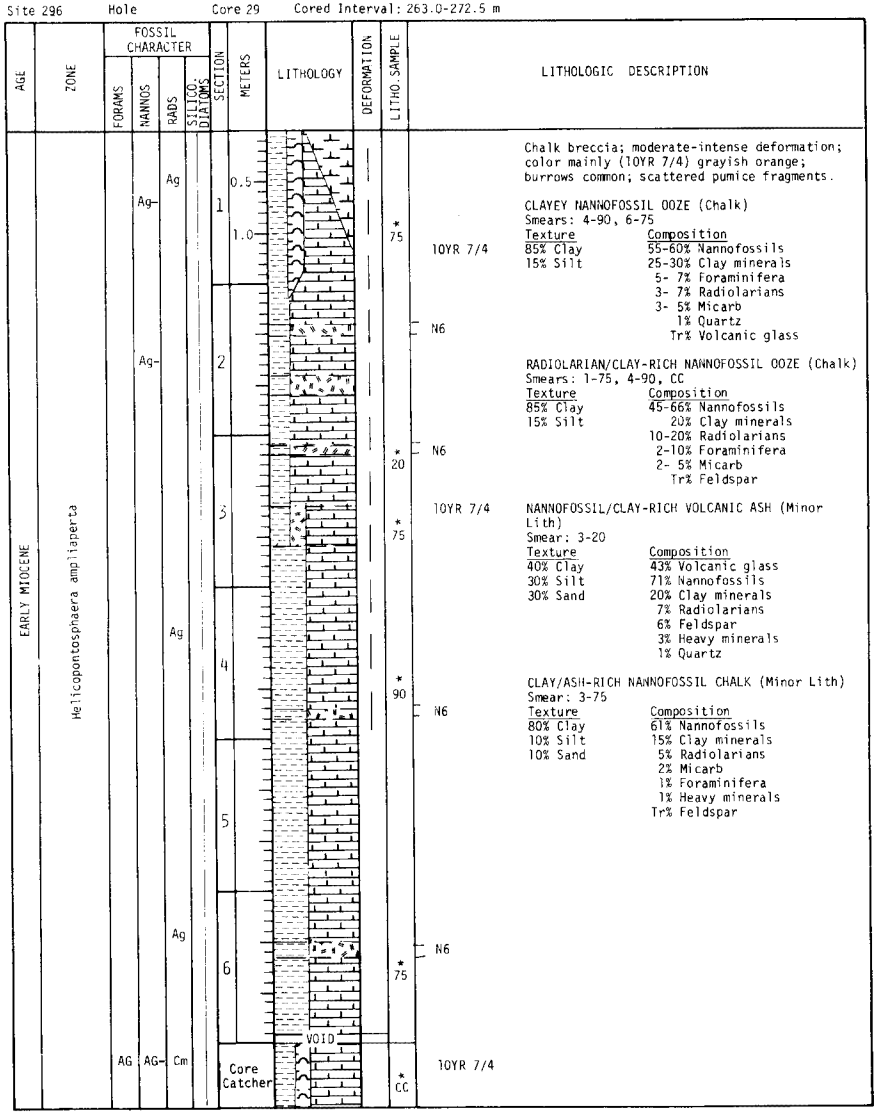
Explanatory notes in chapter 1

Site 296 Hole Core 28 Cored Interval: 253.5-263.0 m



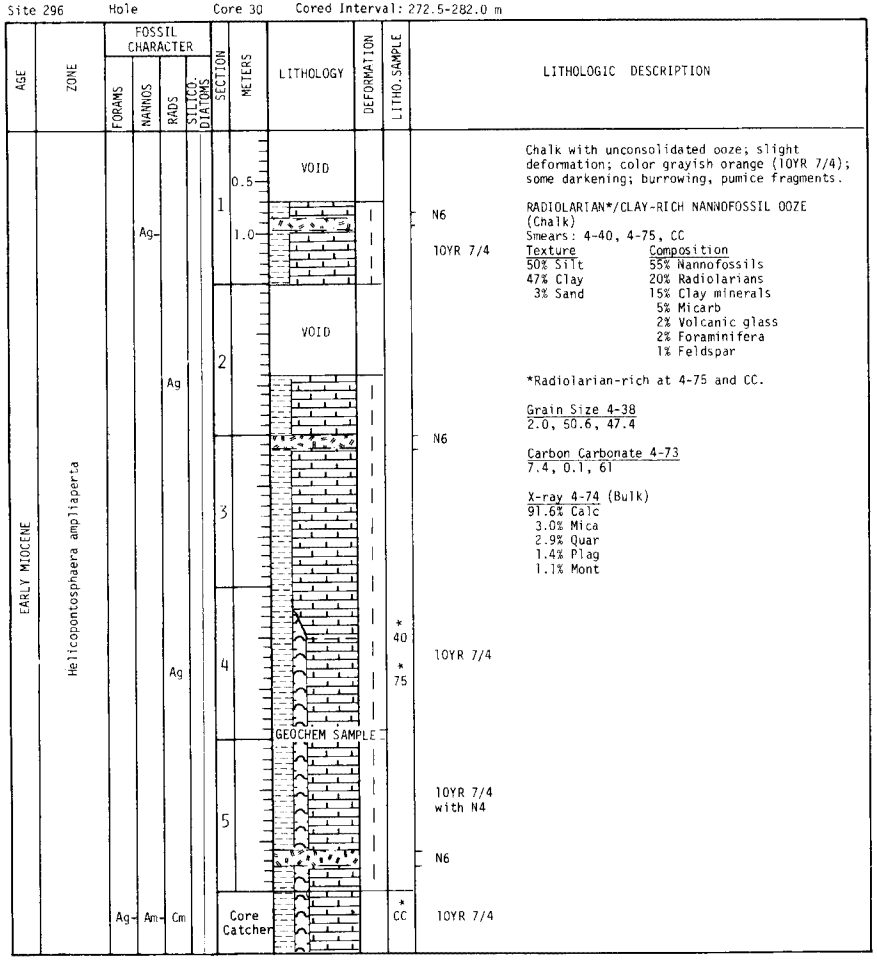
Explanatory notes in chapter 1

Site 296 Hole Core 29 Cored Interval: 263.0-272.5 m



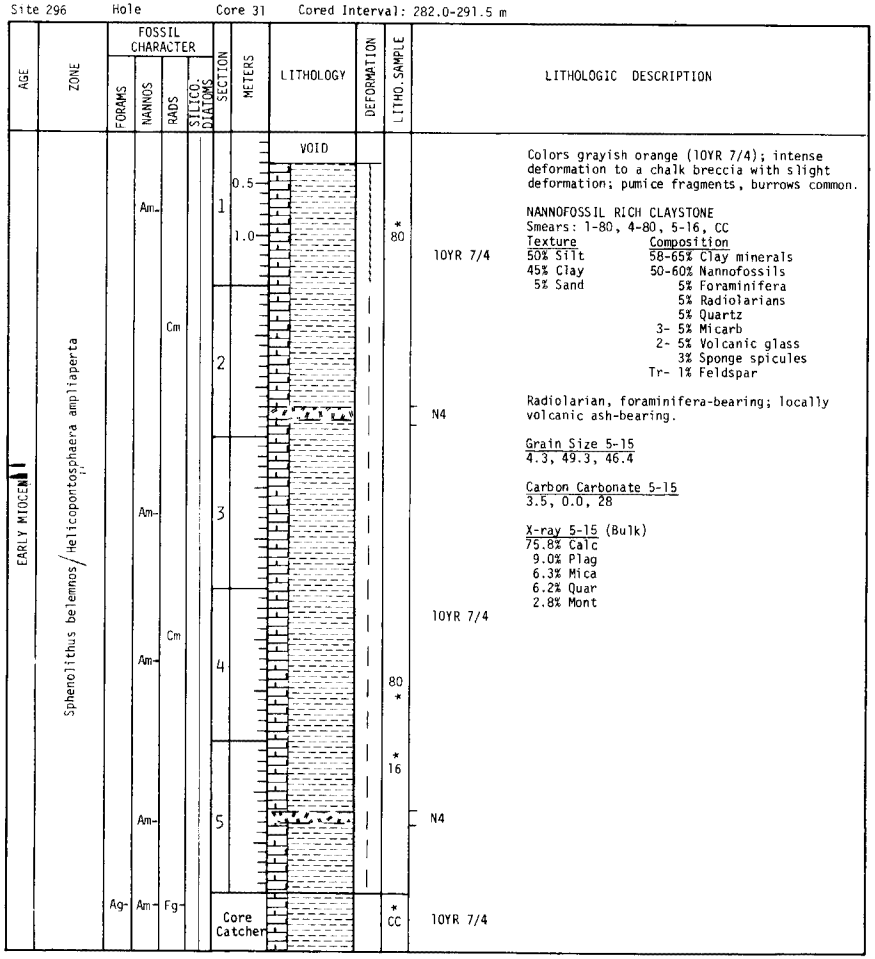
Explanatory notes in chapter 1

Site 296 Hole Core 30 Cored Interval: 272.5-282.0 m



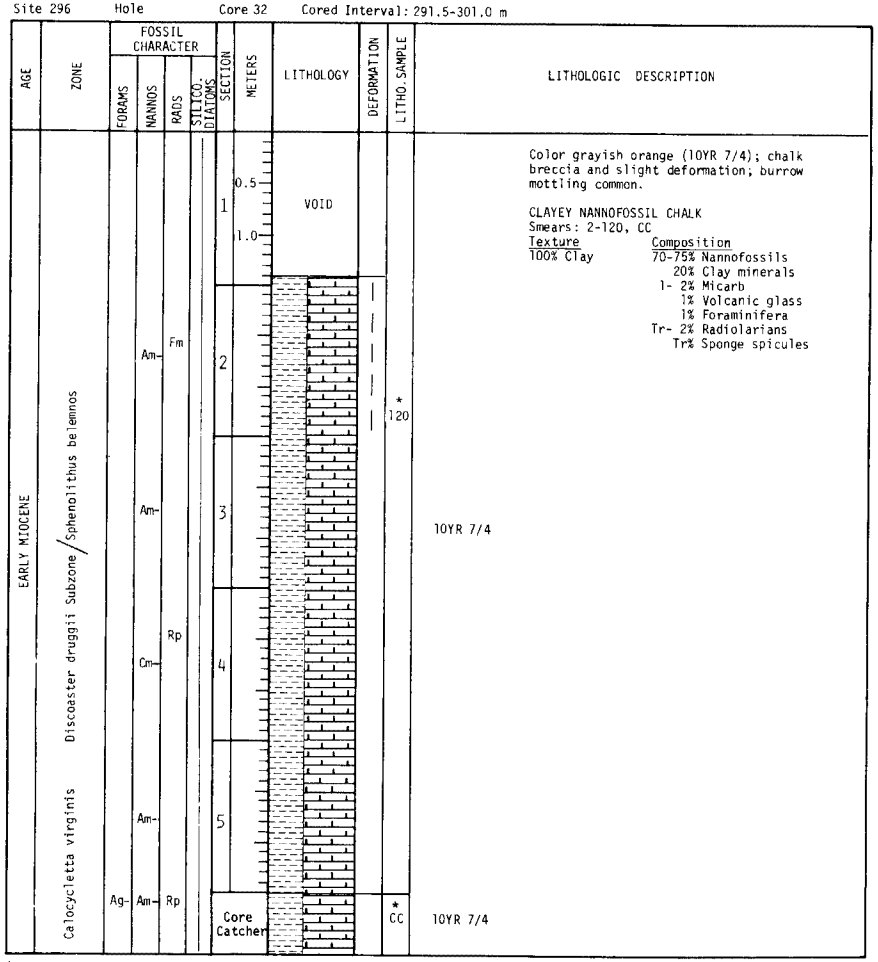
Explanatory notes in chapter 1

Site 296 Hole Core 31 Cored Interval: 282.0-291.5 m



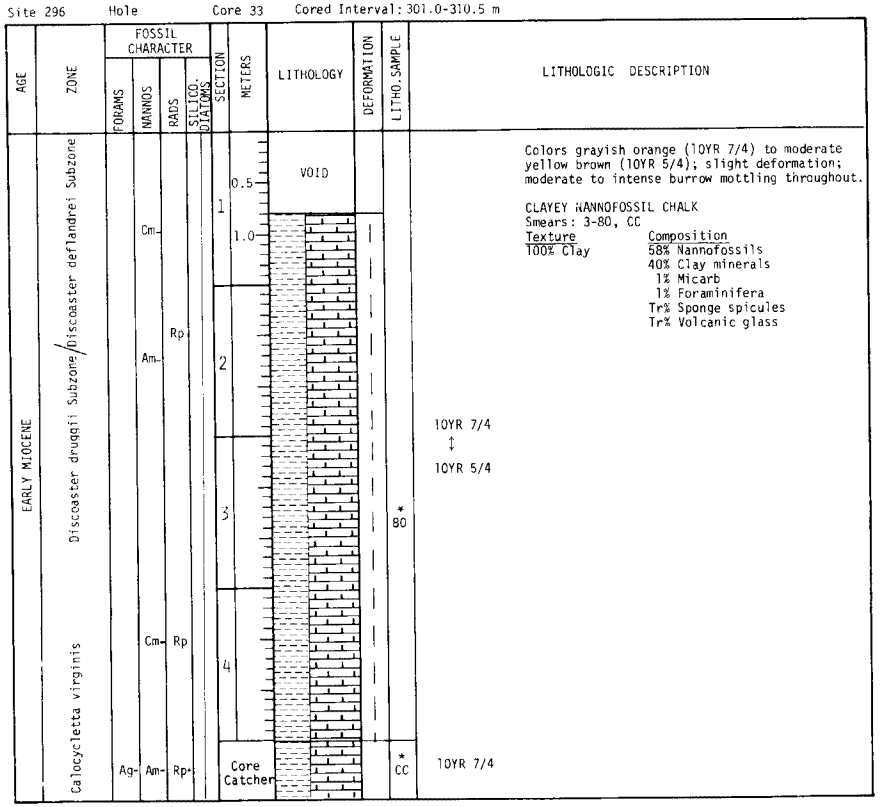
Explanatory notes in chapter 1

Site 296 Hole Core 32 Cored Interval: 291.5-301.0 m



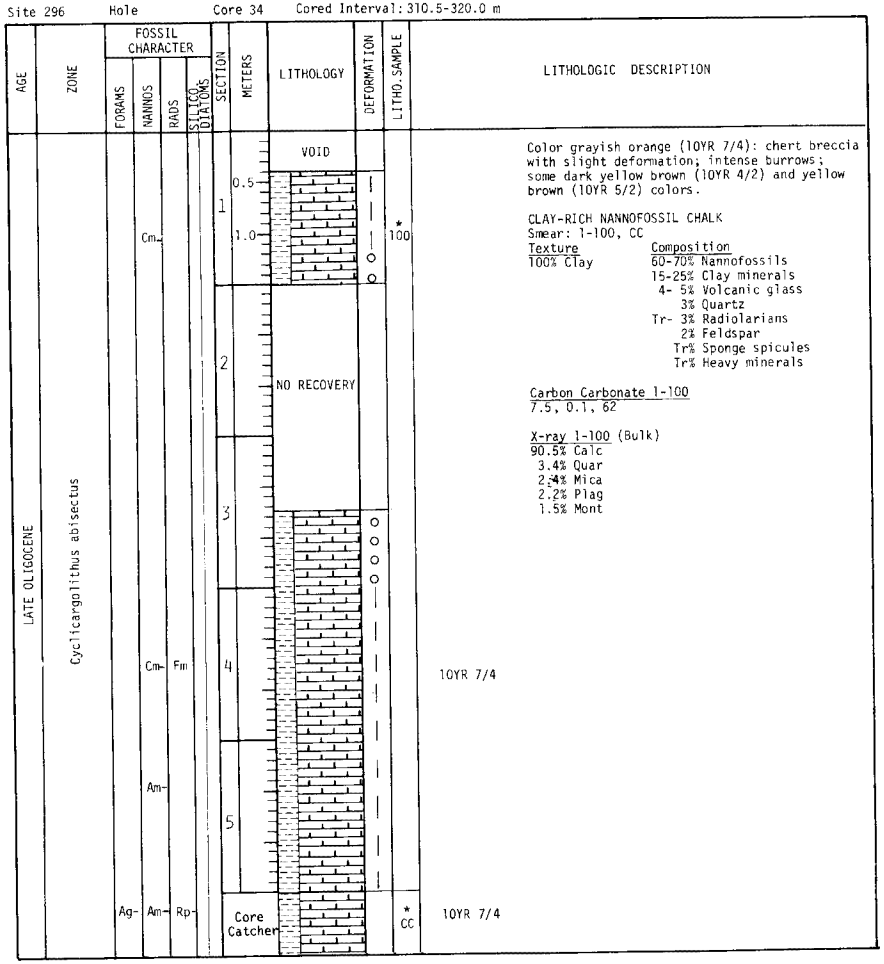
Explanatory notes in chapter 1

Site 296 Hole Core 33 Cored Interval: 301.0-310.5 m



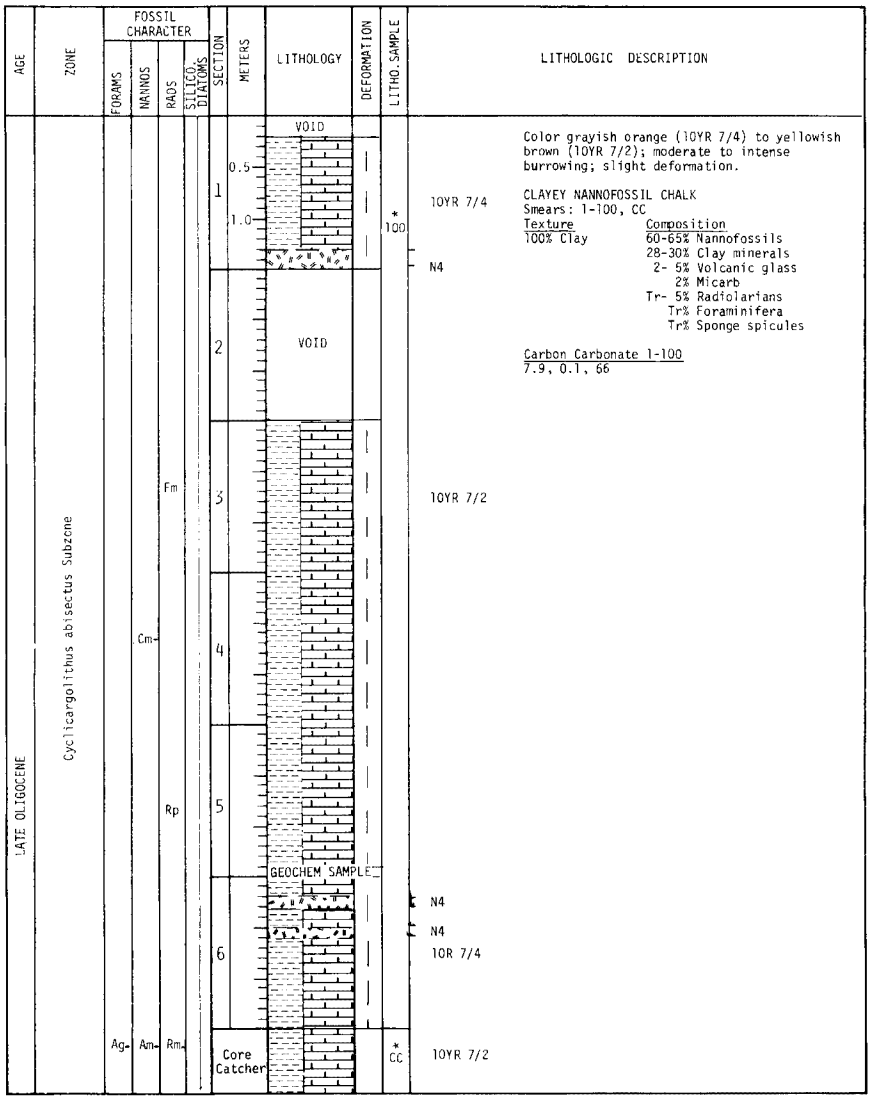
Explanatory notes in chapter 1

Site 296 Hole Core 34 Cored Interval: 310.5-320.0 m



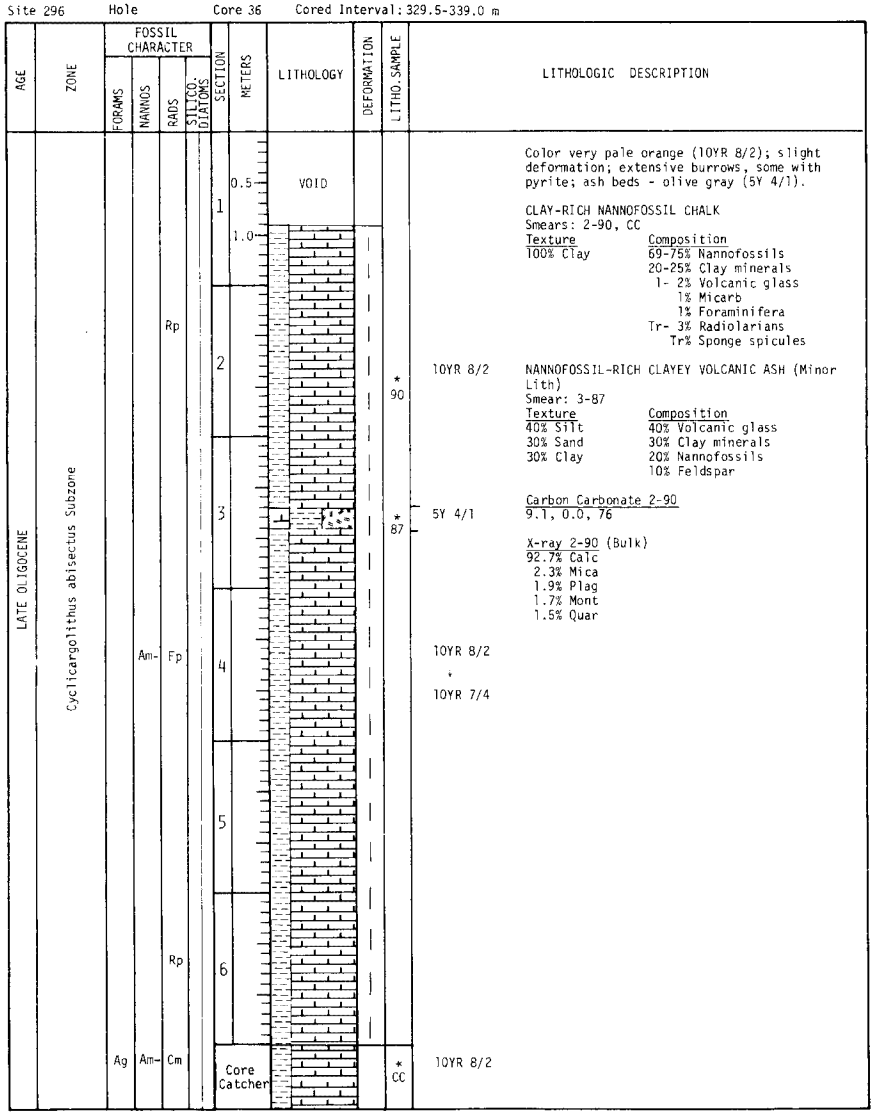
Explanatory notes in chapter 1

Site 296 Hole Core 35 Cored Interval: 320.0-329.5 m



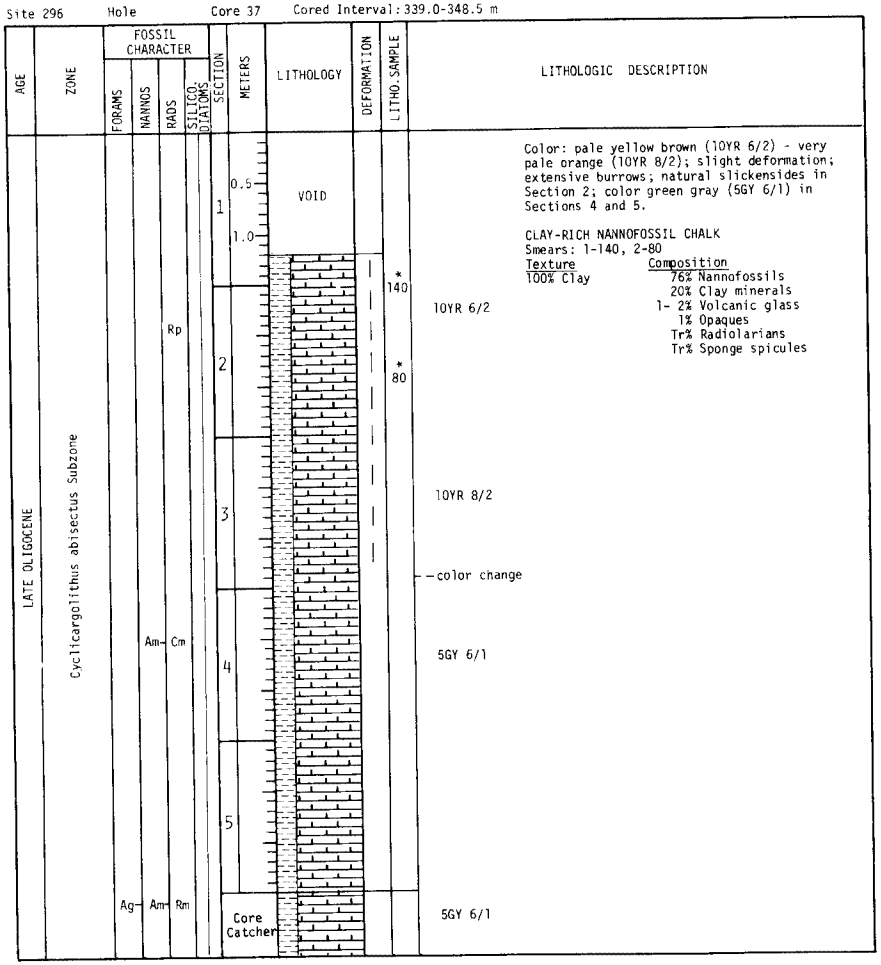
Explanatory notes in chapter 1

Site 296 Hole Core 36 Cored Interval: 329.5-339.0 m



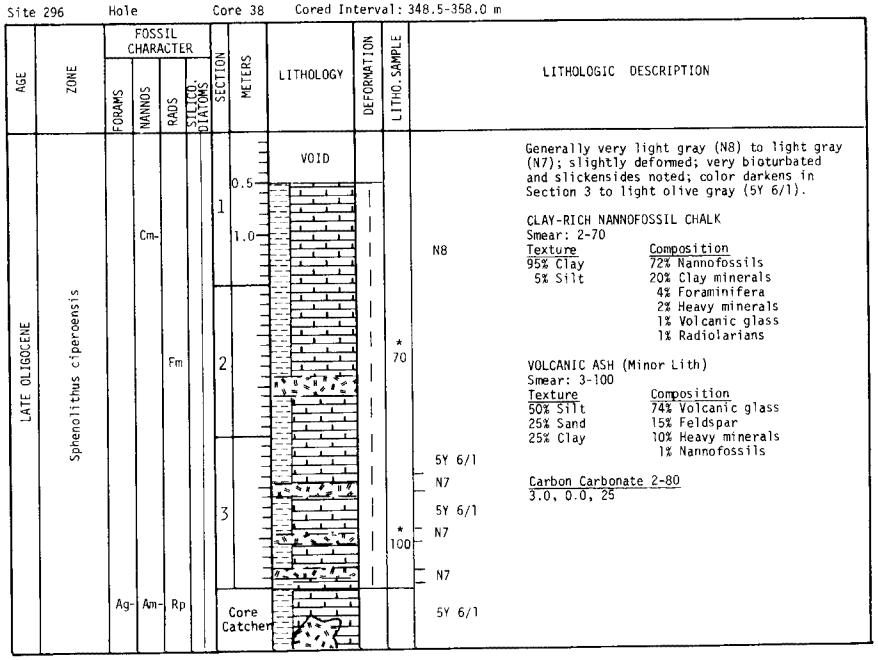
Explanatory notes in chapter 1

Site 296 Hole Core 37 Cored Interval: 339.0-348.5 m



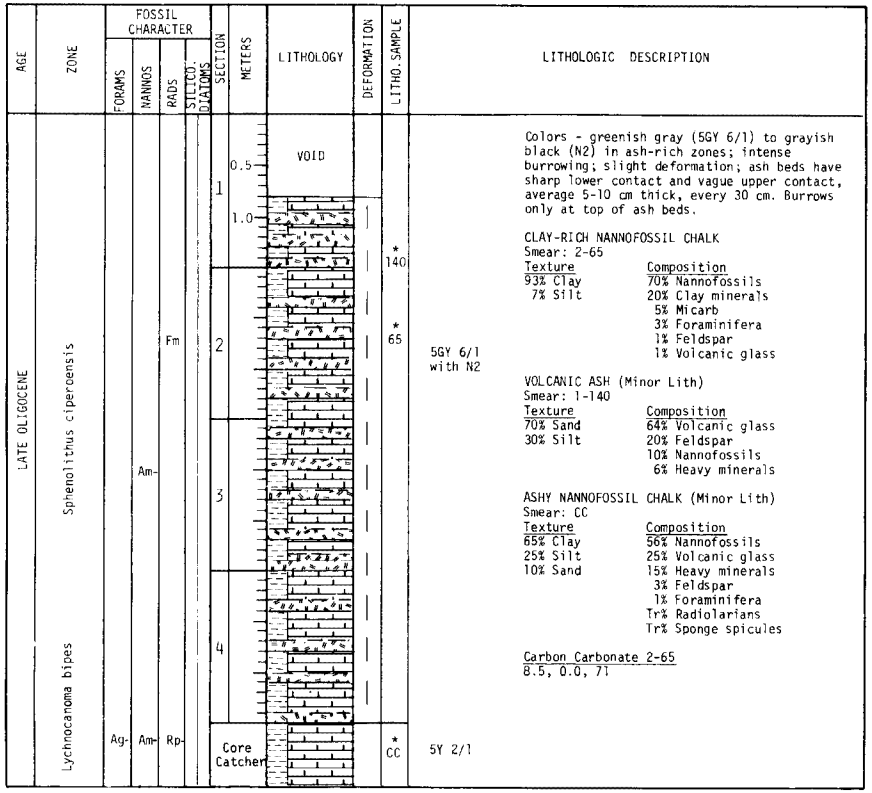
Explanatory notes in chapter 1

Site 296 Hole Core 38 Cored Interval: 348.5-358.0 m



Explanatory notes in chapter 1

Site 296 Hole Core 39 Cored Interval: 358.0-367.5 m



LITHOLOGIC DESCRIPTION

Colors - greenish gray (5GY 6/1) to grayish black (N2) in ash-rich zones; intense burrowing; slight deformation; ash beds have sharp lower contact and vague upper contact, average 5-10 cm thick, every 30 cm. Burrows only at top of ash beds.

CLAY-RICH NANNOFOSSIL CHALK
Smear: 2-65

Texture	Composition
93% Clay	70% Nannofossils
7% Silt	20% Clay minerals
	5% Micarb
	3% Foraminifera
	1% Feldspar
	1% Volcanic glass

VOLCANIC ASH (Minor Lith)
Smear: 1-140

Texture	Composition
70% Sand	64% Volcanic glass
30% Silt	20% Feldspar
	10% Nannofossils
	6% Heavy minerals

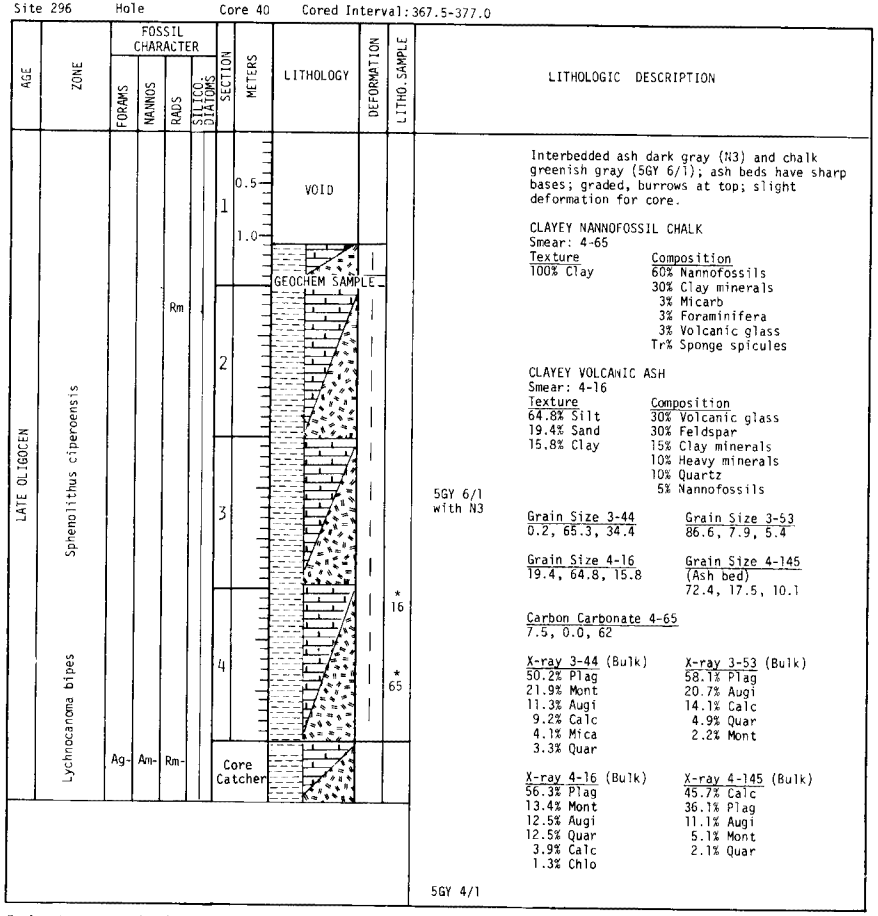
ASHY NANNOFOSSIL CHALK (Minor Lith)
Smear: CC

Texture	Composition
65% Clay	56% Nannofossils
25% Silt	25% Volcanic glass
10% Sand	15% Heavy minerals
	3% Feldspar
	1% Foraminifera
	Tr% Radiolarians
	Tr% Sponge spicules

Carbon Carbonate 2-65
8.5, 0.0, 71

Explanatory notes in chapter 1

Site 296 Hole Core 40 Cored Interval: 367.5-377.0



Interbedded ash dark gray (N3) and chalk greenish gray (5GY 6/1); ash beds have sharp bases; graded, burrows at top; slight deformation for core.

CLAYEY NANNOFOSSIL CHALK
Smear: 4-65

Texture	Composition
100% Clay	60% Nannofossils
	30% Clay minerals
	3% Micarb
	3% Foraminifera
	3% Volcanic glass
	Tr% Sponge spicules

CLAYEY VOLCANIC ASH
Smear: 4-16

Texture	Composition
64.8% Silt	30% Volcanic glass
19.4% Sand	30% Feldspar
15.8% Clay	15% Clay minerals
	10% Heavy minerals
	10% Quartz
	5% Nannofossils

Grain Size 3-44
0.2, 65.3, 34.4

Grain Size 3-53
86.6, 7.9, 5.4

Grain Size 4-16
19.4, 64.8, 15.8

Grain Size 4-145 (Ash bed)
72.4, 17.5, 10.1

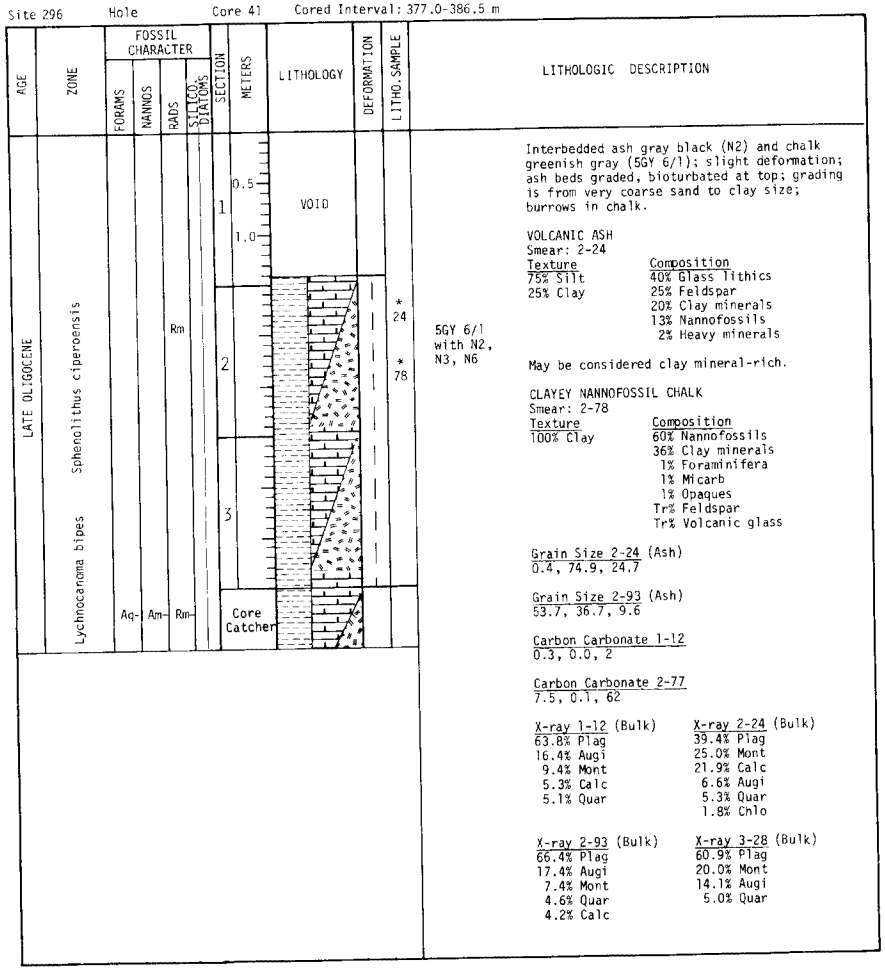
Carbon Carbonate 4-65
7.5, 0.0, 62

X-ray 3-44 (Bulk)	X-ray 3-53 (Bulk)
50.2% Plag	58.1% Plag
21.9% Mont	20.7% Augi
11.3% Augi	14.1% Calc
9.2% Calc	4.9% Quar
4.1% Mica	2.2% Mont
3.3% Quar	

X-ray 4-16 (Bulk)	X-ray 4-145 (Bulk)
56.3% Plag	45.7% Calc
13.4% Mont	36.1% Plag
12.5% Augi	11.1% Augi
12.5% Quar	5.1% Mont
3.9% Calc	2.1% Quar
1.3% Chlo	

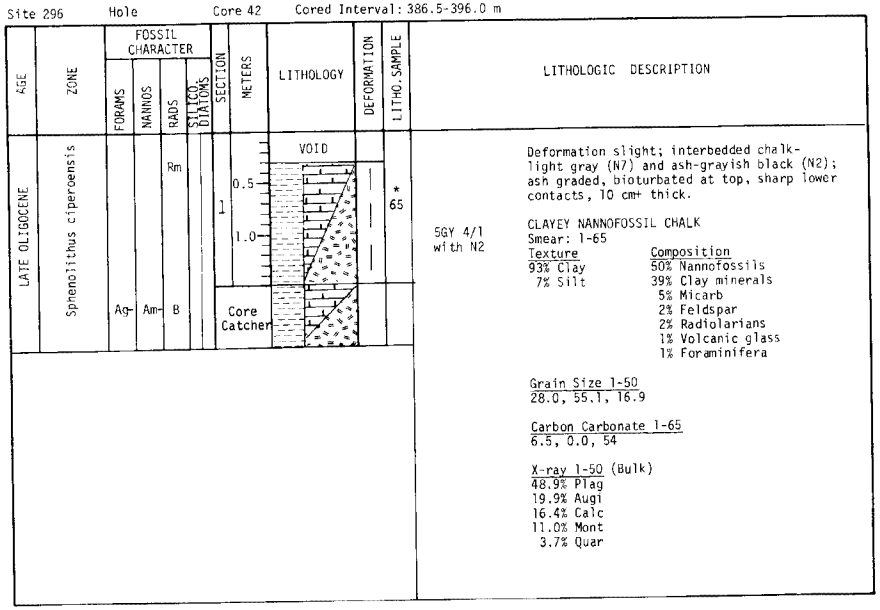
Explanatory notes in chapter 1

Site 296 Hole Core 41 Cored Interval: 377.0-386.5 m



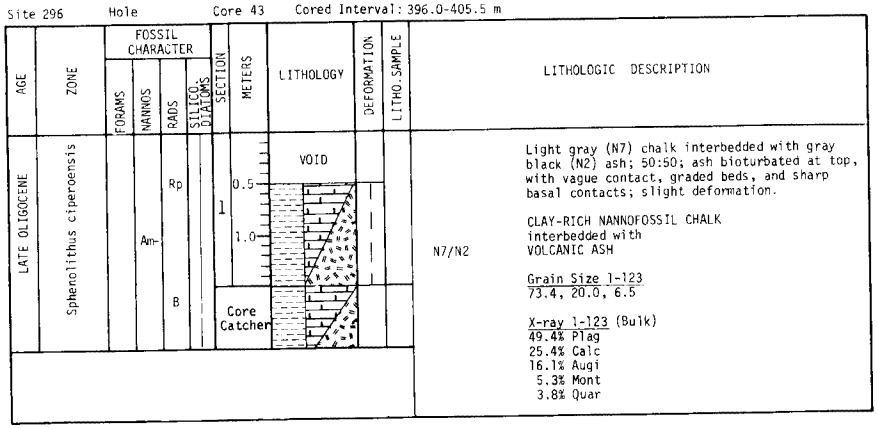
Explanatory notes in chapter 1

Site 296 Hole Core 42 Cored Interval: 386.5-396.0 m



Explanatory notes in chapter 1

Site 296 Hole Core 43 Cored Interval: 396.0-405.5 m



Explanatory notes in chapter 1

Site 296 Hole Core 44 Cored Interval: 405.5-415.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	SILICO. DIATOMS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	Sphenolithus ciperoensis Lychnocanoma bipes	Ag-	Am-	Fp Rm		1	0.5 1.0	VOID			Color light gray medium (N6) to grayish black (N2). CLAY-RICH NANNOFOSSIL CHALK interbedded with VOLCANIC ASH N6/N2
						Core Catcher					

Explanatory notes in chapter 1

Site 296 Hole Core 45 Cored Interval: 415.0-424.5 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	SILICO. DIATOMS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	Sphenolithus ciperoensis Lychnocanoma bipes	Ag-	Am-	B Rp-		1	0.5 1.0			* 45	Slight drilling deformation; medium light gray (N6) throughout core; and even-colored; less ash-chalk bedding. CLAY-RICH NANNOFOSSIL CHALK Smear: 1-45 Texture: 70% Silt, 30% Clay Composition: 54% Nannofossils, 15% Clay minerals, 10% Feldspar, 8% Heavy minerals, 8% Volcanic glass, 5% Micarb, Tr% Foraminifera, Tr% Sponge spicules N6
						2		VOID			Locally ash-rich. Carbon Carbonate 1-71 (Ash layer) 3.4, 0.0, 28
						3		GEOCHEM SAMPLE			N6
						Core Catcher					5GY 4/1

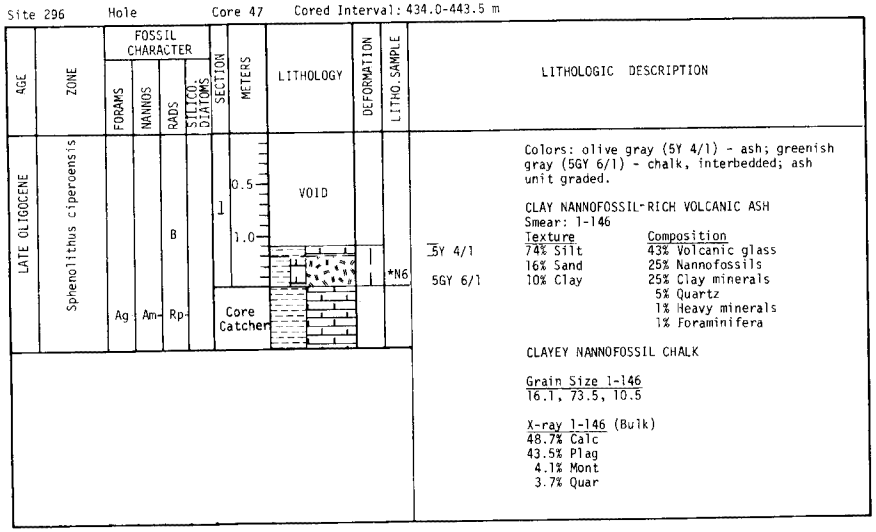
Explanatory notes in chapter 1

Site 296 Hole Core 46 Cored Interval: 424.5-434.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	SILICO. DIATOMS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
LATE OLIGOCENE	Sphenolithus ciperoensis Lychnocanoma bipes			Rp		1	0.5 1.0				Slight deformation; dominant colors, olive gray (5Y 4/1) and greenish gray (5GY 6/1); ash-rich nannofossil chalk occurs locally in Section 2; ash fragments sand size; moderate to intense burrowing. 5Y 4/1 CLAYEY NANNOFOSSIL CHALK Smear: 4-55 Texture: 80% Clay, 20% Silt Composition: 50% Nannofossils, 38% Clay minerals, 5% Micarb, 2% Foraminifera, 1% Feldspar, 1% Heavy minerals, 1% Volcanic glass, 1% Opaques, 1% Radiolarians, Tr% Sponge spicules
						2		VOID			5Y 4/1 Locally ash-rich in Section 2.
						3					color change 5GY 6/1 Carbon Carbonate 4-55 7.7, 0.0, 64
				Rm		4				* 55	
		Ag-	Am-	Rm		Core Catcher					5GY 6/1

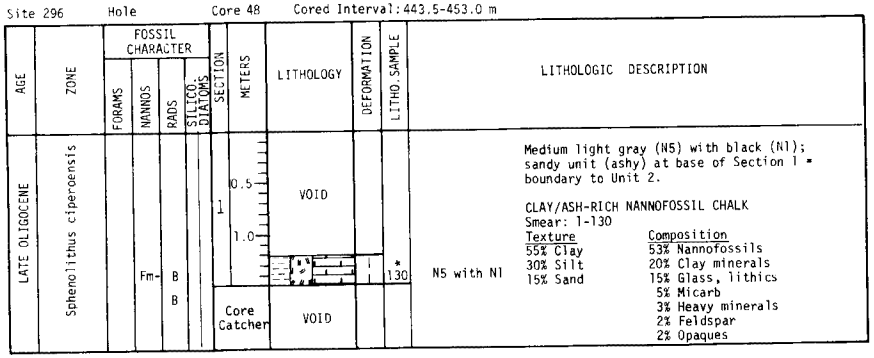
Explanatory notes in chapter 1

Site 296 Hole Core 47 Cored Interval: 434.0-443.5 m



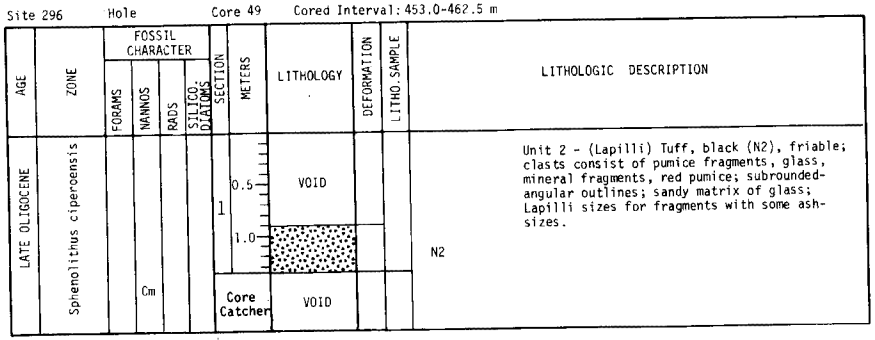
Explanatory notes in chapter 1

Site 296 Hole Core 48 Cored Interval: 443.5-453.0 m



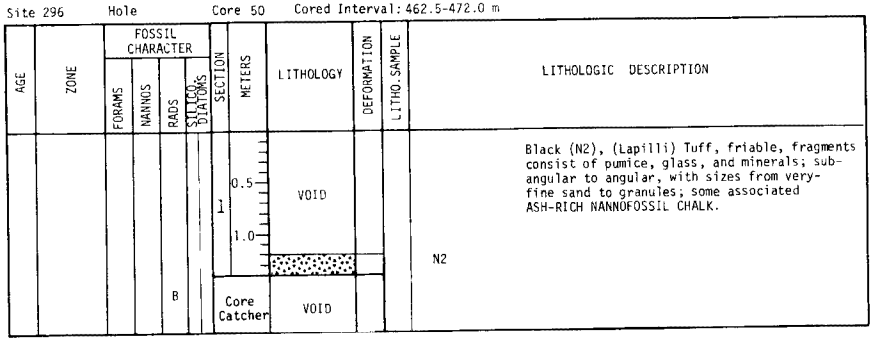
Explanatory notes in chapter 1

Site 296 Hole Core 49 Cored Interval: 453.0-462.5 m



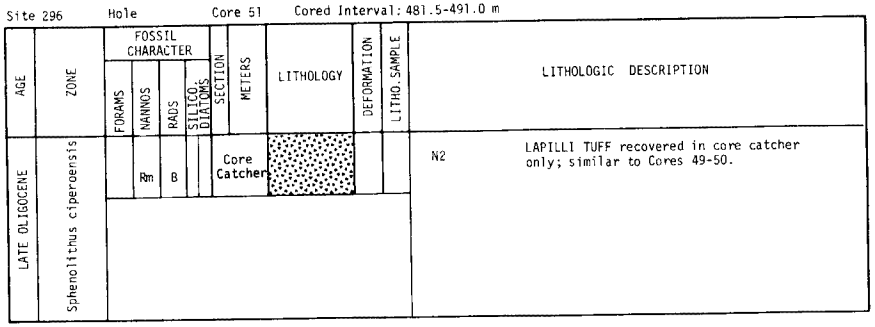
Explanatory notes in chapter 1

Site 296 Hole Core 50 Cored Interval: 462.5-472.0 m



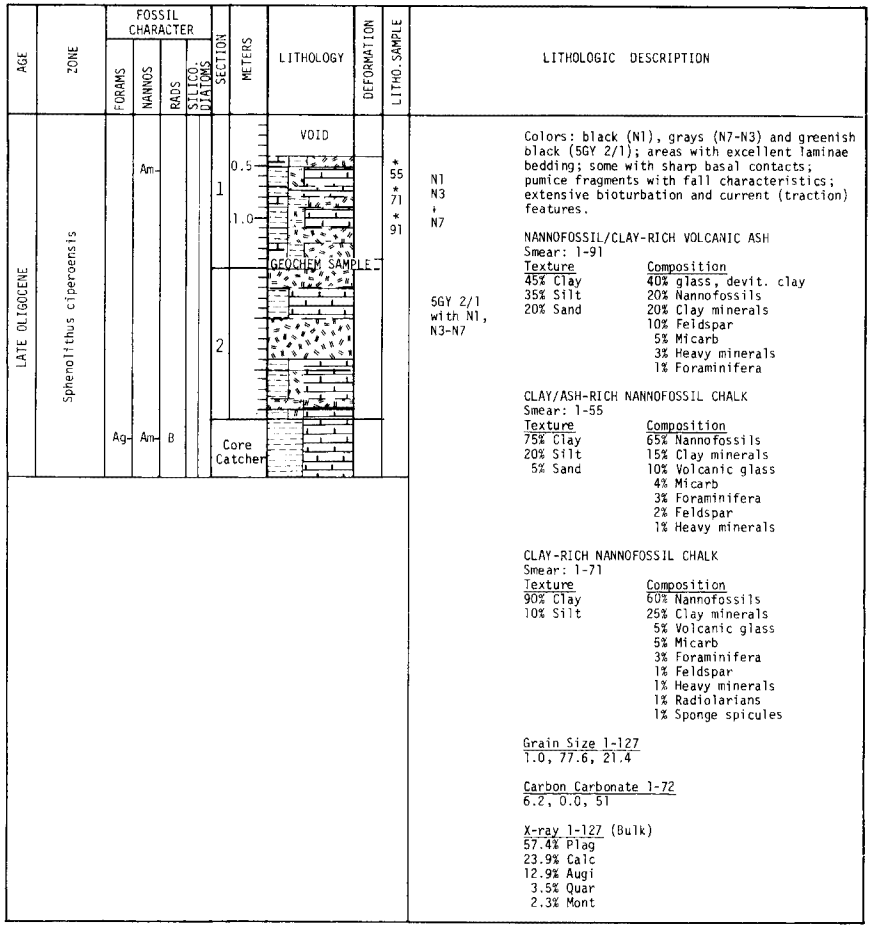
Explanatory notes in chapter 1

Site 296 Hole Core 51 Cored Interval: 481.5-491.0 m



Explanatory notes in chapter 1

Site 296 Hole Core 52 Cored Interval: 548.0-557.5 m



N1
N3
+
N7

5GY 2/1 with N1, N3-N7

Colors: black (N1), grays (N7-N3) and greenish black (5GY 2/1); areas with excellent laminae bedding; some with sharp basal contacts; pumice fragments with fall characteristics; extensive bioturbation and current (traction) features.

NANNOFOSSIL/CLAY-RICH VOLCANIC ASH
Smear: 1-91

Texture	Composition
45% Clay	40% glass, devit. clay
35% Silt	20% Nannofossils
20% Sand	20% Clay minerals
	10% Feldspar
	5% Micarb
	3% Heavy minerals
	1% Foraminifera

CLAY/ASH-RICH NANNOFOSSIL CHALK
Smear: 1-55

Texture	Composition
75% Clay	65% Nannofossils
20% Silt	15% Clay minerals
5% Sand	10% Volcanic glass
	4% Micarb
	3% Foraminifera
	2% Feldspar
	1% Heavy minerals

CLAY-RICH NANNOFOSSIL CHALK
Smear: 1-71

Texture	Composition
90% Clay	60% Nannofossils
10% Silt	25% Clay minerals
	5% Volcanic glass
	5% Micarb
	3% Foraminifera
	1% Feldspar
	1% Heavy minerals
	1% Radiolarians
	1% Sponge spicules

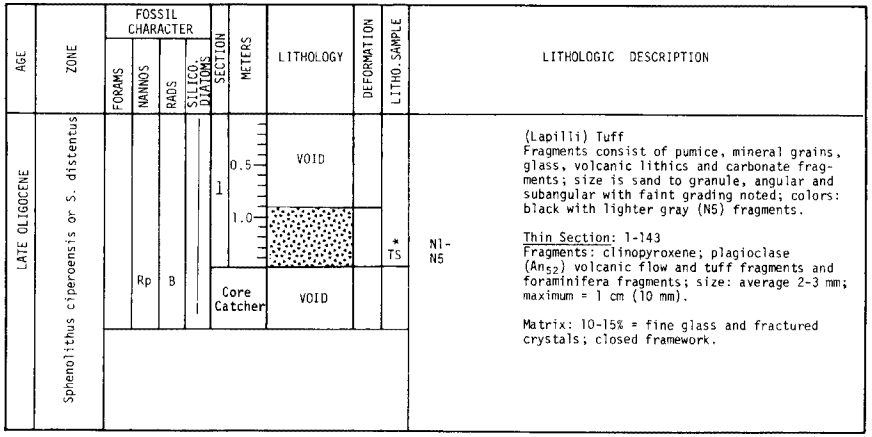
Grain Size 1-127
1.0, 77.6, 21.4

Carbon Carbonate 1-72
6.2, 0.0, 51

X-ray 1-127 (Bulk)
57.4% Plag
23.9% Calc
12.9% Augi
3.5% Quar
2.3% Mont

Explanatory notes in chapter 1

Site 296 Hole Core 53 Cored Interval: 567.0-576.5 m



N1-N5

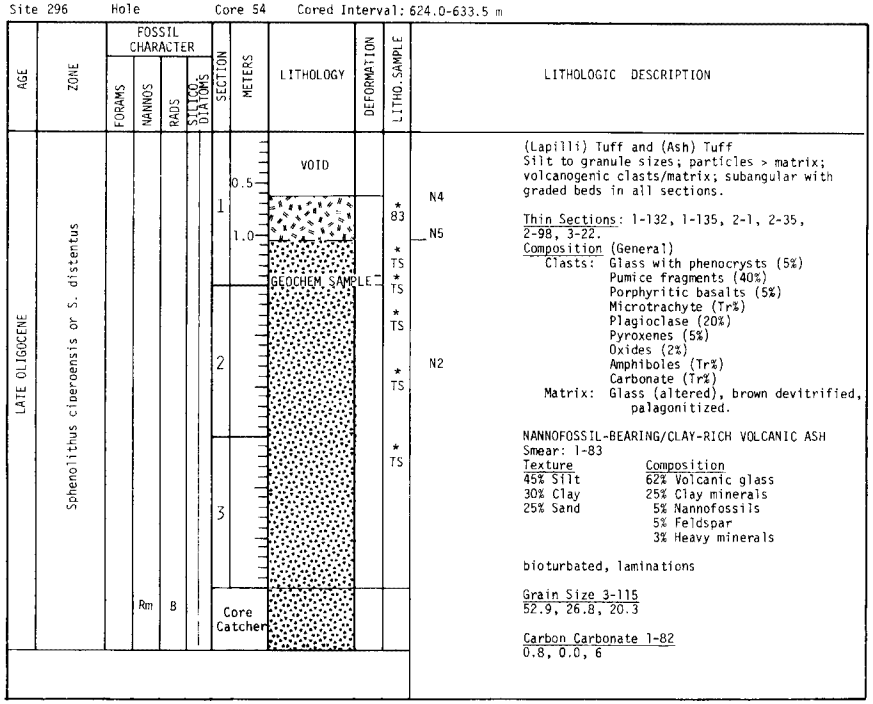
(Lapilli) Tuff
Fragments consist of pumice, mineral grains, glass, volcanic lithics and carbonate fragments; size is sand to granule, angular and subangular with faint grading noted; colors: black with lighter gray (N5) fragments.

Thin Section: 1-143
Fragments: clinopyroxene; plagioclase (An_{52}) volcanic flow and tuff fragments and foraminifera fragments; size: average 2-3 mm; maximum = 1 cm (10 mm).

Matrix: 10-15% = fine glass and fractured crystals; closed framework.

Explanatory notes in chapter 1

Site 296 Hole Core 54 Cored Interval: 624.0-633.5 m



N4
N5
N2

(Lapilli) Tuff and (Ash) Tuff
Silt to granule sizes; particles > matrix; volcanogenic clasts/matrix; subangular with graded beds in all sections.

Thin Sections: 1-132, 1-135, 2-1, 2-35, 2-98, 3-22.
Composition (General)
Clasts: Glass with phenocrysts (5%)
Pumice fragments (40%)
Porphyritic basalts (5%)
Microtrachyte (Tr%)
Plagioclase (20%)
Pyroxenes (5%)
Oxides (2%)
Amphiboles (Tr%)
Carbonate (Tr%)
Matrix: Glass (altered), brown devitrified, palagonitized.

NANNOFOSSIL-BEARING/CLAY-RICH VOLCANIC ASH
Smear: 1-83

Texture	Composition
45% Silt	62% Volcanic glass
30% Clay	25% Clay minerals
25% Sand	5% Nannofossils
	5% Feldspar
	3% Heavy minerals

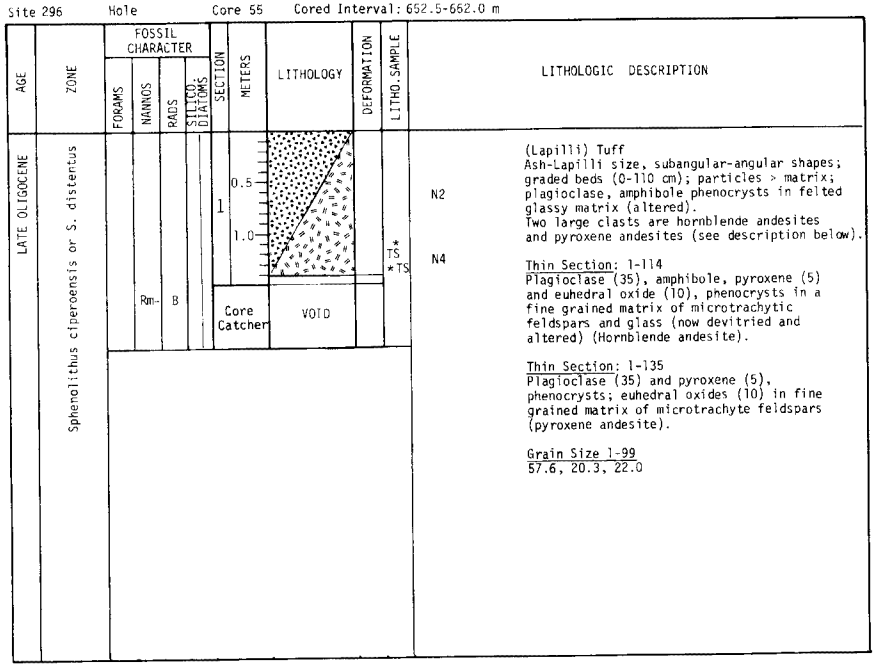
bioturbated, laminations

Grain Size 3-115
52.9, 26.8, 20.3

Carbon Carbonate 1-82
0.8, 0.0, 6

Explanatory notes in chapter 1

Site 296 Hole Core 55 Cored Interval: 652.5-662.0 m



LITHOLOGIC DESCRIPTION

(Lapilli) Tuff
Ash-Lapilli size, subangular-angular shapes; graded beds (0-110 cm); particles > matrix; plagioclase, amphibole phenocrysts in felted glassy matrix (altered).
Two large clasts are hornblende andesites and pyroxene andesites (see description below).

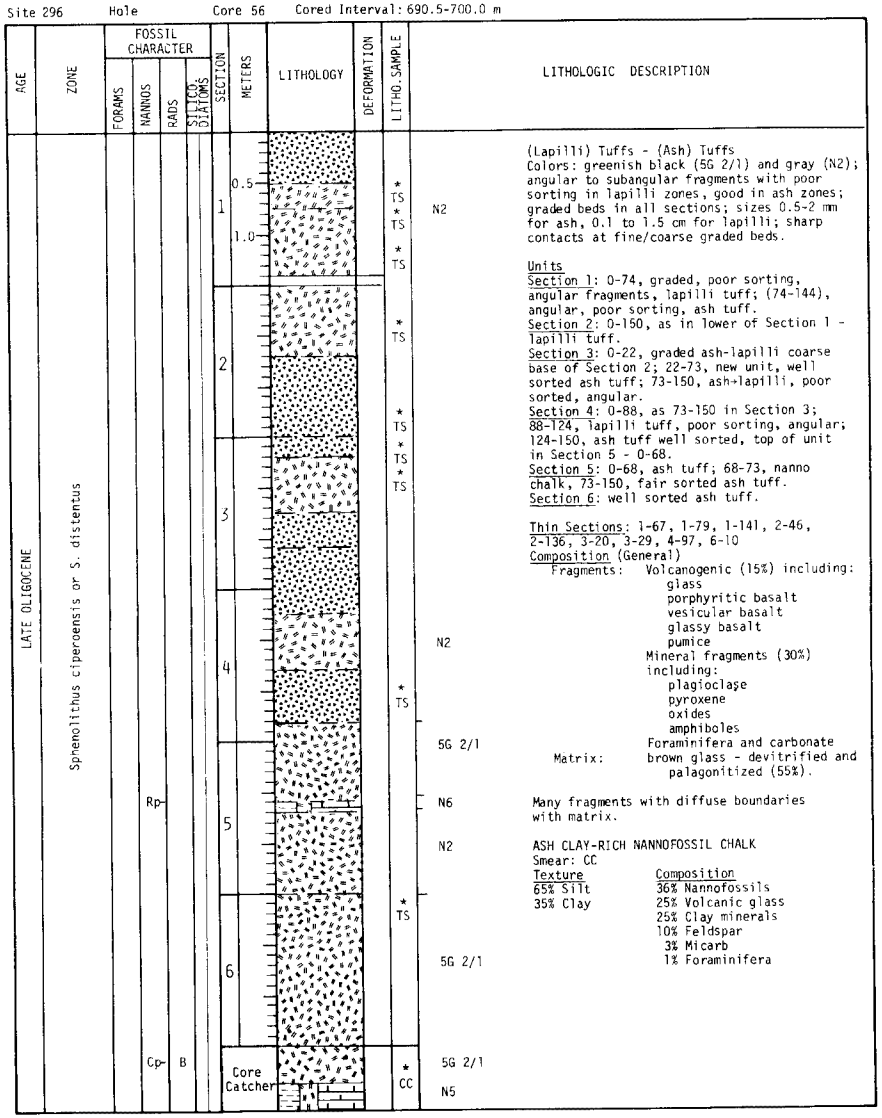
Thin Section: 1-114
Plagioclase (35), amphibole, pyroxene (5) and euhedral oxide (10), phenocrysts in a fine grained matrix of microtrachytic feldspars and glass (now devitried and altered) (Hornblende andesite).

Thin Section: 1-135
Plagioclase (35) and pyroxene (5), phenocrysts; euhedral oxides (10) in fine grained matrix of microtrachyte feldspars (pyroxene andesite).

Grain Size 1-99
57.6, 20.3, 22.0

Explanatory notes in chapter 1

Site 296 Hole Core 56 Cored Interval: 690.5-700.0 m



LITHOLOGIC DESCRIPTION

(Lapilli) Tuffs - (Ash) Tuffs
Colors: greenish black (5G 2/1) and gray (N2); angular to subangular fragments with poor sorting in lapilli zones, good in ash zones; graded beds in all sections; sizes 0.5-2 mm for ash, 0.1 to 1.5 cm for lapilli; sharp contacts at fine/coarse graded beds.

Units
Section 1: 0-74, graded, poor sorting, angular fragments, lapilli tuff; (74-144), angular, poor sorting, ash tuff.
Section 2: 0-150, as in lower of Section 1 - lapilli tuff.
Section 3: 0-22, graded ash-lapilli coarse base of Section 2; 22-73, new unit, well sorted ash tuff; 73-150, ash+lapilli, poor sorted, angular.
Section 4: 0-88, as 73-150 in Section 3; 88-124, lapilli tuff, poor sorting, angular; 124-150, ash tuff well sorted, top of unit in Section 5 - 0-68.
Section 5: 0-68, ash tuff; 68-73, nanno chalk, 73-150, fair sorted ash tuff.
Section 6: well sorted ash tuff.

Thin Sections: 1-67, 1-79, 1-141, 2-46, 2-136, 3-20, 3-29, 4-97, 6-10
Composition (General)
Fragments: Volcanogenic (15%) including:
glass
porphyritic basalt
vesicular basalt
glassy basalt
pumice
Mineral fragments (30%) including:
plagioclase
pyroxene
oxides
amphiboles
Foraminifera and carbonate
Matrix: brown glass - devitrified and palagonitized (55%).

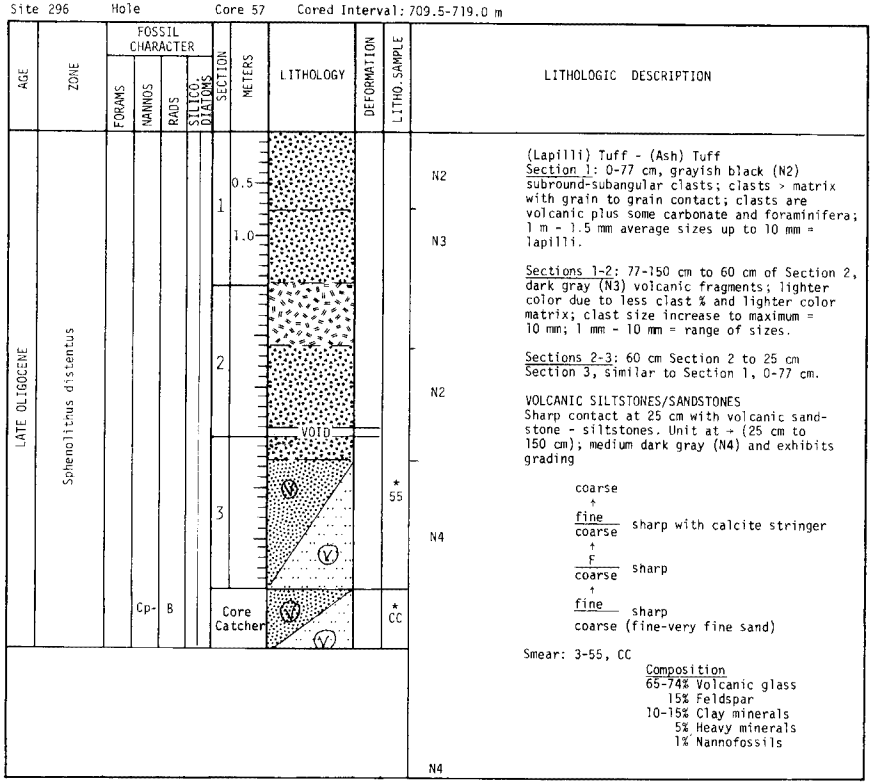
Many fragments with diffuse boundaries with matrix.

ASH CLAY-RICH NANNOFOSSIL CHALK
Smear: CC

Texture	Composition
65% Silt	36% Nannofossils
35% Clay	25% Volcanic glass
	25% Clay minerals
	10% Feldspar
	3% Micarb
	1% Foraminifera

Explanatory notes in chapter 1

Site 296 Hole Core 57 Cored Interval: 709.5-719.0 m



LITHOLOGIC DESCRIPTION

(Lapilli) Tuff - (Ash) Tuff
Section 1: 0-77 cm, grayish black (N2) subround-subangular clasts; clasts > matrix with grain to grain contact; clasts are volcanic plus some carbonate and foraminifera; 1 m - 1.5 mm average sizes up to 10 mm = lapilli.

Sections 1-2: 77-150 cm to 60 cm of Section 2, dark gray (N3) volcanic fragments; lighter color due to less clast % and lighter color matrix; clast size increase to maximum = 10 mm; 1 mm - 10 mm = range of sizes.

Sections 2-3: 60 cm Section 2 to 25 cm Section 3, similar to Section 1, 0-77 cm.

VOLCANIC SILTSTONES/SANDSTONES
Sharp contact at 25 cm with volcanic sandstone - siltstones. Unit at ± (25 cm to 150 cm); medium dark gray (N4) and exhibits grading

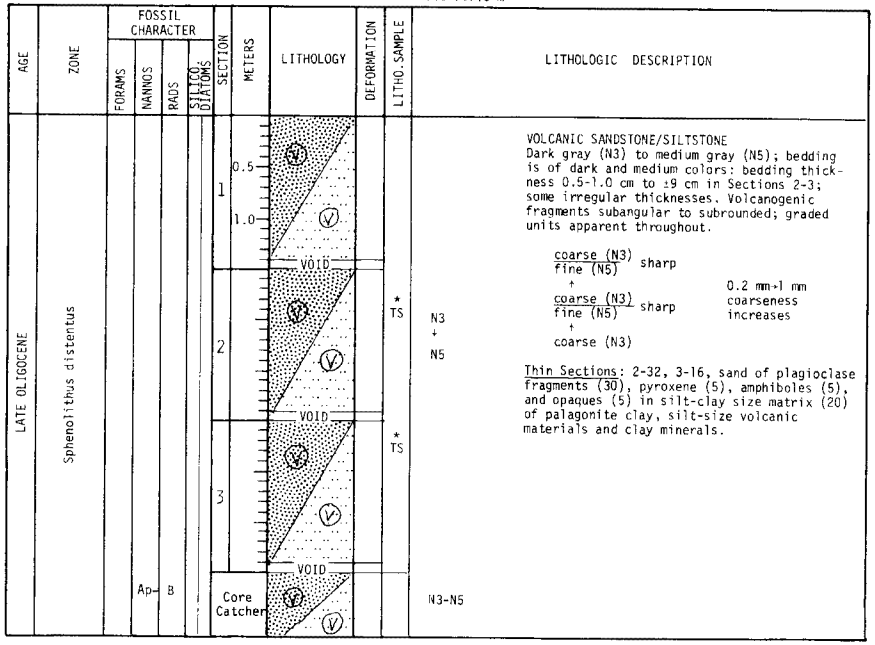
coarse / fine — sharp with calcite stringer
f / coarse — sharp
fine / coarse — sharp
coarse (fine-very fine sand)

Smear: 3-55, CC

Composition
65-74% Volcanic glass
15% Feldspar
10-15% Clay minerals
5% Heavy minerals
1% Nannofossils

Explanatory notes in chapter 1

Site 296 Hole Core 58 Cored Interval: 747.5-757.0 m



LITHOLOGIC DESCRIPTION

VOLCANIC SANDSTONE/SILTSTONE
Dark gray (N3) to medium gray (N5); bedding is of dark and medium colors: bedding thickness 0.5-1.0 cm to ±9 cm in Sections 2-3; some irregular thicknesses. Volcanogenic fragments subangular to subrounded; graded units apparent throughout.

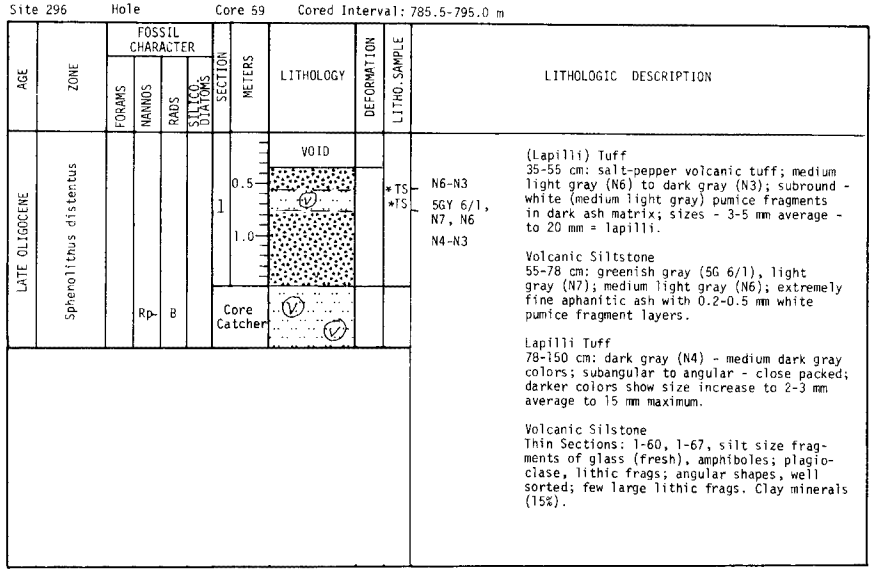
coarse (N3) / fine (N5) sharp
+
coarse (N3) / fine (N5) sharp
+
coarse (N3)

0.2 mm→1 mm coarseness increases

Thin Sections: 2-32, 3-16, sand of plagioclase fragments (30), pyroxene (5), amphiboles (5), and opaques (5) in silt-clay size matrix (20) of palagonite clay, silt-size volcanic materials and clay minerals.

Explanatory notes in chapter 1

Site 296 Hole Core 59 Cored Interval: 785.5-795.0 m



(Lapilli) Tuff
35-55 cm: salt-pepper volcanic tuff; medium light gray (N6) to dark gray (N3); subround - white (medium light gray) pumice fragments in dark ash matrix; sizes - 3-5 mm average - to 20 mm = lapilli.

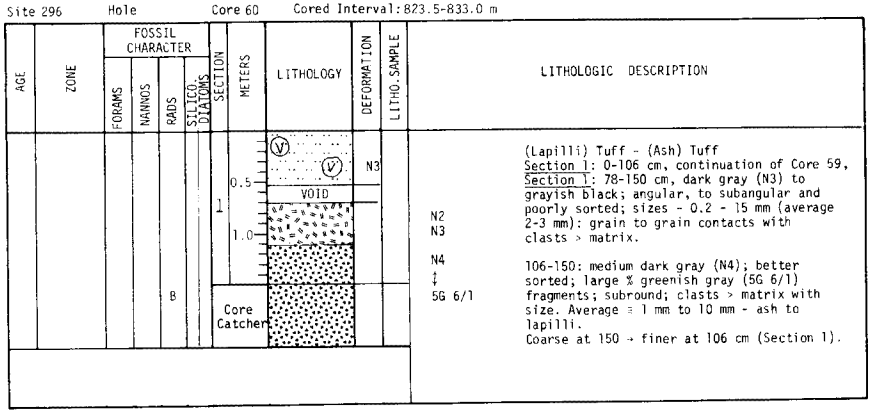
Volcanic Siltstone
55-78 cm: greenish gray (5G 6/1), light gray (N7); medium light gray (N6); extremely fine aphanitic ash with 0.2-0.5 mm white pumice fragment layers.

Lapilli Tuff
78-150 cm: dark gray (N4) - medium dark gray colors; subangular to angular - close packed; darker colors show size increase to 2-3 mm average to 15 mm maximum.

Volcanic Silstone
Thin Sections: 1-60, 1-67, silt size fragments of glass (fresh), amphiboles; plagioclase, lithic frags; angular shapes, well sorted; few large lithic frags. Clay minerals (15%).

Explanatory notes in chapter 1

Site 296 Hole Core 60 Cored Interval: 823.5-833.0 m

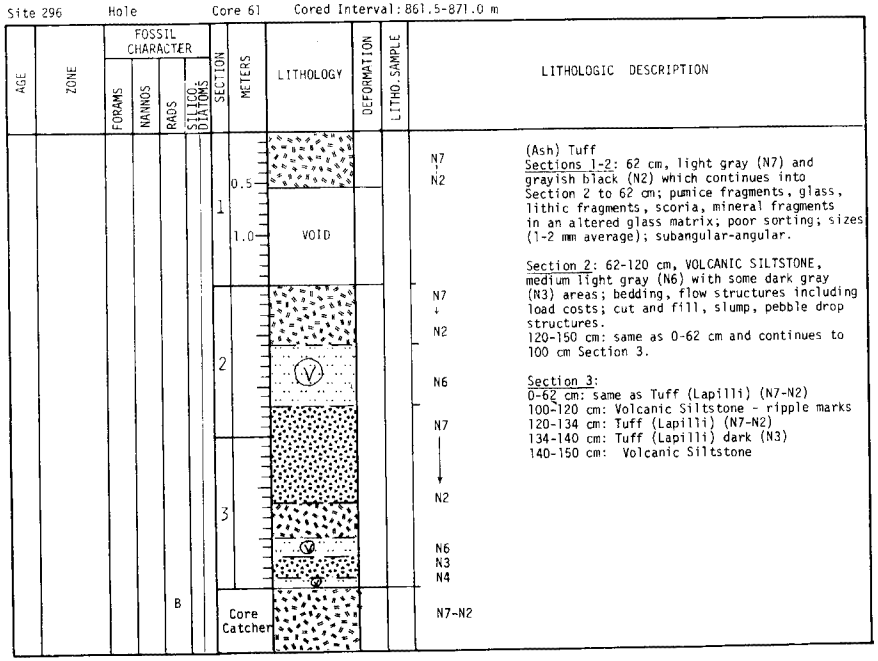


(Lapilli) Tuff - (Ash) Tuff
Section 1: 0-106 cm, continuation of Core 59,
Section 1: 78-150 cm, dark gray (N3) to grayish black; angular, to subangular and poorly sorted; sizes - 0.2 - 15 mm (average 2-3 mm): grain to grain contacts with clasts > matrix.

106-150: medium dark gray (N4); better sorted; large % greenish gray (5G 6/1) fragments; subround; clasts > matrix with size. Average = 1 mm to 10 mm - ash to lapilli.
Coarse at 150 → finer at 106 cm (Section 1).

Explanatory notes in chapter 1

Site 296 Hole Core 61 Cored Interval: 861.5-871.0 m



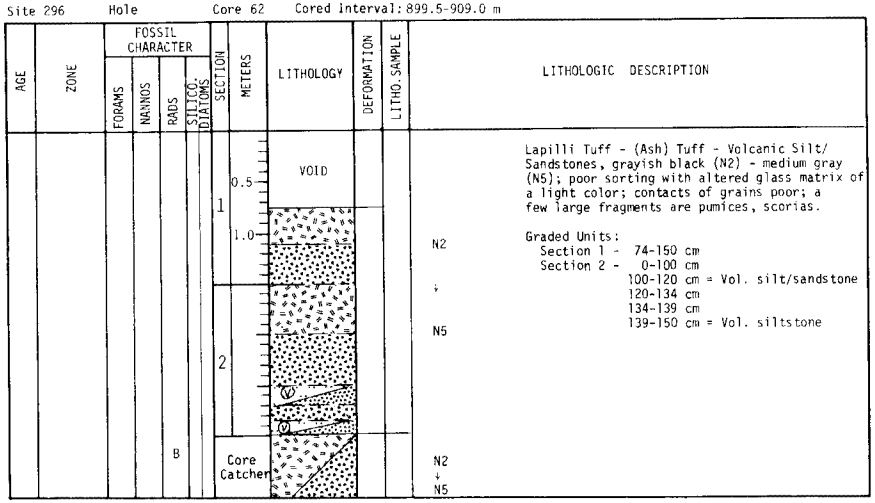
(Ash) Tuff
Sections 1-2: 62 cm, light gray (N7) and grayish black (N2) which continues into Section 2 to 62 cm; pumice fragments, glass, lithic fragments, scoria, mineral fragments in an altered glass matrix; poor sorting; sizes (1-2 mm average); subangular-angular.

Section 2: 62-120 cm, VOLCANIC SILTSTONE, medium light gray (N6) with some dark gray (N3) areas; bedding, flow structures including load costs; cut and fill, slump, pebble drop structures.
120-150 cm: same as 0-62 cm and continues to 100 cm Section 3.

Section 3:
0-62 cm: same as Tuff (Lapilli) (N7-N2)
100-120 cm: Volcanic Siltstone - ripple marks
120-134 cm: Tuff (Lapilli) (N7-N2)
134-140 cm: Tuff (Lapilli) dark (N3)
140-150 cm: Volcanic Siltstone

Explanatory notes in chapter 1

Site 296 Hole Core 62 Cored Interval: 899.5-909.0 m

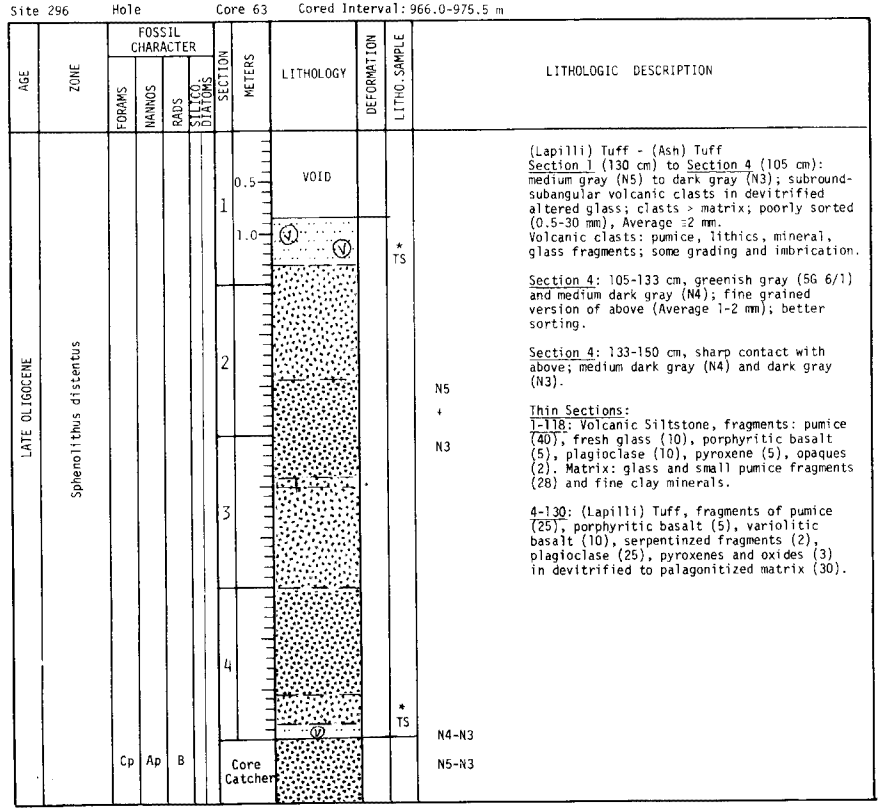


Lapilli Tuff - (Ash) Tuff - Volcanic Silt/Sandstones, grayish black (N2) - medium gray (N5); poor sorting with altered glass matrix of a light color; contacts of grains poor; a few large fragments are pumices, scorias.

Graded Units:
Section 1 - 74-150 cm
Section 2 - 0-100 cm
100-120 cm = Vol. silt/sandstone
120-134 cm
134-139 cm
139-150 cm = Vol. siltstone

Explanatory notes in chapter 1

Site 296 Hole Core 63 Cored Interval: 966.0-975.5 m



(Lapilli) Tuff - (Ash) Tuff
Section 1 (130 cm) to Section 4 (105 cm): medium gray (N5) to dark gray (N3); subround-subangular volcanic clasts in devitrified altered glass; clasts > matrix; poorly sorted (0.5-30 mm), Average ≈2 mm.
Volcanic clasts: pumice, lithics, mineral, glass fragments; some grading and imbrication.

Section 4: 105-133 cm, greenish gray (5G 6/1) and medium dark gray (N4); fine grained version of above (Average 1-2 mm); better sorting.

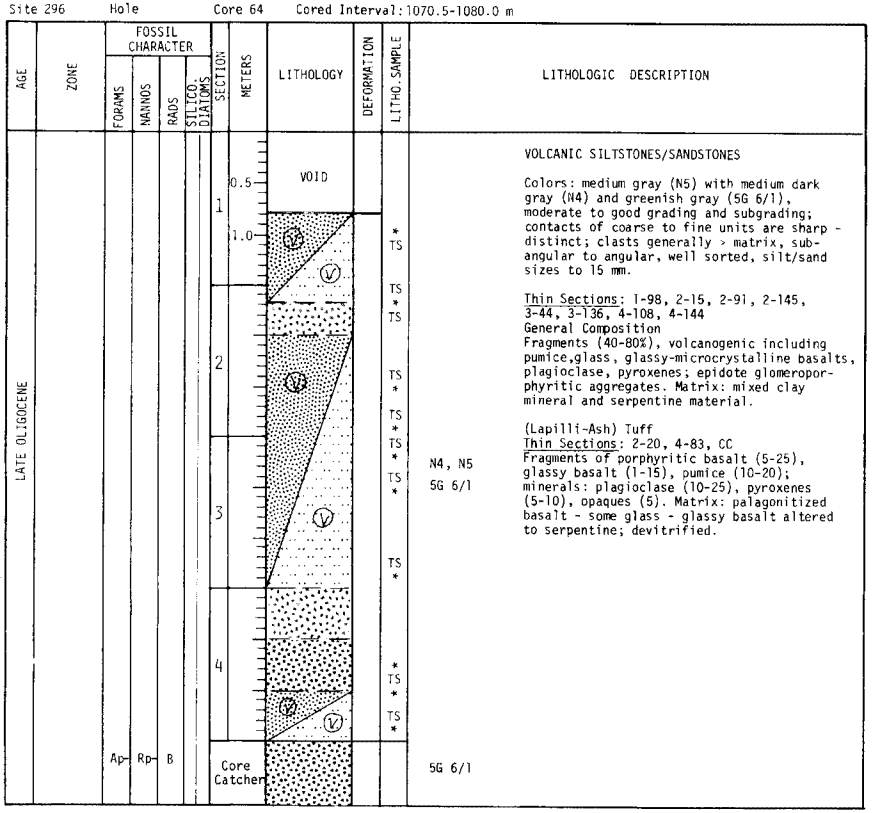
Section 4: 133-150 cm, sharp contact with above; medium dark gray (N4) and dark gray (N3).

Thin Sections:
1-118: Volcanic Siltstone, fragments: pumice (40), fresh glass (10), porphyritic basalt (5), plagioclase (10), pyroxene (5), opaques (2). Matrix: glass and small pumice fragments (28) and fine clay minerals.

4-130: (Lapilli) Tuff, fragments of pumice (25), porphyritic basalt (5), variolitic basalt (10), serpentinzed fragments (2), plagioclase (25), pyroxenes and oxides (3) in devitrified to palagonitized matrix (30).

Explanatory notes in chapter 1

Site 296 Hole Core 64 Cored Interval: 1070.5-1080.0 m



VOLCANIC SILTSTONES/SANDSTONES

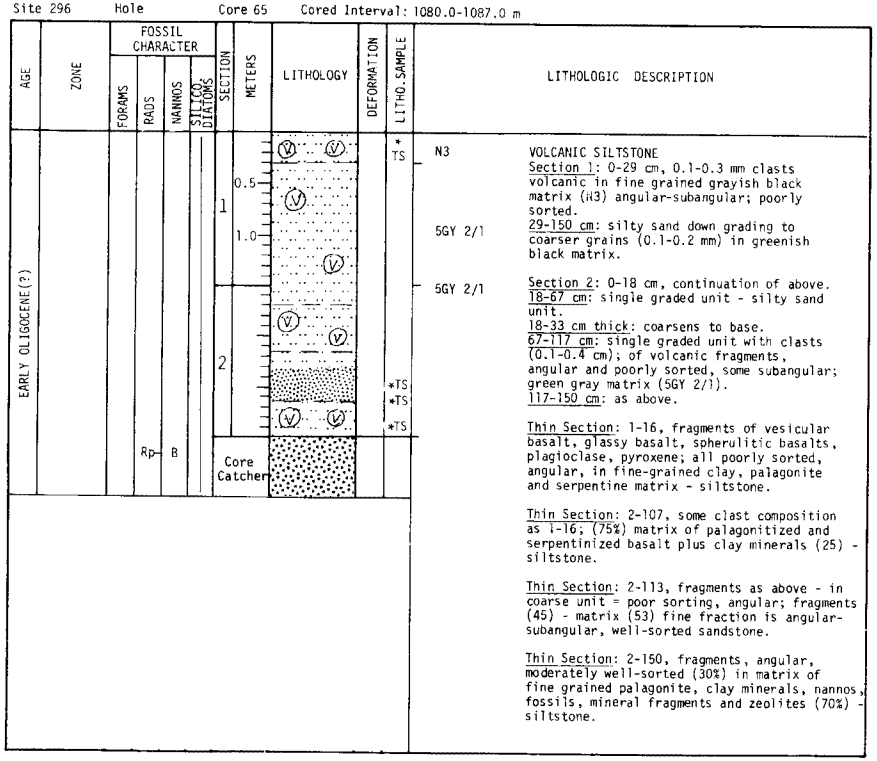
Colors: medium gray (N5) with medium dark gray (N4) and greenish gray (5G 6/1), moderate to good grading and subgrading; contacts of coarse to fine units are sharp - distinct; clasts generally > matrix, sub-angular to angular, well sorted, silt/sand sizes to 15 mm.

Thin Sections: 1-98, 2-15, 2-91, 2-145, 3-44, 3-136, 4-108, 4-144
General Composition
Fragments (40-80%), volcanogenic including pumice, glass, glassy-microcrystalline basalts, plagioclase, pyroxenes; epidote glomeroporphyritic aggregates. Matrix: mixed clay mineral and serpentine material.

(Lapilli-Ash) Tuff
Thin Sections: 2-20, 4-83, CC
Fragments of porphyritic basalt (5-25), glassy basalt (1-15), pumice (10-20); minerals: plagioclase (10-25), pyroxenes (5-10), opaques (5). Matrix: palagonitized basalt - some glass - glassy basalt altered to serpentine; devitrified.

Explanatory notes in chapter 1

Site 296 Hole Core 65 Cored Interval: 1080.0-1087.0 m



VOLCANIC SILTSTONE
Section 1: 0-29 cm, 0.1-0.3 mm clasts volcanic in fine grained grayish black matrix (N3) angular-subangular; poorly sorted.
29-150 cm: silty sand down grading to coarser grains (0.1-0.2 mm) in greenish black matrix.

Section 2: 0-18 cm, continuation of above.
18-67 cm: single graded unit - silty sand unit.
18-33 cm thick: coarsens to base.
67-117 cm: single graded unit with clasts (0.1-0.4 cm); of volcanic fragments, angular and poorly sorted, some subangular; green gray matrix (5GY 2/1).
117-150 cm: as above.

Thin Section: 1-16, fragments of vesicular basalt, glassy basalt, spherulitic basalts, plagioclase, pyroxene; all poorly sorted, angular, in fine-grained clay, palagonite and serpentine matrix - siltstone.

Thin Section: 2-107, some clast composition as 1-16, (75%) matrix of palagonitized and serpentinized basalt plus clay minerals (25) - siltstone.

Thin Section: 2-113, fragments as above - in coarse unit - poor sorting, angular; fragments (45) - matrix (53) fine fraction is angular-subangular, well-sorted sandstone.

Thin Section: 2-150, fragments, angular, moderately well-sorted (30%) in matrix of fine grained palagonite, clay minerals, nannos, fossils, mineral fragments and zeolites (70%) - siltstone.

Explanatory notes in chapter 1

DEEP SEA DRILLING PROJECT

LEG 31 SITE 297

SITE SUMMARY SHEET

POSITION: Latitude: 30°52.36'N Longitude: 134°09.89'E

Water depth (from sea level): 4458 corrected meters (Echo sounding)

Bottom felt at: 4480.5 meters (drill pipe) Penetration: 297-679.5 m
279A-200.5 m

Number of Holes: 2 Number of Cores: 297-27 and 297A-0

Total length of cored section: 297-242.5 m
297A-0 m Total core recovered: 297-124.2 m

Percentage of core recovery: 297-51.2%

OLDEST SEDIMENT CORED:

Depth below sea floor: 679.5 meters Nature: Vitric ash and ash-rich claystone

Age: early mid Miocene or late early Miocene

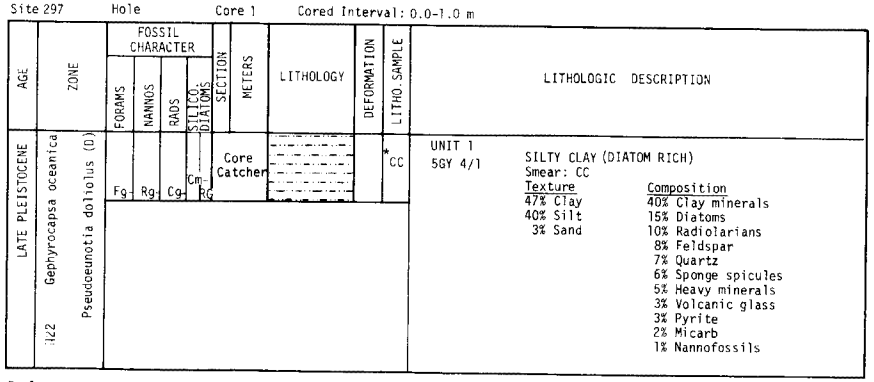
Inferred depth to basement: 780 meters

PRINCIPAL RESULTS:

Site 297 is located in the northwestern corner of the Shikoku Basin directly south of the Nankai Trough and Shikoku Island. The stratigraphic section consists of 54 meters of Pleistocene diatom/ash rich clay, 36 meters of Pleistocene clay-rich nannofossil ooze, 240 meters of Pleistocene-late Pliocene claystone, 247 meters of late-early Pliocene claystone and turbidite sands and silts with displaced shallow water foraminifera, and 122 meters of early Pliocene(?) to middle Miocene vitric ash and claystone. Cessation of turbidite deposition of continental material including plant debris in early Pliocene. Probably marks formation of the Nankai Trough, and an increase in rate of subduction in this trench.

Although basement was not reached due to technical difficulties, seismic reflection and refraction data indicate that basalt lies approximately 780 meters below the bottom of the hole, and is of early Miocene age.

Site 297 Hole Core 1 Cored Interval: 0.0-1.0 m



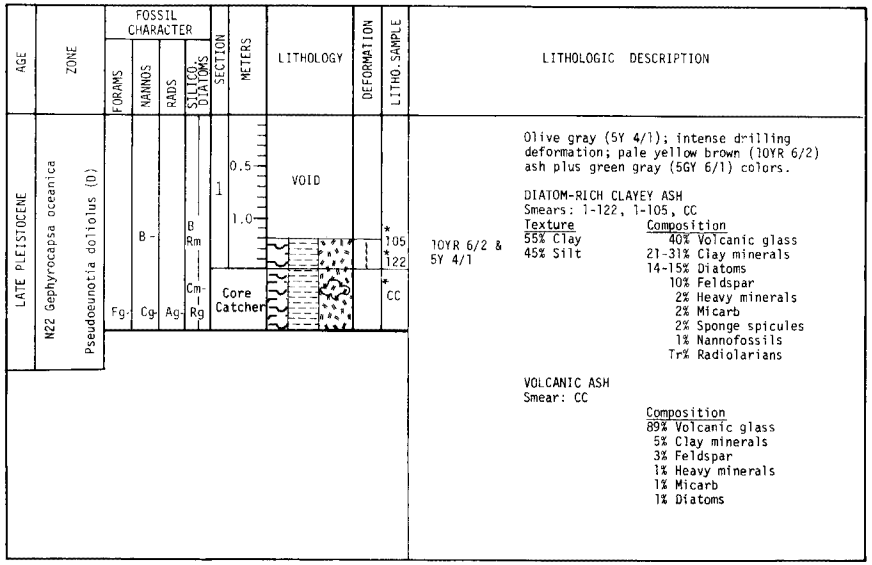
UNIT 1
5GY 4/1

SILTY CLAY (DIATOM RICH)
Smear: CC

Texture	Composition
47% Clay	40% Clay minerals
40% Silt	15% Diatoms
3% Sand	10% Radiolarians
	8% Feldspar
	7% Quartz
	6% Sponge spicules
	5% Heavy minerals
	3% Volcanic glass
	3% Pyrite
	2% Micarb
	1% Nannofossils

Explanatory notes in chapter 1

Site 297 Hole Core 2 Cored Interval: 1.0-10.5 m



10YR 6/2 & 5Y 4/1

Olive gray (5Y 4/1); intense drilling deformation; pale yellow brown (10YR 6/2) ash plus green gray (5GY 6/1) colors.

DIATOM-RICH CLAYEY ASH
Smears: 1-122, 1-105, CC

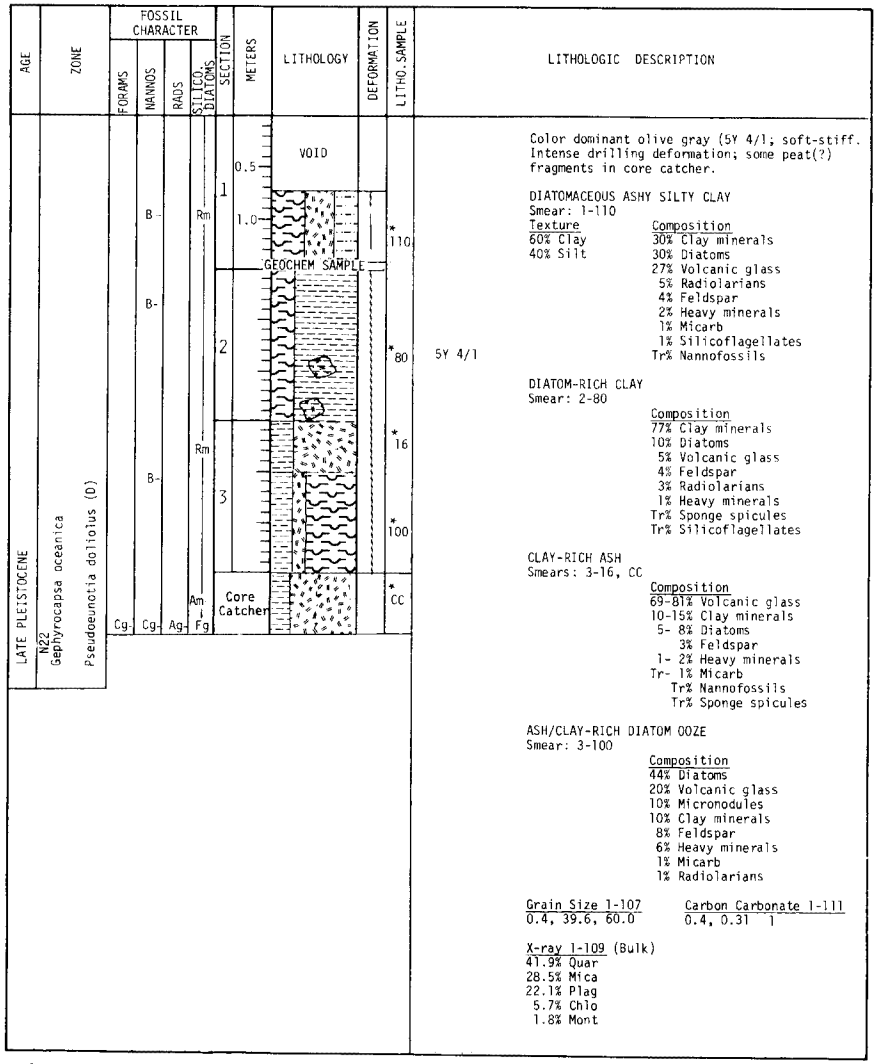
Texture	Composition
55% Clay	40% Volcanic glass
45% Silt	21-31% Clay minerals
	14-15% Diatoms
	10% Feldspar
	2% Heavy minerals
	2% Micarb
	2% Sponge spicules
	1% Nannofossils
	Tr% Radiolarians

VOLCANIC ASH
Smear: CC

Composition
89% Volcanic glass
5% Clay minerals
3% Feldspar
1% Heavy minerals
1% Micarb
1% Diatoms

Explanatory notes in chapter 1

Site 297 Hole Core 3 Cored Interval: 20.0-29.5 m



5Y 4/1

Color dominant olive gray (5Y 4/1; soft-stiff. Intense drilling deformation; some peat(?) fragments in core catcher.

DIATOMACEOUS ASHY SILTY CLAY
Smear: 1-110

Texture	Composition
60% Clay	30% Clay minerals
40% Silt	30% Diatoms
	27% Volcanic glass
	5% Radiolarians
	4% Feldspar
	2% Heavy minerals
	1% Micarb
	1% Silicoflagellates
	Tr% Nannofossils

DIATOM-RICH CLAY
Smear: 2-80

Composition
77% Clay minerals
10% Diatoms
5% Volcanic glass
4% Feldspar
3% Radiolarians
1% Heavy minerals
Tr% Sponge spicules
Tr% Silicoflagellates

CLAY-RICH ASH
Smears: 3-16, CC

Composition
69-81% Volcanic glass
10-15% Clay minerals
5- 8% Diatoms
3% Feldspar
1- 2% Heavy minerals
Tr- 1% Micarb
Tr% Nannofossils
Tr% Sponge spicules

ASH/CLAY-RICH DIATOM OOZE
Smear: 3-100

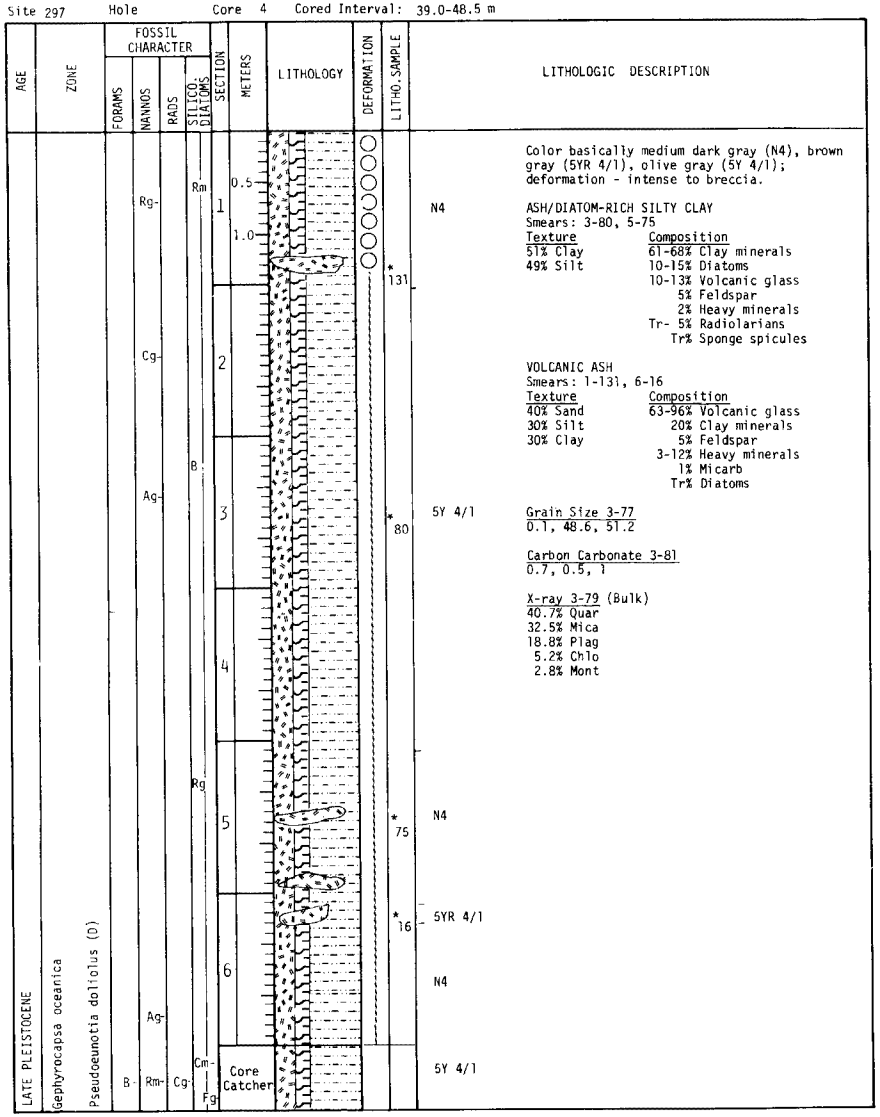
Composition
44% Diatoms
20% Volcanic glass
10% Micronodules
10% Clay minerals
8% Feldspar
6% Heavy minerals
1% Micarb
1% Radiolarians

Grain Size 1-107	Carbon Carbonate 1-111
0.4, 39.6, 60.0	0.4, 0.31 1

X-ray 1-109 (Bulk)
41.9% Quar
28.5% Mica
22.1% Plag
5.7% Chlo
1.8% Mont

Explanatory notes in chapter 1

Site 297 Hole Core 4 Cored Interval: 39.0-48.5 m



Color basically medium dark gray (N4), brown gray (5YR 4/1), olive gray (5Y 4/1); deformation - intense to breccia.

ASH/DIATOM-RICH SILTY CLAY
Smears: 3-80, 5-75

Texture	Composition
51% Clay	61-68% Clay minerals
49% Silt	10-15% Diatoms
	10-13% Volcanic glass
	5% Feldspar
	2% Heavy minerals
	Tr- 5% Radiolarians
	Tr% Sponge spicules

VOLCANIC ASH
Smears: 1-131, 6-16

Texture	Composition
40% Sand	63-96% Volcanic glass
30% Silt	20% Clay minerals
30% Clay	5% Feldspar
	3-12% Heavy minerals
	1% Micarb
	Tr% Diatoms

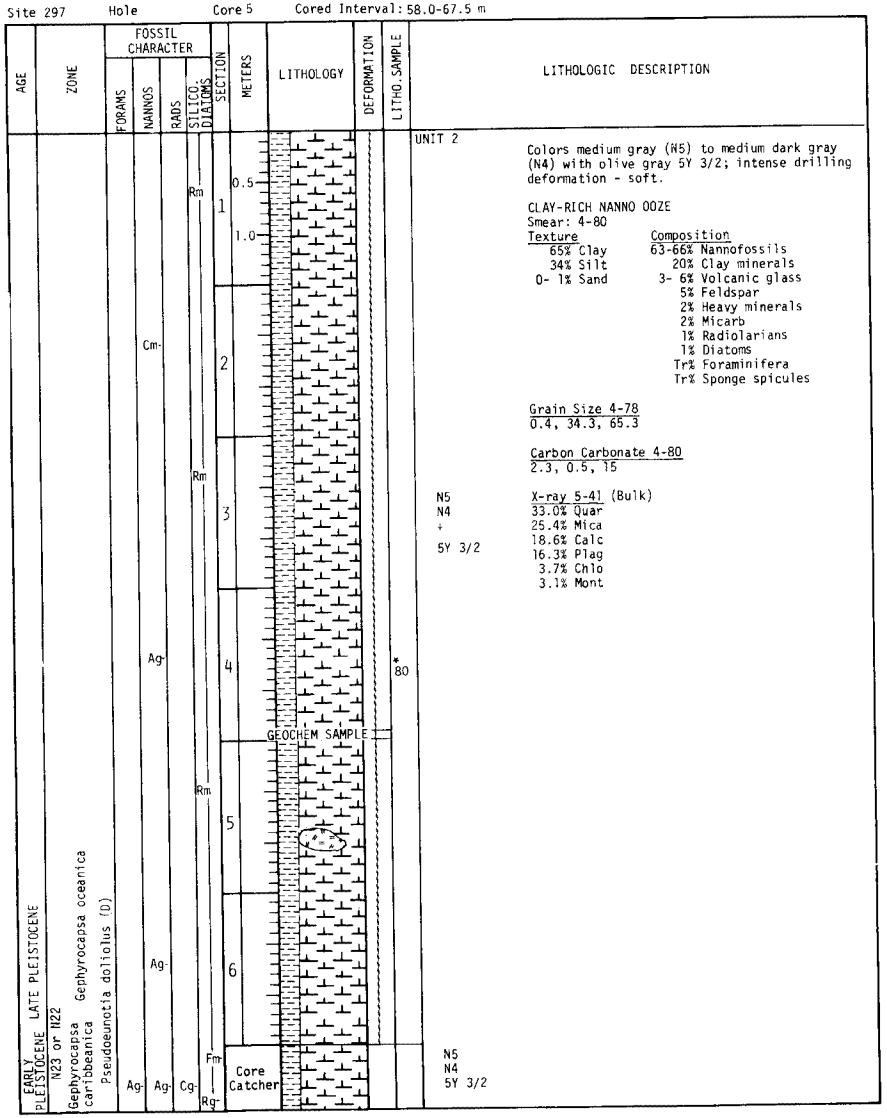
Grain Size 3-77
0.1, 48.6, 51.2

Carbon Carbonate 3-81
0.7, 0.5, 1

X-ray 3-79 (Bulk)
40.7% Quar
32.5% Mica
18.8% Plag
5.2% Chlo
2.8% Mont

Explanatory notes in chapter 1

Site 297 Hole Core 5 Cored Interval: 58.0-67.5 m



Colors medium gray (N5) to medium dark gray (N4) with olive gray 5Y 3/2; intense drilling deformation - soft.

CLAY-RICH NANNO OOZE
Smear: 4-80

Texture	Composition
65% Clay	63-66% Nannofossils
34% Silt	20% Clay minerals
0- 1% Sand	3- 6% Volcanic glass
	5% Feldspar
	2% Heavy minerals
	2% Micarb
	1% Radiolarians
	1% Diatoms
	Tr% Foraminifera
	Tr% Sponge spicules

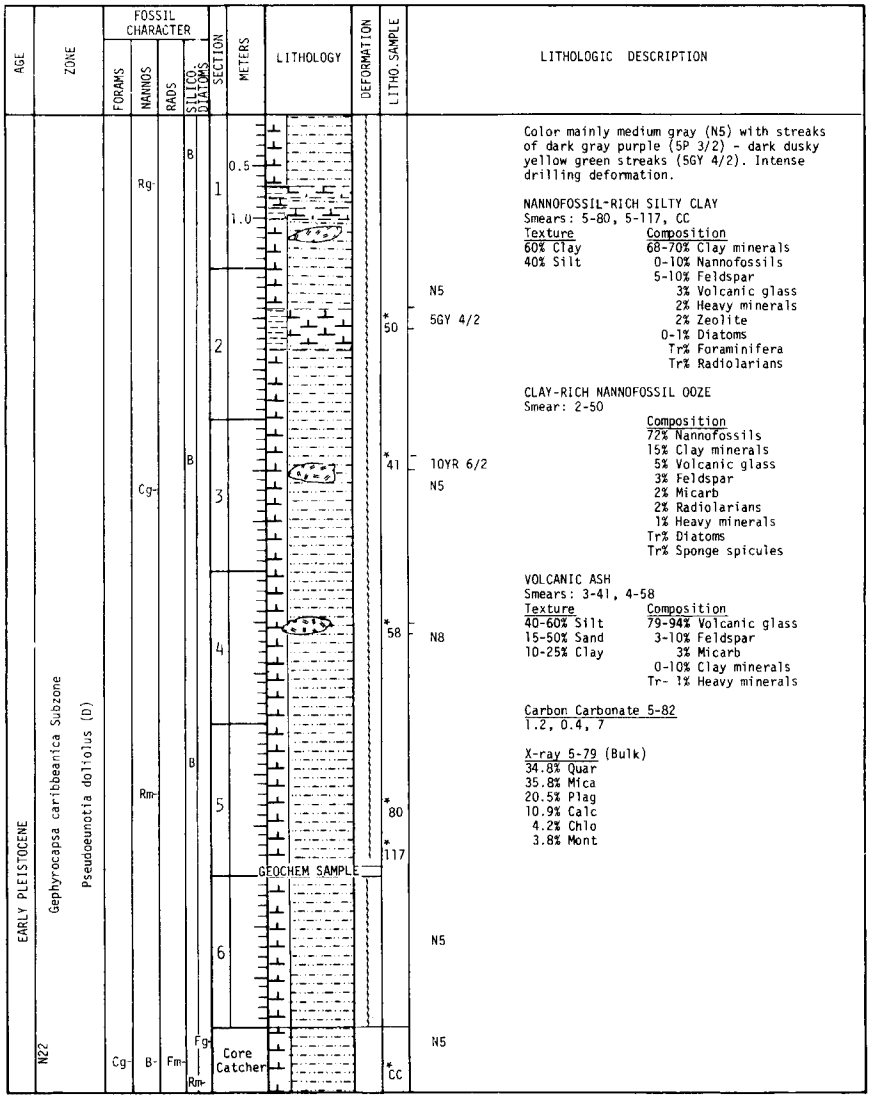
Grain Size 4-78
0.4, 34.3, 65.3

Carbon Carbonate 4-80
2.3, 0.5, 15

X-ray 5-41 (Bulk)
33.0% Quar
25.4% Mica
18.6% Calc
16.3% Plag
3.7% Chlo
3.1% Mont

Explanatory notes in chapter 1

Site 297 Hole Core 6 Cored Interval: 77.0-86.5 m



Color mainly medium gray (N5) with streaks of dark gray purple (5P 3/2) - dark dusky yellow green streaks (5GY 4/2). Intense drilling deformation.

NANNOFOSSIL-RICH SILTY CLAY
Smears: 5-80, 5-117, CC

Texture	Composition
60% Clay	68-70% Clay minerals
40% Silt	0-10% Nannofossils
	5-10% Feldspar
	3% Volcanic glass
	2% Heavy minerals
	2% Zeolite
	0-1% Diatoms
	Tr% Foraminifera
	Tr% Radiolarians

CLAY-RICH NANNOFOSSIL OOZE
Smear: 2-50

Composition
72% Nannofossils
15% Clay minerals
5% Volcanic glass
3% Feldspar
2% Micarb
2% Radiolarians
1% Heavy minerals
Tr% Diatoms
Tr% Sponge spicules

VOLCANIC ASH
Smears: 3-41, 4-58

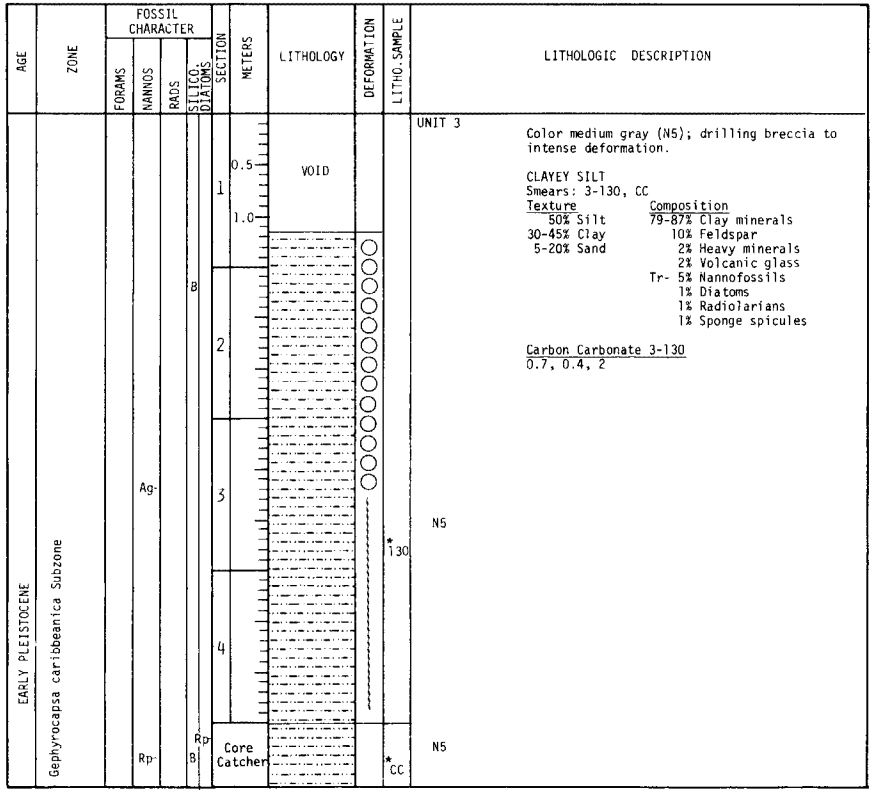
Texture	Composition
40-60% Silt	79-94% Volcanic glass
15-50% Sand	3-10% Feldspar
10-25% Clay	3% Micarb
	0-10% Clay minerals
	Tr- 1% Heavy minerals

Carbon Carbonate 5-82
1.2, 0.4, 7

X-ray 5-79 (Bulk)
34.8% Quar
35.8% Mica
20.5% Plag
10.9% Calc
4.2% Chlo
3.8% Mont

Explanatory notes in chapter 1

Site 297 Hole Core 7 Cored Interval: 96.0-105.5 m



Color medium gray (N5); drilling breccia to intense deformation.

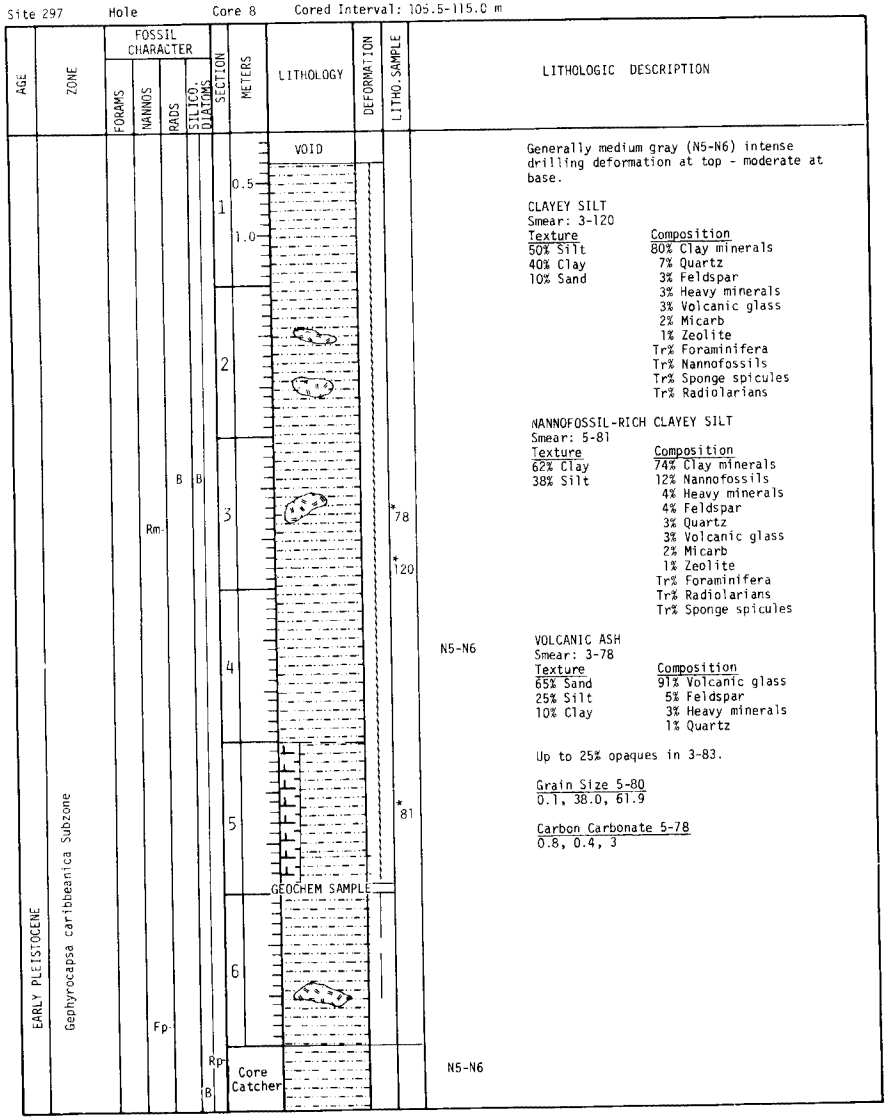
CLAYEY SILT
Smears: 3-130, CC

Texture	Composition
50% Silt	79-87% Clay minerals
30-45% Clay	10% Feldspar
5-20% Sand	2% Heavy minerals
	2% Volcanic glass
	Tr- 5% Nannofossils
	1% Diatoms
	1% Radiolarians
	1% Sponge spicules

Carbon Carbonate 3-130
0.7, 0.4, 2

Explanatory notes in chapter 1

Site 297 Hole Core 8 Cored Interval: 105.5-115.0 m



Generally medium gray (N5-N6) intense drilling deformation at top - moderate at base.

CLAYEY SILT
Smear: 3-120

Texture	Composition
50% Silt	80% Clay minerals
40% Clay	7% Quartz
10% Sand	3% Feldspar
	3% Heavy minerals
	3% Volcanic glass
	2% Micarb
	1% Zeolite
	Tr% Foraminifera
	Tr% Nannofossils
	Tr% Sponge spicules
	Tr% Radiolarians

NANNOFOSSIL-RICH CLAYEY SILT
Smear: 5-81

Texture	Composition
62% Clay	74% Clay minerals
38% Silt	12% Nannofossils
	4% Heavy minerals
	4% Feldspar
	3% Quartz
	3% Volcanic glass
	2% Micarb
	1% Zeolite
	Tr% Foraminifera
	Tr% Radiolarians
	Tr% Sponge spicules

VOLCANIC ASH
Smear: 3-78

Texture	Composition
65% Sand	91% Volcanic glass
25% Silt	5% Feldspar
10% Clay	3% Heavy minerals
	1% Quartz

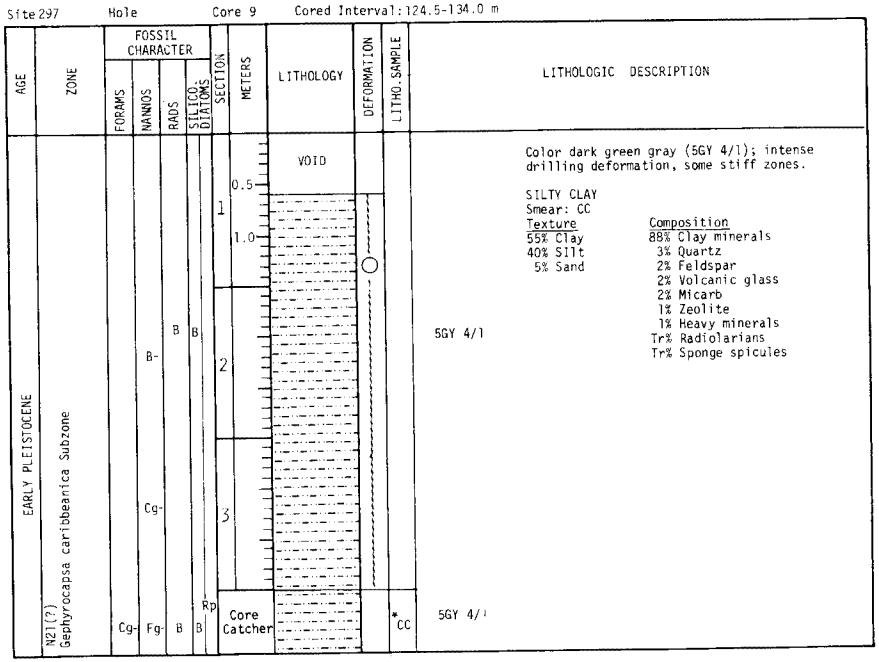
Up to 25% opaques in 3-83.

Grain Size 5-80
0.1, 38.0, 61.9

Carbon Carbonate 5-78
0.8, 0.4, 3

Explanatory notes in chapter 1

Site 297 Hole Core 9 Cored Interval: 124.5-134.0 m



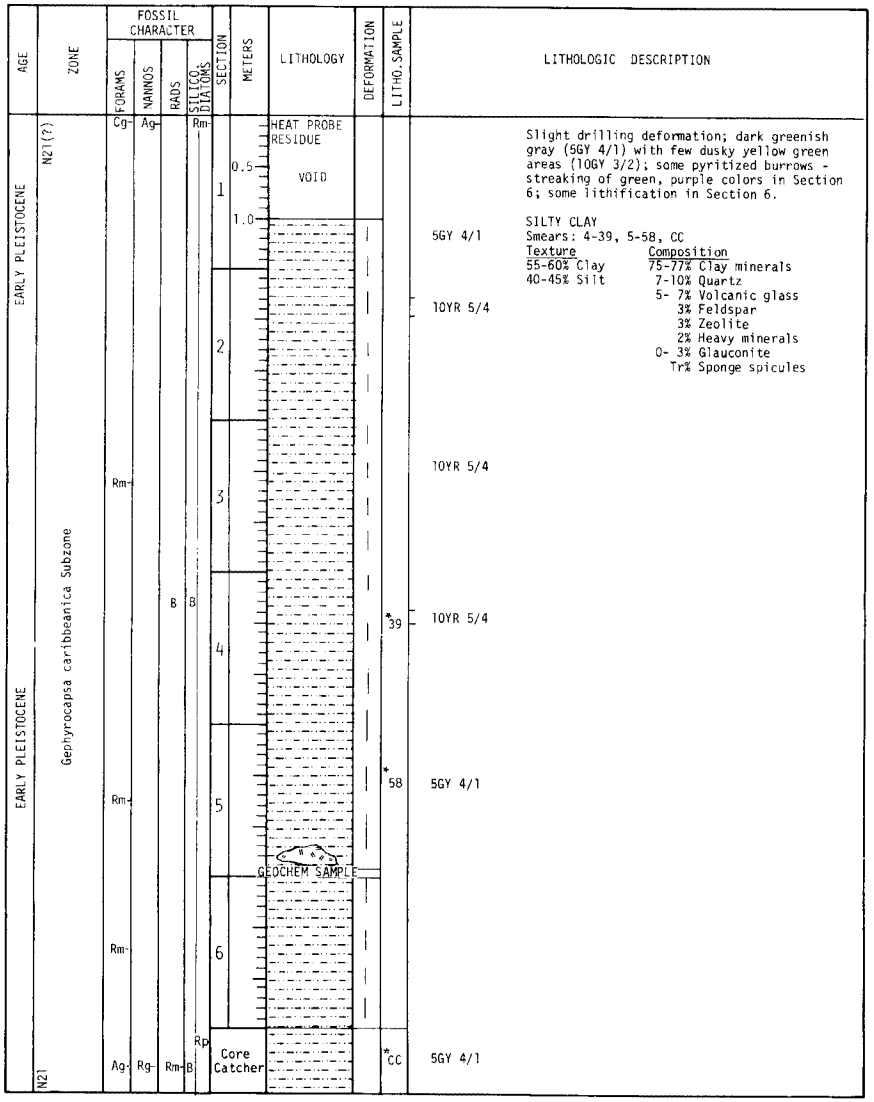
Color dark green gray (5GY 4/1); intense drilling deformation, some stiff zones.

SILTY CLAY
Smear: CC

Texture	Composition
55% Clay	88% Clay minerals
40% Silt	3% Quartz
5% Sand	2% Feldspar
	2% Volcanic glass
	2% Micarb
	1% Zeolite
	1% Heavy minerals
	Tr% Radiolarians
	Tr% Sponge spicules

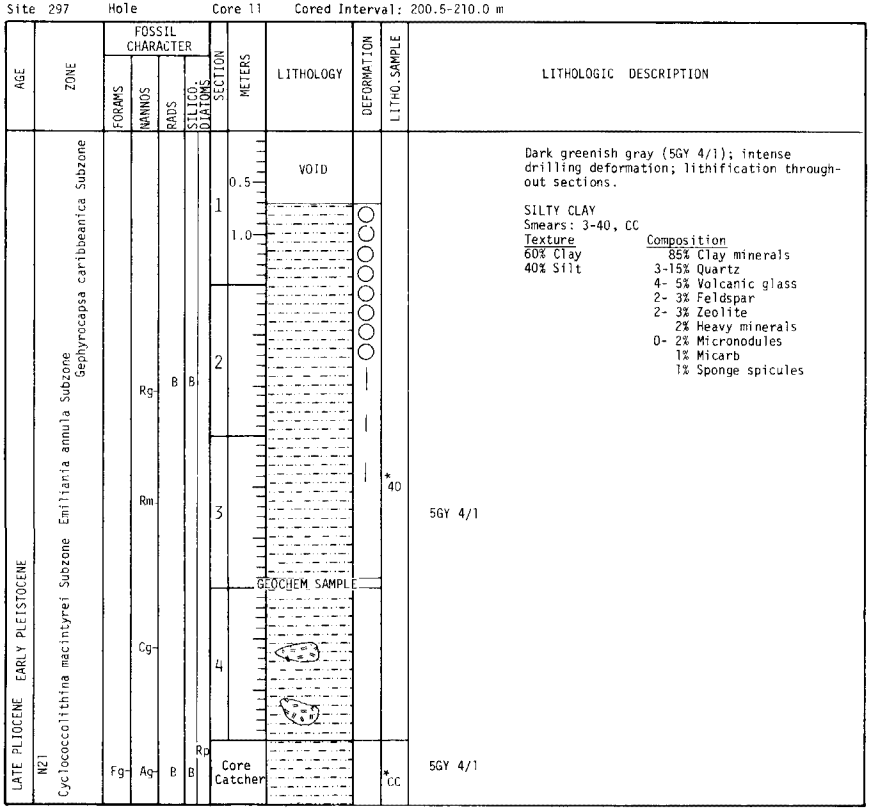
Explanatory notes in chapter 1

Site 297 Hole Core 10 Cored Interval: 153.0-162.5



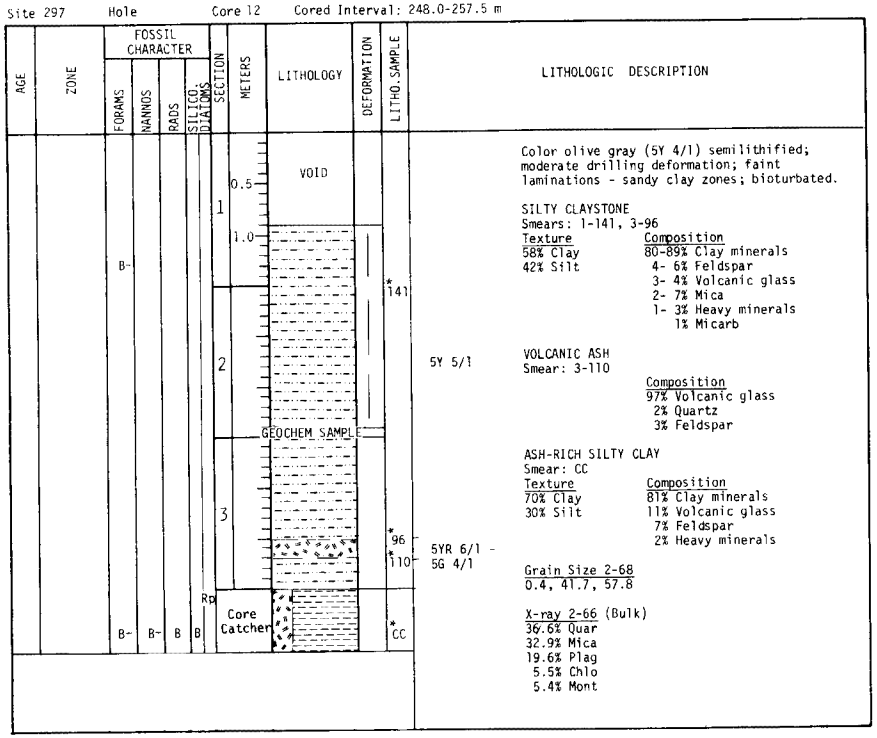
Explanatory notes in chapter 1

Site 297 Hole Core 11 Cored Interval: 200.5-210.0 m



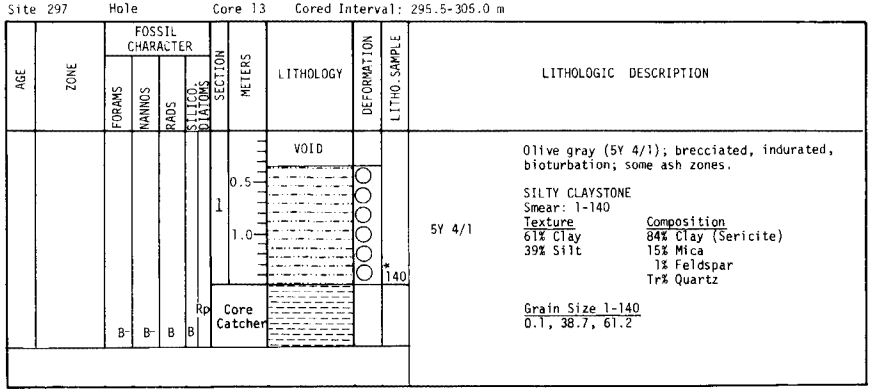
Explanatory notes in chapter 1

Site 297 Hole Core 12 Cored Interval: 248.0-257.5 m



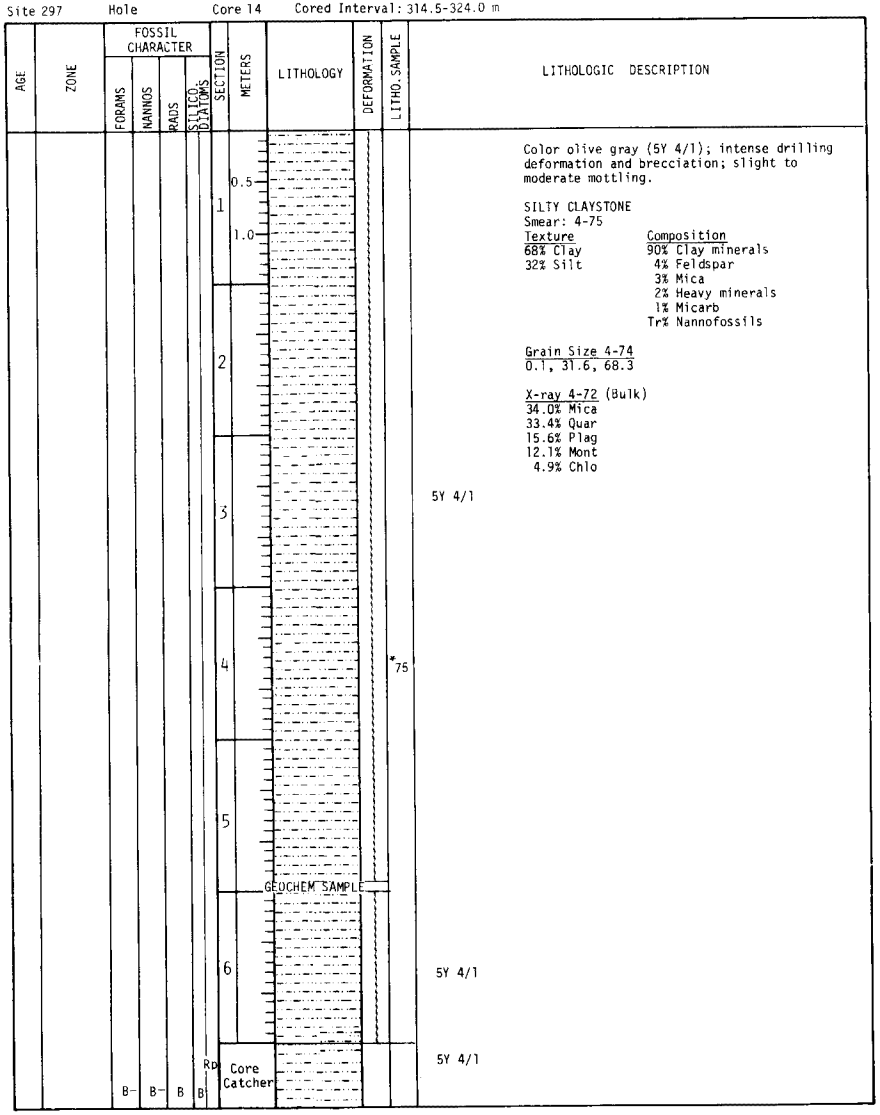
Explanatory notes in chapter 1

Site 297 Hole Core 13 Cored Interval: 295.5-305.0 m



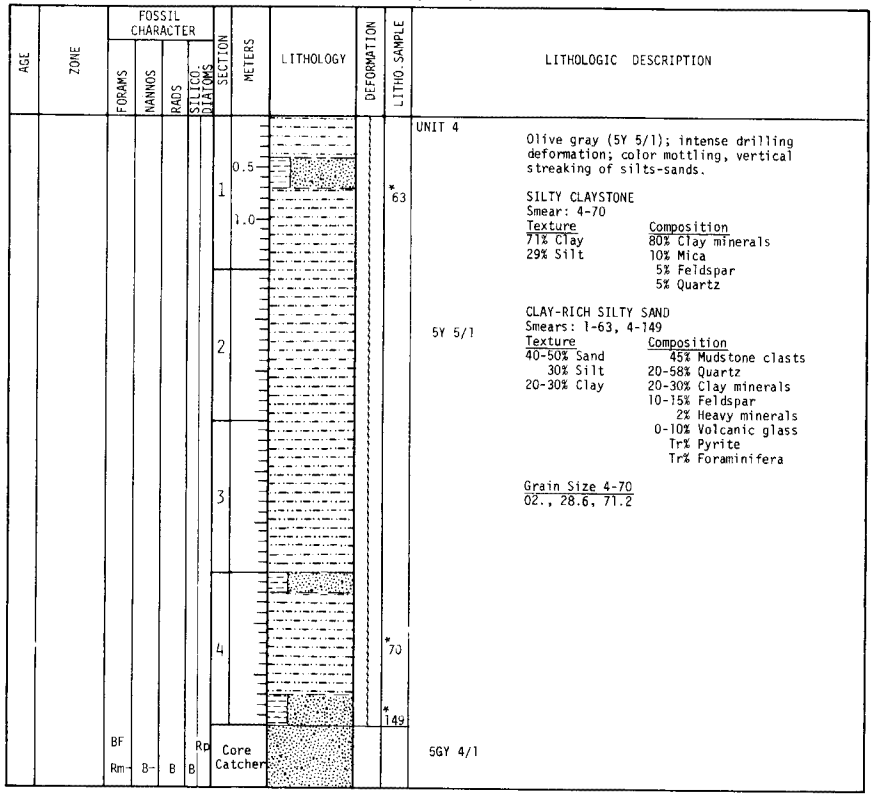
Explanatory notes in chapter 1

Site 297 Hole Core 14 Cored Interval: 314.5-324.0 m



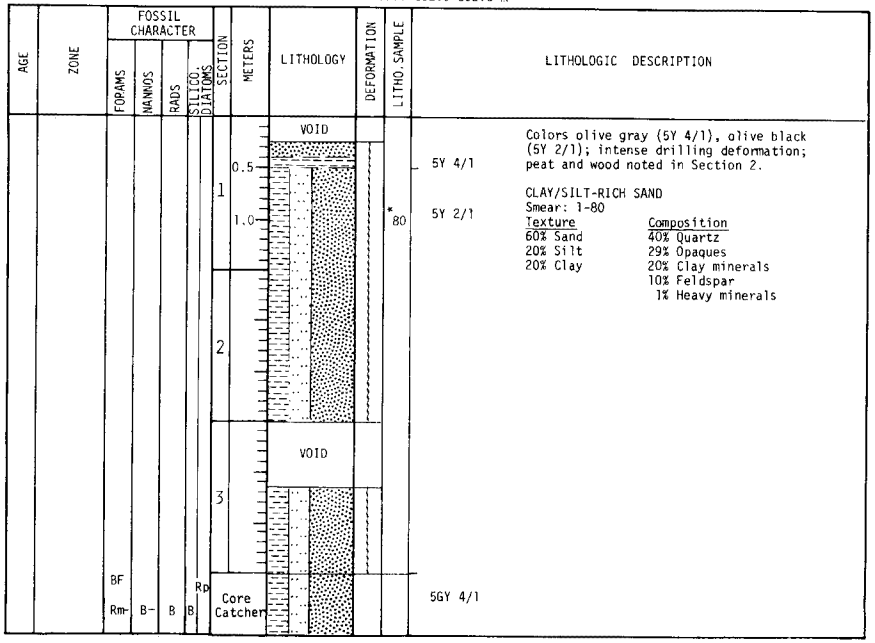
Explanatory notes in chapter 1

Site 297 Hole Core 15 Cored Interval: 333.5-343.0 m

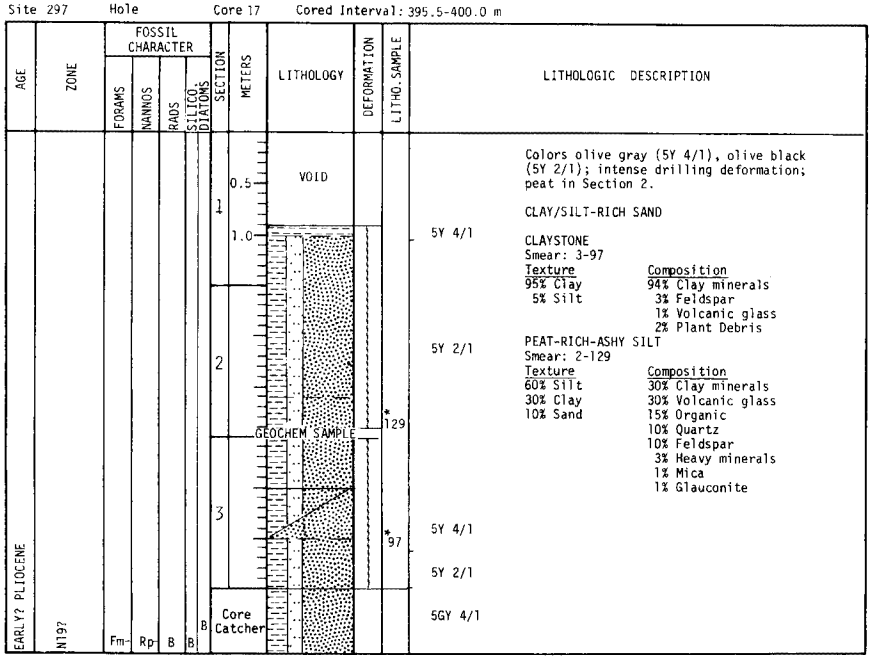


Explanatory notes in chapter 1

Site 297 Hole Core 16 Cored Interval: 352.5-362.0 m

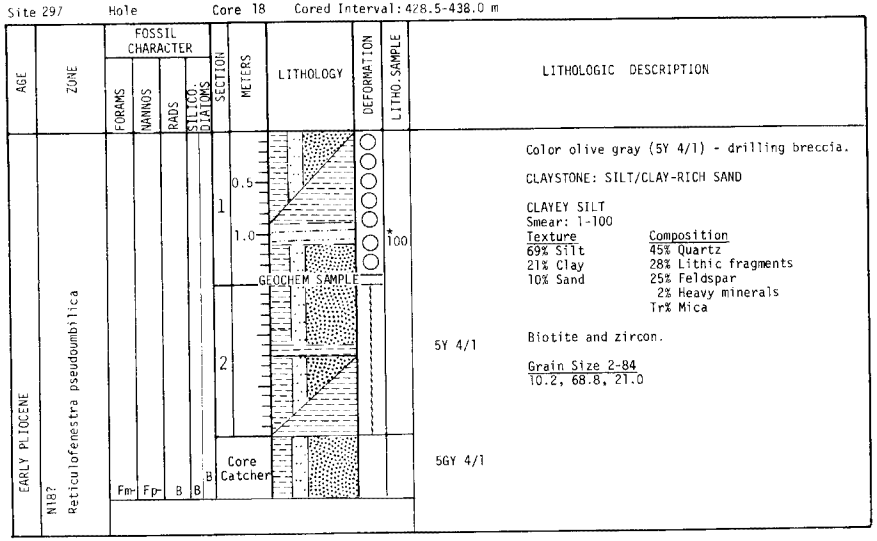


Site 297 Hole Core 17 Cored Interval: 395.5-400.0 m



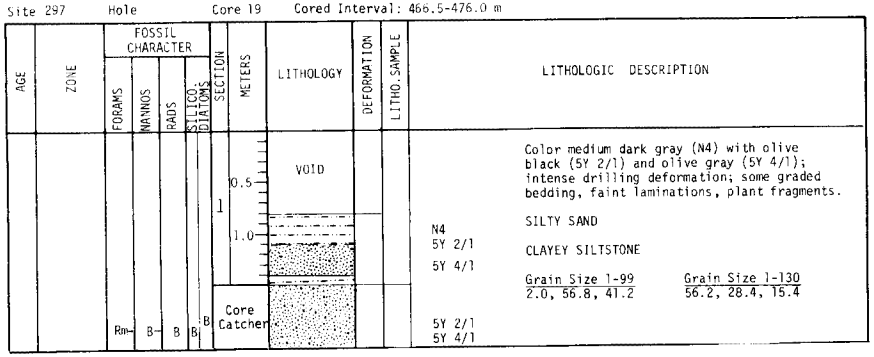
Explanatory notes in chapter 1

Site 297 Hole Core 18 Cored Interval: 428.5-438.0 m



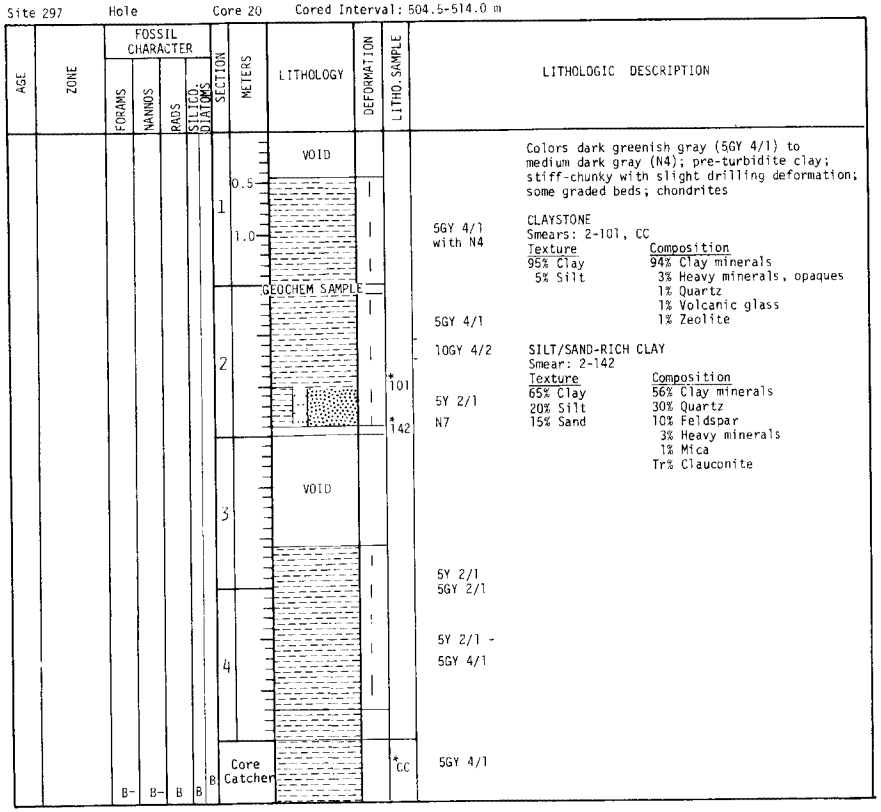
Explanatory notes in chapter 1

Site 297 Hole Core 19 Cored Interval: 466.5-476.0 m



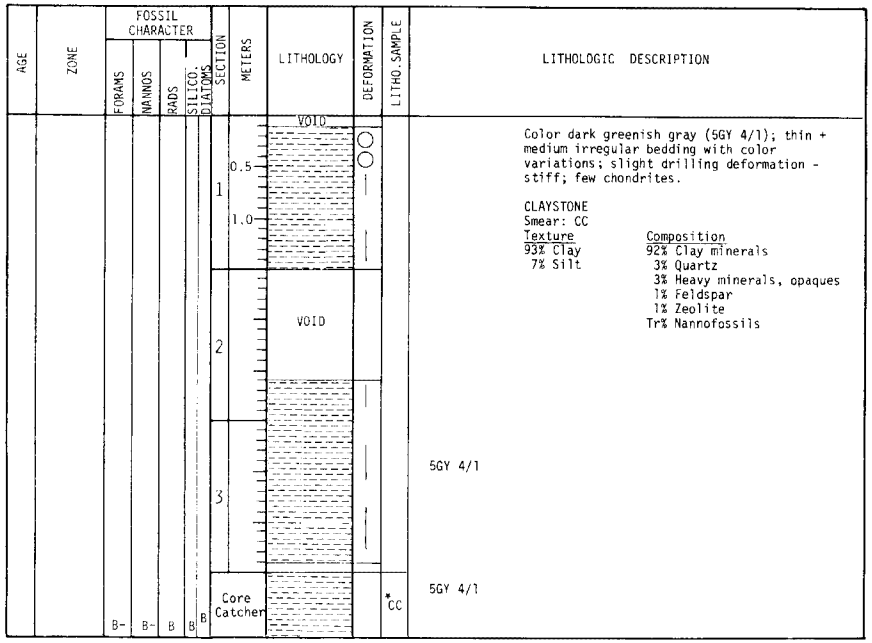
Explanatory notes in chapter 1

Site 297 Hole Core 20 Cored Interval: 504.5-514.0 m



Explanatory notes in chapter 1

Site 297 Hole Core 21 Cored Interval: 523.5-533.0 m



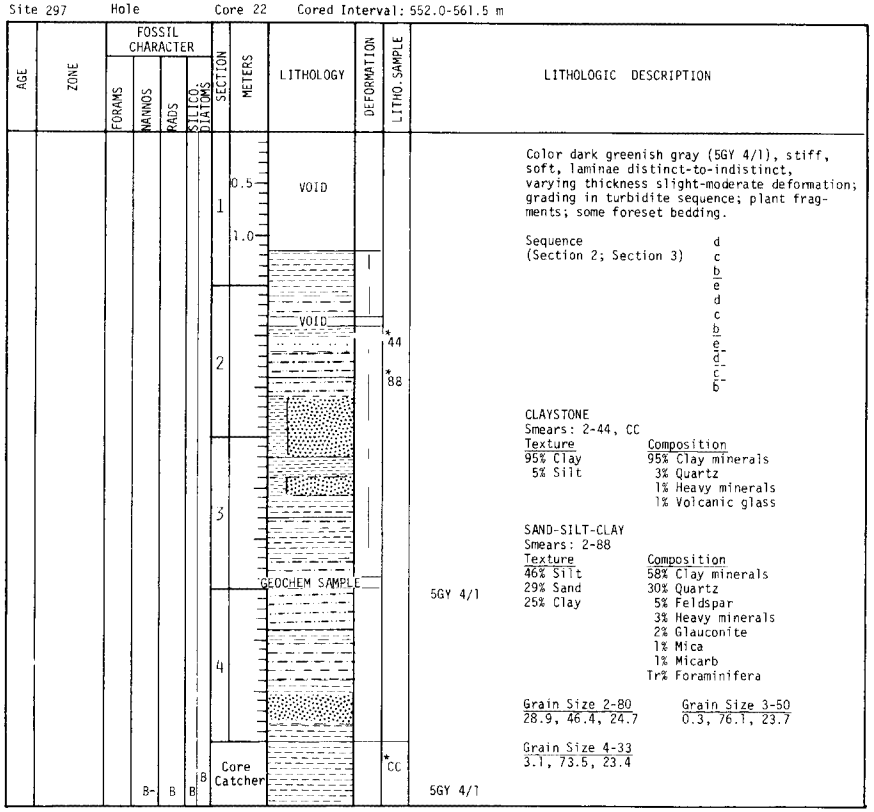
Color dark greenish gray (5GY 4/1); thin + medium irregular bedding with color variations; slight drilling deformation - stiff; few chondrites.

CLAYSTONE
Smear: CC

Texture	Composition
93% Clay	92% Clay minerals
7% Silt	3% Quartz
	3% Heavy minerals, opaques
	1% Feldspar
	1% Zeolite
	Tr% Nannofossils

Explanatory notes in chapter 1

Site 297 Hole Core 22 Cored Interval: 552.0-561.5 m



Color dark greenish gray (5GY 4/1), stiff, soft, laminae distinct-to-indistinct, varying thickness slight-moderate deformation; grading in turbidite sequence; plant fragments; some foreset bedding.

Sequence (Section 2; Section 3): d c b e d c b e d c b

CLAYSTONE
Smears: 2-44, CC

Texture	Composition
95% Clay	95% Clay minerals
5% Silt	3% Quartz
	1% Heavy minerals
	1% Volcanic glass

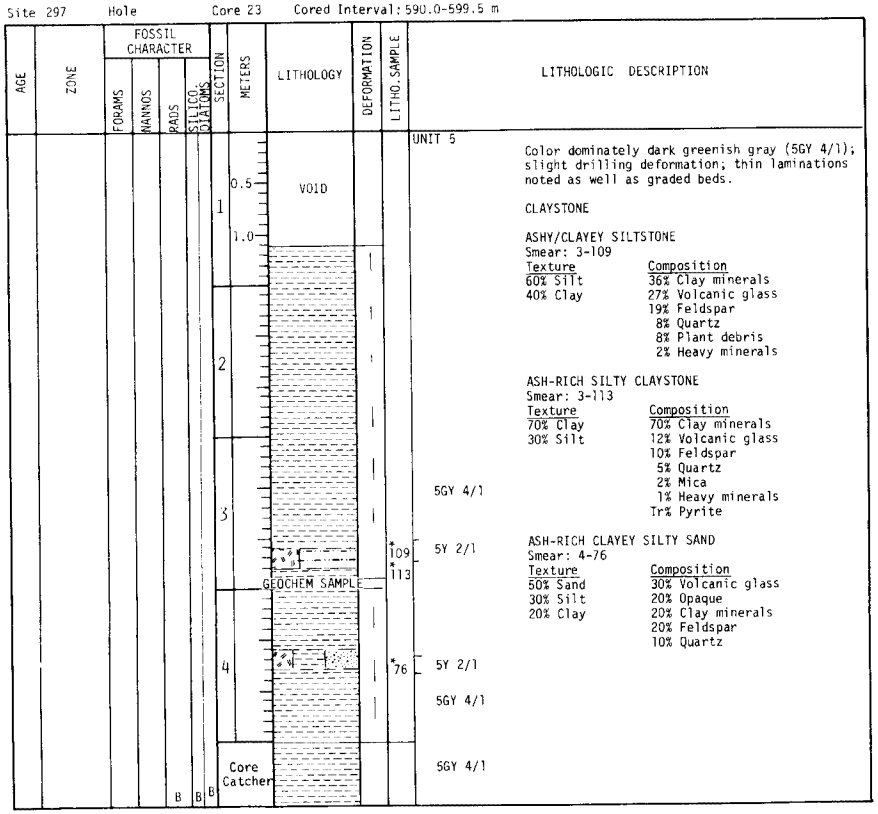
SAND-SILT-CLAY
Smears: 2-88

Texture	Composition
46% Silt	58% Clay minerals
29% Sand	30% Quartz
25% Clay	5% Feldspar
	3% Heavy minerals
	2% Glauconite
	1% Mica
	1% Micarb
	Tr% Foraminifera

Grain Size 2-80: 28.9, 46.4, 24.7
Grain Size 3-50: 0.3, 76.1, 23.7
Grain Size 4-33: 3.1, 73.5, 23.4

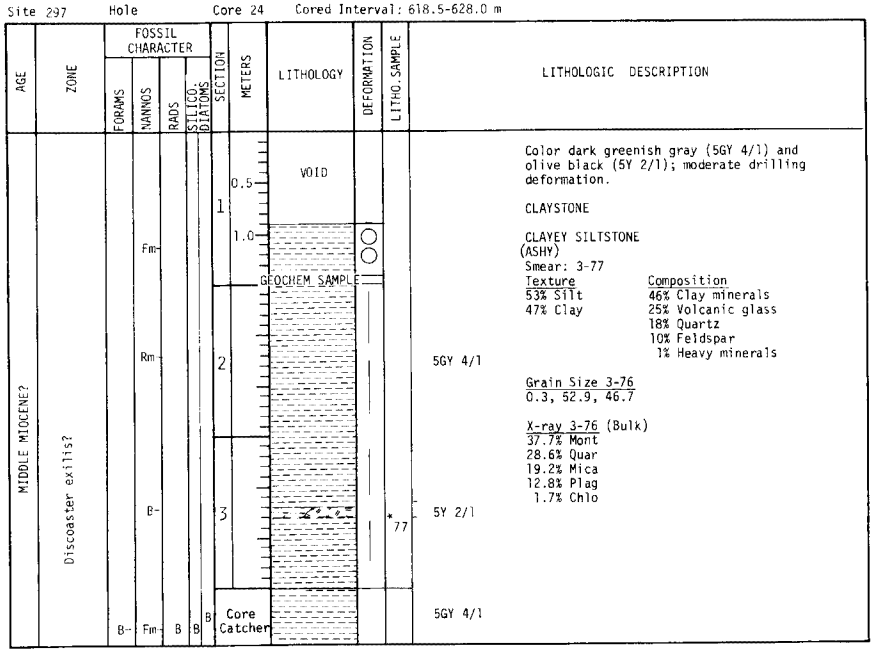
Explanatory notes in chapter 1

Site 297 Hole Core 23 Cored Interval: 590.0-599.5 m



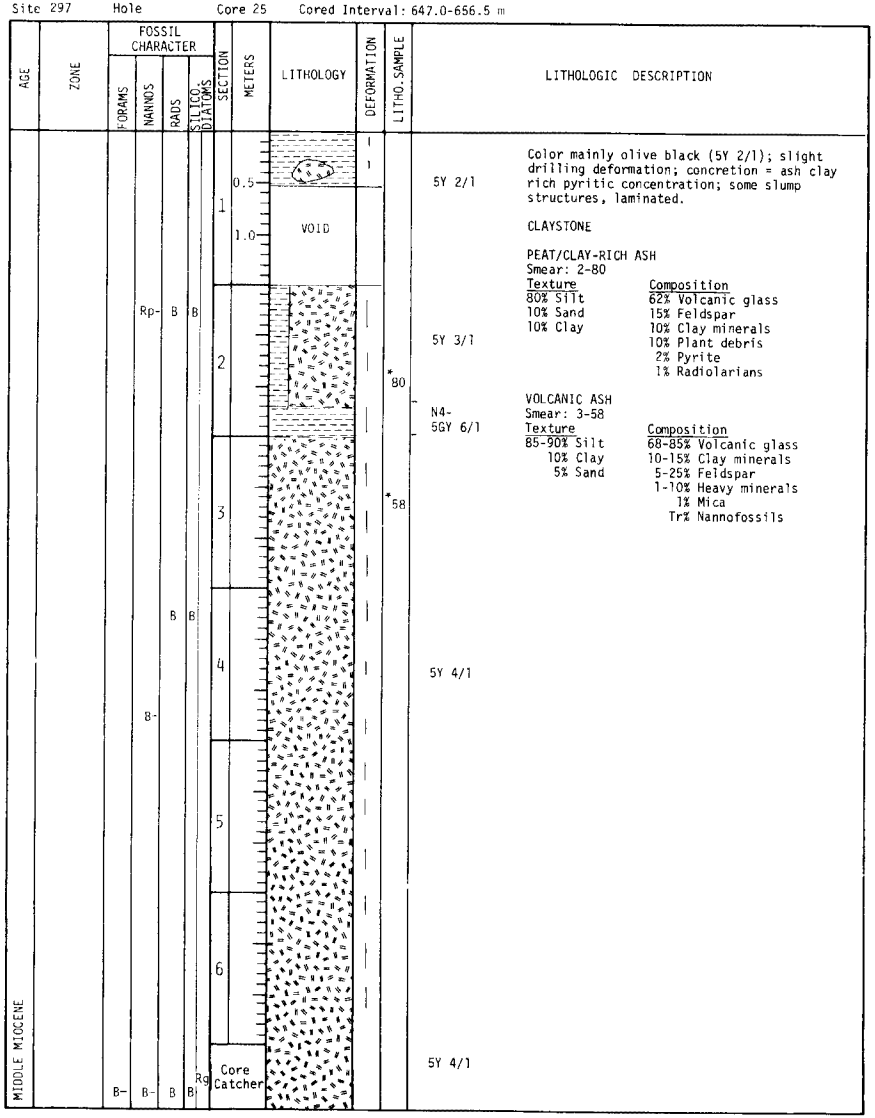
Explanatory notes in chapter 1

Site 297 Hole Core 24 Cored Interval: 618.5-628.0 m



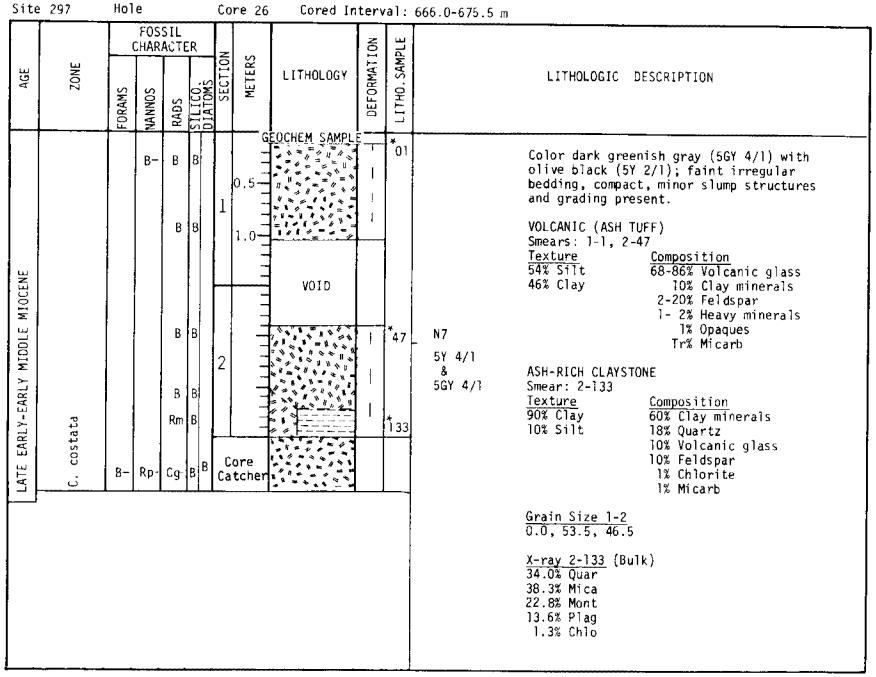
Explanatory notes in chapter 1

Site 297 Hole Core 25 Cored Interval: 647.0-656.5 m



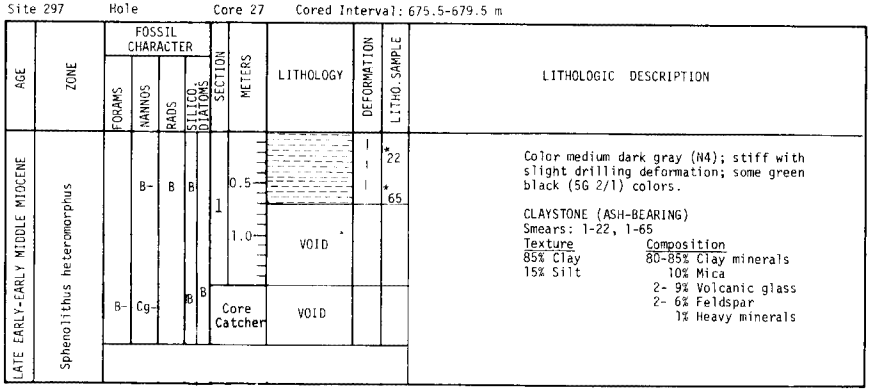
Explanatory notes in chapter 1

Site 297 Hole Core 26 Cored Interval: 666.0-675.5 m



Explanatory notes in chapter 1

Site 297 Hole Core 27 Cored Interval: 675.5-679.5 m



Explanatory notes in chapter 1

DEEP SEA DRILLING PROJECT

LEG 31 SITE 298

SITE SUMMARY SHEET

POSITION: Latitude: 31°42.93'N Longitude: 133°36.22'E

Water depth (from sea level): 4628 corrected meters (Echo sounding)

Bottom felt at: 4659 meters (drill pipe) Penetration: 298-611 m
298A-98 m

Number of Holes: 2 Number of Cores: 298-16 and 298A-1

Total length of cored section: 298-145.5 m
298A-9.5 m
Total core recovered: 298-66.8 m
298A-0.4 m

Percentage of core recovery: 298-45.8% and 298A-4.2%

OLDEST SEDIMENT CORED:

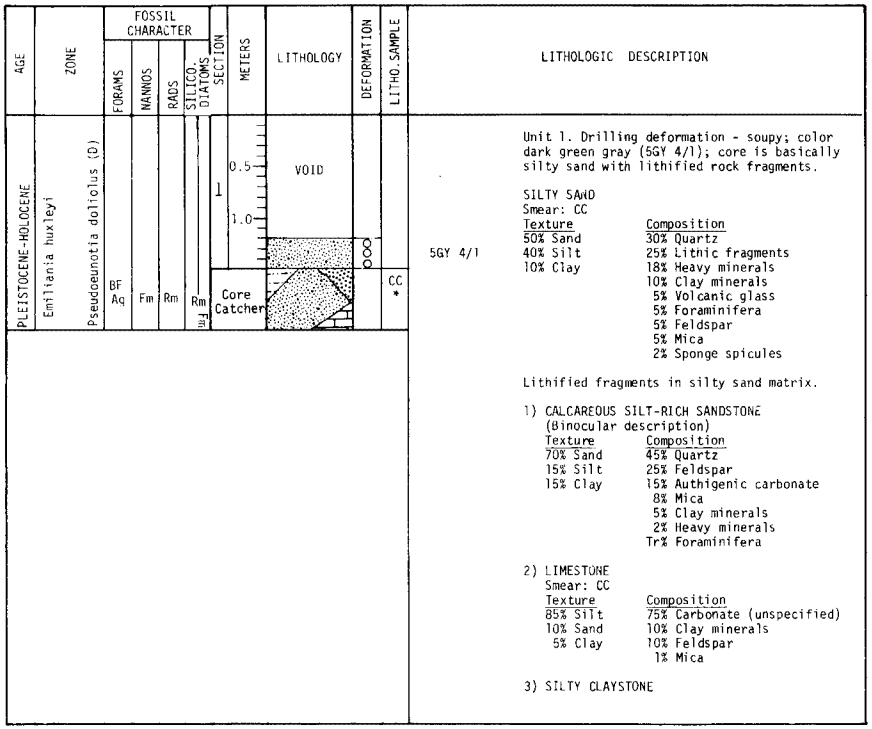
Depth below sea floor: 611 meters Nature: Silt/shale

Age: early Pleistocene

PRINCIPAL RESULTS:

Drilled on the lower, inner slope of Nankai Trough off Shikoku Island, Japan, Hole 298 encountered a stratigraphic section consisting of 183 meters of Holocene(?) - late Pleistocene turbidite cobble-size fragment bearing clayey and silty sand and silty clay underlain by 427 meters of late to early Pleistocene clay(stone), silt (stone) and clayey-silty sand. Anomalous compaction and small scale structures become evident below a depth of 300 meters, and increase in intensity downward. Below 500 meters, the beds are overturned, with dips averaging 13°. Structures in Hole 298, together with reflection profiles, demonstrate the accretion of an overturned fold consisting of tectonically dewatered trench sediments as a result of subduction at a rate of 3 cm/year.

Site 298 Hole Core 1 Cored Interval: 0.0-3.0 m



Unit 1. Drilling deformation - soupy; color dark green gray (5GY 4/1); core is basically silty sand with lithified rock fragments.

SILTY SAND
Smear: CC

Texture	Composition
50% Sand	30% Quartz
40% Silt	25% Litnic fragments
10% Clay	18% Heavy minerals
	10% Clay minerals
	5% Volcanic glass
	5% Foraminifera
	5% Feldspar
	5% Mica
	2% Sponge spicules

Lithified fragments in silty sand matrix.

1) CALCAREOUS SILT-RICH SANDSTONE
(Binocular description)

Texture	Composition
70% Sand	45% Quartz
15% Silt	25% Feldspar
15% Clay	15% Authigenic carbonate
	8% Mica
	5% Clay minerals
	2% Heavy minerals
	Tr% Foraminifera

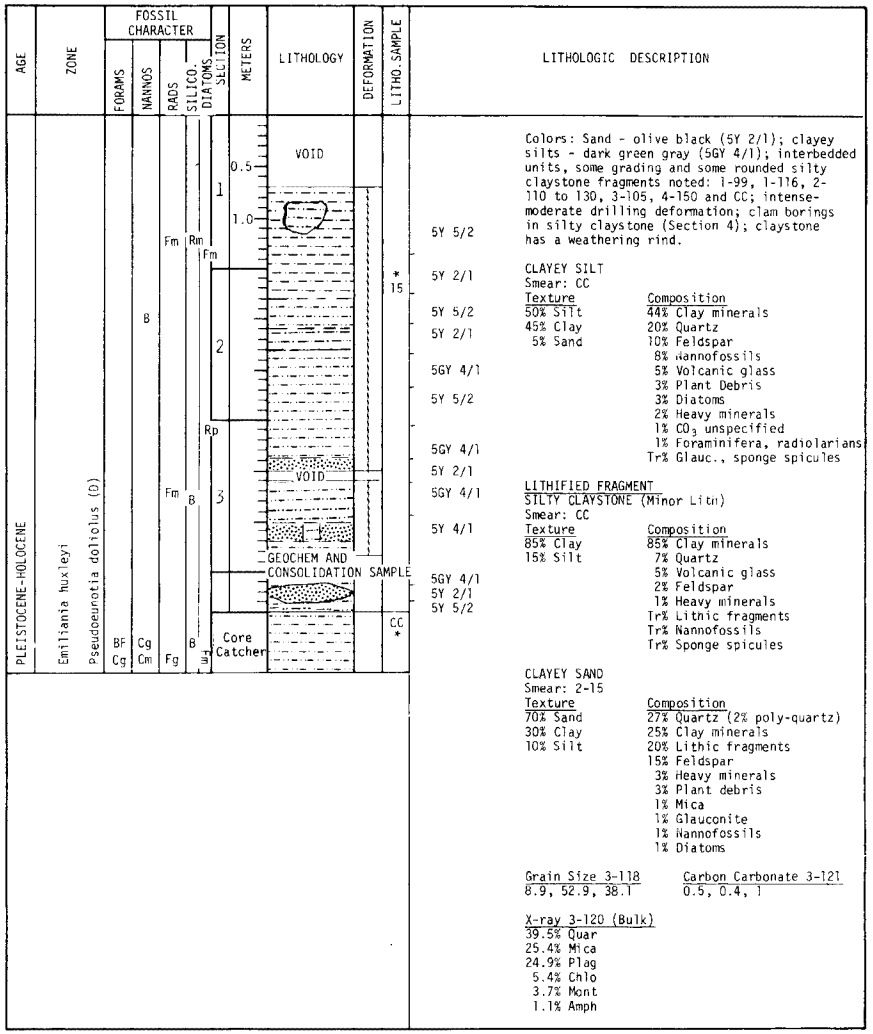
2) LIMESTONE
Smear: CC

Texture	Composition
85% Silt	75% Carbonate (unspecified)
10% Sand	10% Clay minerals
5% Clay	10% Feldspar
	1% Mica

3) SILTY CLAYSTONE

Explanatory notes in chapter 1

Site 298 Hole Core 2 Cored Interval: 126.5-130.0 m



Colors: Sand - olive black (5Y 2/1); clayey silts - dark green gray (5GY 4/1); interbedded units, some grading and some rounded silty claystone fragments noted: 1-99, 1-116, 2-110 to 130, 3-105, 4-150 and CC; intense-moderate drilling deformation; clam borings in silty claystone (Section 4); claystone has a weathering rind.

CLAYEY SILT
Smear: CC

Texture	Composition
50% Silt	44% Clay minerals
45% Clay	20% Quartz
5% Sand	10% Feldspar
	8% Nannofossils
	5% Volcanic glass
	3% Plant Debris
	3% Diatoms
	2% Heavy minerals
	1% CO_3 unspecified
	1% Foraminifera, radiolarians
	Tr% Glauc., sponge spicules

LITHIFIED FRAGMENT
SILTY CLAYSTONE (Minor Litn)
Smear: CC

Texture	Composition
85% Clay	85% Clay minerals
15% Silt	7% Quartz
	5% Volcanic glass
	2% Feldspar
	1% Heavy minerals
	Tr% Litnic fragments
	Tr% Nannofossils
	Tr% Sponge spicules

CLAYEY SAND
Smear: 2-15

Texture	Composition
70% Sand	27% Quartz (2% poly-quartz)
30% Clay	25% Clay minerals
10% Silt	20% Lithic fragments
	15% Feldspar
	3% Heavy minerals
	3% Plant debris
	1% Mica
	1% Glauconite
	1% Nannofossils
	1% Diatoms

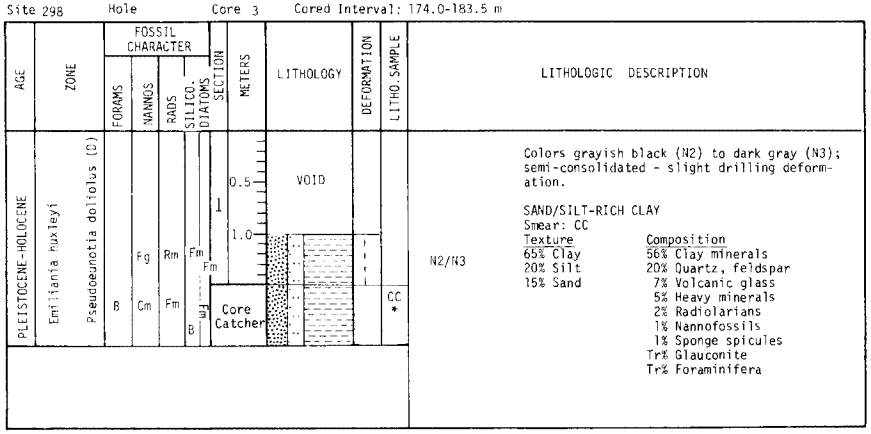
Grain Size 3-118	Carbon Carbonate 3-121
8.9, 52.9, 38.1	0.5, 0.4, 1

X-ray 3-120 (Bulk)

39.5%	Quar
25.4%	Mica
24.9%	Plag
5.4%	Chlo
3.7%	Mont
1.1%	Amph

Explanatory notes in chapter 1

Site 298 Hole Core 3 Cored Interval: 174.0-183.5 m



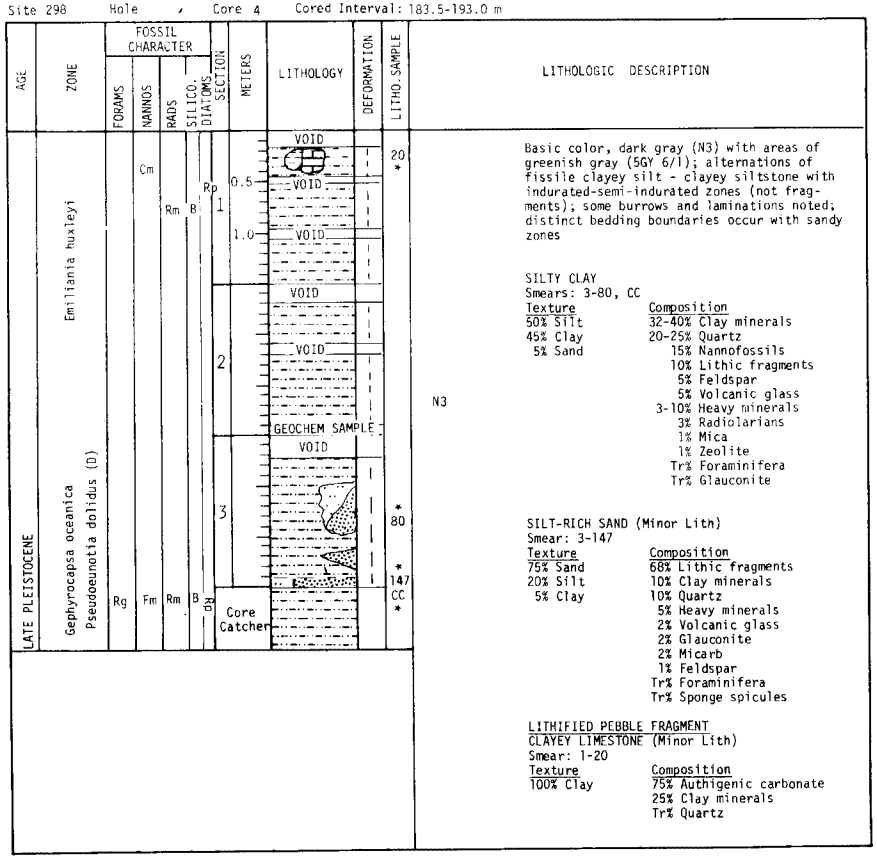
Colors grayish black (N2) to dark gray (N3); semi-consolidated - slight drilling deformation.

SAND/SILT-RICH CLAY
Smear: CC

Texture	Composition
65% Clay	56% Clay minerals
20% Silt	20% Quartz, feldspar
15% Sand	7% Volcanic glass
	5% Heavy minerals
	2% Radiolarians
	1% Nannofossils
	1% Sponge spicules
	Tr% Glauconite
	Tr% Foraminifera

Explanatory notes in chapter 1

Site 298 Hole Core 4 Cored Interval: 183.5-193.0 m



Basic color, dark gray (N3) with areas of greenish gray (5GY 6/1); alternations of fissile clayey silt - clayey siltstone with indurated-semi-indurated zones (not fragments); some burrows and laminations noted; distinct bedding boundaries occur with sandy zones

SILTY CLAY
Smears: 3-80, CC

Texture	Composition
50% Silt	32-40% Clay minerals
45% Clay	20-25% Quartz
5% Sand	15% Nannofossils
	10% Lithic fragments
	5% Feldspar
	5% Volcanic glass
	3-10% Heavy minerals
	3% Radiolarians
	1% Mica
	1% Zeolite
	Tr% Foraminifera
	Tr% Glauconite

SILT-RICH SAND (Minor Lith)
Smear: 3-147

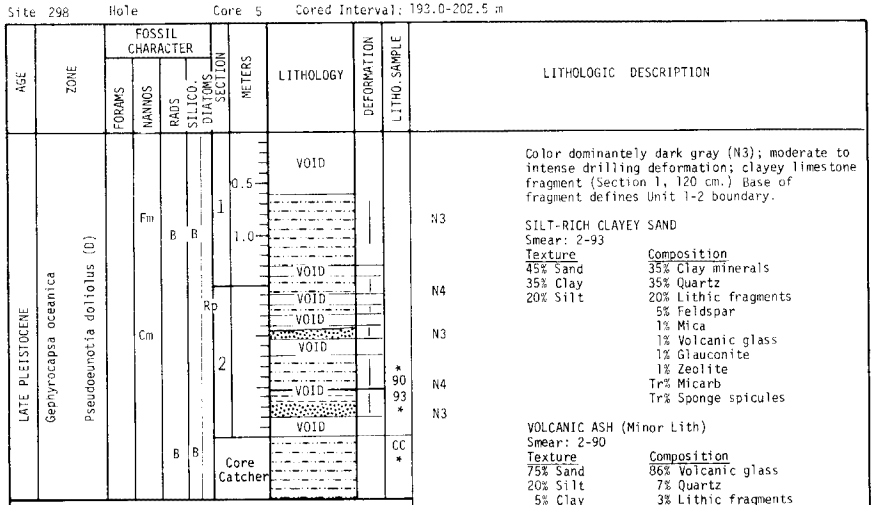
Texture	Composition
75% Sand	68% Lithic fragments
20% Silt	10% Clay minerals
5% Clay	10% Quartz
	5% Heavy minerals
	2% Volcanic glass
	2% Glauconite
	2% Micarb
	1% Feldspar
	Tr% Foraminifera
	Tr% Sponge spicules

LITHIFIED PEBBLE FRAGMENT
CLAYEY LIMESTONE (Minor Lith)
Smear: 1-20

Texture	Composition
100% Clay	75% Authigenic carbonate
	25% Clay minerals
	Tr% Quartz

Explanatory notes in chapter 1

Site 298 Hole Core 5 Cored Interval: 193.0-202.5 m



Color dominantely dark gray (N3); moderate to intense drilling deformation; clayey limestone fragment (Section 1, 120 cm.) Base of fragment defines Unit 1-2 boundary.

SILT-RICH CLAYEY SAND
Smear: 2-93

Texture	Composition
45% Sand	35% Clay minerals
35% Clay	35% Quartz
20% Silt	20% Lithic fragments
	5% Feldspar
	1% Mica
	1% Volcanic glass
	1% Glauconite
	1% Zeolite
	Tr% Micarb
	Tr% Sponge spicules

VOLCANIC ASH (Minor Lith)
Smear: 2-90

Texture	Composition
75% Sand	86% Volcanic glass
20% Silt	7% Quartz
5% Clay	3% Lithic fragments
	2% Clay minerals
	1% Heavy minerals
	1% Glauconite
	1% Micarb
	1% Nannofossils

CLAYEY SILT
Smear: CC

Texture	Composition
50% Silt	60% Clay minerals
45% Clay	30% Quartz, feldspar
5% Sand	5% Nannofossils
	2% Mica
	1% Volcanic glass
	1% Micarb
	Tr% Glauconite
	Tr% Foraminifera

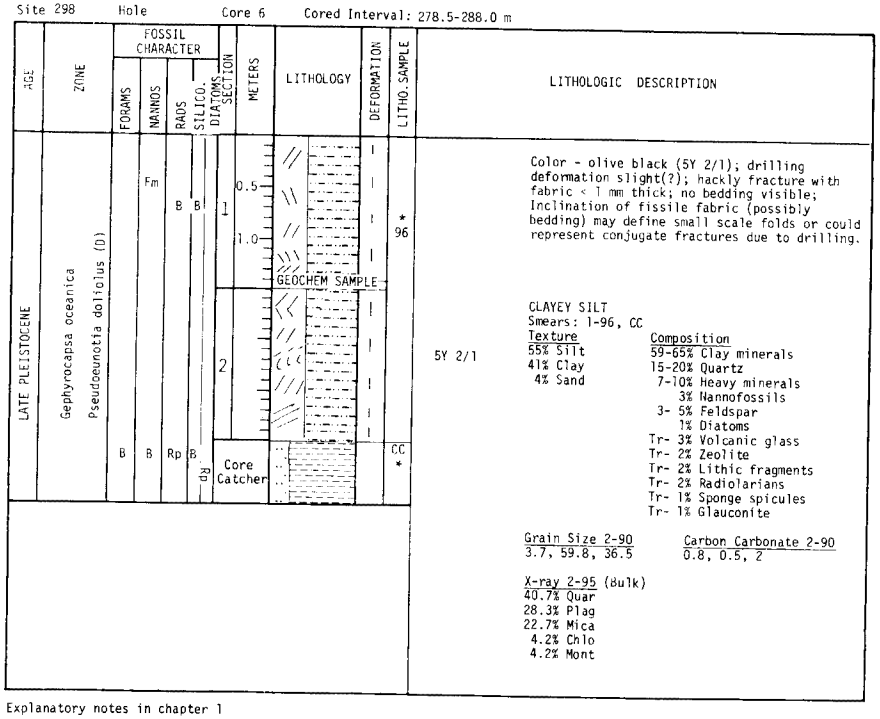
Grain Size 2-131 (from lower portion, but not base of graded bed)
5.0, 72.6, 22.4

Carbon Carbonate 2-135
0.9, 0.4, 3

X-ray 2-133 (Bulk)
46.8% Quar
28.3% Plag
16.2% Mica
5.6% Calc
3.0% Chlo

Explanatory notes in chapter 1

Site 298 Hole Core 6 Cored Interval: 278.5-288.0 m



LITHOLOGIC DESCRIPTION

Color - olive black (5Y 2/1); drilling deformation slight(?); hackly fracture with fabric < 1 mm thick; no bedding visible; Inclination of fissile fabric (possibly bedding) may define small scale folds or could represent conjugate fractures due to drilling.

CLAYEY SILT
Smears: 1-96, CC

Texture	Composition
55% Silt	59-65% Clay minerals
41% Clay	15-20% Quartz
4% Sand	7-10% Heavy minerals
	3% Nannofossils
	3- 5% Feldspar
	1% Diatoms
	Tr- 3% Volcanic glass
	Tr- 2% Zeolite
	Tr- 2% Lithic fragments
	Tr- 2% Radiolarians
	Tr- 1% Sponge spicules
	Tr- 1% Glauconite

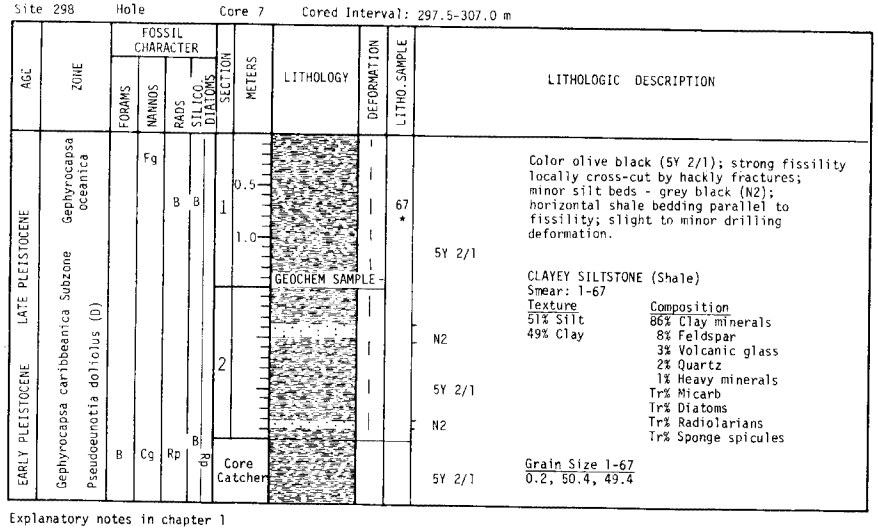
Grain Size 2-90
3.7, 59.8, 36.5

Carbon Carbonate 2-90
0.8, 0.5, 2

X-ray 2-95 (Bulk)
40.7% Quar
28.3% Plag
22.7% Mica
4.2% Chlo
4.2% Mont

Explanatory notes in chapter 1

Site 298 Hole Core 7 Cored Interval: 297.5-307.0 m



LITHOLOGIC DESCRIPTION

Color olive black (5Y 2/1); strong fissility locally cross-cut by hackly fractures; minor silt beds - grey black (N2); horizontal shale bedding parallel to fissility; slight to minor drilling deformation.

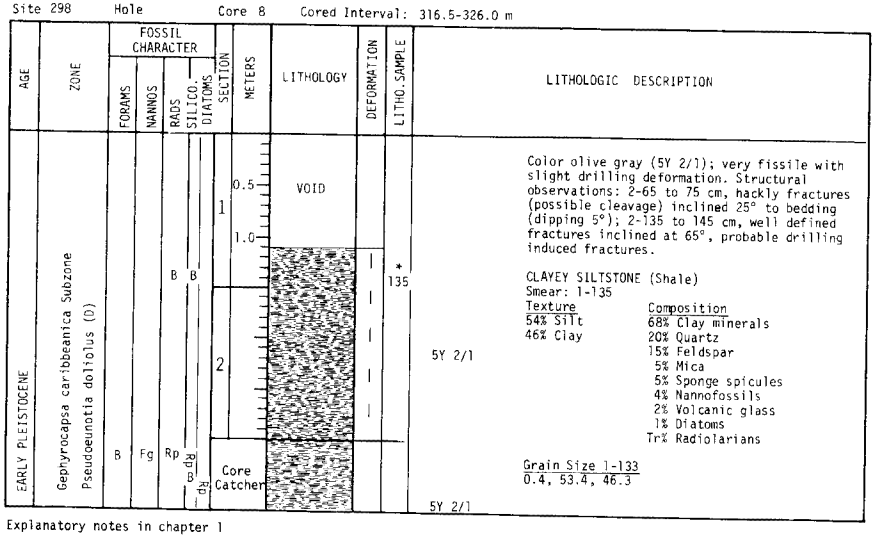
CLAYEY SILTSTONE (Shale)
Smear: 1-67

Texture	Composition
51% Silt	86% Clay minerals
49% Clay	8% Feldspar
	3% Volcanic glass
	2% Quartz
	1% Heavy minerals
	Tr% Micarb
	Tr% Diatoms
	Tr% Radiolarians
	Tr% Sponge spicules

Grain Size 1-67
0.2, 50.4, 49.4

Explanatory notes in chapter 1

Site 298 Hole Core 8 Cored Interval: 316.5-326.0 m



Color olive gray (5Y 2/1); very fissile with slight drilling deformation. Structural observations: 2-65 to 75 cm, hackly fractures (possible cleavage) inclined 25° to bedding (dipping 5°); 2-135 to 145 cm, well defined fractures inclined at 65°, probable drilling induced fractures.

CLAYEY SILTSTONE (Shale)
Smear: 1-135

Texture	Composition
54% Silt	68% Clay minerals
46% Clay	20% Quartz
	15% Feldspar
	5% Mica
	5% Sponge spicules
	4% Nannofossils
	2% Volcanic glass
	1% Diatoms
	Tr% Radiolarians

Grain Size 1-133
0.4, 53.4, 46.3

Explanatory notes in chapter 1

Site Hole Core 9 Cored Interval: 335.5-345.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
EARLY PLEISTOCENE	Gephyrocapsa caribbeanica Subzone	Rg	Ag	B	B	1	0.5	VOID		* 73	10Y 4/2
							1.0	GEOCHEM AND CONSOLIDATION SAMPLE			
						2				* 75	5Y 3/2
		B	Rm	Rp	dy B	Core Catcher		VOID			

Color olive gray (5Y 3/2). Slight drilling deformation, bedding horizontal - 5°, hackly fractures inclined 25-28° (left); fissility (parallel to bedding) is cross-cut by hackly fractures.
ASH-RICH SILTY CLAYSTONE (Shale)
Smear: 2-75

Texture	Composition
53% Clay	40% Clay minerals
47% Silt	26% Volcanic glass
	20% Feldspar
	8% Quartz
	3% Opaques
	2% Micarb
	1% Heavy minerals
	Tr% Glauconite
	Tr% Sponge spicules
	Tr% Nannofossils

CLAY NANNOFOSSIL-RICH VITRIC ASH (Minor Lith)
Smear: 1-73

Texture	Composition
80% Silt	55% Volcanic glass
20% Clay	20% Clay minerals
	15% Nannofossils
	6% Feldspar
	2% Micarb
	1% Heavy minerals
	1% Foraminifera
	Tr% Diatoms
	Tr% Sponge spicules
	Tr% Radiolarians

Grain Size 1-131: 0.1, 46.6, 53.3
Carbon Carbonate 1-131: 1.2, 0.6, 5

X-ray 1-131 (Bulk)
31.0% Quar
30.1% Mica
24.0% Plag
6.9% Chlo
3.6% Calc
3.4% Mont
1.1% Amph

Explanatory notes in chapter 1

Site 298 Hole Core 10 Cored Interval: 364.0-373.5 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	SILICO. DIATOMS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
EARLY PLEISTOCENE	Gephyrocapsa caribbeanica Subzone / Pseudoeunotia doliolus (D)			B		1	0.5				5Y 3/2
							1.0				
						2					
						3				* 40	N5
										* 145	5Y 2/1
											N5
						4				* 40	N5
											5GY 4/1
		B	Ag	Rp	B dy	Core Catcher		VOID			5Y 2/1

Color olive gray (5Y 3/2); slight drilling deformation, chunky with fissility; bedding horizontal to 10-20° (Section 3), 10-27° (Section 4); graded sand bed 145 cm (Section 3) dips 19-25° = turbidite-base; hackly fractures - 16° (Section 1), 29° (Section 2), and 20-35° (Section 3); drilling induced shear surface (Section 4) dips 40°; hackly fractures may represent incipient cleavage.

ASH-RICH SILTY CLAYSTONE (Shale)
Smear: 4-40

Texture	Composition
60% Clay	40% Clay minerals
40% Silt	24% Volcanic glass
	15% Feldspar
	15% Heavies
	3% Sponge spicules
	2% Diatoms
	1% Nannofossils

VOLCANIC ASH (Minor Lith)
Smear: 3-40

Texture	Composition
90% Silt	58% Feldspar
5% Clay	26% Volcanic glass
5% Sand	12% Amphibole
	10% Opaques

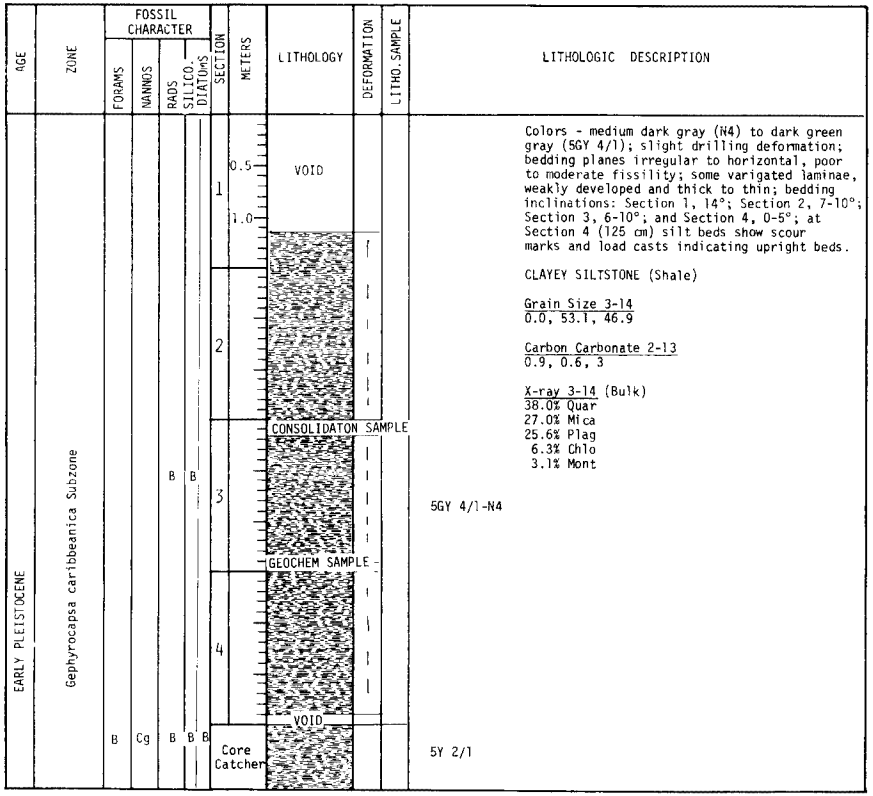
SAND (Minor Lith)
Smear: 3-145

Texture	Composition
85% Sand	34% Heavy minerals
10% Silt	30% Feldspar
5% Clay	10% Volcanic glass
	10% Quartz
	5% Lithic fragments
	1% Foraminifera
	Tr% Radiolarians
	Tr% Sponge spicules

Grain Size 4-40: 0.0, 39.8, 60.2

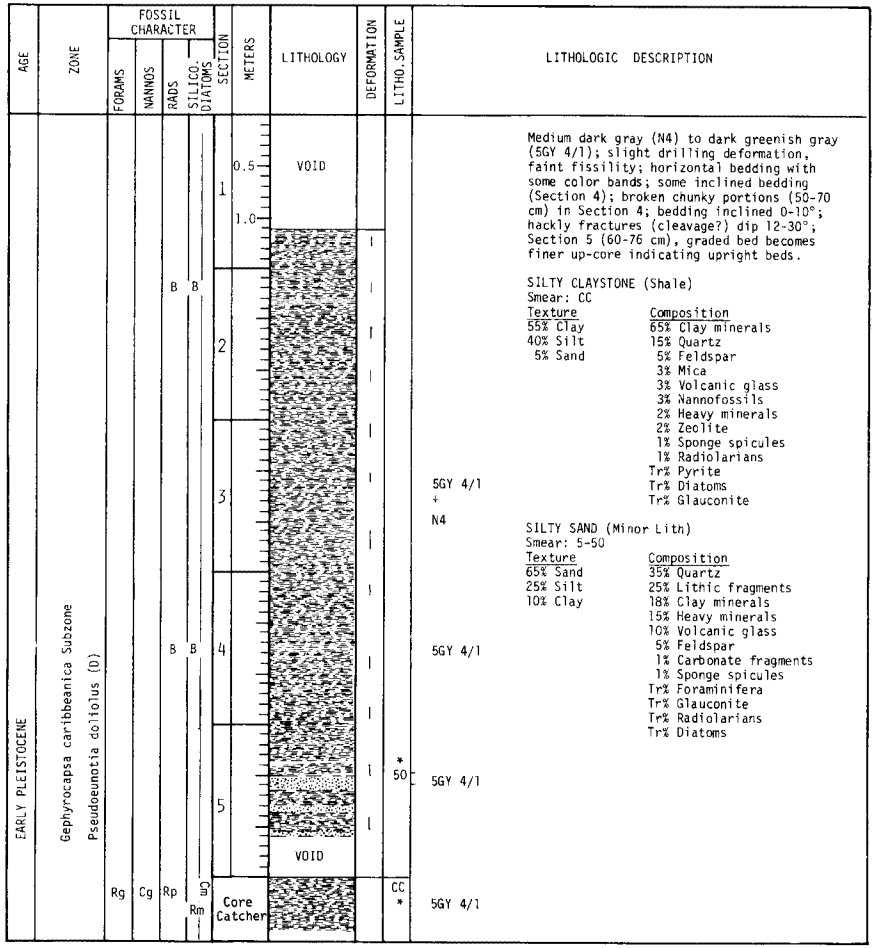
Explanatory notes in chapter 1

Site 298 Hole Core 11 Cored Interval: 392.5-402.0 m



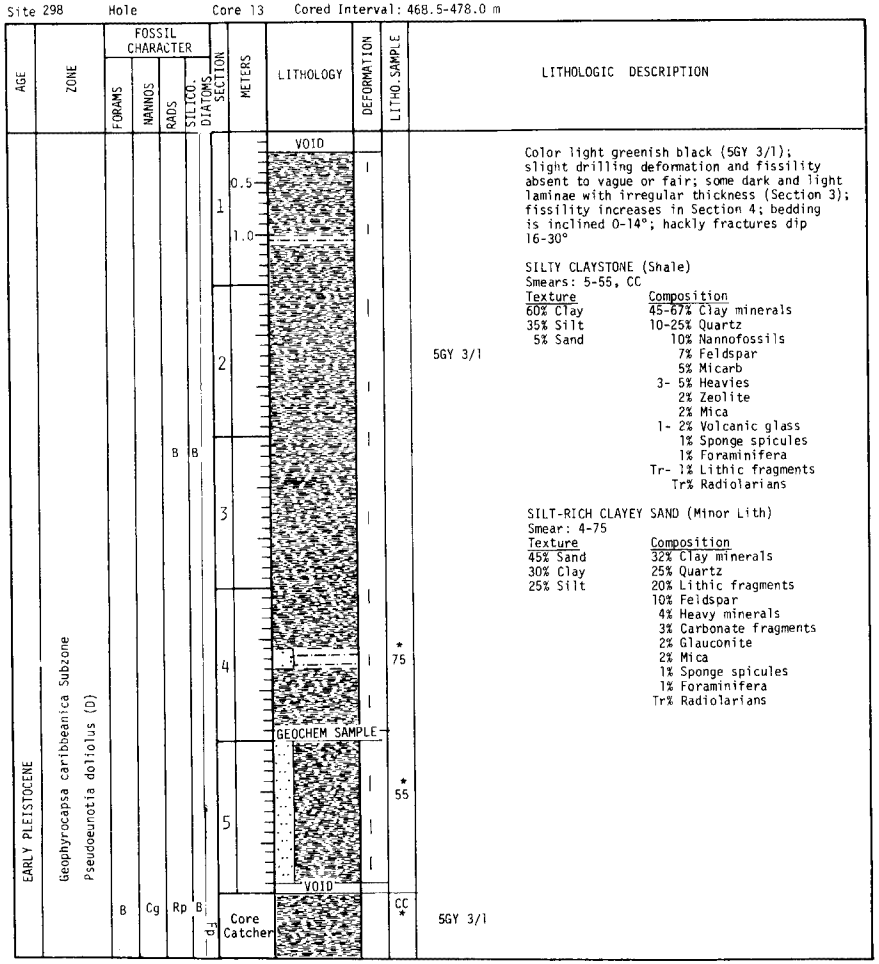
Explanatory notes in chapter 1

Site 298 Hole Core 12 Cored Interval: 421.0-430.5 m



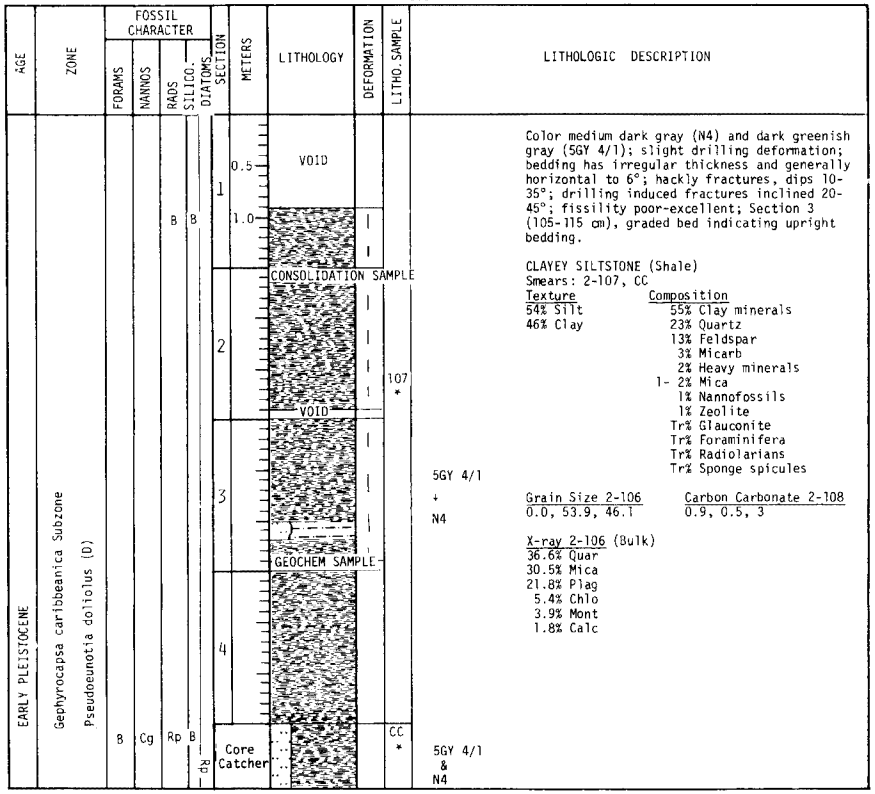
Explanatory notes in chapter 1

Site 298 Hole Core 13 Cored Interval: 468.5-478.0 m



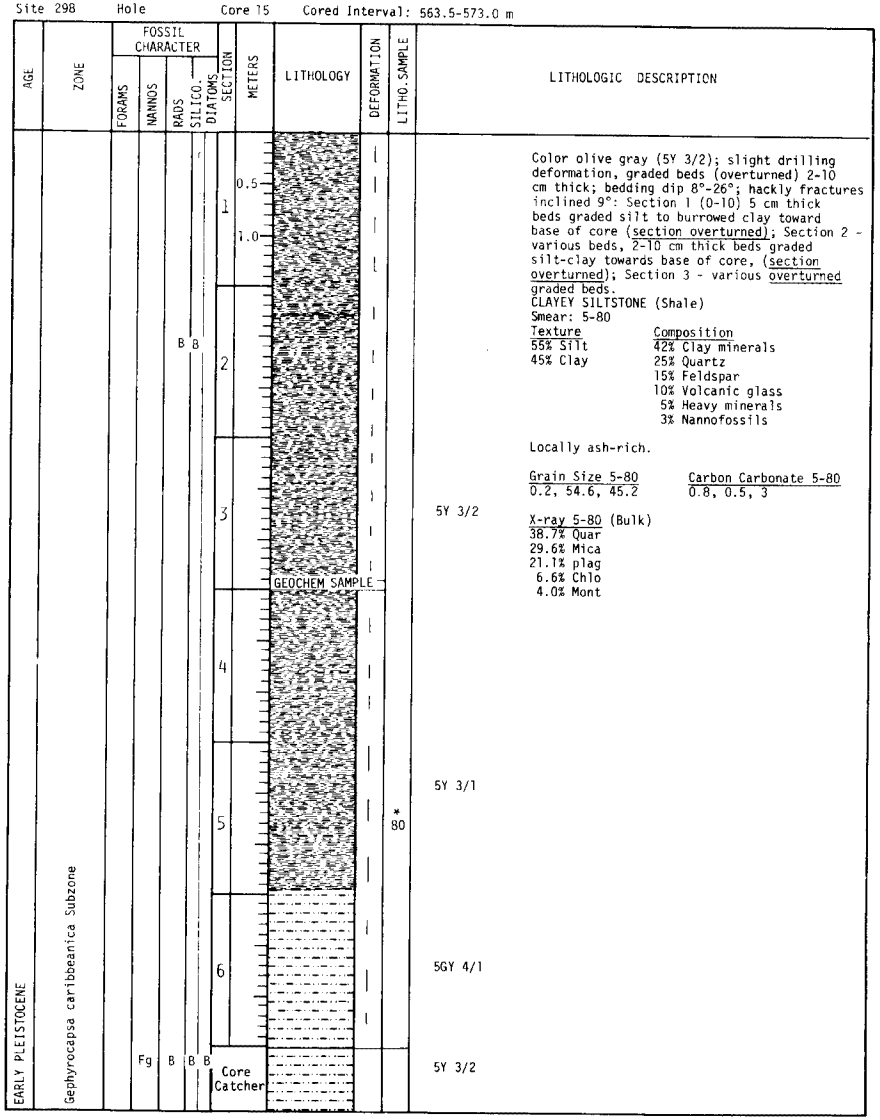
Explanatory notes in chapter 1

Site 298 Hole Core 14 Cored Interval: 516.0-525.5 m



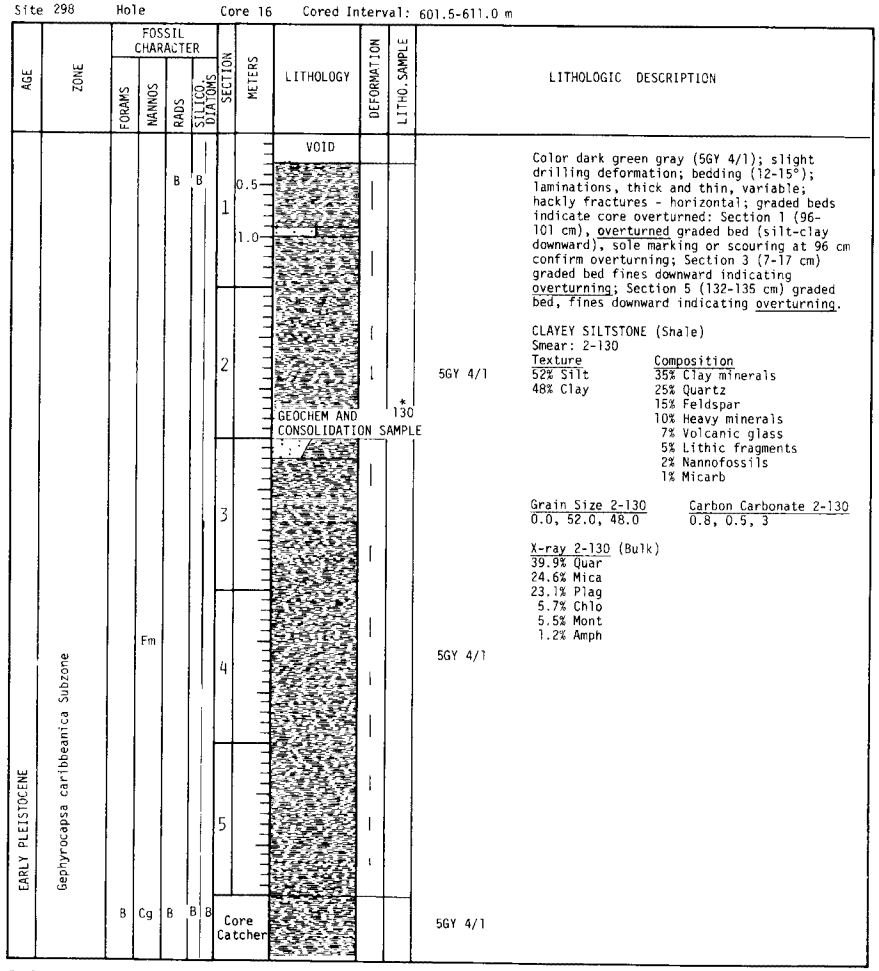
Explanatory notes in chapter 1

Site 298 Hole Core 15 Cored Interval: 563.5-573.0 m



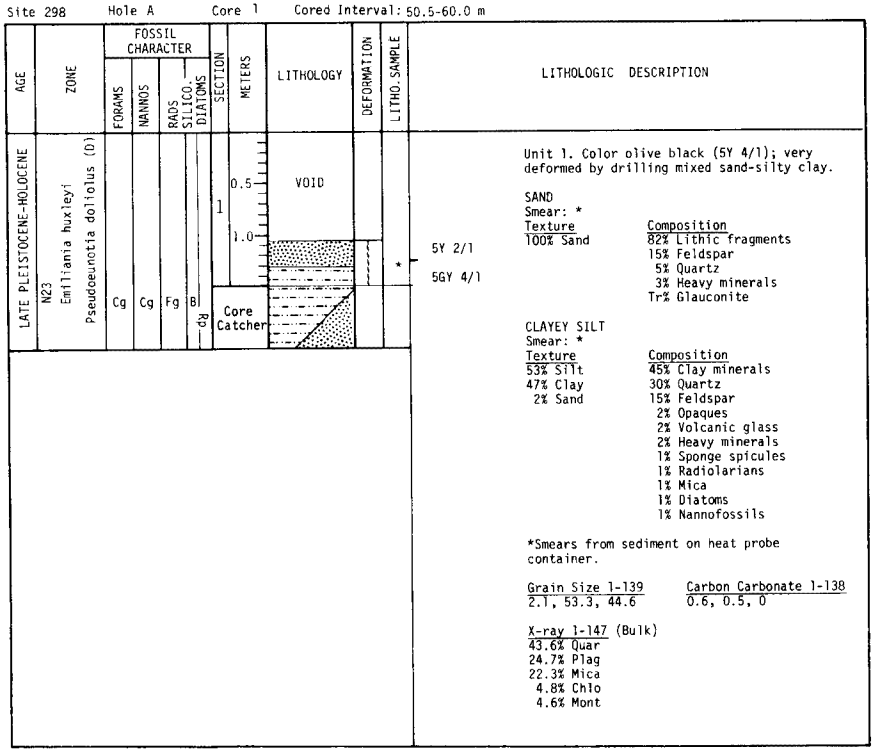
Explanatory notes in chapter 1

Site 298 Hole Core 16 Cored Interval: 601.5-611.0 m



Explanatory notes in chapter 1

Site 298 Hole A Core 1 Cored Interval: 50.5-60.0 m



Explanatory notes in chapter 1

DEEP SEA DRILLING PROJECT

LEG 31 SITE 299

SITE SUMMARY SHEET

POSITION: Latitude: 39°29.69'N Longitude: 137°39.72'E

Water depth (from sea level): 2599 corrected meters (Echo sounding)

Bottom felt at: 2604.5 meters (drill pipe) Penetration: 532 m

Number of Holes: 1 Number of Cores: 38

Total length of cored section: 361 m Total core recovered: 172.3 m

Percentage of core recovery: 47.7%

OLDEST SEDIMENT CORED:

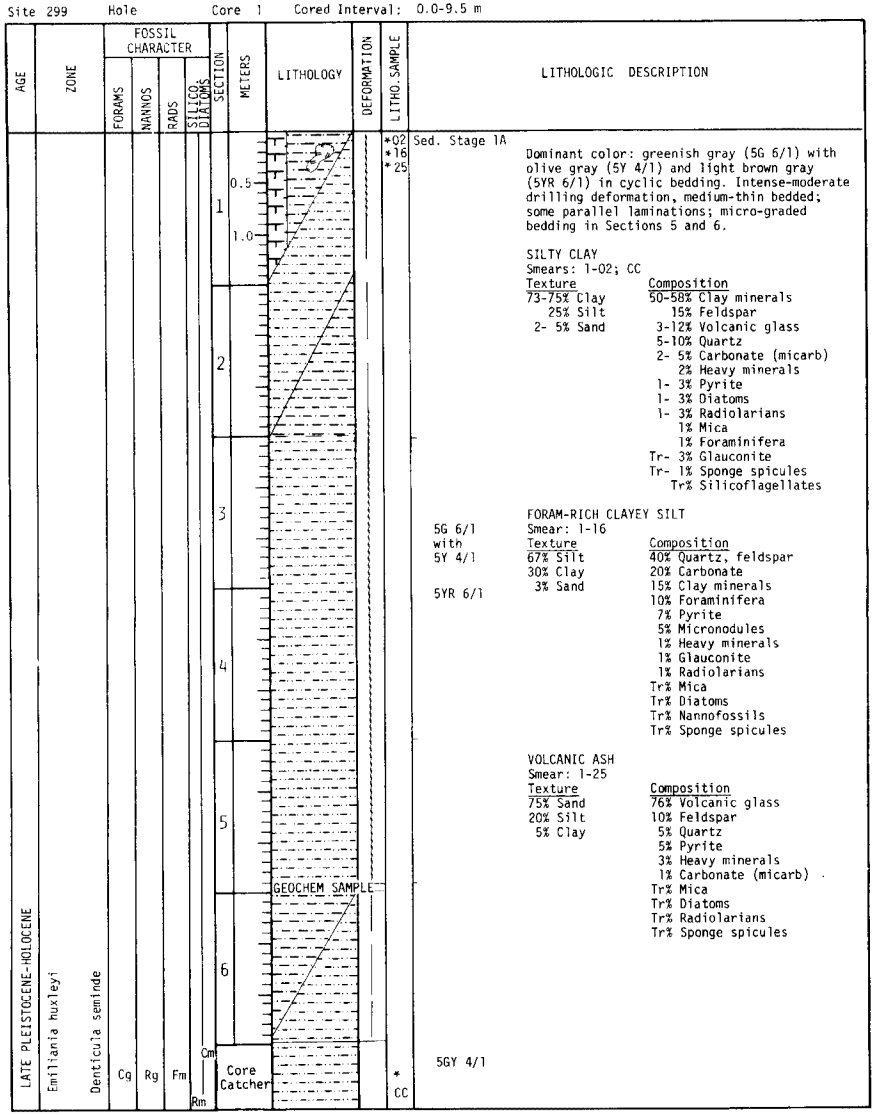
Depth below sea floor: 532 meters Nature: Silty claystone

Age: late Miocene(?)

PRINCIPAL RESULTS:

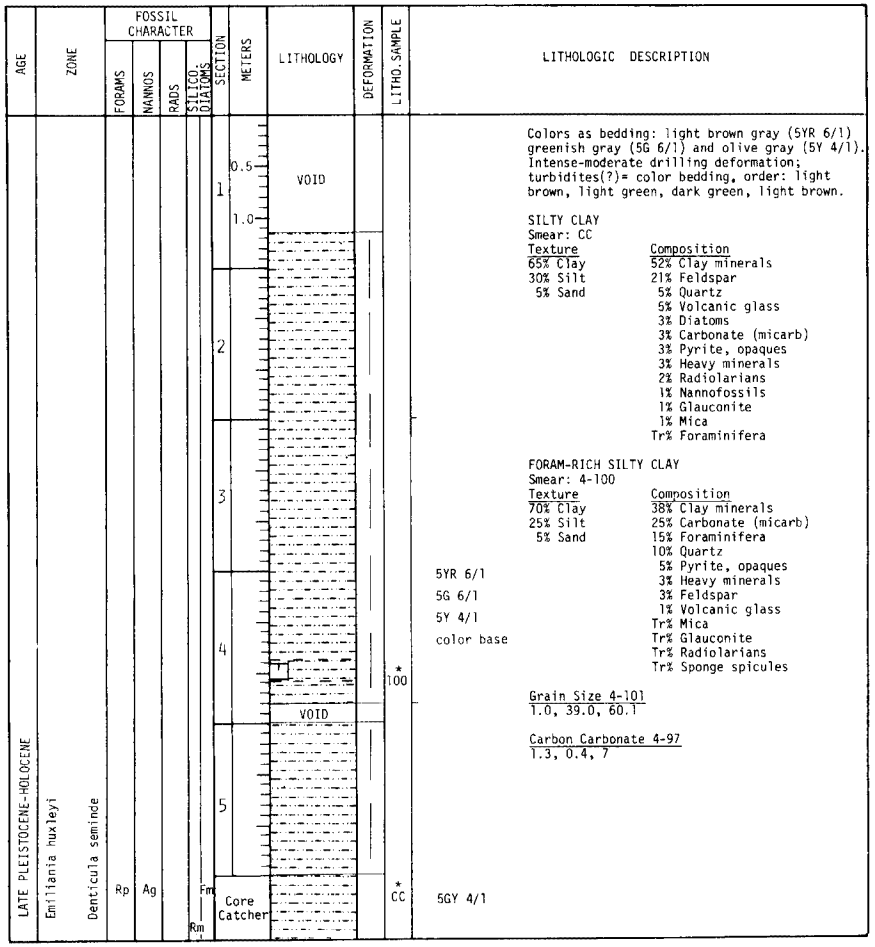
Site 299 was drilled in the northeast Yamato Basin in the Sea of Japan. Penetrated about 475 meters of late Pleistocene through early Pliocene sand, silt, and clay submarine channel sands overbank deposits representing deposition in the Toyama Trough complex. The underlying 57 meters of clay and siltstone apparently represent late Miocene distal turbidites deposited as the submarine fan initally transgressed westward.

Site 299 Hole Core 1 Cored Interval: 0.0-9.5 m



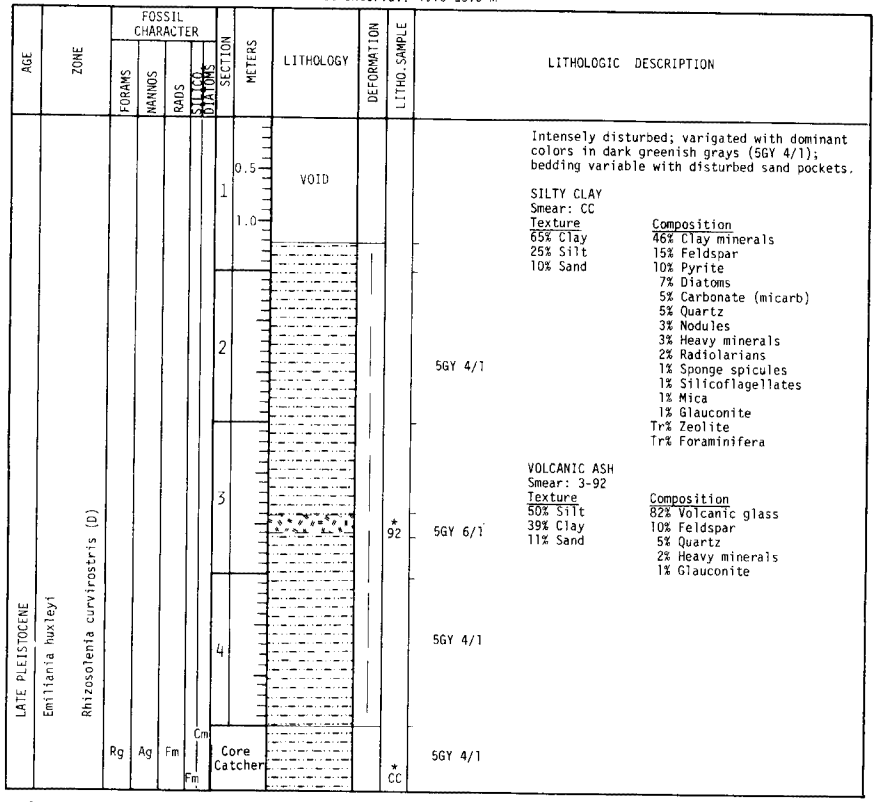
Explanatory notes in chapter 1

Site 299 Hole Core 2 Cored Interval: 9.5-19.0 m



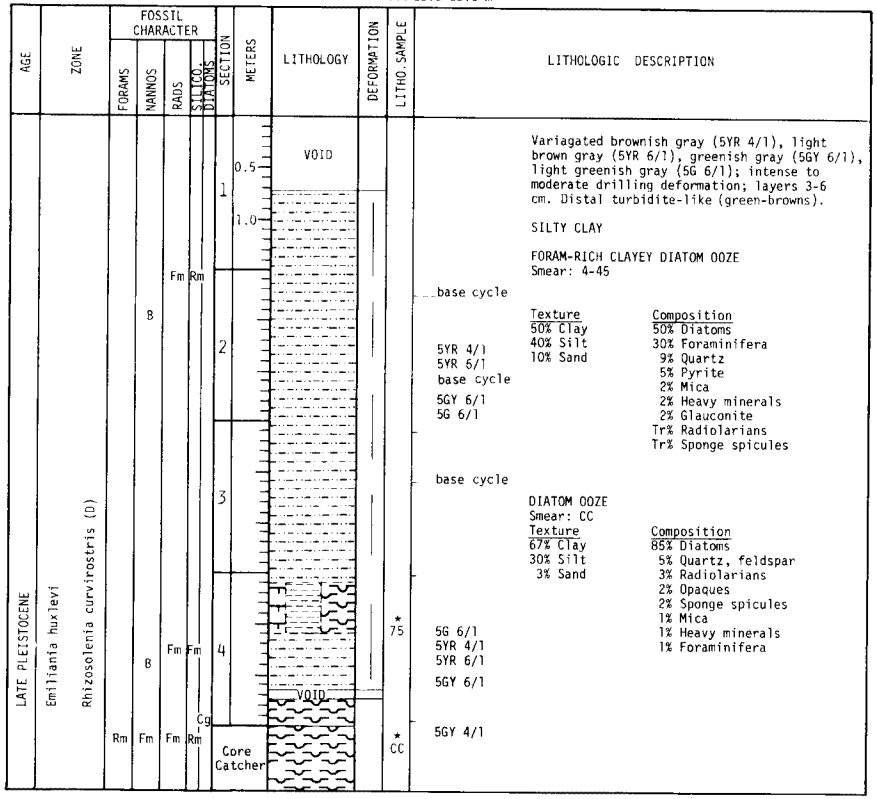
Explanatory notes in chapter 1

Site 299 Hole Core 3 Cored Interval: 19.0-28.5 m



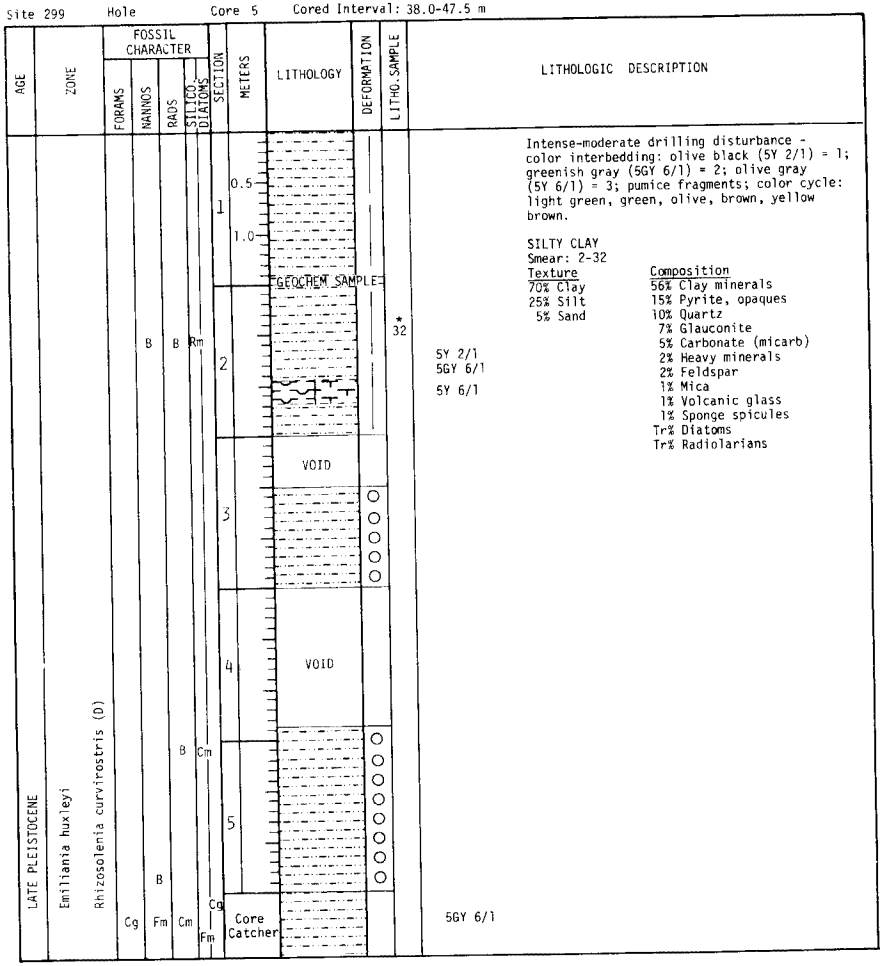
Explanatory notes in chapter 1

Site 299 Hole Core 4 Cored Interval: 28.5-38.0 m



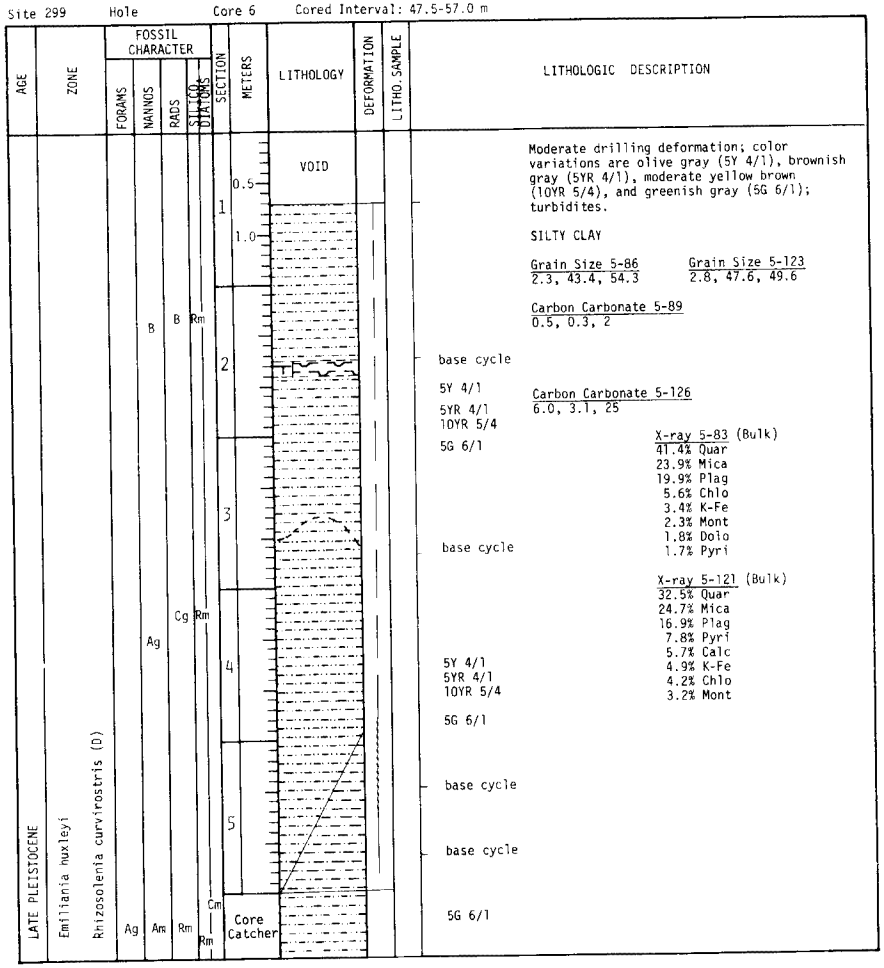
Explanatory notes in chapter 1

Site 299 Hole Core 5 Cored Interval: 38.0-47.5 m



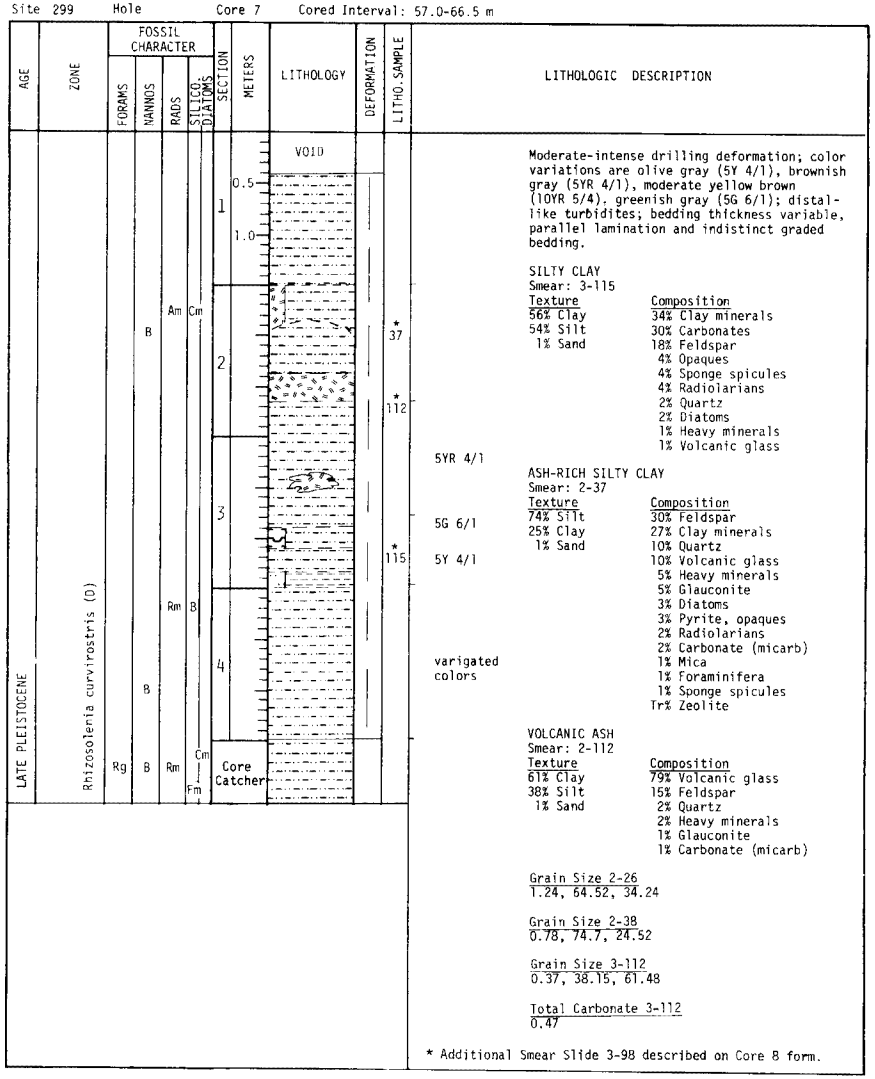
Explanatory notes in chapter 1

Site 299 Hole Core 6 Cored Interval: 47.5-57.0 m



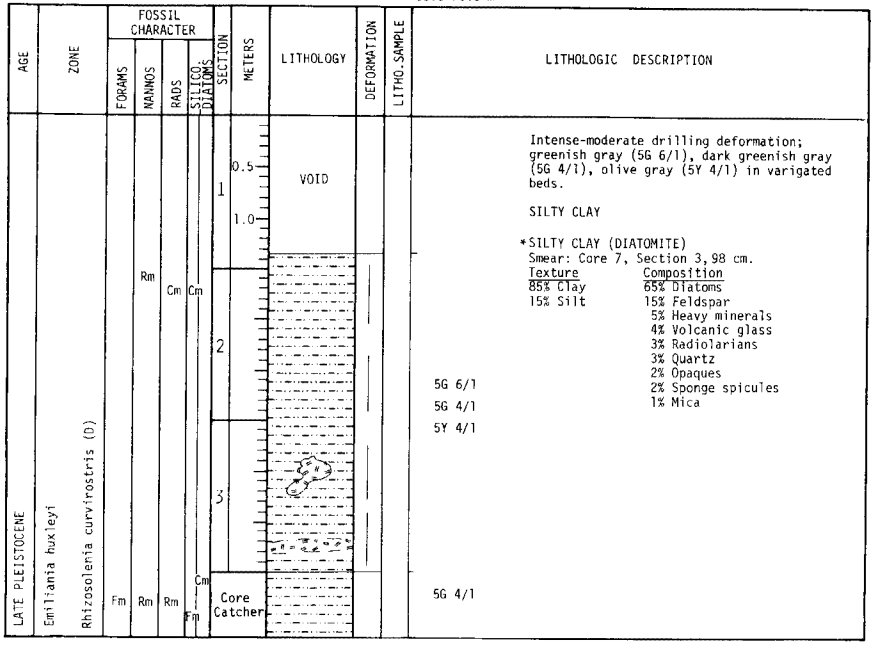
Explanatory notes in chapter 1

Site 299 Hole Core 7 Cored Interval: 57.0-66.5 m



Explanatory notes in chapter 1

Site 299 Hole Core 8 Cored Interval: 66.5-76.0 m



Explanatory notes in chapter 1

Site 299 Hole Core 9 Cored Interval: 76.0-85.5 m

AGE: LATE PLEISTOCENE
ZONE: Gephyrocapsa oceanica; Rhizosolenia curvirostris (D)
FOSSIL CHARACTER: FORAMS, NANNOS, RADS, SILICO. DIATOMS
SECTION, METERS, LITHOLOGY, DEFORMATION, LITHO.SAMPLE

FORAMS: juvenile
NANNOS: B
RADS: Rm Cg; B Cg
SILICO. DIATOMS: Rm Rp Rp Rp Rm

LITHOLOGIC DESCRIPTION

Sed. Stage 1B

Colors olive gray (5Y 4/1), pale green (5G 6/1), light olive gray (5Y 6/1), brownish gray (5YR 4/1) and ash is a very light gray (N8); interbeds; moderate drilling deformation; bedding thicknesses vary.

SILTY CLAY

CLAYEY SAND

Grain Size 5-71
10.7, 83.0, 6.3

Grain Size 5-97
17.4, 71.3, 11.3

Grain Size 5-115
20.9, 65.7, 13.4

Grain Size 5-132
26.2, 59.8, 14.0

Grain Size 5-142
26.5, 64.7, 8.8

Grain Size 3-140
89.8, 7.1, 3.1

Carbon Carbonate 5-49
1.3, 1.0, 3

X-ray 5-53 (Bulk)
30.5% Quar
26.2% Plag
15.0% Mica
10.3% Mont
4.6% K-Fe
3.8% Calc
3.5% Kaol
3.5% Pyri
2.6% Chlo

Grain Size 5-40
1.53, 38.73, 54.37

Total Carbonate 5-40
2.26

5Y 4/1
5G 6/1
5Y 6/1
5YR 4/1
N8
5GY 2/1
5YR 4/1
5Y 4/1
5G 6/1
5Y 6/1
5YR 4/1
5Y 4/1
5G 6/1
5Y 4/1
5G 4/1

VOID
VOID
VOID
Core Catcher

Explanatory notes in chapter 1

Site 299 Hole Core 10 Cored Interval: 85.5-95.0 m

AGE: LATE PLEISTOCENE
ZONE: Gephyrocapsa oceanica; Rhizosolenia curvirostris (D)
FOSSIL CHARACTER: FORAMS, NANNOS, RADS, SILICO. DIATOMS
SECTION, METERS, LITHOLOGY, DEFORMATION, LITHO.SAMPLE

FORAMS: Juvenile
NANNOS: Fm
RADS: B Fg; Fm; Fm B B
SILICO. DIATOMS: Rm Fp Rp Cm Fm

LITHOLOGIC DESCRIPTION

Colors dark greenish gray (5GY 4/1), olive black (5Y 2/1), greenish gray (5G 6/1) in thick and thin laminae;

SILTY CLAY

CLAYEY SAND

base of cycle

base of cycle

5GY 4/1
5Y 2/1
5G 6/1

NANNOFOSSIL-RICH CARBONATE SILTY CLAY
Smear: 4-17

Texture	Composition
55% Clay	40% Clay minerals
40% Silt	38% Carbonate
5% Sand	12% Nannofossils
	3% Feldspar
	3% Volcanic glass
	1% Quartz
	1% Heavy minerals
	1% Glauconite
	1% Pyrite

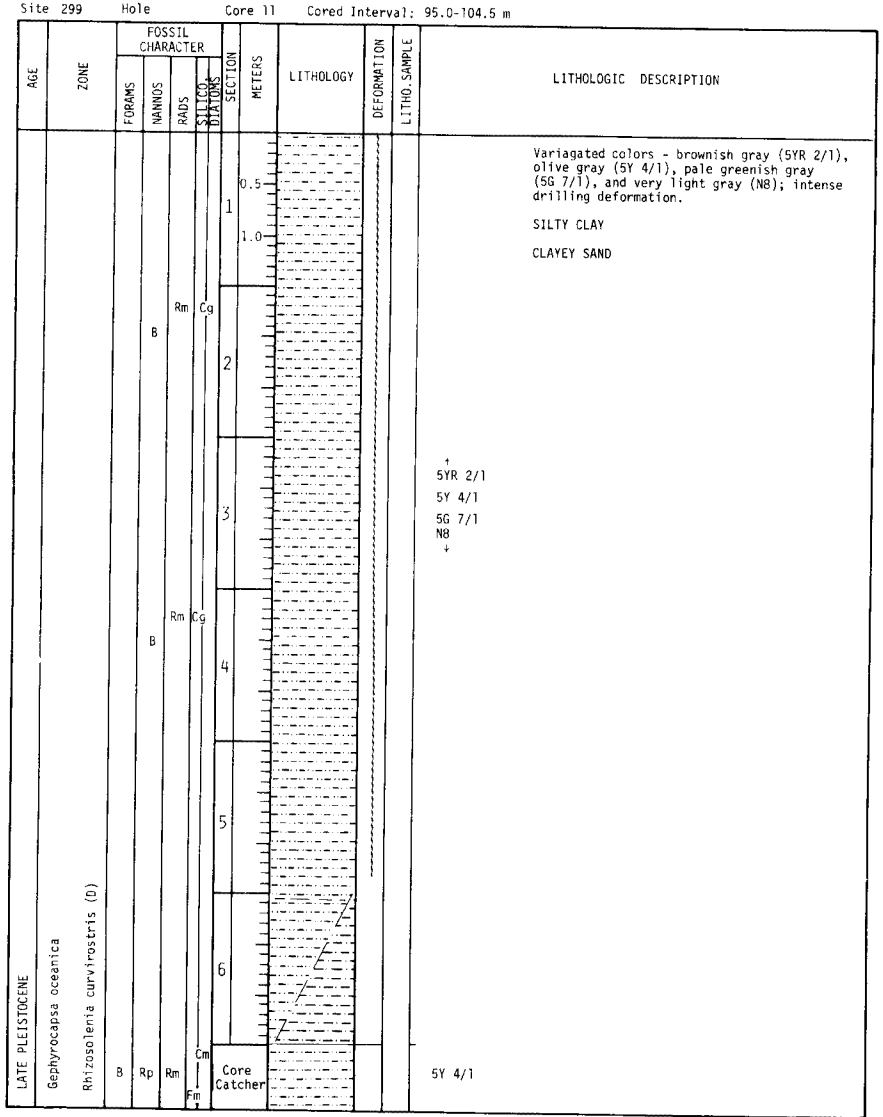
5GY 4/1
5Y 2/1
5G 6/1

5GY 4/1

VOID
GEOCHEM SAMPLE
Core Catcher

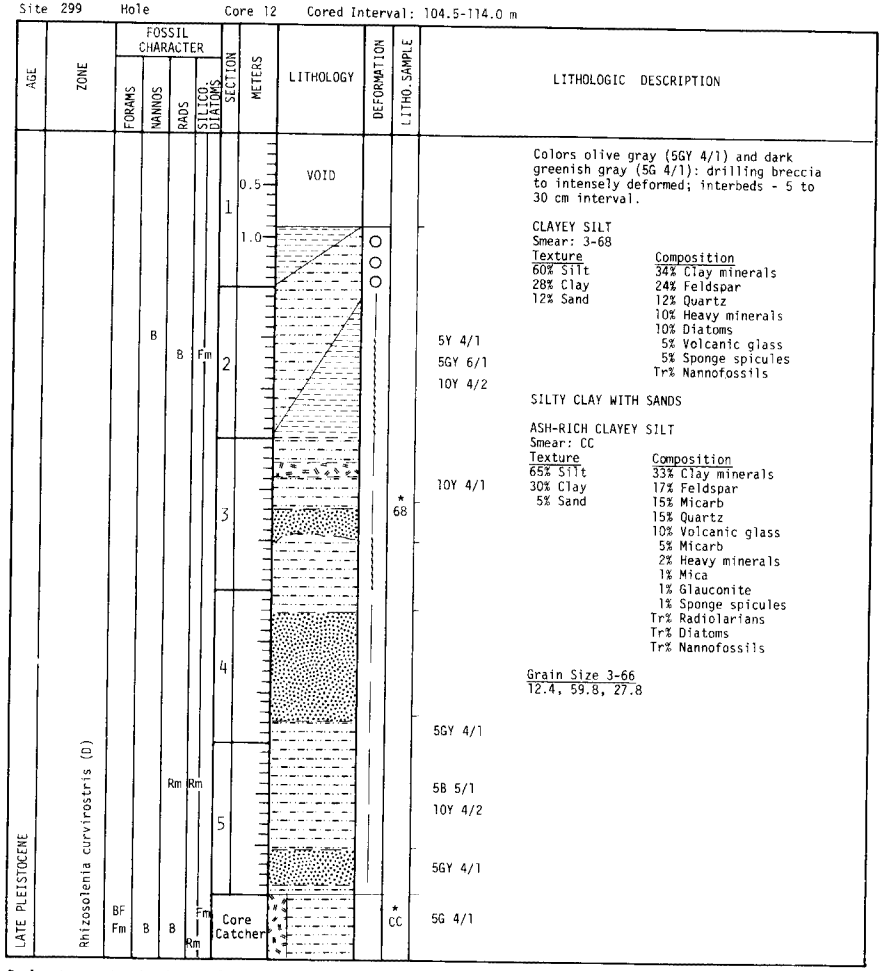
Explanatory notes in chapter 1

Site 299 Hole Core 11 Cored Interval: 95.0-104.5 m



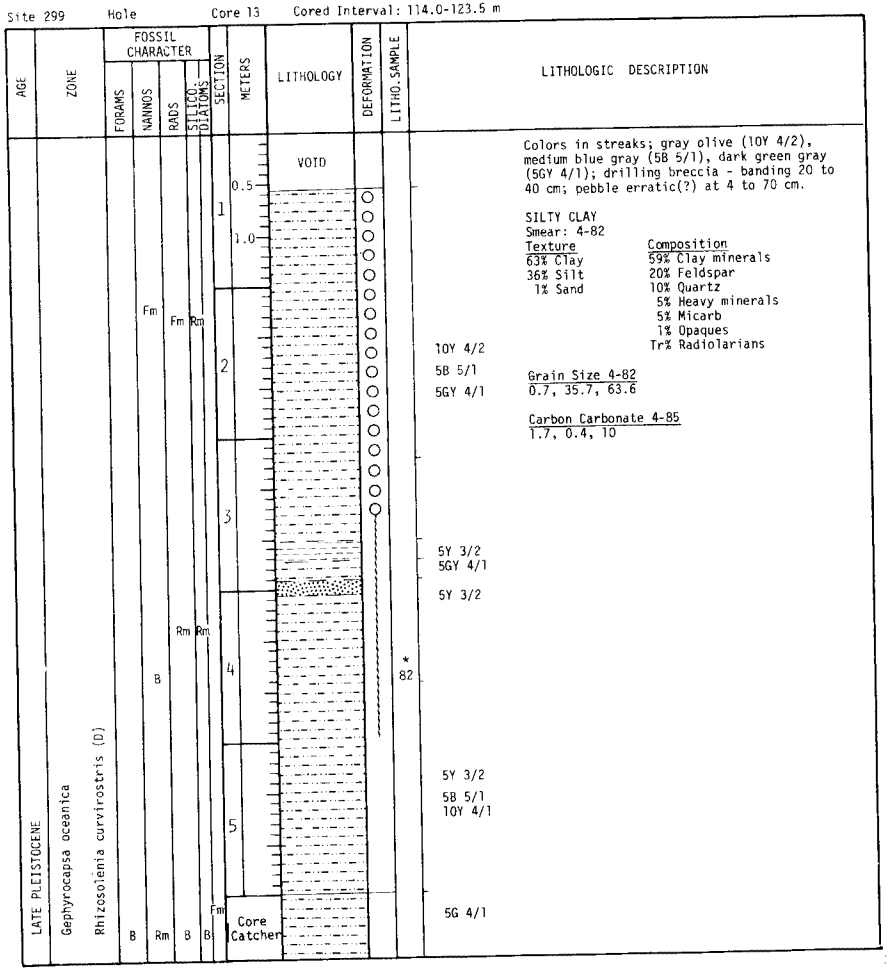
Explanatory notes in chapter 1

Site 299 Hole Core 12 Cored Interval: 104.5-114.0 m



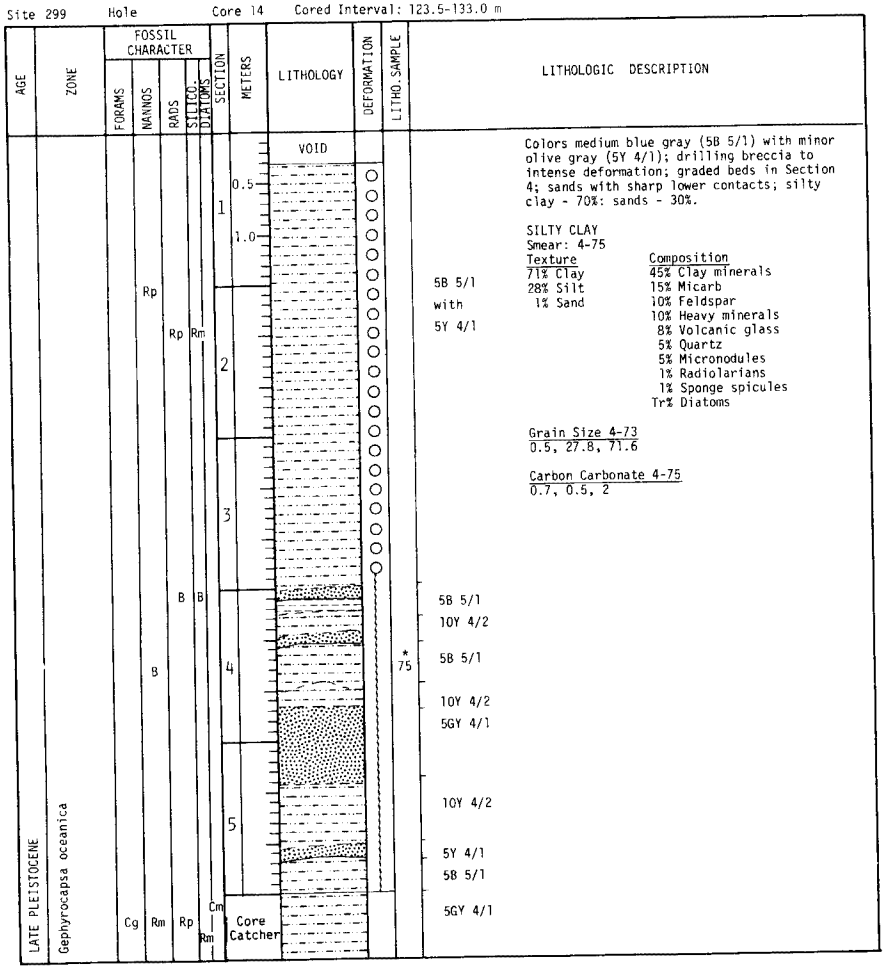
Explanatory notes in chapter 1

Site 299 Hole Core 13 Cored Interval: 114.0-123.5 m



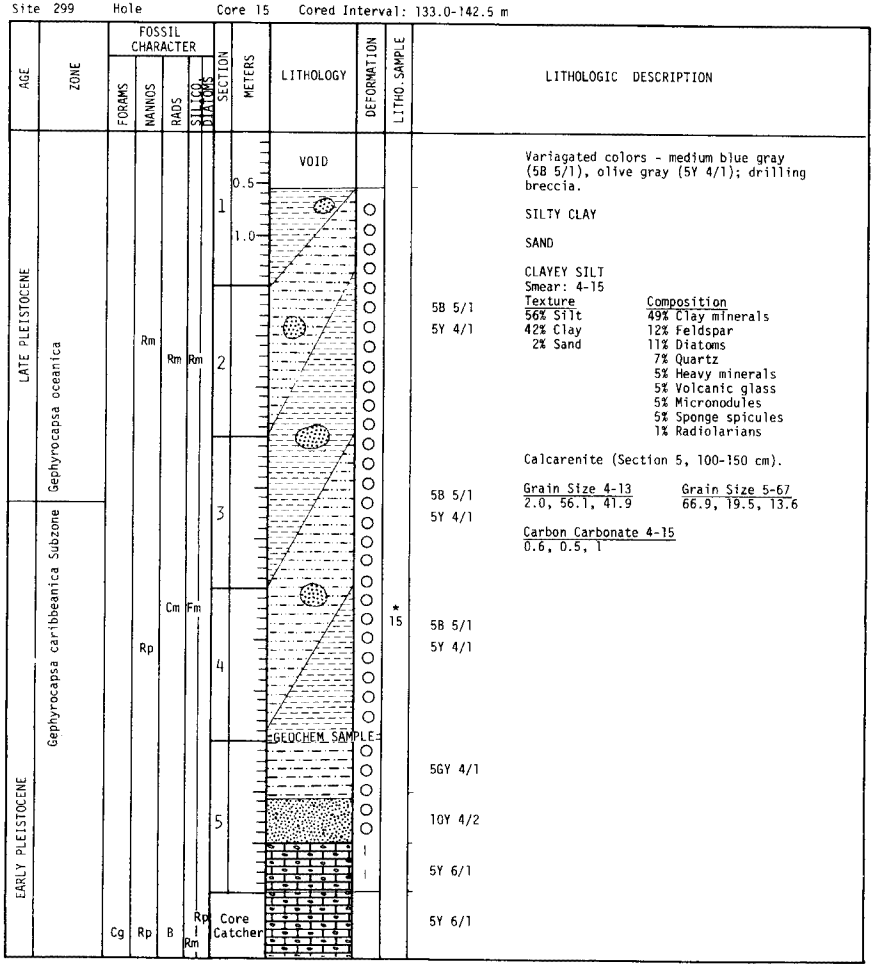
Explanatory notes in chapter 1

Site 299 Hole Core 14 Cored Interval: 123.5-133.0 m



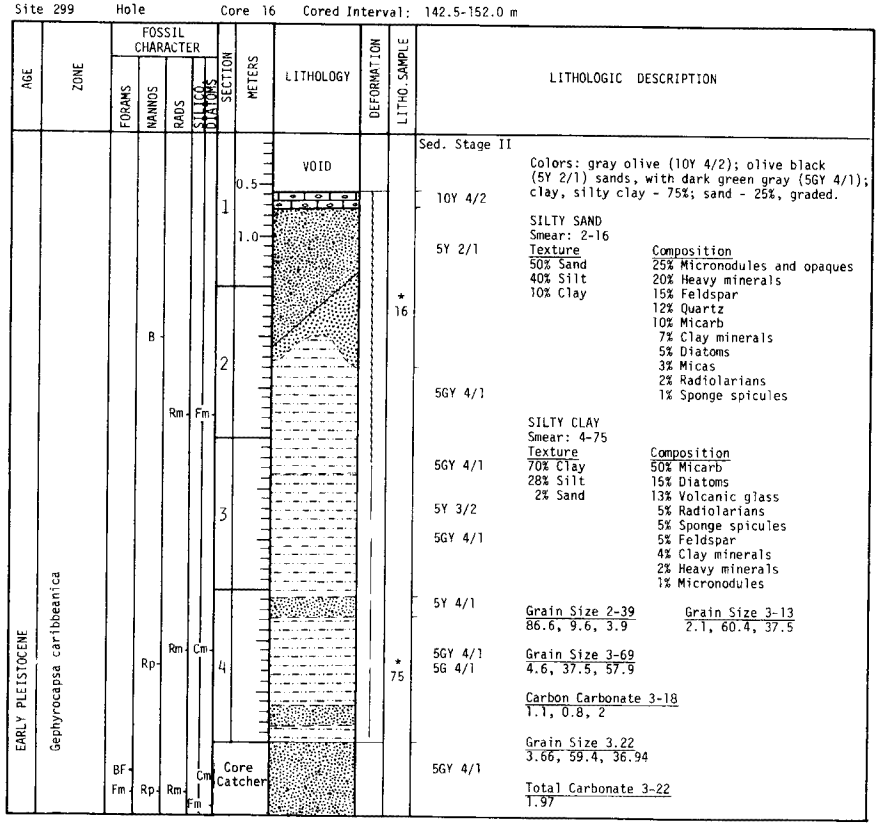
Explanatory notes in chapter 1

Site 299 Hole Core 15 Cored Interval: 133.0-142.5 m



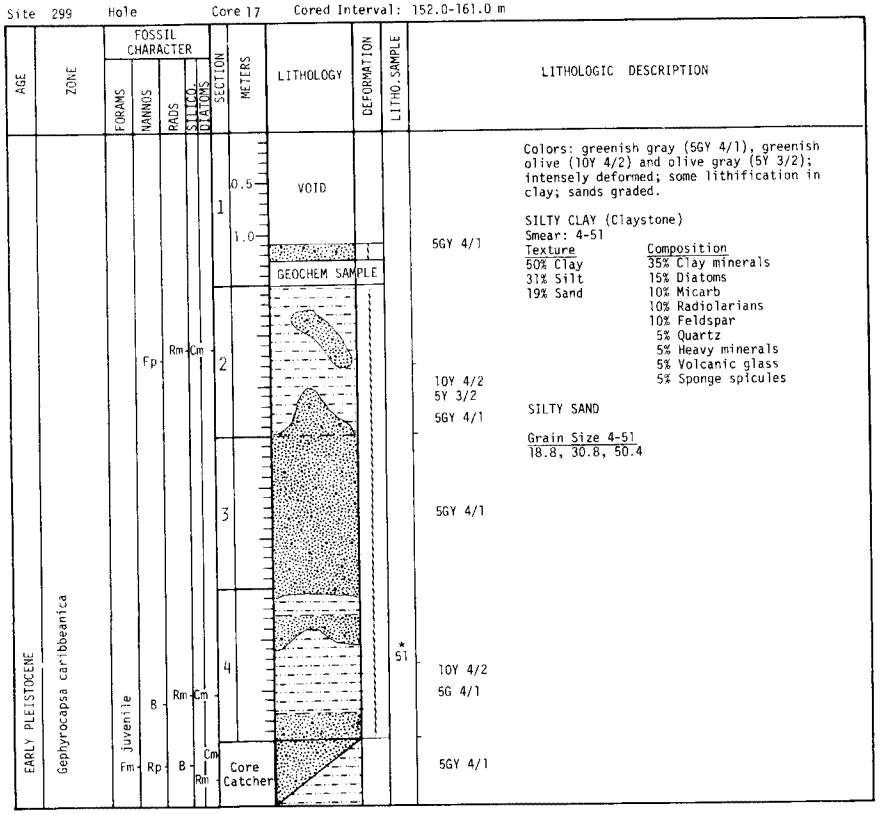
Explanatory notes in chapter 1

Site 299 Hole Core 16 Cored Interval: 142.5-152.0 m



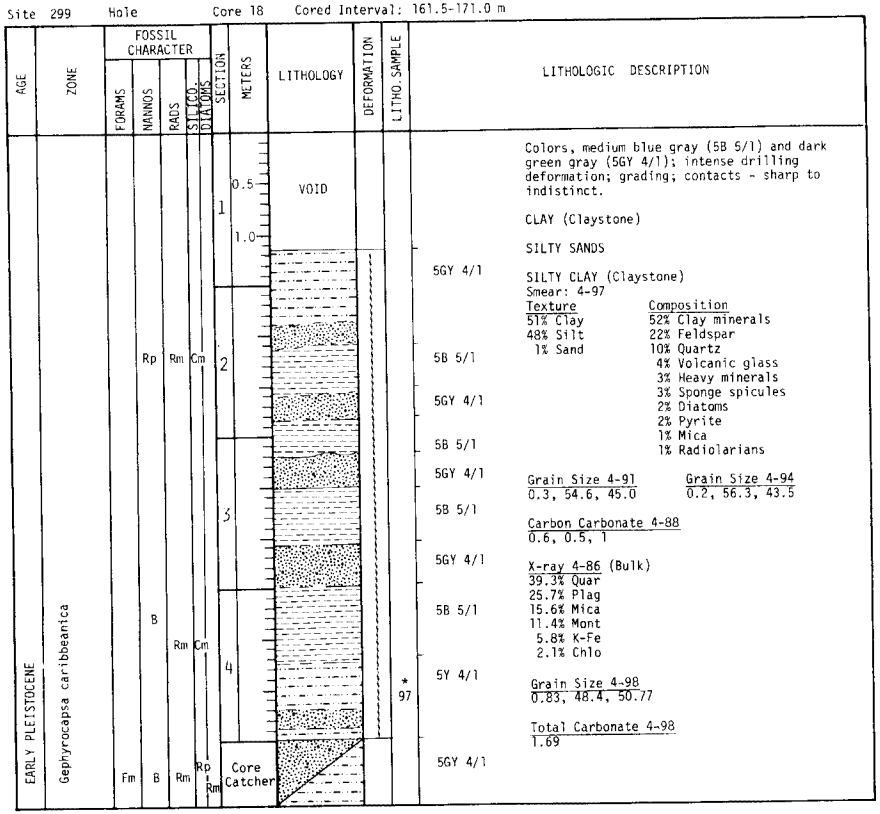
Explanatory notes in chapter 1

Site 299 Hole Core 17 Cored Interval: 152.0-161.0 m



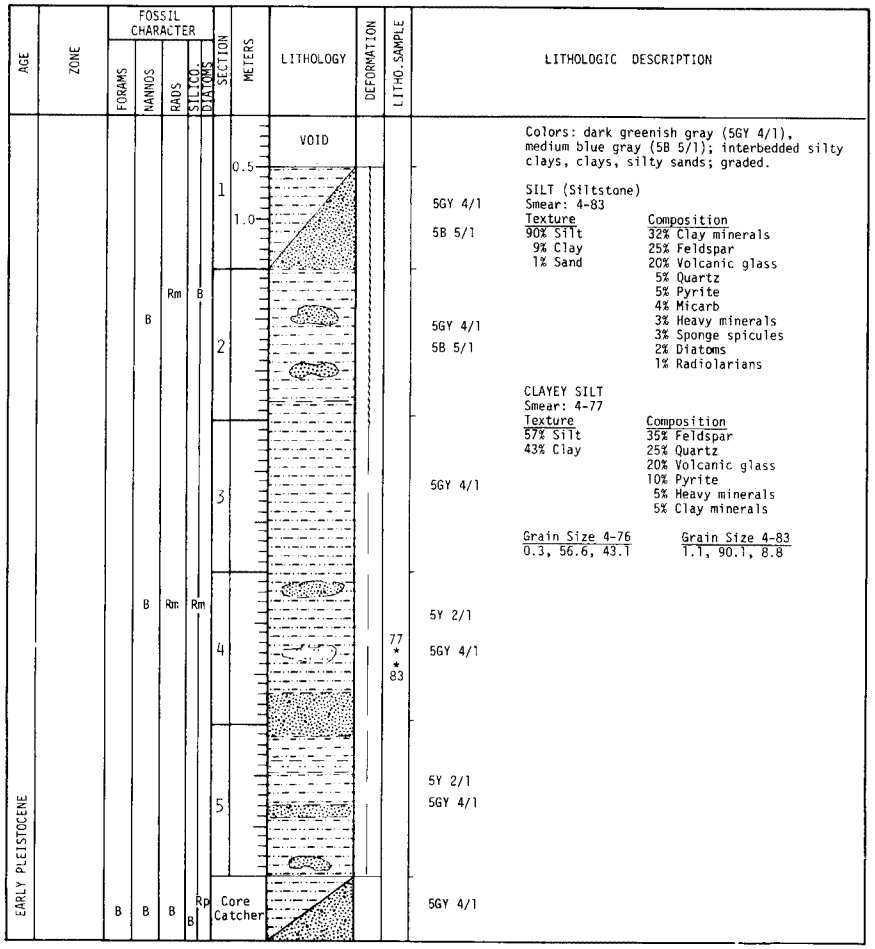
Explanatory notes in chapter 1

Site 299 Hole Core 18 Cored Interval: 161.5-171.0 m



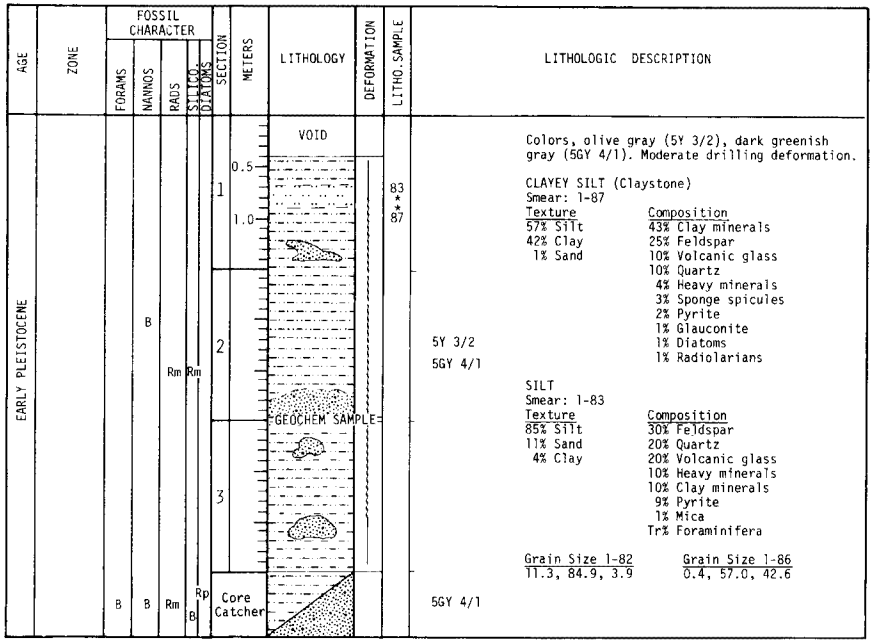
Explanatory notes in chapter 1

Site 299 Hole Core 19 Cored Interval: 171.0-180.5 m



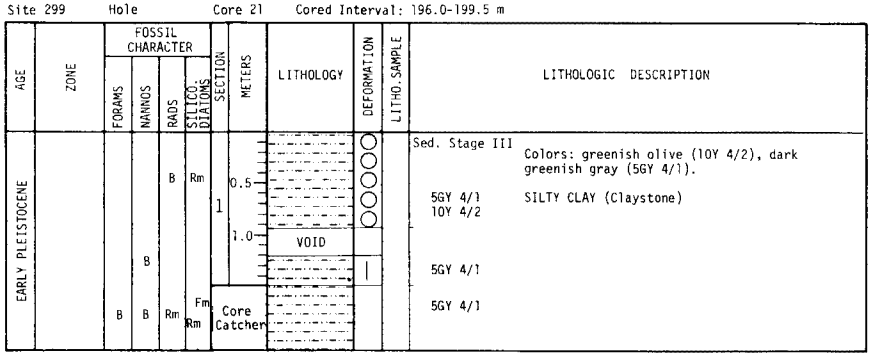
Explanatory notes in chapter 1

Site 299 Hole Core 20 Cored Interval: 180.5-190.0 m



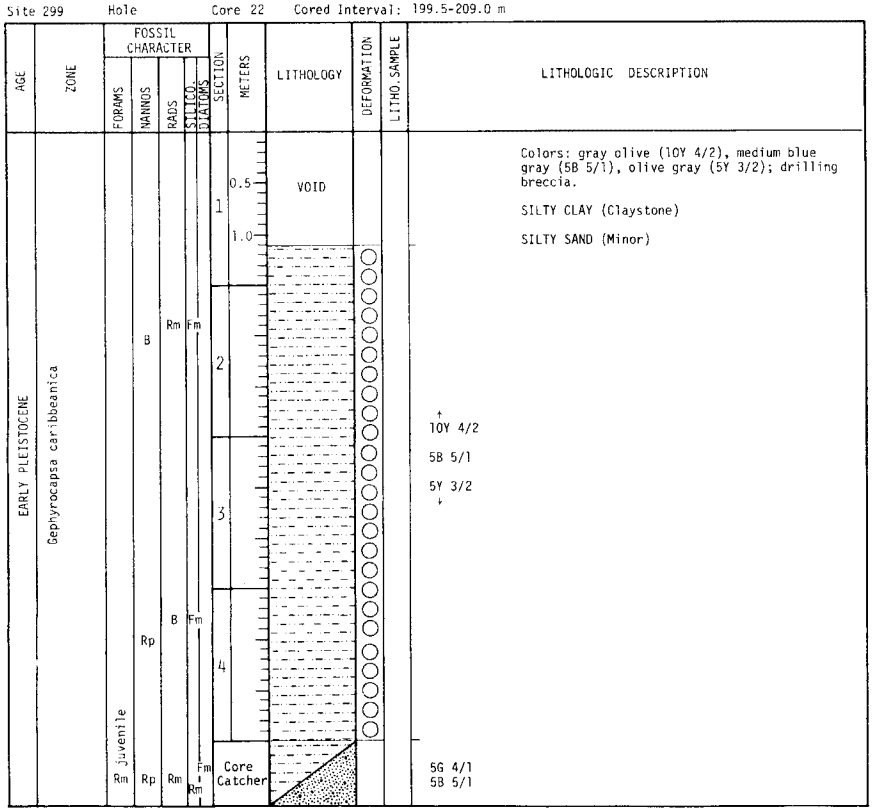
Explanatory notes in chapter 1

Site 299 Hole Core 21 Cored Interval: 196.0-199.5 m



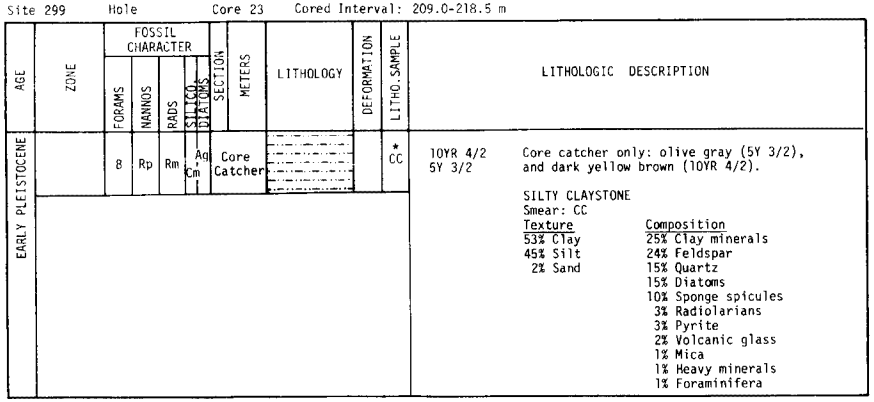
Explanatory notes in chapter 1

Site 299 Hole Core 22 Cored Interval: 199.5-209.0 m



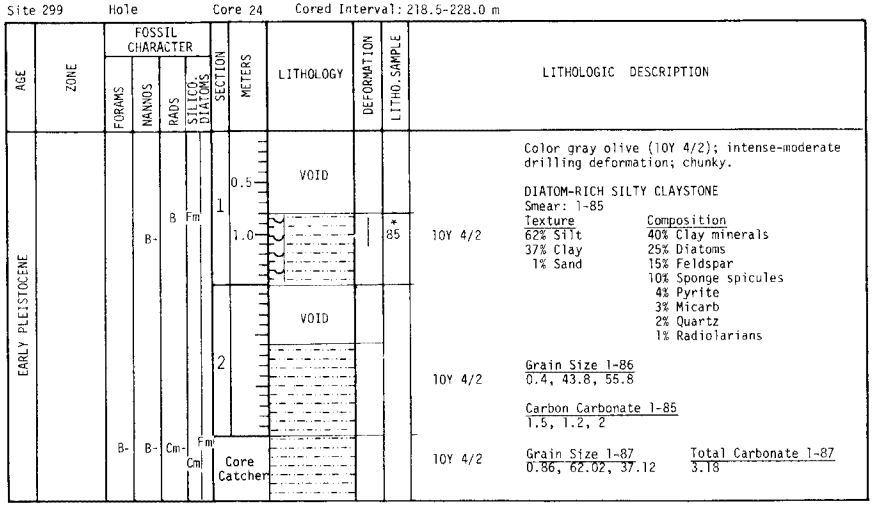
Explanatory notes in chapter 1

Site 299 Hole Core 23 Cored Interval: 209.0-218.5 m



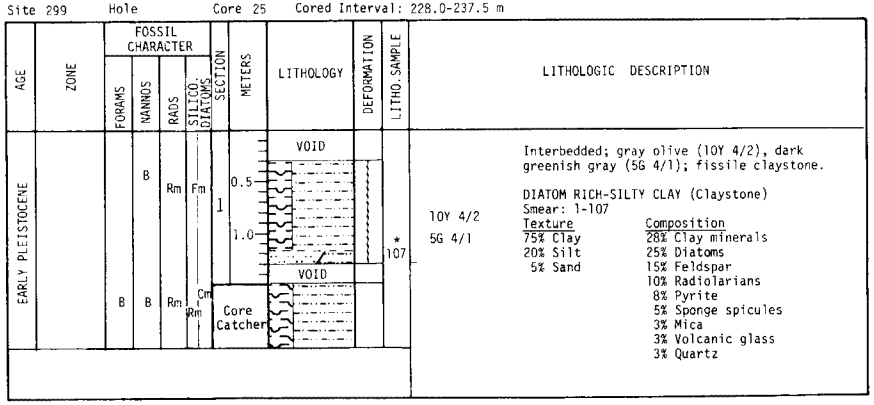
Explanatory notes in chapter 1

Site 299 Hole Core 24 Cored Interval: 218.5-228.0 m



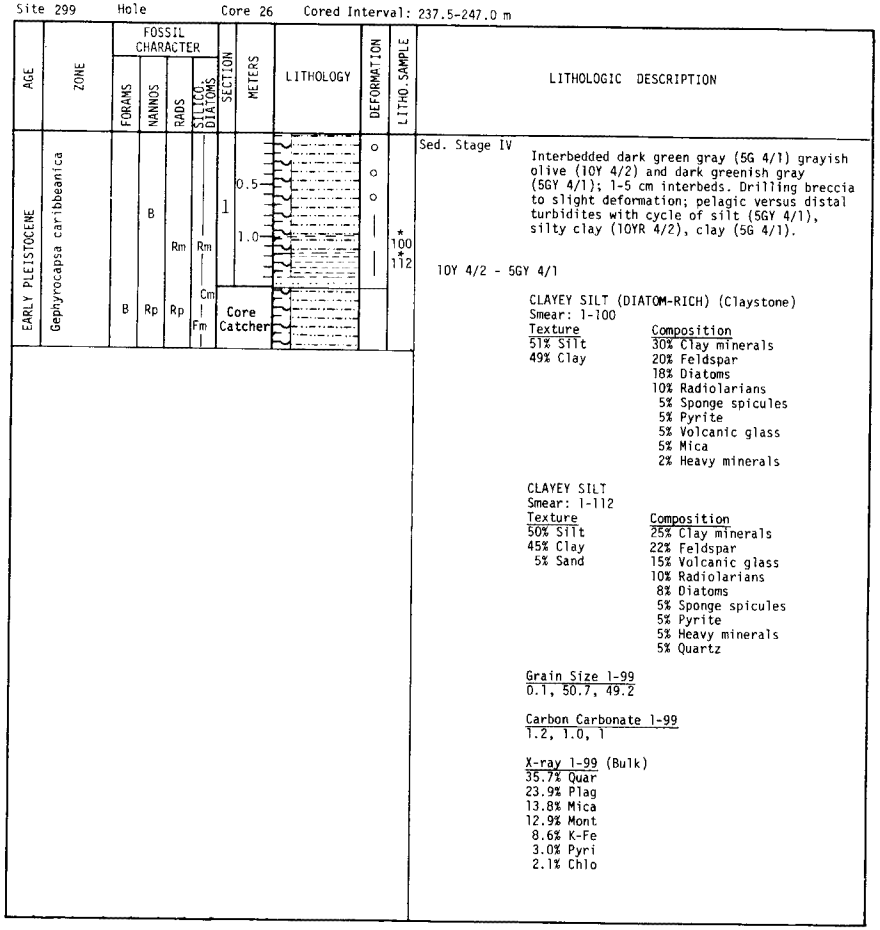
Explanatory notes in chapter 1

Site 299 Hole Core 25 Cored Interval: 228.0-237.5 m



Explanatory notes in chapter 1

Site 299 Hole Core 26 Cored Interval: 237.5-247.0 m



Sed. Stage IV

Interbedded dark green gray (5G 4/1) grayish olive (10Y 4/2) and dark greenish gray (5GY 4/1); 1-5 cm interbeds. Drilling breccia to slight deformation; pelagic versus distal turbidites with cycle of silt (5GY 4/1), silty clay (10YR 4/2), clay (5G 4/1).

10Y 4/2 - 5GY 4/1

CLAYEY SILT (DIATOM-RICH) (Claystone)
Smear: 1-100

Texture	Composition
51% Silt	30% Clay minerals
49% Clay	20% Feldspar
	18% Diatoms
	10% Radiolarians
	5% Sponge spicules
	5% Pyrite
	5% Volcanic glass
	5% Mica
	2% Heavy minerals

CLAYEY SILT
Smear: 1-112

Texture	Composition
50% Silt	25% Clay minerals
45% Clay	22% Feldspar
5% Sand	15% Volcanic glass
	10% Radiolarians
	8% Diatoms
	5% Sponge spicules
	5% Pyrite
	5% Heavy minerals
	5% Quartz

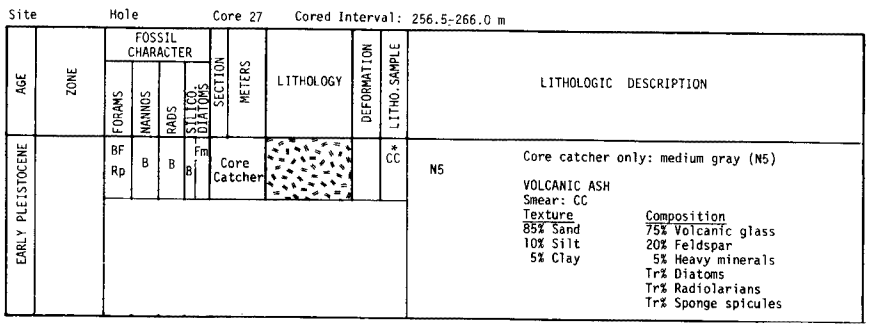
Grain Size 1-99
0.1, 50.7, 49.2

Carbon Carbonate 1-99
1.2, 1.0, 1

X-ray 1-99 (Bulk)
35.7% Quar
23.9% Plag
13.8% Mica
12.9% Mont
8.6% K-Fe
3.0% Pyri
2.1% Chlo

Explanatory notes in chapter 1

Site Hole Core 27 Cored Interval: 256.5-266.0 m



N5

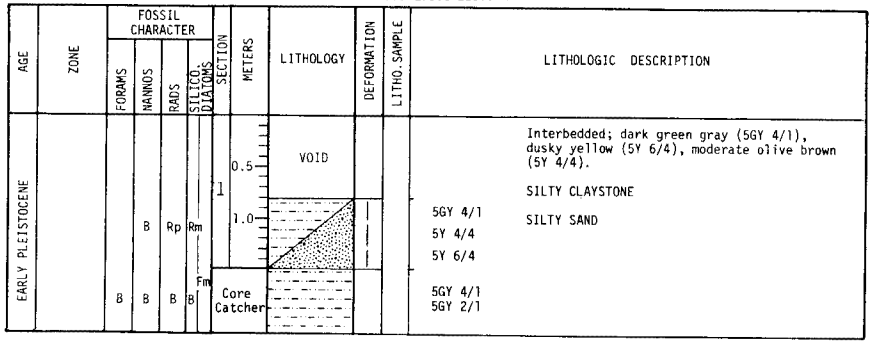
Core catcher only: medium gray (N5)

VOLCANIC ASH
Smear: CC

Texture	Composition
85% Sand	75% Volcanic glass
10% Silt	20% Feldspar
5% Clay	5% Heavy minerals
	Tr% Diatoms
	Tr% Radiolarians
	Tr% Sponge spicules

Explanatory notes in chapter 1

Site 299 Hole Core 28 Cored Interval: 275.5-285.0 m



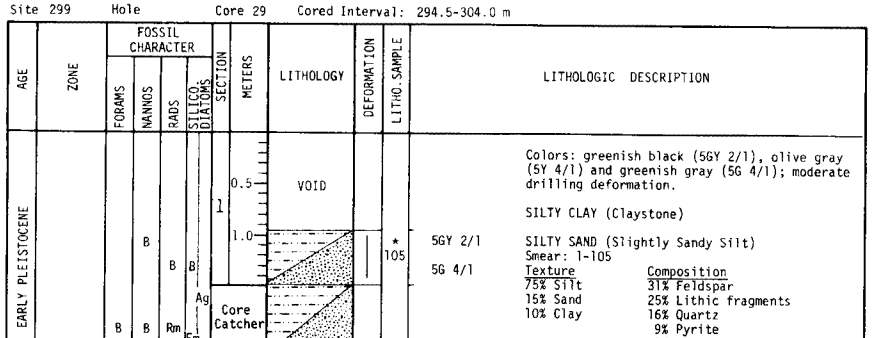
Interbedded; dark green gray (5GY 4/1), dusky yellow (5Y 6/4), moderate olive brown (5Y 4/4).

SILTY CLAYSTONE

SILTY SAND

Explanatory notes in chapter 1

Site 299 Hole Core 29 Cored Interval: 294.5-304.0 m



Colors: greenish black (5GY 2/1), olive gray (5Y 4/1) and greenish gray (5G 4/1); moderate drilling deformation.

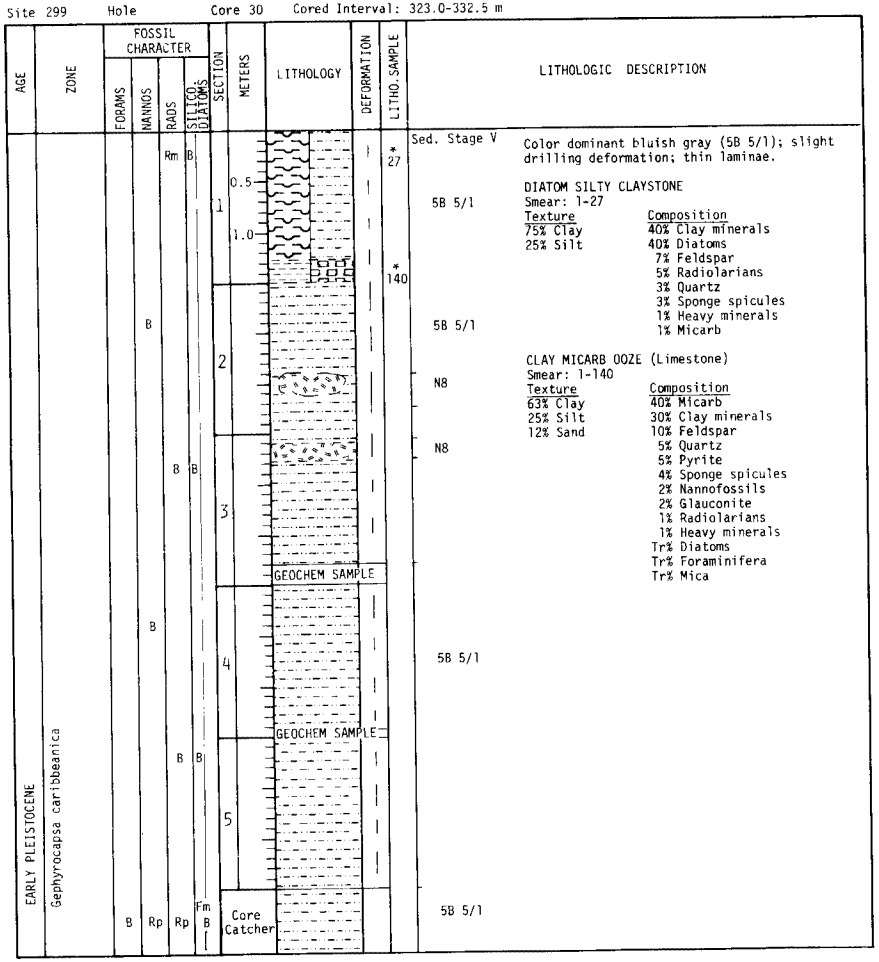
SILTY CLAY (Claystone)

SILTY SAND (Slightly Sandy Silt)
Smear: 1-105

Texture	Composition
75% Silt	31% Feldspar
15% Sand	25% Lithic fragments
10% Clay	16% Quartz
	9% Pyrite
	8% Heavy minerals
	2% Volcanic glass
	2% Sponge spicules
	2% Micarb
	2% Glauconite
	2% Mica
	1% Diatoms
	Tr% Radiolarians
	Tr% Foraminifera

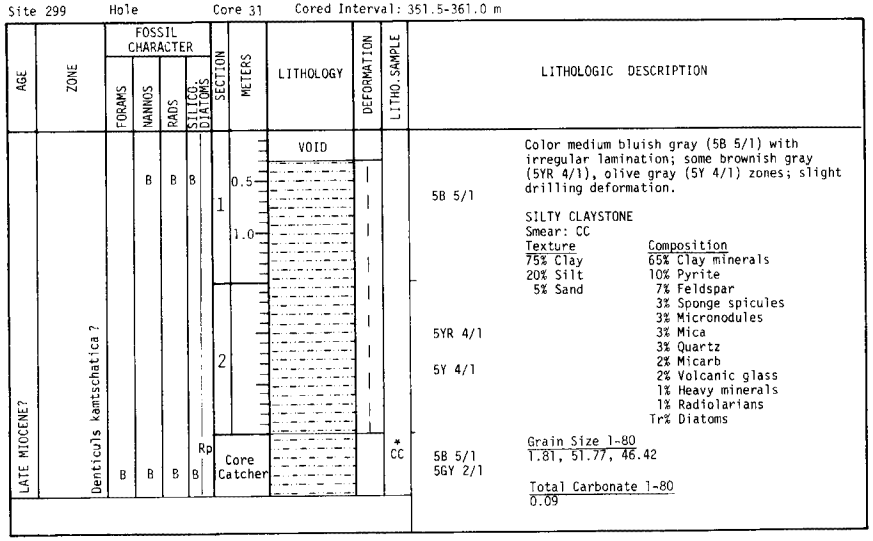
Explanatory notes in chapter 1

Site 299 Hole Core 30 Cored Interval: 323.0-332.5 m



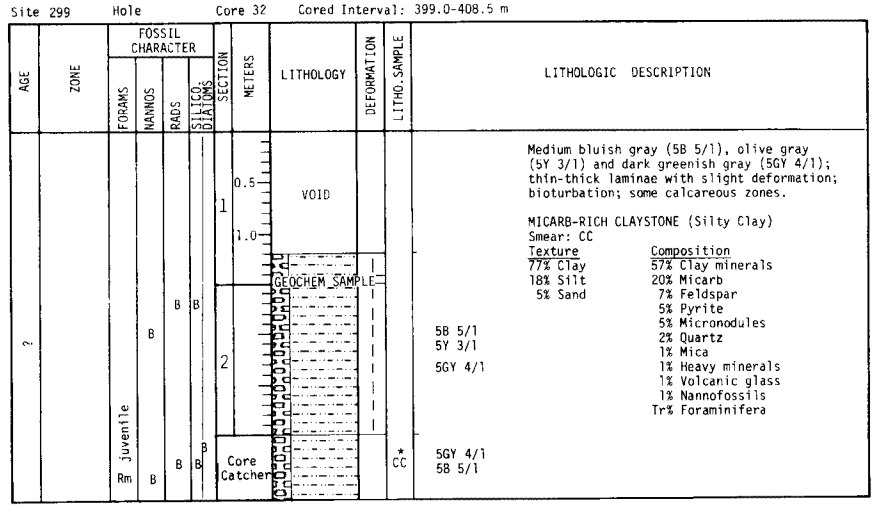
Explanatory notes in chapter 1

Site 299 Hole Core 31 Cored Interval: 351.5-361.0 m



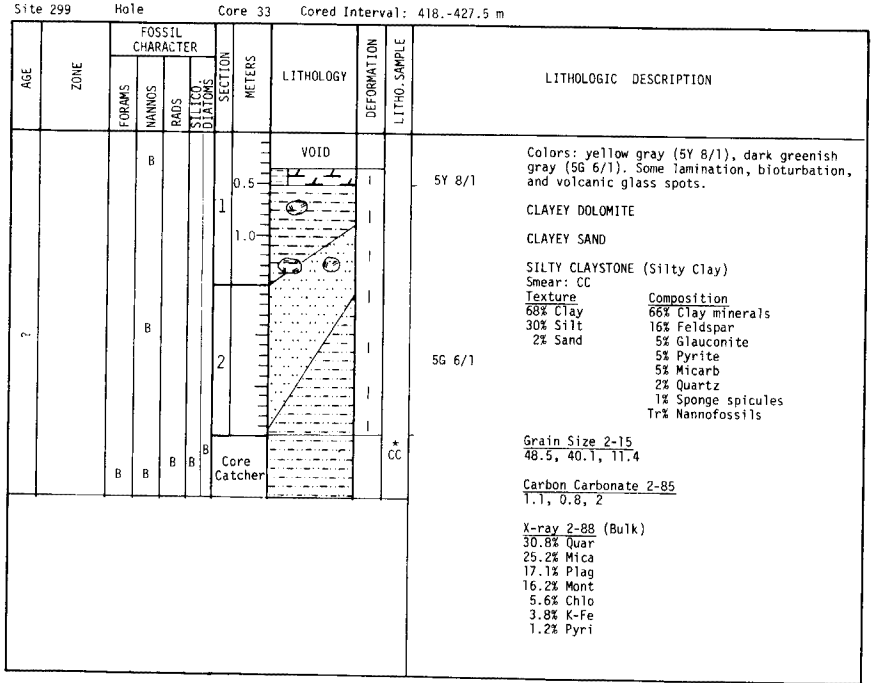
Explanatory notes in chapter 1

Site 299 Hole Core 32 Cored Interval: 399.0-408.5 m



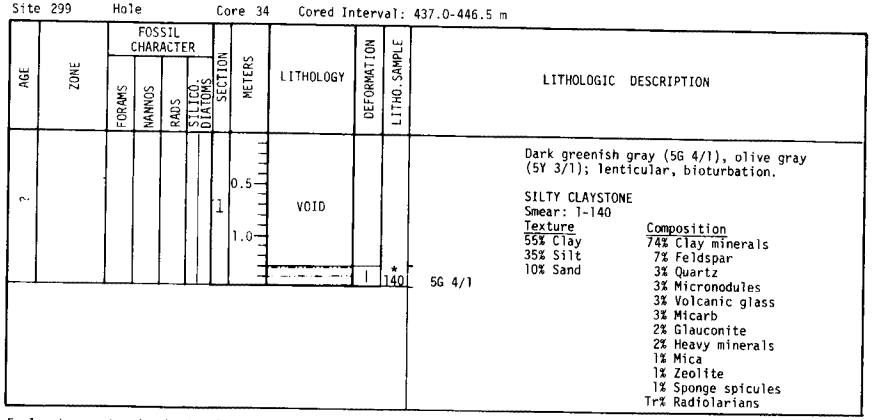
Explanatory notes in chapter 1

Site 299 Hole Core 33 Cored Interval: 418.-427.5 m



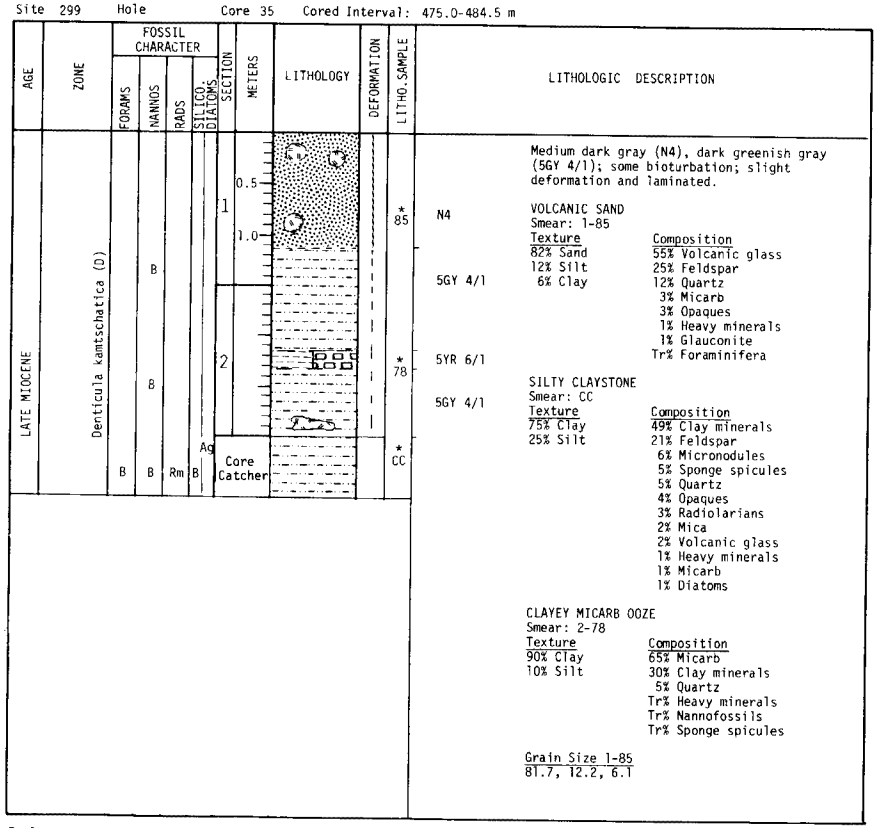
Explanatory notes in chapter 1

Site 299 Hole Core 34 Cored Interval: 437.0-446.5 m



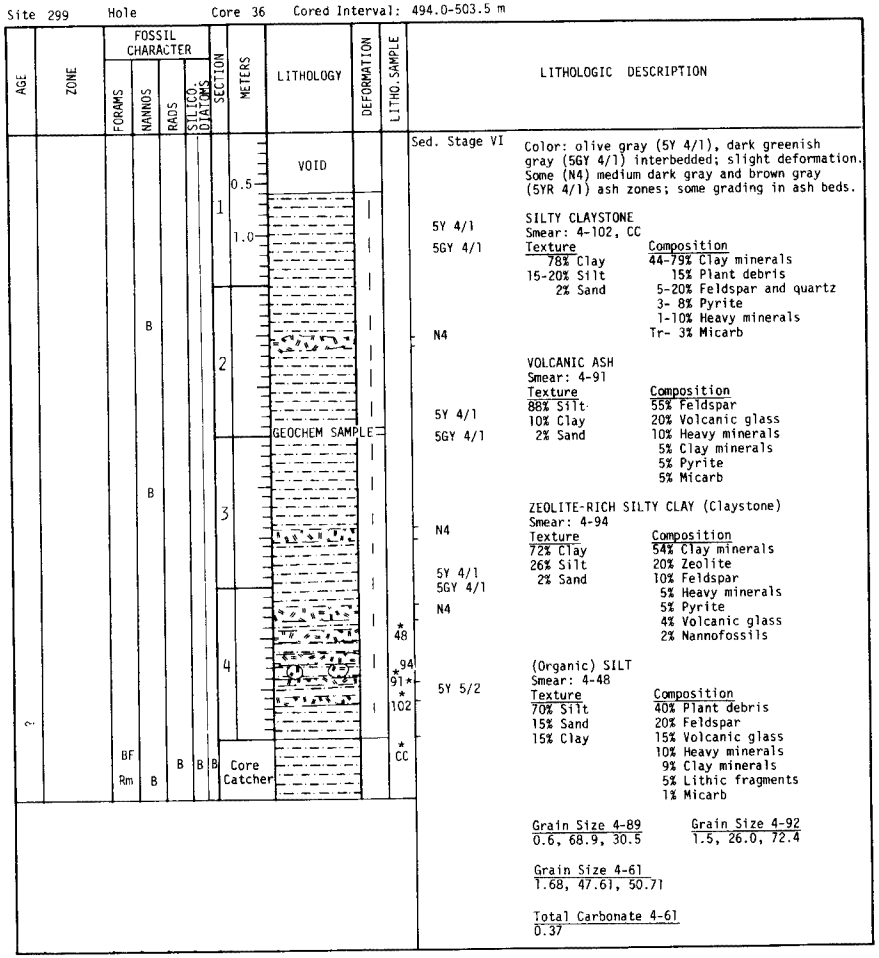
Explanatory notes in chapter 1

Site 299 Hole Core 35 Cored Interval: 475.0-484.5 m



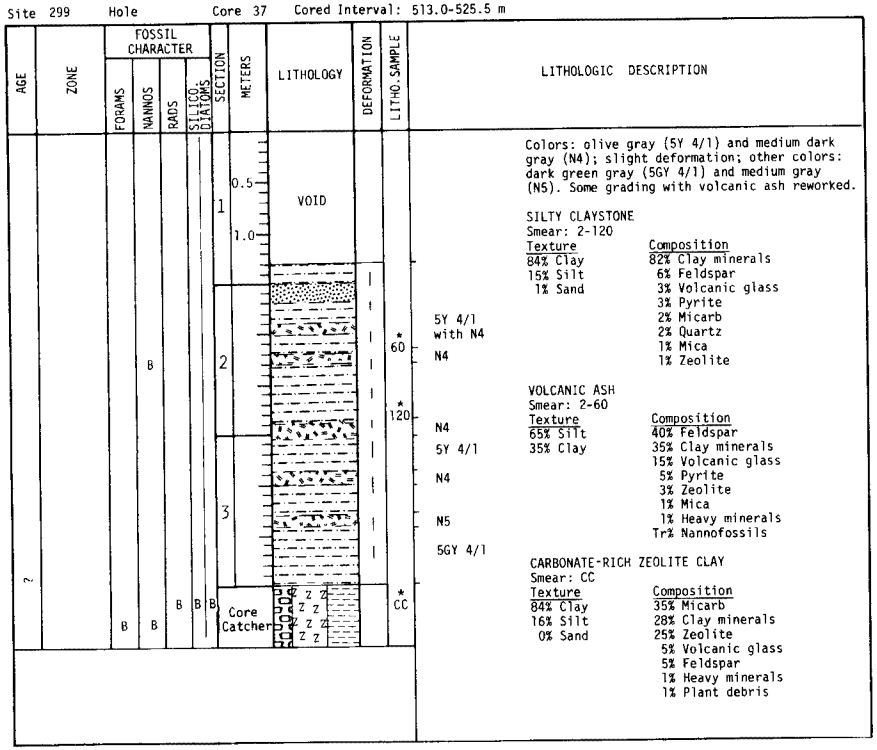
Explanatory notes in chapter 1

Site 299 Hole Core 36 Cored Interval: 494.0-503.5 m



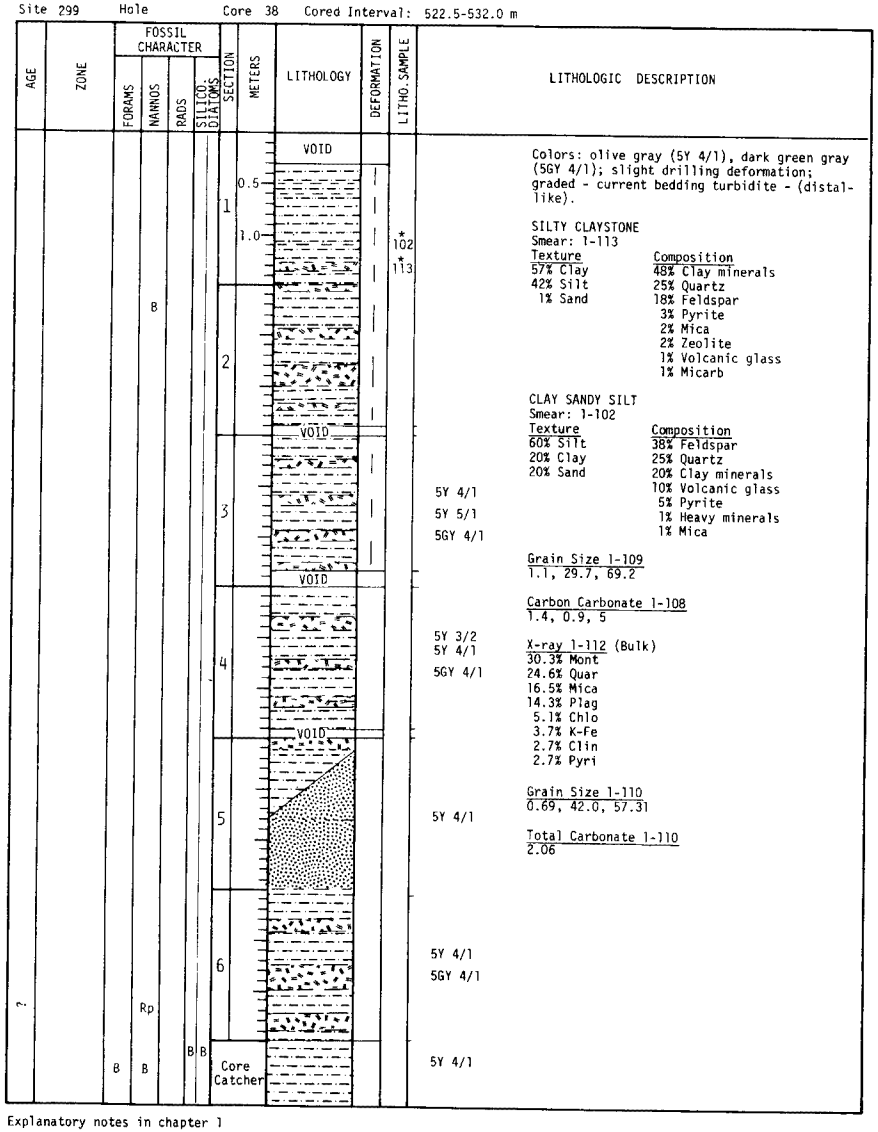
Explanatory notes in chapter 1

Site 299 Hole Core 37 Cored Interval: 513.0-525.5 m



Explanatory notes in chapter 1

Site 299 Hole Core 38 Cored Interval: 522.5-532.0 m



Explanatory notes in chapter 1

1417

DEEP SEA DRILLING PROJECT

LEG 31 SITE 300

SITE SUMMARY SHEET

POSITION: Latitude: 41°02.96'N Longitude: 136°06.30'E

Water depth (from sea level): 3427 corrected meters (Echo sounding)

Bottom felt at: 3426 meters (drill pipe) Penetration: 117 m

Number of Holes: 1 Number of Cores: 2

Total length of cored section: 10.5 m Total core recovered: trace

Percentage of core recovery: 0%

OLDEST SEDIMENT CORED:

Depth below sea floor: 117 meters Nature: Silty clay and sand

Age: late Pleistocene

PRINCIPAL RESULTS:

Site 300 was drilled in the east central Japan Abyssal Plain (or basin) adjacent to Yamato Rise. Encountered difficulty in spudding hole due to surface sand and gravel finally washing to 117 meters through sand to set drill collars. Pipe and core barrel badly stuck due to caving sand; site abandoned due to prospect of further caving, and unexpectedly thick sand section. Traces of sediment recovered indicate Pleistocene turbidites perhaps forming active suprafan of Toyama fan-channel system.

Site 300 Hole Core 1 Cored Interval: 0.0-1.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	SILICO. DIATOMS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
LATE PLEISTOCENE	Denticula seminae (D)	Cg	Rp	Fm	Fm Ag	Core Catcher				CC	5GY 4/1

Only a trace amount of material recovered in core catcher. Color - dark green gray (5GY 4/1). H_2S odor noticeable.

Silty clay matrix with silt, sand and pebbles. Pebbles up to 2 cm include: granite, pumice, black Mn crusts.

SILTY CLAY
Smear: CC

Texture	Composition
60% Clay	30% Feldspar
40% Silt	25% Clay minerals
	20% Quartz
	9% Sponge spicules
	6% Radiolarians
	5% Diatoms
	5% Pyrite
	1% Mica
	Tr% Heavy minerals

Heavy minerals include amphiboles.

Explanatory notes in chapter 1

Site 300 Hole Core 2 Cored Interval: 105.5-117.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	SILICO. DIATOMS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
LATE PLEISTOCENE	Denticula seminae (D)	Cm	Cg	Rm	Rm Ag	Core Catcher				CC	5GY 4/1

Trace of core catcher material and material in bit - hole abandoned.

DIATOM SILTY CLAY
Smear: Bit

Texture	Composition
70% Clay	40% Clay minerals
25% Silt	30% Diatoms
5% Sand	15% Feldspar
	5% Quartz
	3% Pyrite
	3% Radiolarians
	2% Heavy minerals
	2% Glauconite
	1% Sponge spicules
	Tr% Mica

SAND
Smear: CC

Texture	Composition
95% Sand	50% Quartz, feldspar
5% Silt	30% Lithic fragments
	10% Pyrite, opaques
	5% Heavy minerals
	3% Micarb
	2% Glauconite

SILTY CLAY
Smear: CC

Texture	Composition
63% Clay	49% Clay minerals
30% Silt	20% Feldspar
7% Sand	7% Pyrite, opaques
	5% Quartz
	5% Micronodules
	3% Diatoms
	3% Heavy minerals
	3% Mica
	2% Micarb
	1% Glauconite
	1% Sponge spicules
	1% Radiolarians
	Tr% Nannofossils

Explanatory notes in chapter 1

144

DEEP SEA DRILLING PROJECT

LEG 31 SITE 301

SITE SUMMARY SHEET

POSITION: Latitude: 41°03.75'N Longitude: 134°02.86'E

Water depth (from sea level): 3520 corrected meters (Echo sounding)

Bottom felt at: 3521 meters (drill pipe) Penetration: 497 m

Number of Holes: 1 Number of Cores: 20

Total length of cored section: 183.5 m Total core recovered: 49.9 m

Percentage of core recovery: 27.2%

OLDEST SEDIMENT CORED:

Depth below sea floor: 497 meters Nature: Clayey diatomite

Age: late Miocene

PRINCIPAL RESULTS:

Site 301 was drilled in the east central portion of the Japan Abyssal Plain in hopes of obtaining objectives originally planned for abandoned Site 300 drilled to the northeast. Stratigraphic section consists of 240.5 meters of Pleistocene distal turbidites, fine sands, silts, silty clays and clays underlain by 256 meters of Pliocene to late Miocene clayey diatomite and diatomaceous claystone with a few sand interbeds representing two of the later stages of filling of this basin. Unfortunately, the site had to be abandoned before completing objectives due to critically high ethane/methane ratio similar to that found at Site 299.

Site 301 Hole Core 1 Cored Interval: 0.0-3.0 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	SILICO. DIATOMS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						Core Catcher					Punch core - no recovery; very strong H_2S odor in barrel.

Explanatory notes in chapter 1

Site 301 Hole Core 2 Cored Interval: 117.0-126.5 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	SILICO. DIATOMS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
LATE PLEISTOCENE	Gephyrocapsa oceanica / Rhizosolenia curvirostris (D)	Cg	Fm	Fm Rm Fm Fm Rm Ag	Rm Ag	1 2 3 4 5 6 Core Catcher	0.5 1.0	VOID VOID VOID VOID		* 20 * 75 * 111 * 104 * 101 * CC	Unit 1. Colors: dominant olive gray (5Y 3/2), dark greenish gray (5GY 4/1), olive black (5Y 2/1), grayish olive green (5GY 3/2) and medium olive brown (5Y 4/4); bedding, irregular thicknesses; intense-moderate deformation; soupy, soft to firm; strong H_2S odor. 5Y 3/2 5GY 4/1 5GY 4/1 SILTY CLAY Smear: 3-75, CC Texture: 67% Clay, 30% Silt, 3% Sand Composition: 60% Clay minerals, 10% Feldspar, 10% Diatoms, 7% Micronodules, 6% Quartz, 4% Micarb, 3% Heavy minerals, 2% Mica, 2% Volcanic glass, 1% Sponge spicules, Tr% Radiolarians, Tr% Glauconite 5Y 2/1 GEOCHEM SAMPLE 5GY 3/2 SAND Smear: 3-20 Texture: 85% Sand, 15% Clay Composition: 30% Feldspar, 20% Quartz, 10% Clay minerals, 5% Heavy minerals, 5% Micronodules, 5% Micarb, 5% Diatoms, 3% Volcanic glass, 2% Mica, 1% Sponge spicules, 1% Radiolarians, 1% Foraminifera, 1% Glauconite 5Y 4/4 5Y 2/1 Volcanic Ash (Minor Lith) Smear: 4-111, 6-101 Clay and Foram-Rich Diatom Ooze (Minor Lith) Smear: 5-104 Grain Size 3-19: 85.0, 0.0, 15.0 X-ray 3-74 (Bulk): 36.0% Quar, 24.8% Mica, 19.7% Plag, 6.0% K-Fe, 5.9% Pyri, 3.9% Chlo, 2.0% Calc, 1.9% Mont Carbon Carbonate 3-76: 1.8, 1.2, 4 5Y 4/4 5Y 3/2 Carbon Carbonate 5-103: 3.4, 1.7, 14 5Y 3/2 5G 4/1 with 5Y 3/2 5Y 3/2

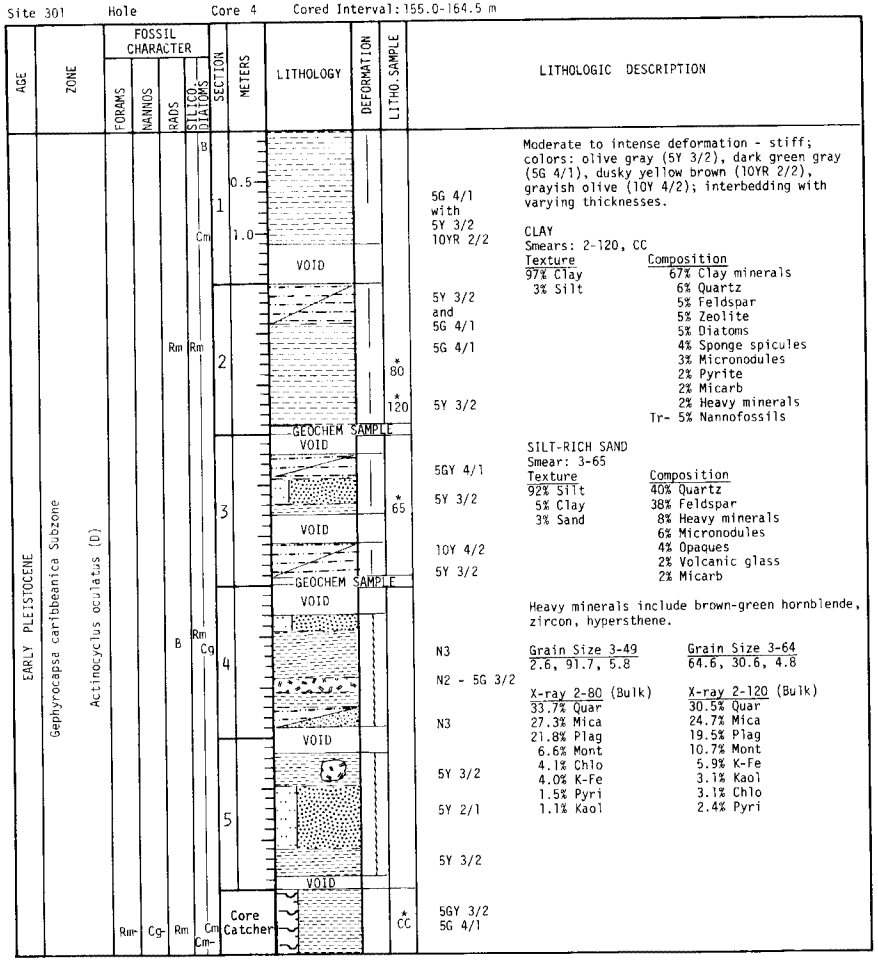
Explanatory notes in chapter 1

Site 301 Hole Core 3 Cored Interval: 136.0-145.5 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	SILICO. DIATOMS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
EARLY PLEISTOCENE	Actinocyclus oculatus (D)	B		B Ag Cm B Fm Cm Ag Cm		1 2 Core Catcher	0.5 1.0	VOID VOID VOID VOID		* 90	Colors: olive gray (5Y 3/2), olive black (5Y 2/1), light gray (N7), dark greenish gray (5G 4/1); moderate drilling deformation; firm. 5Y 3/2 and 5Y 2/1 SILT Smear: 1-90 Texture: 76% Silt, 21% Clay, 3% Sand Composition: 58% Quartz, 20% Feldspar, 7% Heavy minerals, 5% Mica, 5% Opaques, 3% Micarb, 3% Diatoms, 1% Volcanic glass, 1% Radiolarians, Tr% Foraminifera 5GY 3/2 5Y 3/2 5G 4/1 5Y 3/2 SILTY CLAY VOLCANIC ASH (Minor Lith) 5Y 3/2 Grain Size 1-90: 2.9, 75.8, 21.3

Explanatory notes in chapter 1

Site 301 Hole Core 4 Cored Interval: 155.0-164.5 m



LITHOLOGIC DESCRIPTION

Moderate to intense deformation - stiff; colors: olive gray (5Y 3/2), dark green gray (5G 4/1), dusky yellow brown (10YR 2/2), grayish olive (10Y 4/2); interbedding with varying thicknesses.

CLAY
Smears: 2-120, CC

Texture	Composition
97% Clay	67% Clay minerals
3% Silt	6% Quartz
	5% Feldspar
	5% Zeolite
	5% Diatoms
	4% Sponge spicules
	3% Micronodules
	2% Pyrite
	2% Micarb
	2% Heavy minerals
	Tr- 5% Nannofossils

SILT-RICH SAND
Smear: 3-65

Texture	Composition
92% Silt	40% Quartz
5% Clay	38% Feldspar
3% Sand	8% Heavy minerals
	6% Micronodules
	4% Opaques
	2% Volcanic glass
	2% Micarb

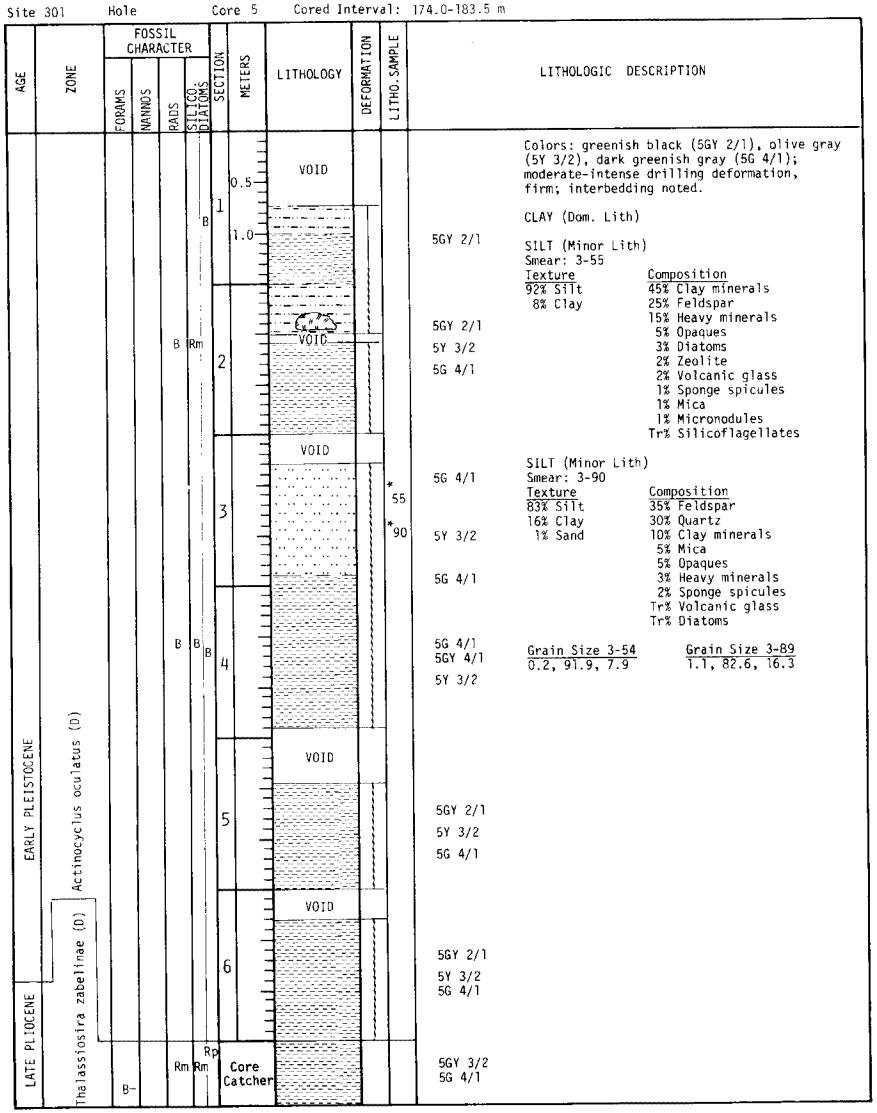
Heavy minerals include brown-green hornblende, zircon, hypersthene.

Grain Size 3-49	Grain Size 3-64
2.6, 91.7, 5.8	64.6, 30.6, 4.8

X-ray 2-80 (Bulk)	X-ray 2-120 (Bulk)
33.7% Quar	30.5% Quar
27.3% Mica	24.7% Mica
21.8% Plag	19.5% Plag
6.6% Mont	10.7% Mont
4.1% Chlo	5.9% K-Fe
4.0% K-Fe	3.1% Kaol
1.5% Pyri	3.1% Chlo
1.1% Kaol	2.4% Pyri

Explanatory notes in chapter 1

Site 301 Hole Core 5 Cored Interval: 174.0-183.5 m



Colors: greenish black (5GY 2/1), olive gray (5Y 3/2), dark greenish gray (5G 4/1); moderate-intense drilling deformation, firm; interbedding noted.

CLAY (Dom. Lith)

SILT (Minor Lith)
Smear: 3-55

Texture	Composition
92% Silt	45% Clay minerals
8% Clay	25% Feldspar
	15% Heavy minerals
	5% Opaques
	3% Diatoms
	2% Zeolite
	2% Volcanic glass
	1% Sponge spicules
	1% Mica
	1% Micronodules
	Tr% Silicoflagellates

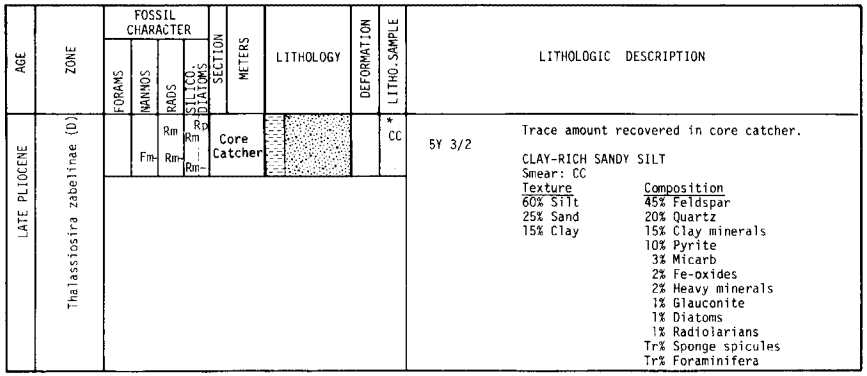
SILT (Minor Lith)
Smear: 3-90

Texture	Composition
83% Silt	35% Feldspar
16% Clay	30% Quartz
1% Sand	10% Clay minerals
	5% Mica
	5% Opaques
	3% Heavy minerals
	2% Sponge spicules
	Tr% Volcanic glass
	Tr% Diatoms

Grain Size 3-54	Grain Size 3-89
0.2, 91.9, 7.9	1.1, 82.6, 16.3

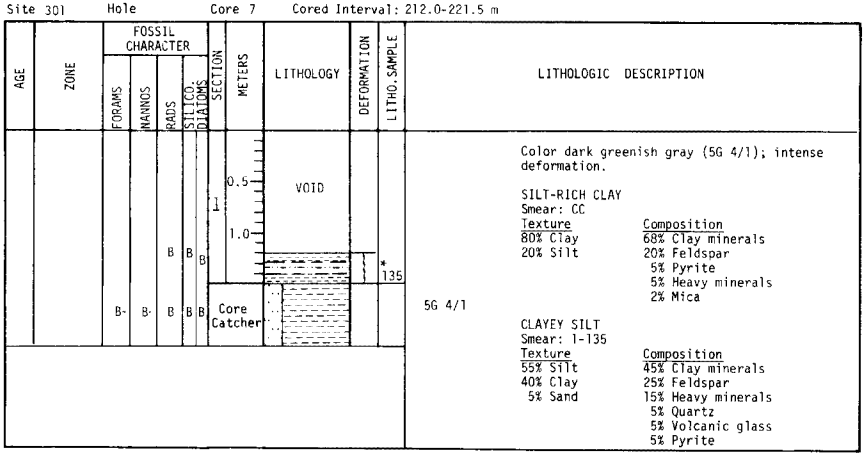
Explanatory notes in chapter 1

Site 301 Hole Core 6 Cored Interval: 193.0-202.5 m



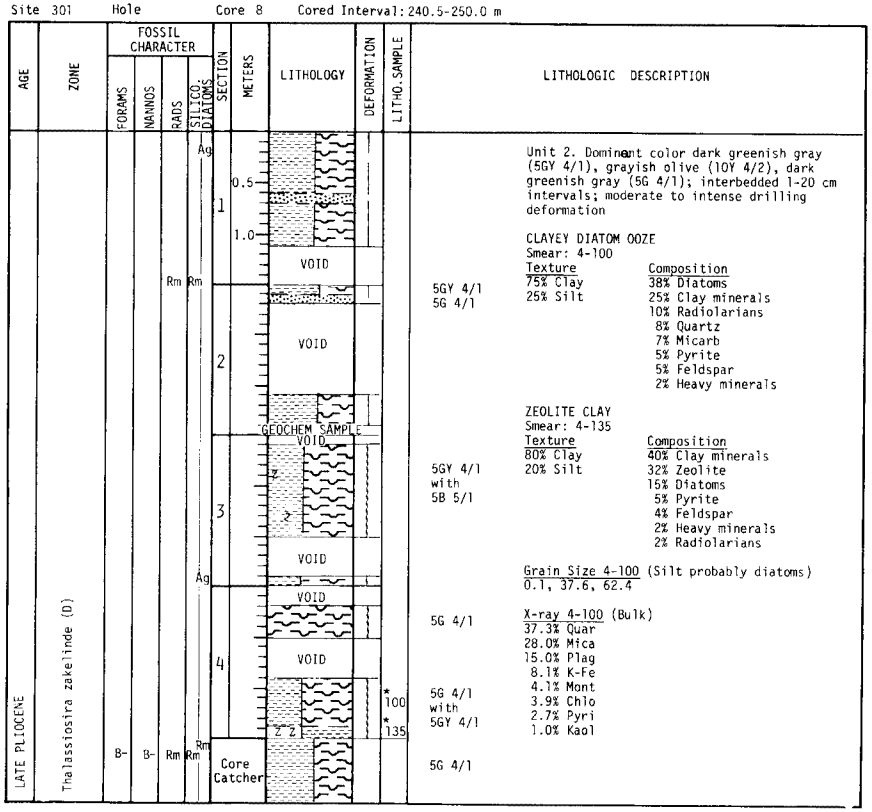
Explanatory notes in chapter 1

Site 301 Hole Core 7 Cored Interval: 212.0-221.5 m



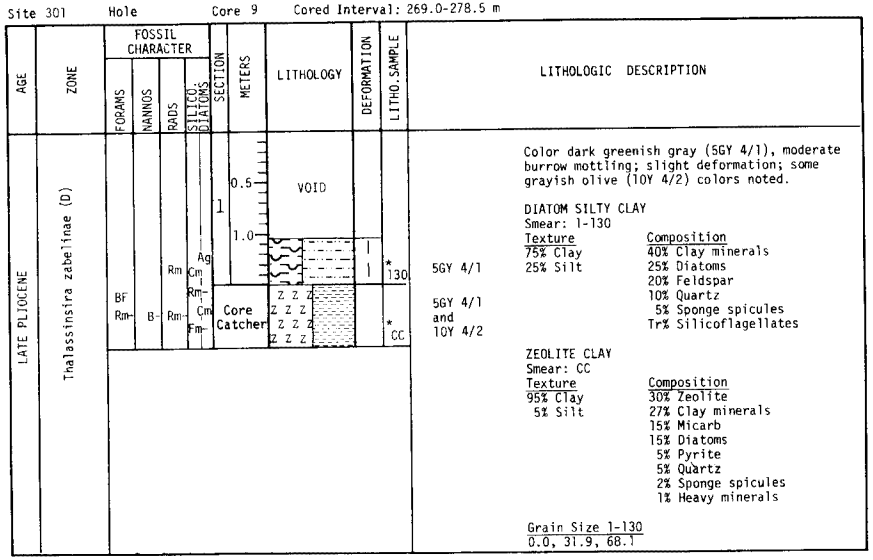
Explanatory notes in chapter 1

Site 301 Hole Core 8 Cored Interval: 240.5-250.0 m



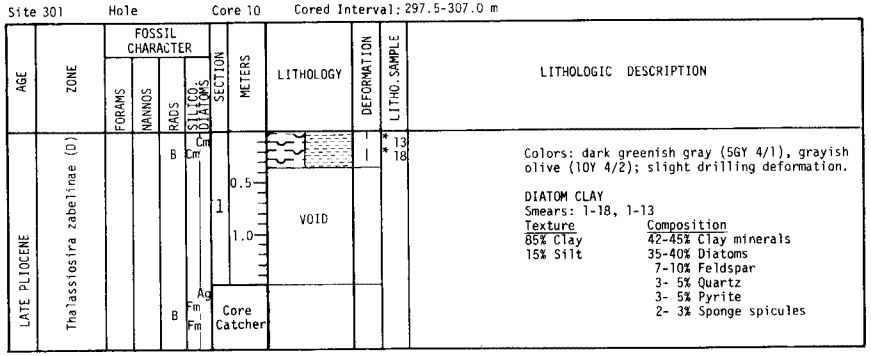
Explanatory notes in chapter 1

Site 301 Hole Core 9 Cored Interval: 269.0-278.5 m



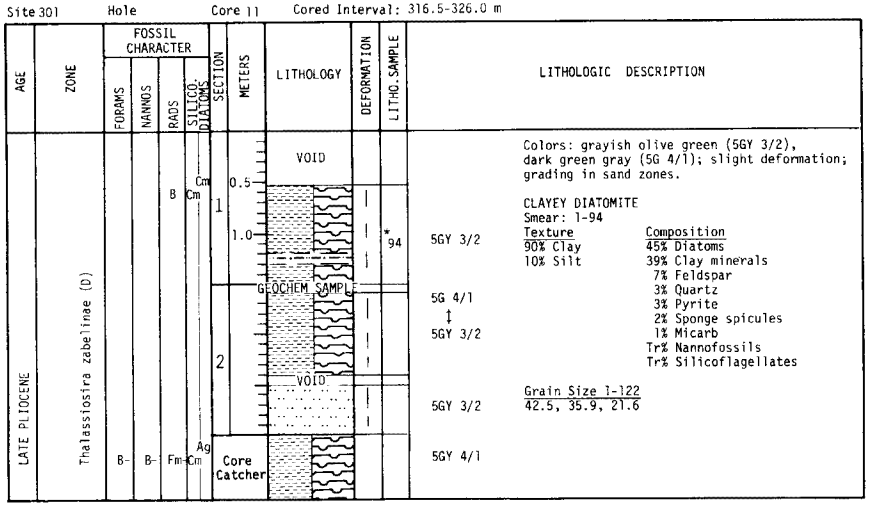
Explanatory notes in chapter 1

Site 301 Hole Core 10 Cored Interval: 297.5-307.0 m



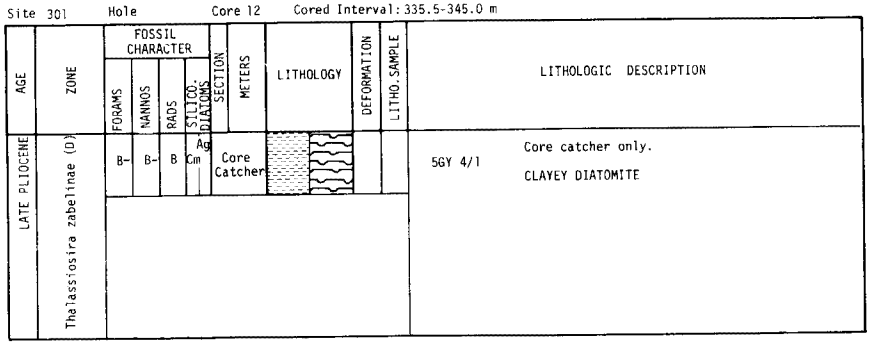
Explanatory notes in chapter 1

Site 301 Hole Core 11 Cored Interval: 316.5-326.0 m



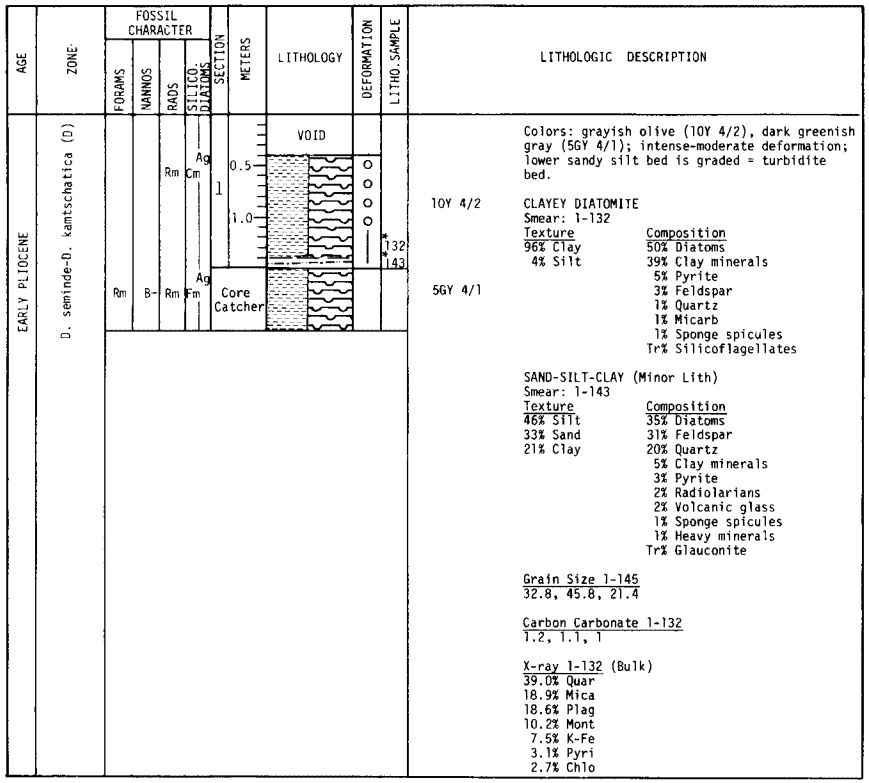
Explanatory notes in chapter 1

Site 301 Hole Core 12 Cored Interval: 335.5-345.0 m



Explanatory notes in chapter 1

Site 301 Hole Core 13 Cored Interval: 354.5-364.0 m



LITHOLOGIC DESCRIPTION

Colors: grayish olive (10Y 4/2), dark greenish gray (5GY 4/1); intense-moderate deformation; lower sandy silt bed is graded = turbidite bed.

CLAYEY DIATOMITE
Smear: 1-132

Texture	Composition
96% Clay	50% Diatoms
4% Silt	39% Clay minerals
	5% Pyrite
	3% Feldspar
	1% Quartz
	1% Micarb
	1% Sponge spicules
	Tr% Silicoflagellates

SAND-SILT-CLAY (Minor Lith)
Smear: 1-143

Texture	Composition
46% Silt	35% Diatoms
33% Sand	31% Feldspar
21% Clay	20% Quartz
	5% Clay minerals
	3% Pyrite
	2% Radiolarians
	2% Volcanic glass
	1% Sponge spicules
	1% Heavy minerals
	Tr% Glauconite

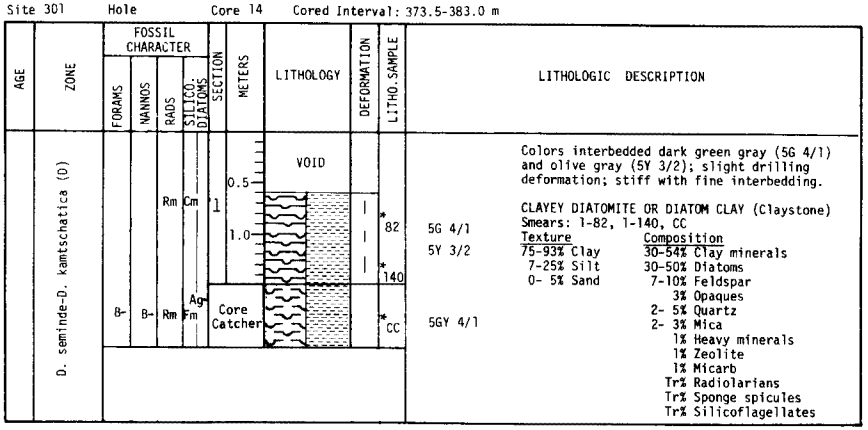
Grain Size 1-145
32.8, 45.8, 21.4

Carbon Carbonate 1-132
1.2, 1.1, 1

X-ray 1-132 (Bulk)
39.0% Quar
18.9% Mica
18.6% Plag
10.2% Mont
7.5% K-Fe
3.1% Pyri
2.7% Chlo

Explanatory notes in chapter 1

Site 301 Hole Core 14 Cored Interval: 373.5-383.0 m



LITHOLOGIC DESCRIPTION

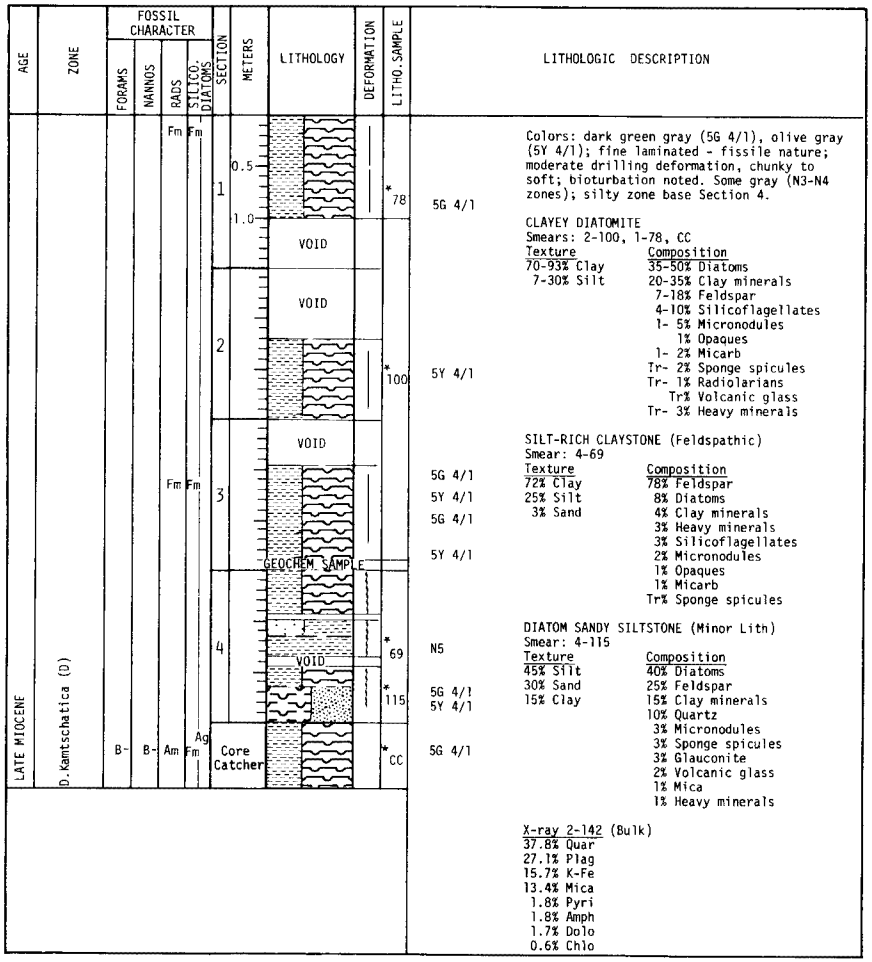
Colors interbedded dark green gray (5G 4/1) and olive gray (5Y 3/2); slight drilling deformation; stiff with fine interbedding.

CLAYEY DIATOMITE OR DIATOM CLAY (Claystone)
Smears: 1-82, 1-140, CC

Texture	Composition
75-93% Clay	30-54% Clay minerals
7-25% Silt	30-50% Diatoms
0- 5% Sand	7-10% Feldspar
	3% Opaques
	2- 5% Quartz
	2- 3% Mica
	1% Heavy minerals
	1% Zeolite
	1% Micarb
	Tr% Radiolarians
	Tr% Sponge spicules
	Tr% Silicoflagellates

Explanatory notes in chapter 1

Site 301 Hole Core 15 Cored Interval: 392.5-402.0 m



LITHOLOGIC DESCRIPTION

Colors: dark green gray (5G 4/1), olive gray (5Y 4/1); fine laminated - fissile nature; moderate drilling deformation, chunky to soft; bioturbation noted. Some gray (N3-N4 zones); silty zone base Section 4.

CLAYEY DIATOMITE
Smears: 2-100, 1-78, CC

Texture	Composition
70-93% Clay	35-50% Diatoms
7-30% Silt	20-35% Clay minerals
	7-18% Feldspar
	4-10% Silicoflagellates
	1- 5% Micronodules
	1% Opaques
	1- 2% Micarb
	Tr- 2% Sponge spicules
	Tr- 1% Radiolarians
	Tr% Volcanic glass
	Tr- 3% Heavy minerals

SILT-RICH CLAYSTONE (Feldspathic)
Smear: 4-69

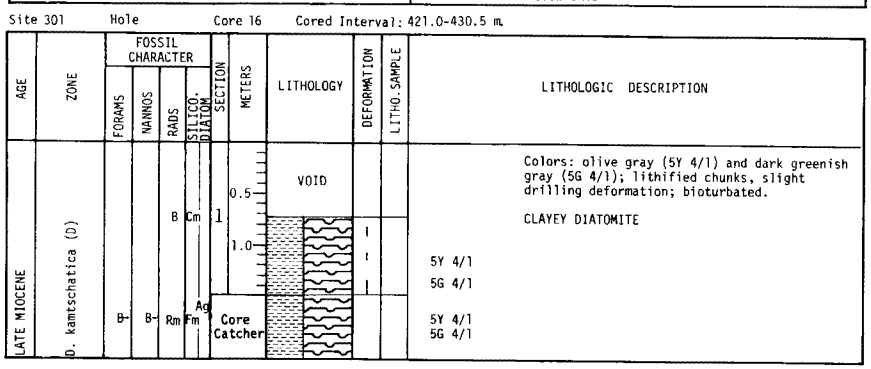
Texture	Composition
72% Clay	78% Feldspar
25% Silt	8% Diatoms
3% Sand	4% Clay minerals
	3% Heavy minerals
	3% Silicoflagellates
	2% Micronodules
	1% Opaques
	1% Micarb
	Tr% Sponge spicules

DIATOM SANDY SILTSTONE (Minor Lith)
Smear: 4-115

Texture	Composition
45% Silt	40% Diatoms
30% Sand	25% Feldspar
15% Clay	15% Clay minerals
	10% Quartz
	3% Micronodules
	3% Sponge spicules
	3% Glauconite
	2% Volcanic glass
	1% Mica
	1% Heavy minerals

X-ray 2-142 (Bulk)
37.8% Quar
27.1% Plag
15.7% K-Fe
13.4% Mica
1.8% Pyri
1.8% Amph
1.7% Dolo
0.6% Chlo

Site 301 Hole Core 16 Cored Interval: 421.0-430.5 m



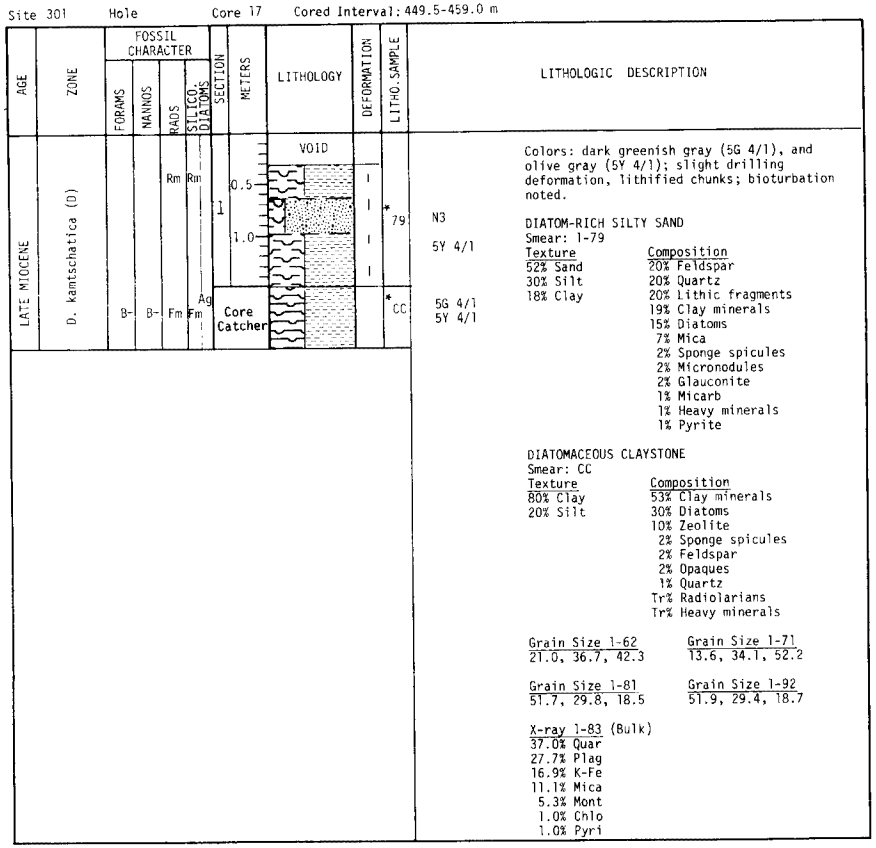
LITHOLOGIC DESCRIPTION

Colors: olive gray (5Y 4/1) and dark greenish gray (5G 4/1); lithified chunks, slight drilling deformation; bioturbated.

CLAYEY DIATOMITE

Explanatory notes in chapter 1

Site 301 Hole Core 17 Cored Interval: 449.5-459.0 m



LITHOLOGIC DESCRIPTION

Colors: dark greenish gray (5G 4/1), and olive gray (5Y 4/1); slight drilling deformation, lithified chunks; bioturbation noted.

N3
5Y 4/1
5G 4/1
5Y 4/1

DIATOM-RICH SILTY SAND
Smear: 1-79

Texture	Composition
52% Sand	20% Feldspar
30% Silt	20% Quartz
18% Clay	20% Lithic fragments
	19% Clay minerals
	15% Diatoms
	7% Mica
	2% Sponge spicules
	2% Micronodules
	2% Glauconite
	1% Micarb
	1% Heavy minerals
	1% Pyrite

DIATOMACEOUS CLAYSTONE
Smear: CC

Texture	Composition
80% Clay	53% Clay minerals
20% Silt	30% Diatoms
	10% Zeolite
	2% Sponge spicules
	2% Feldspar
	2% Opaques
	1% Quartz
	Tr% Radiolarians
	Tr% Heavy minerals

Grain Size 1-62
21.0, 36.7, 42.3

Grain Size 1-71
13.6, 34.1, 52.2

Grain Size 1-81
51.7, 29.8, 18.5

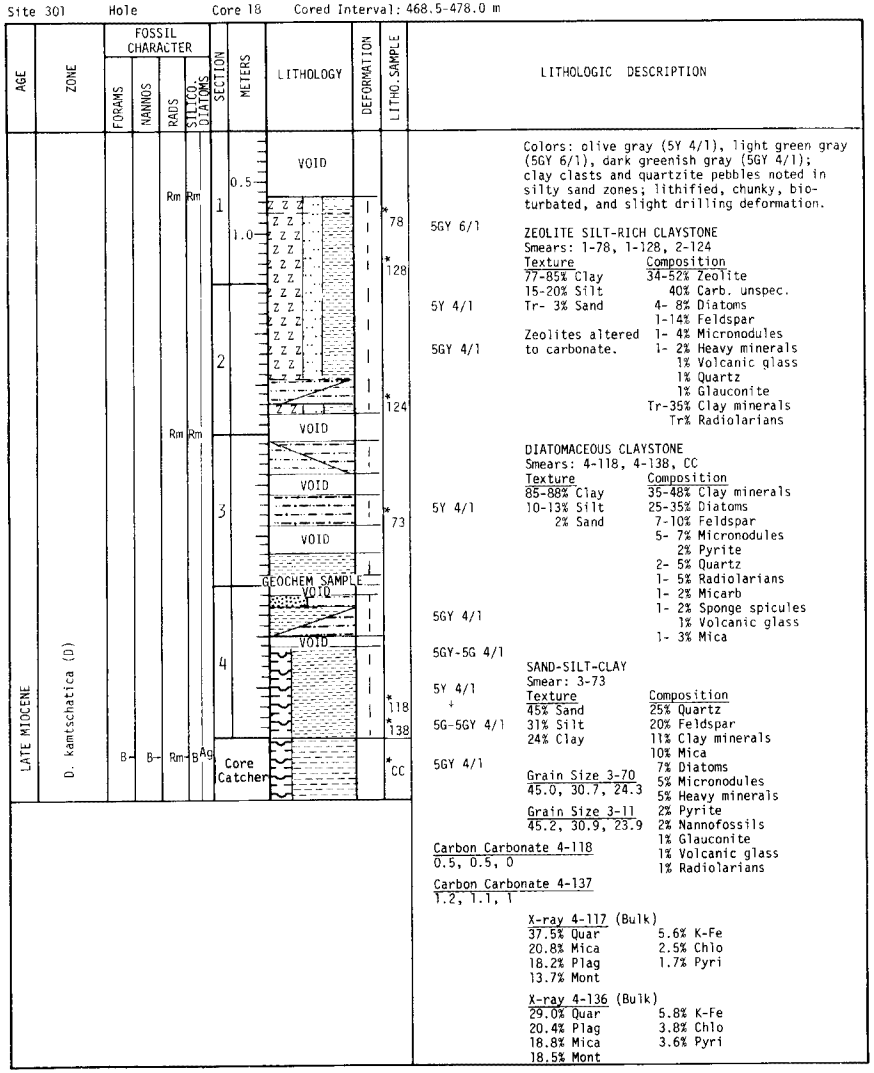
Grain Size 1-92
51.9, 29.4, 18.7

X-ray 1-83 (Bulk)

37.0% Quar	
27.7% Plag	
16.9% K-Fe	
11.1% Mica	
5.3% Mont	
1.0% Chlo	
1.0% Pyri	

Explanatory notes in chapter 1

Site 301 Hole Core 18 Cored Interval: 468.5-478.0 m



LITHOLOGIC DESCRIPTION

Colors: olive gray (5Y 4/1), light green gray (5GY 6/1), dark greenish gray (5GY 4/1); clay clasts and quartzite pebbles noted in silty sand zones; lithified, chunky, bioturbated, and slight drilling deformation.

5GY 6/1
5Y 4/1
5GY 4/1

ZEOLITE SILT-RICH CLAYSTONE
Smears: 1-78, 1-128, 2-124

Texture	Composition
77-85% Clay	34-52% Zeolite
15-20% Silt	40% Carb. unspec.
Tr- 3% Sand	4- 8% Diatoms
	1-14% Feldspar
Zeolites altered	1- 4% Micronodules
to carbonate.	1- 2% Heavy minerals
	1% Volcanic glass
	1% Quartz
	1% Glauconite
	Tr-35% Clay minerals
	Tr% Radiolarians

5Y 4/1
5GY 4/1
5GY-5G 4/1
5Y 4/1
↓
5G-5GY 4/1
5GY 4/1

DIATOMACEOUS CLAYSTONE
Smears: 4-118, 4-138, CC

Texture	Composition
85-88% Clay	35-48% Clay minerals
10-13% Silt	25-35% Diatoms
2% Sand	7-10% Feldspar
	5- 7% Micronodules
	2% Pyrite
	2- 5% Quartz
	1- 5% Radiolarians
	1- 2% Micarb
	1- 2% Sponge spicules
	1% Volcanic glass
	1- 3% Mica

SAND-SILT-CLAY
Smear: 3-73

Texture	Composition
45% Sand	25% Quartz
31% Silt	20% Feldspar
24% Clay	11% Clay minerals
	10% Mica
	7% Diatoms
	5% Micronodules
	5% Heavy minerals
	2% Pyrite
	2% Nannofossils
	1% Glauconite
	1% Volcanic glass
	1% Radiolarians

Grain Size 3-70
45.0, 30.7, 24.3

Grain Size 3-11
45.2, 30.9, 23.9

Carbon Carbonate 4-118
0.5, 0.5, 0

Carbon Carbonate 4-137
1.2, 1.1, 1

X-ray 4-117 (Bulk)

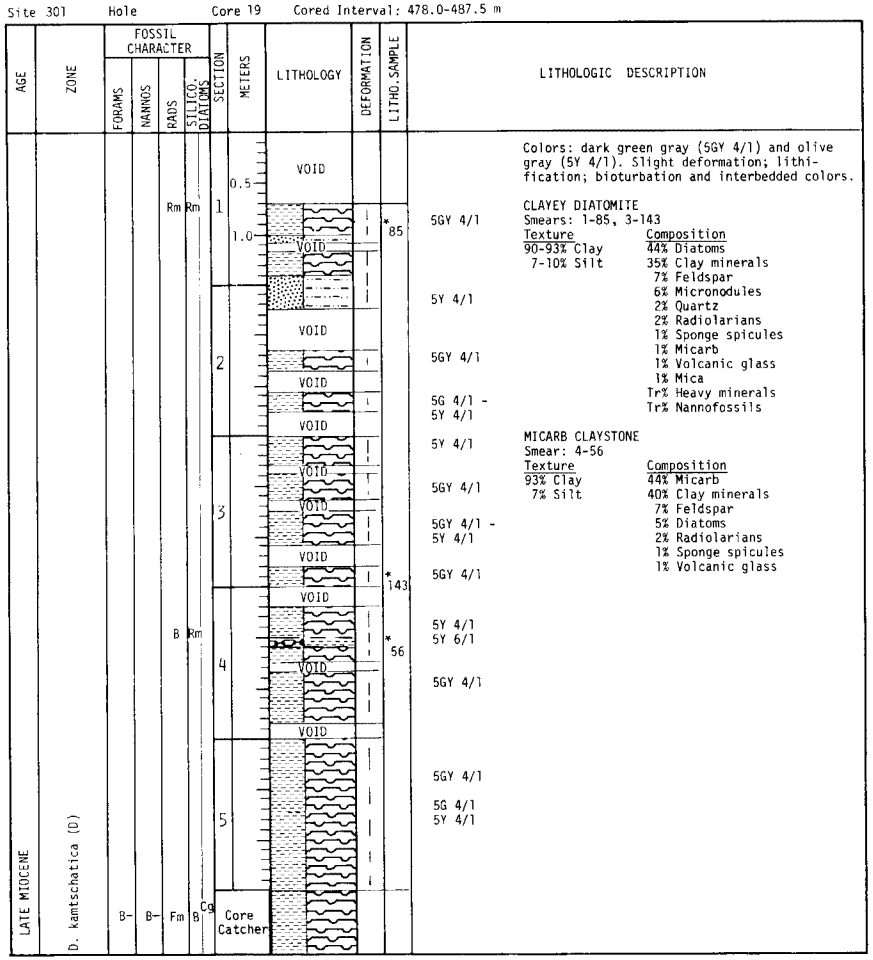
37.5% Quar	5.6% K-Fe
20.8% Mica	2.5% Chlo
18.2% Plag	1.7% Pyri
13.7% Mont	

X-ray 4-136 (Bulk)

29.0% Quar	5.8% K-Fe
20.4% Plag	3.8% Chlo
18.8% Mica	3.6% Pyri
18.5% Mont	

Explanatory notes in chapter 1

Site 301 Hole Core 19 Cored Interval: 478.0-487.5 m



Colors: dark green gray (5GY 4/1) and olive gray (5Y 4/1). Slight deformation; lithification; bioturbation and interbedded colors.

CLAYEY DIATOMITE
Smears: 1-85, 3-143

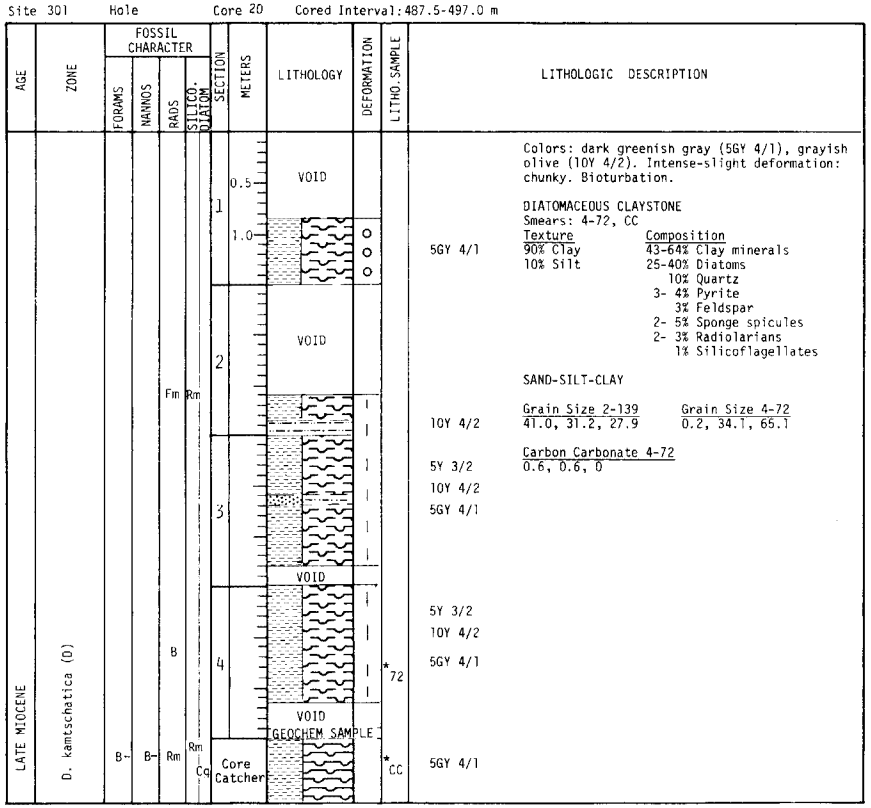
Texture	Composition
90-93% Clay	44% Diatoms
7-10% Silt	35% Clay minerals
	7% Feldspar
	6% Micronodules
	2% Quartz
	2% Radiolarians
	1% Sponge spicules
	1% Micarb
	1% Volcanic glass
	1% Mica
	Tr% Heavy minerals
	Tr% Nannofossils

MICARB CLAYSTONE
Smear: 4-56

Texture	Composition
93% Clay	44% Micarb
7% Silt	40% Clay minerals
	7% Feldspar
	5% Diatoms
	2% Radiolarians
	1% Sponge spicules
	1% Volcanic glass

Explanatory notes in chapter 1

Site 301 Hole Core 20 Cored Interval: 487.5-497.0 m



Colors: dark greenish gray (5GY 4/1), grayish olive (10Y 4/2). Intense-slight deformation: chunky. Bioturbation.

DIATOMACEOUS CLAYSTONE
Smears: 4-72, CC

Texture	Composition
90% Clay	43-64% Clay minerals
10% Silt	25-40% Diatoms
	10% Quartz
	3- 4% Pyrite
	3% Feldspar
	2- 5% Sponge spicules
	2- 3% Radiolarians
	1% Silicoflagellates

SAND-SILT-CLAY

Grain Size 2-139	Grain Size 4-72
41.0, 31.2, 27.9	0.2, 34.1, 65.1

Carbon Carbonate 4-72
0.6, 0.6, 0

Explanatory notes in chapter 1

18

DEEP SEA DRILLING PROJECT

LEG 31 SITE 302

SITE SUMMARY SHEET

POSITION: Latitude: 40°20.13'N Longitude: 136°54.01'E

Water depth (from sea level): 2399 corrected meters (Echo sounding)

Bottom felt at: 2414.5 meters (drill pipe) Penetration: 531.5 m

Number of Holes: 1 Number of Cores: 18

Total length of cored section: 164.5 m Total core recovered: 91 m

Percentage of core recovery: 55.3%

OLDEST SEDIMENT CORED:

Depth below sea floor: 531.5 meters Nature: Silty sand and green tuff

Age: late Miocene

PRINCIPAL RESULTS:

Site 302 was drilled on the northern end of Yamato Rise in the central part of the Sea of Japan. The stratigraphic section recovered consists of about 28.5 meters of Pleistocene clayey diatom ooze and ash, 38(?) meters of Pleistocene zeolitic clay and micarb, 281.5 meters of late Pliocene-late Miocene diatomaceous ooze, 177 meters of Miocene zeolitic clay, and 2 meters of early Miocene(?)-unfossiliferous silty volcanic sand and green tuff. Diatom zonation indicates all of the late Pliocene is absent from this sequence and a major unconformity is tenatively placed at the base of Core 5 (76 meters). Due to medical emergency had to rapidly drill to acoustic basement with only three cores pulled below 275 meters. Upper half of column represents good siliceous biostratigraphic reference section with dominantly boreal biofacies. Oligocene nannofossils, and green tuffs at base of hole tend to support mid-Tertiary opening of sea.

Site 302 Hole Core 1 Cored Interval: 0.0-9.5 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	SILICO. DIATOMS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
LATE PLEISTOCENE	G. pachyderma-G. umbilicata (F) Gephyrocapsa oceanica Rhizosolenia curvirostris (D)	Cg	Rm	Cm	Fm	Core Catcher				CC	5GY 4/1

Unit 1. Trace amount recovered in core catcher, dark greenish gray (5GY 4/1).

DIATOM-RICH SILTY CLAY
Smear: CC

Texture	Composition
60% Clay	30% Clay minerals
40% Silt	20% Diatoms
	15% Feldspar
	12% Quartz
	7% Sponge spicules
	5% Pyrite
	5% Micarb
	3% Foraminifera
	3% Silicoflagellates
	Tr% Volcanic glass

Explanatory notes in chapter 1

Site 302 Hole Core 2 Cored Interval: 19.0-28.5 m

AGE	ZONE	FOSSIL CHARACTER: FORAMS	NANNOS	RADS	SILICO. DIATOMS	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
LATE PLEISTOCENE	G. pachyderma-G. umbilicata (F) Rhizosolenia curvirostris (D)	Cg	Rm	Ag	ug	Core Catcher				CC *	5GY 4/1

VOID

GEOCHEM SAMPLE

Colors: greenish gray (5GY 4/1) and greenish black (5GY 4/1); deformation-drilling breccia to intense deformation; some pumice fragments and mudstone erratics.

DIATOM-RICH SILTY CLAY

5GY 4/1 ↓ 5GY 2/1

CLAYEY DIATOMACEOUS OOZE (Minor Lith)
Smear: CC

Texture	Composition
80% Clay	40% Diatoms
20% Silt	35% Clay minerals
	10% Sponge spicules
	7% Feldspar
	3% Quartz
	3% Pyrite
	2% Micarb

MICARB OOZE (Minor Lith)
Smear: 2-90

Texture	Composition
80% Clay	40% Micarb
20% Silt	30% Clay minerals
	10% Feldspar
	10% Diatoms
	5% Pyrite
	3% Heavy minerals
	2% Radiolarians

Grain Size 5-130
4.6, 38.2, 57.2

Carbon Carbonate 5-130
1.3, 0.7, 6

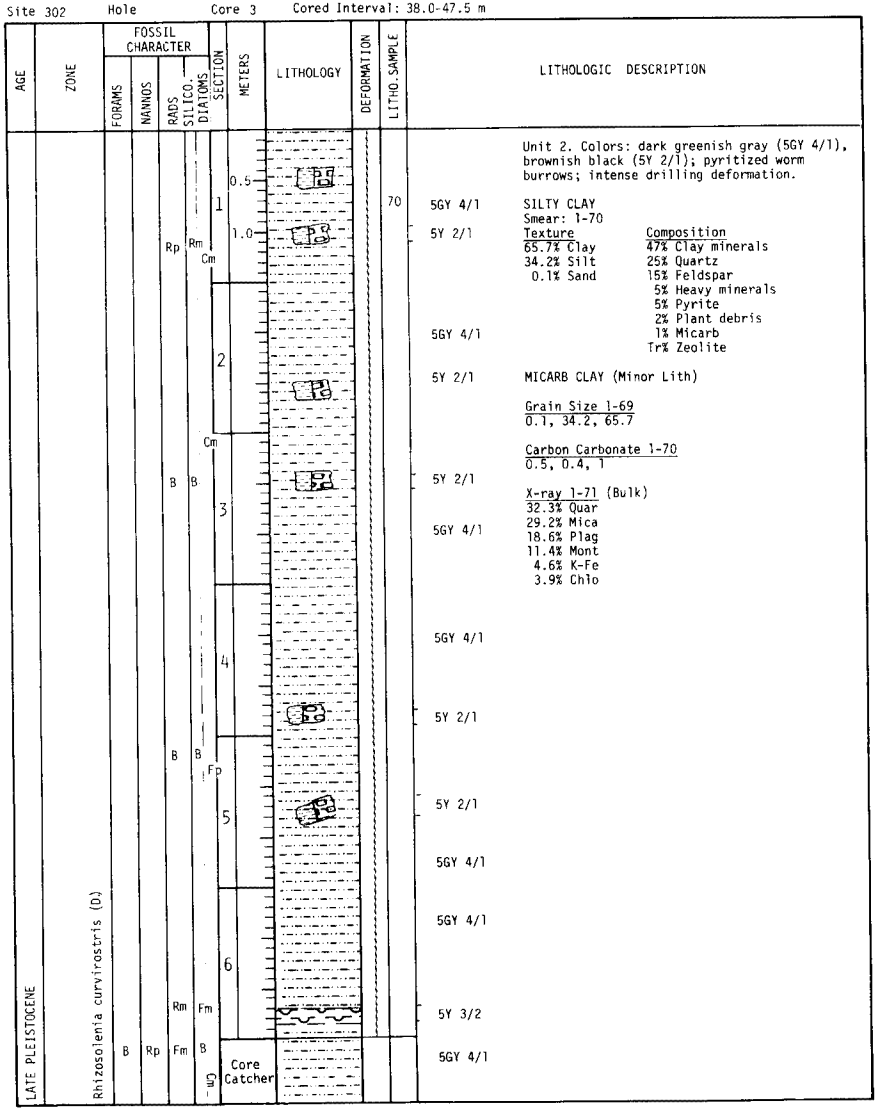
5GY 4/1 ↓ 5GY 2/1

X-ray 5-130 (Bulk)
41.2% Quar
28.7% Mica
18.8% Plag
4.0% Chlo
3.2% Mont
2.9% Calc
1.1% Pyri

5GY 4/1
5GY 2/1
5Y 4/4
5GY 4/1

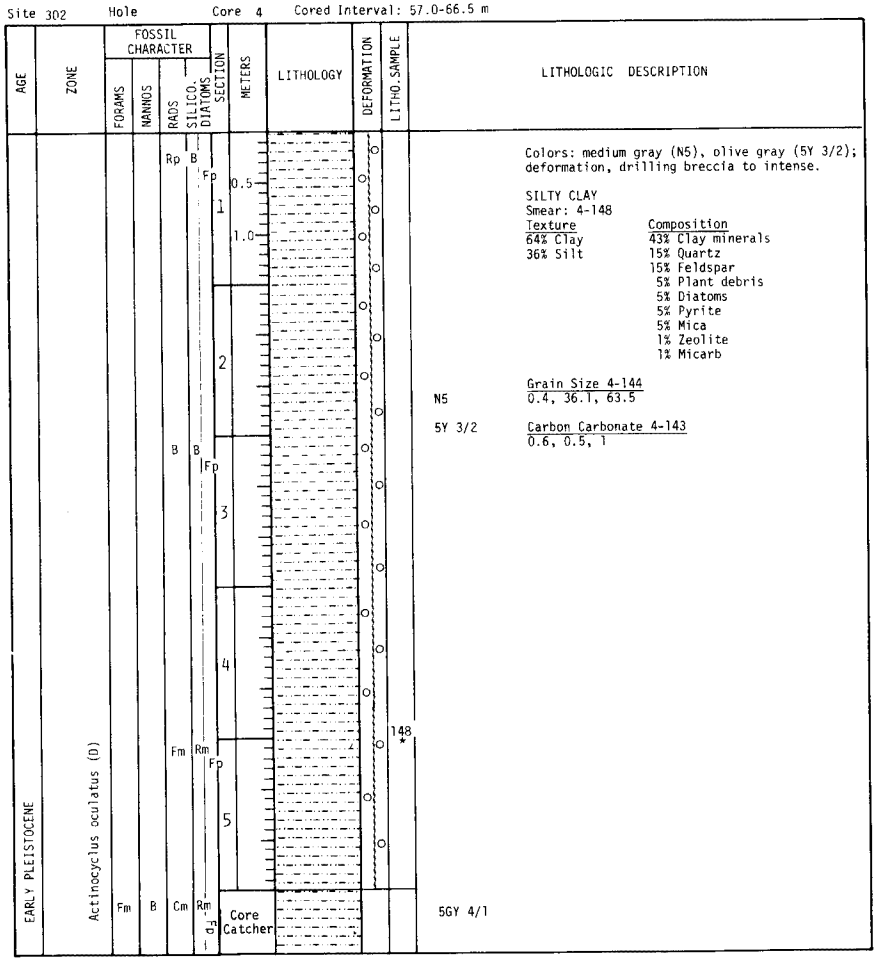
Explanatory notes in chapter 1

Site 302 Hole Core 3 Cored Interval: 38.0-47.5 m



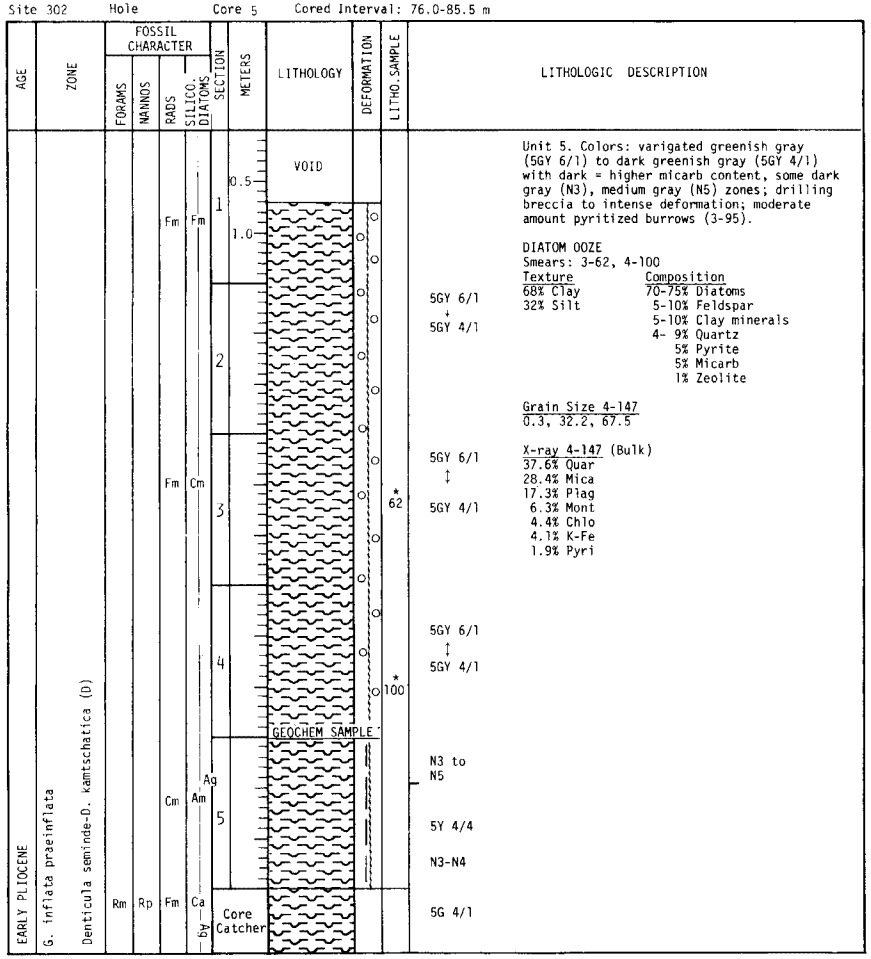
Explanatory notes in chapter 1

Site 302 Hole Core 4 Cored Interval: 57.0-66.5 m



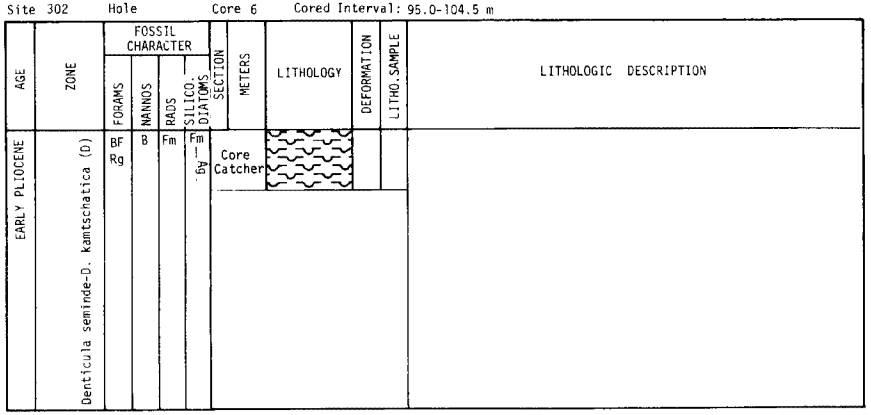
Explanatory notes in chapter 1

Site 302 Hole Core 5 Cored Interval: 76.0-85.5 m



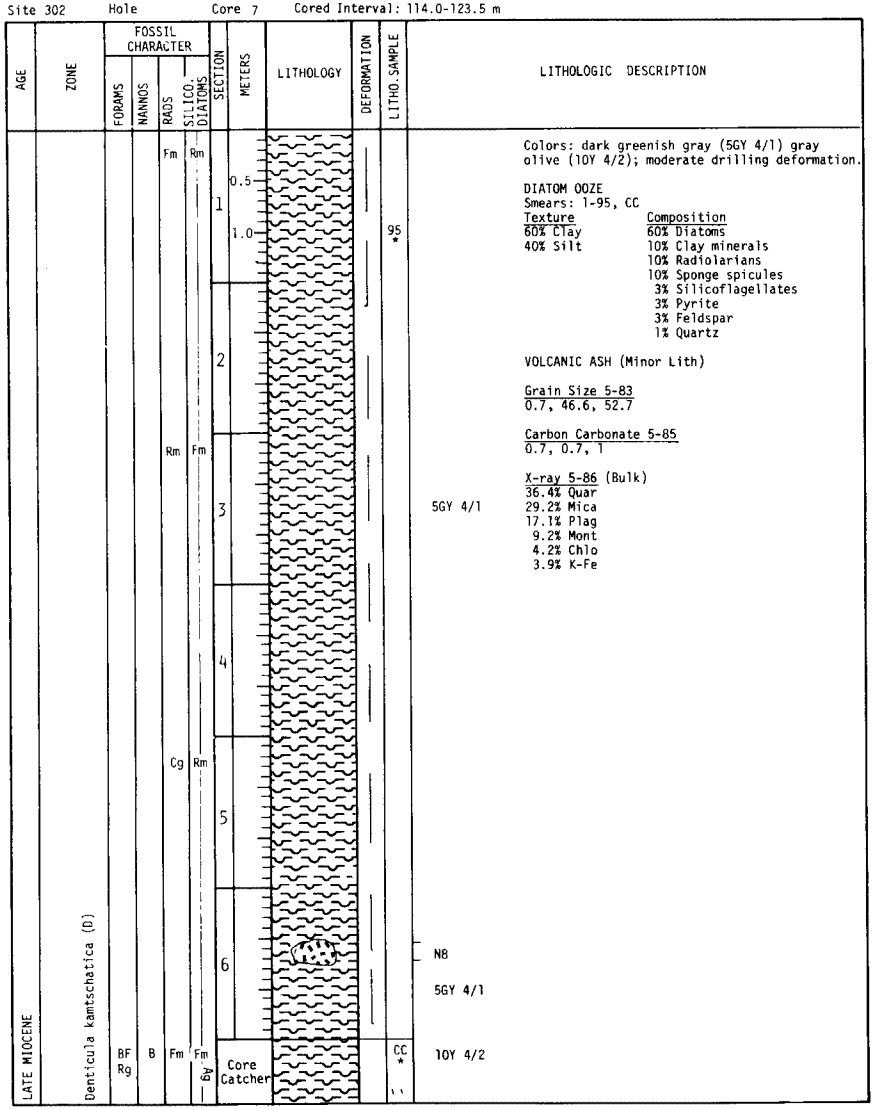
Explanatory notes in chapter 1

Site 302 Hole Core 6 Cored Interval: 95.0-104.5 m



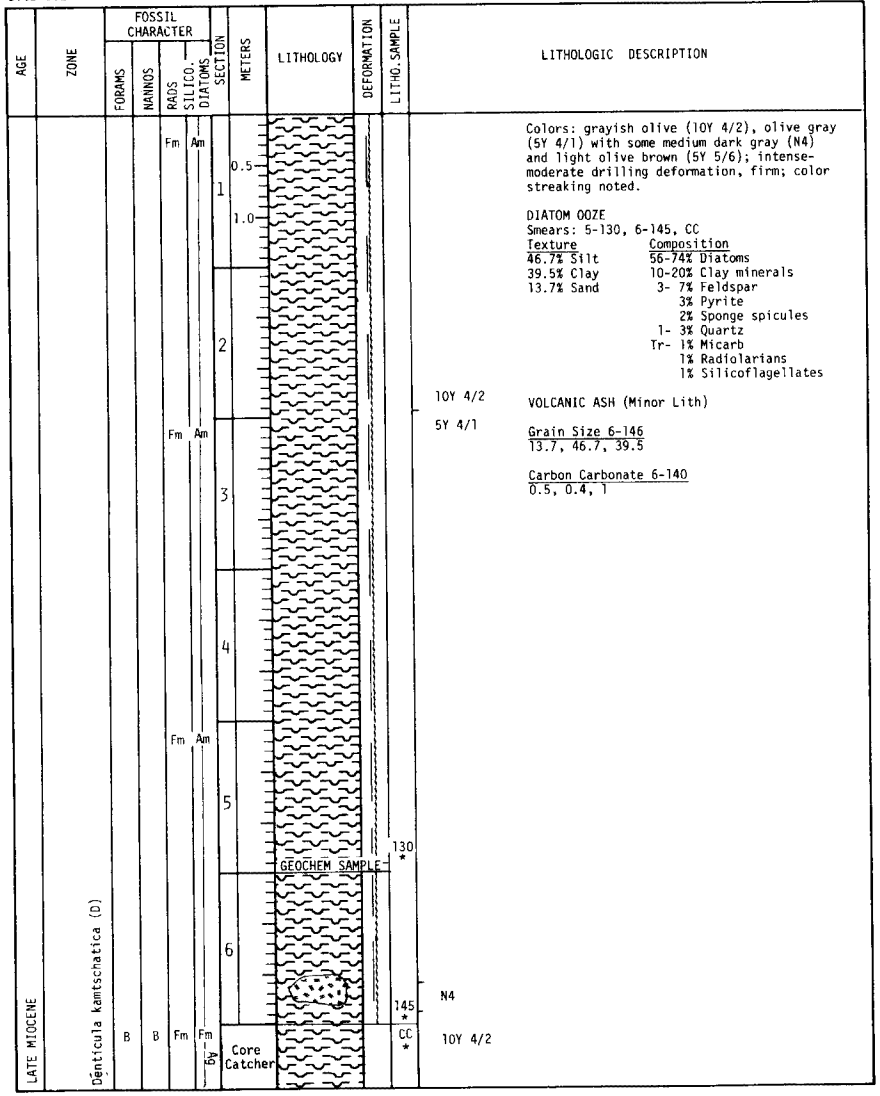
Explanatory notes in chapter 1

Site 302 Hole Core 7 Cored Interval: 114.0-123.5 m

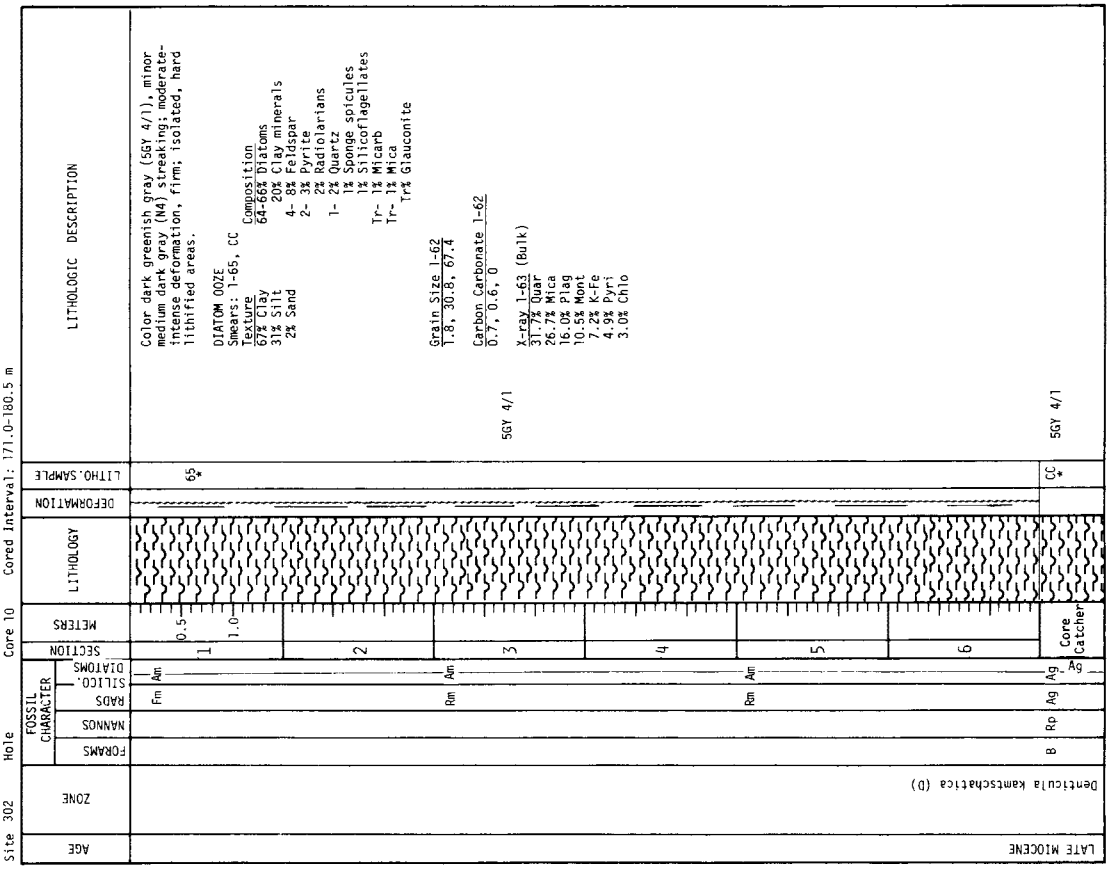


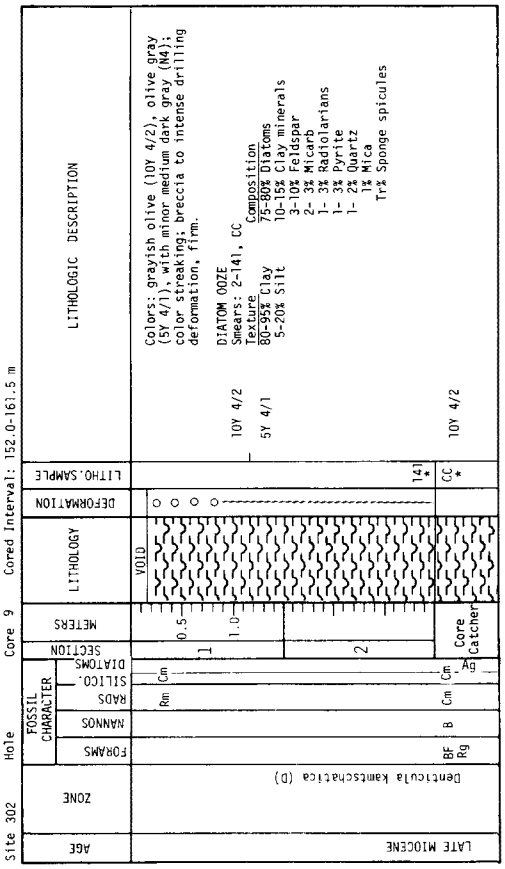
Explanatory notes in chapter 1

Site 302 Hole Core 8 Cored Interval: 133.0-142.5 m

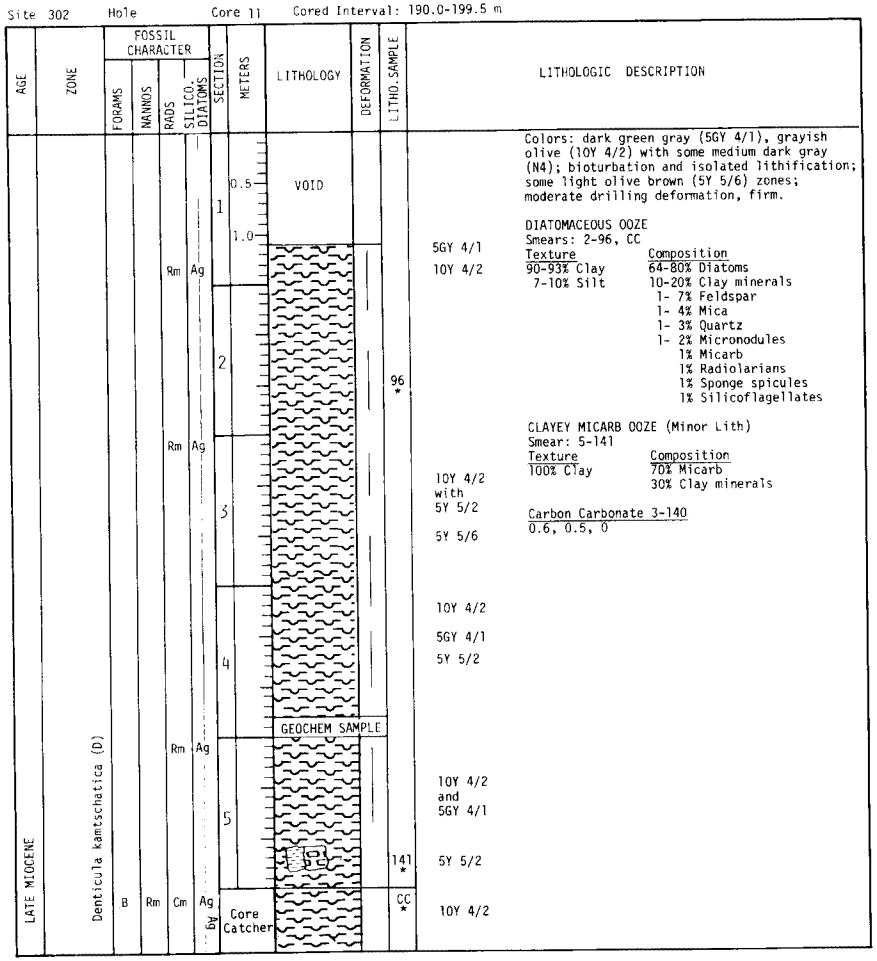


Explanatory notes in chapter 1


Site 302
Hole
Core 10
Cored Interval: 171.0-180.5 m
AGE
ZONE
FOSSIL CHARACTER
FORAMS
NANNOS
RADS
SILICO.
DIATOMS
SECTION
METERS
LITHOLOGY
DEFORMATION
LITHO.SAMPLE
LITHOLOGIC DESCRIPTION
LATE MIOCENE
Denticula kamtschatica (D)
Color dark greenish gray (5GY 4/1), minor medium dark gray (N4) streaking; moderate-intense deformation, firm; isolated, hard lithified areas.
DIATOM OOZE
Smears: 1-65, CC
Texture
67% Clay
31% Silt
2% Sand
Composition
64-66% Diatoms
20% Clay minerals
4- 8% Feldspar
2- 3% Pyrite
2% Radiolarians
1- 2% Quartz
1% Sponge spicules
1% Silicoflagellates
Tr- 1% Micarb
Tr- 1% Mica
Tr% Glauconite
Grain Size 1-62
1.8, 30.8, 67.4
Carbon Carbonate 1-62
0.7, 0.6, 0
X-ray 1-63 (Bulk)
31.7% Quar
26.7% Mica
16.0% Plag
10.5% Mont
7.2% K-Fe
4.9% Pyri
3.0% Chlo
5GY 4/1
Explanatory notes in chapter 1

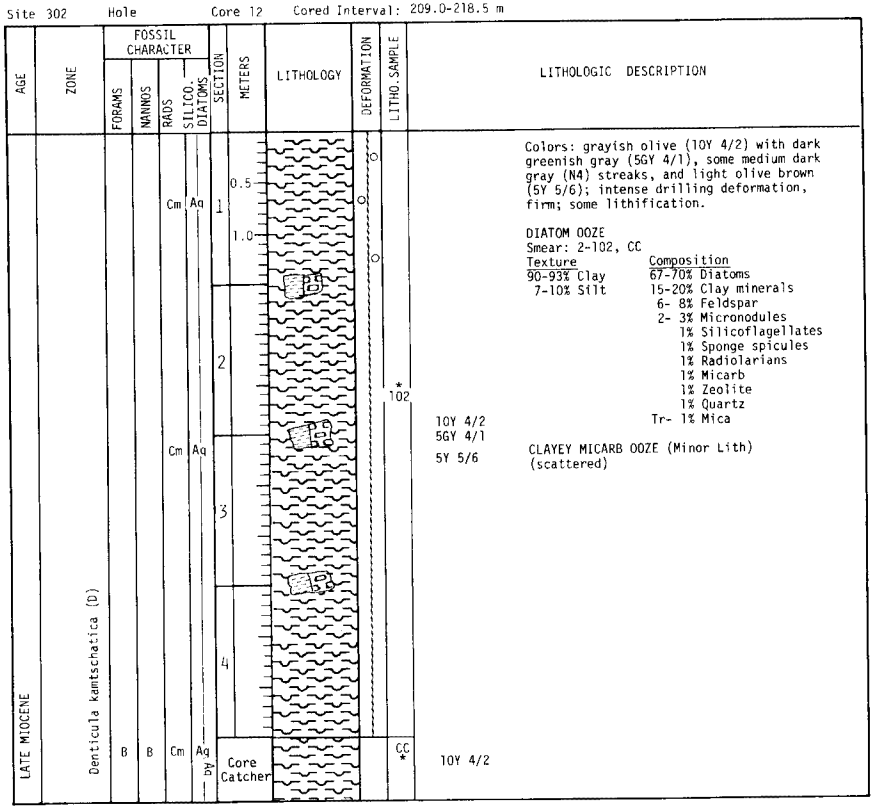

Site 302
Hole
Core 9
Cored Interval: 152.0-161.5 m
AGE
ZONE
FOSSIL CHARACTER
FORAMS
NANNOS
RADS
SILICO.
DIATOMS
SECTION
METERS
LITHOLOGY
DEFORMATION
LITHO.SAMPLE
LITHOLOGIC DESCRIPTION
LATE MIOCENE
Denticula kamtschatica (D)
Colors: grayish olive (10Y 4/2), olive gray (5Y 4/1), with minor medium dark gray (N4); color streaking; breccia to intense drilling deformation, firm.
DIATOM OOZE
Smears: 2-141, CC
Texture
80-95% Clay
5-20% Silt
Composition
75-80% Diatoms
10-15% Clay minerals
3-10% Feldspar
2- 3% Micarb
1- 3% Radiolarians
1- 3% Pyrite
1- 2% Quartz
1% Mica
Tr% Sponge spicules
10Y 4/2
5Y 4/1
10Y 4/2
VOID
Core Catcher
Explanatory notes in chapter 1

Site 302 Hole Core 11 Cored Interval: 190.0-199.5 m

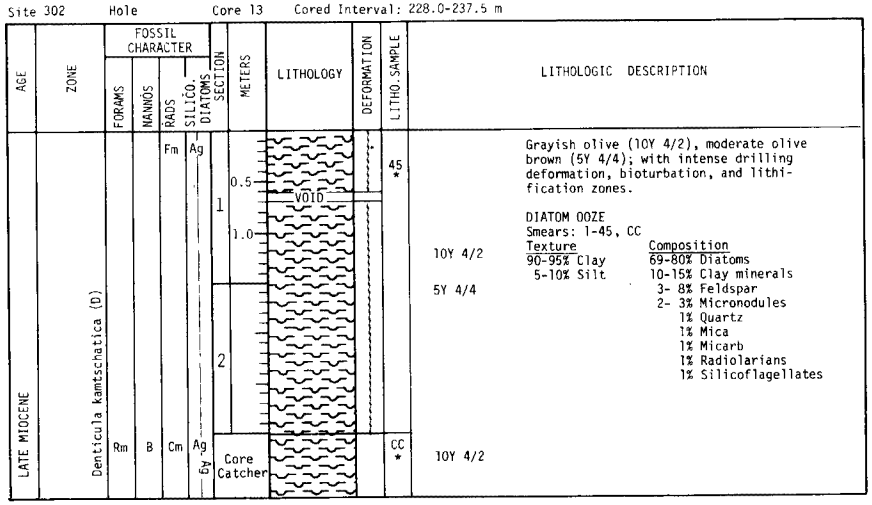


Explanatory notes in chapter 1

Site 302 Hole Core 12 Cored Interval: 209.0-218.5 m

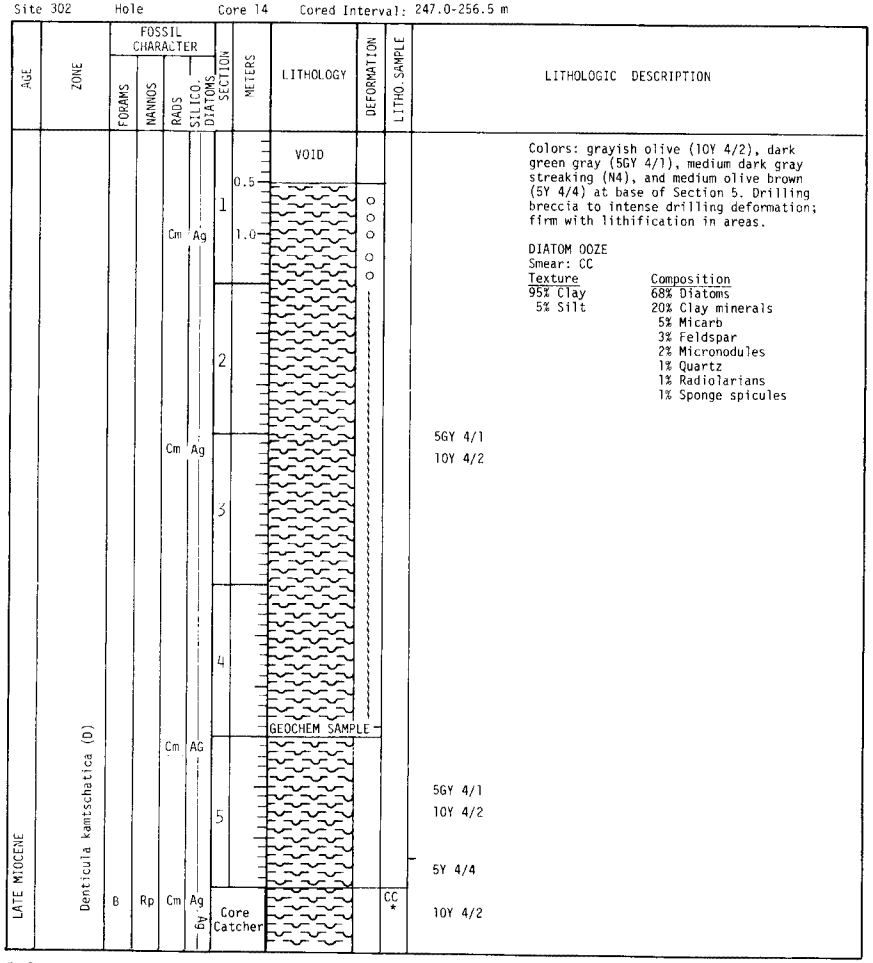


Site 302 Hole Core 13 Cored Interval: 228.0-237.5 m



Explanatory notes in chapter 1

Site 302 Hole Core 14 Cored Interval: 247.0-256.5 m



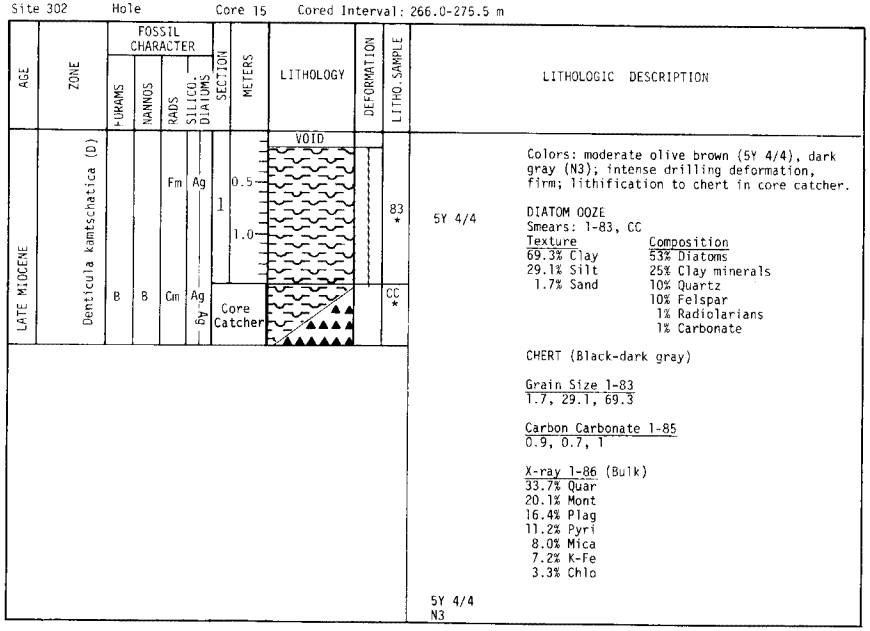
Colors: grayish olive (10Y 4/2), dark green gray (5GY 4/1), medium dark gray streaking (N4), and medium olive brown (5Y 4/4) at base of Section 5. Drilling breccia to intense drilling deformation; firm with lithification in areas.

DIATOM OOZE
Smear: CC

Texture	Composition
95% Clay	68% Diatoms
5% Silt	20% Clay minerals
	5% Micarb
	3% Feldspar
	2% Micronodules
	1% Quartz
	1% Radiolarians
	1% Sponge spicules

Explanatory notes in chapter 1

Site 302 Hole Core 15 Cored Interval: 266.0-275.5 m



Colors: moderate olive brown (5Y 4/4), dark gray (N3); intense drilling deformation, firm; lithification to chert in core catcher.

DIATOM OOZE
Smears: 1-83, CC

Texture	Composition
69.3% Clay	53% Diatoms
29.1% Silt	25% Clay minerals
1.7% Sand	10% Quartz
	10% Felspar
	1% Radiolarians
	1% Carbonate

CHERT (Black-dark gray)

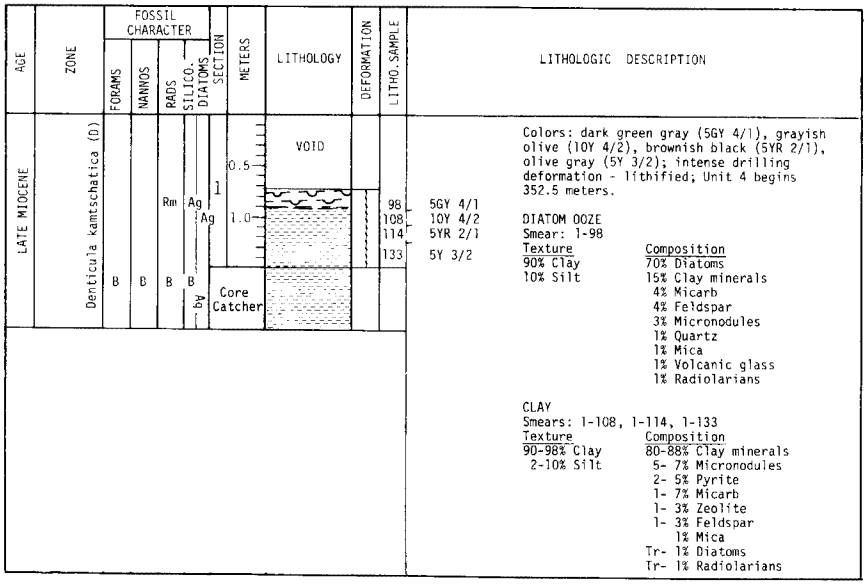
Grain Size 1-83
1.7, 29.1, 69.3

Carbon Carbonate 1-85
0.9, 0.7, 1

X-ray 1-86 (Bulk)
33.7% Quar
20.1% Mont
16.4% Plag
11.2% Pyri
8.0% Mica
7.2% K-Fe
3.3% Chlo

Explanatory notes in chapter 1

Site 302 Hole Core 16 Cored Interval: 351.5-361.0 m



Colors: dark green gray (5GY 4/1), grayish olive (10Y 4/2), brownish black (5YR 2/1), olive gray (5Y 3/2); intense drilling deformation - lithified; Unit 4 begins 352.5 meters.

DIATOM OOZE
Smear: 1-98

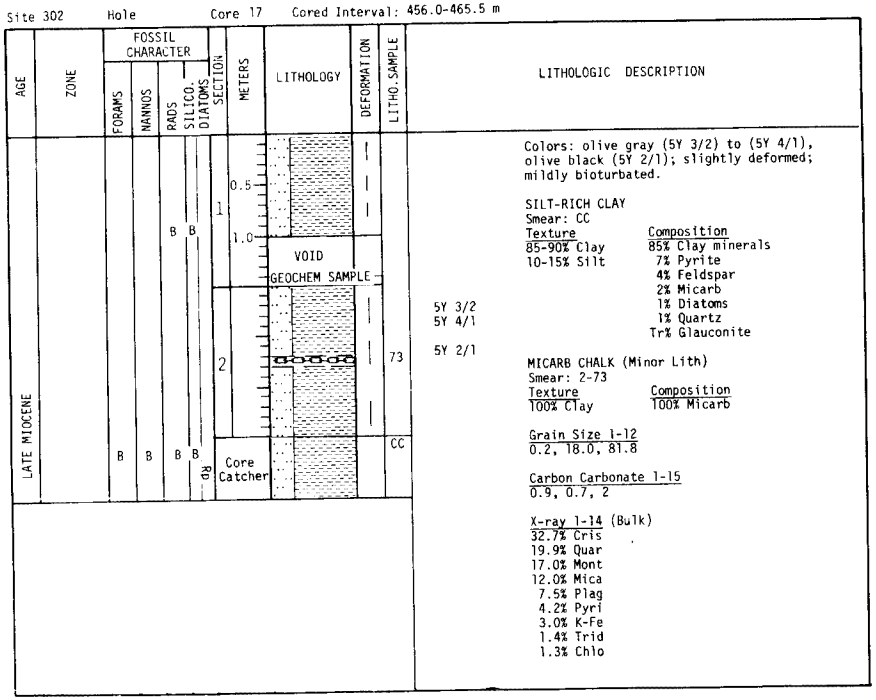
Texture	Composition
90% Clay	70% Diatoms
10% Silt	15% Clay minerals
	4% Micarb
	4% Feldspar
	3% Micronodules
	1% Quartz
	1% Mica
	1% Volcanic glass
	1% Radiolarians

CLAY
Smears: 1-108, 1-114, 1-133

Texture	Composition
90-98% Clay	80-88% Clay minerals
2-10% Silt	5- 7% Micronodules
	2- 5% Pyrite
	1- 7% Micarb
	1- 3% Zeolite
	1- 3% Feldspar
	1% Mica
	Tr- 1% Diatoms
	Tr- 1% Radiolarians

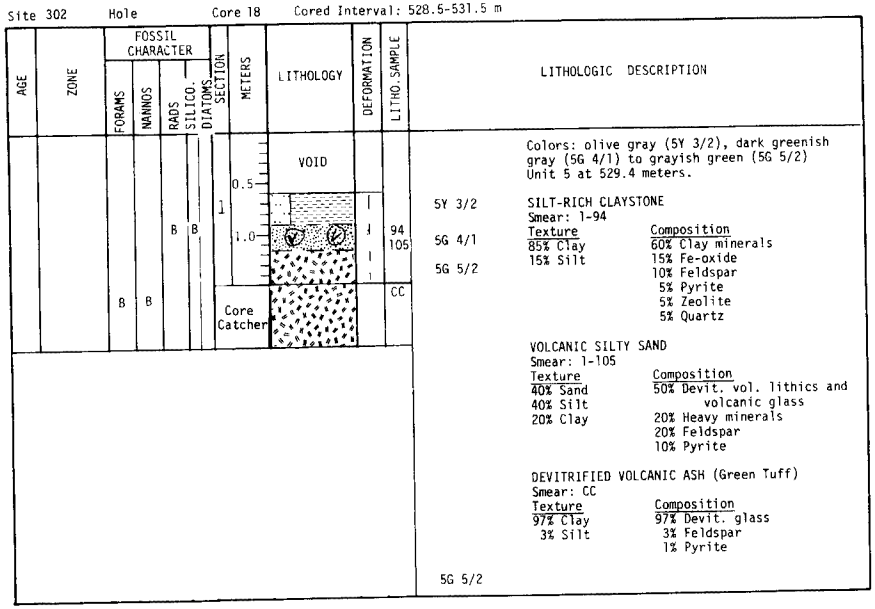
Explanatory notes in chapter 1

Site 302 Hole Core 17 Cored Interval: 456.0-465.5 m



Explanatory notes in chapter 1

Site 302 Hole Core 18 Cored Interval: 528.5-531.5 m



Explanatory notes in chapter 1