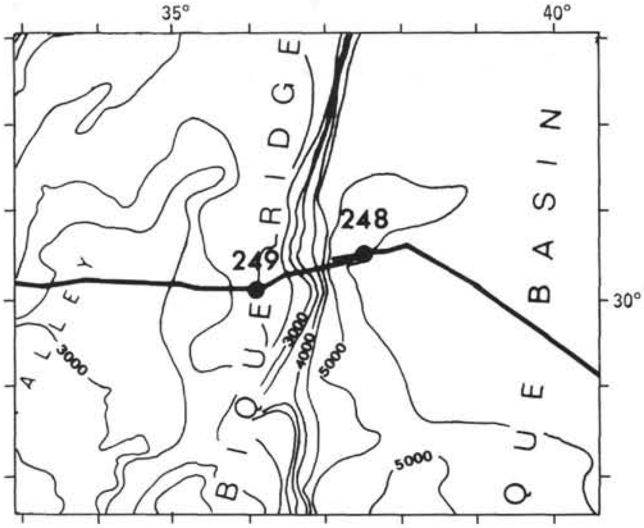
9. SITE 248

The Shipboard Scientific Party[1]

SITE DATA



Location: Mozambique Basin

Position: 29°31.78'S, 37°28.48'E

Water Depth: 4994 meters

Total Penetration: 434 meters

Cores: 17 cores (136 m cut, 40.8 m recovered)

Deepest Unit Recovered: Basalt

BACKGROUND AND OBJECTIVES

The Mozambique Basin is a 300-mile-wide, well-defined depression elongated nearly north-south, which is abruptly bounded on the eastern and western sides by the very steep, linear scarp slopes of the asymmetric Madagascar and Mozambique ridges, respectively, which stand 3-4 km above the basin floor. The floor of the Mozambique Basin forms an abyssal plain at a mean depth of about 4.5 km below sea level on the eastern side, sloping gently westward to depths as great as 5.5 km at the foot of the Mozambique Ridge (Figure 1). The data published by Ewing et al. (1969) show that the sediments beneath the abyssal plain vary in thickness between 0.5 and 1.5 sec DT (double way time); the thickest sediments lying in the center of the basin.

Traced northward from latitude 30°S, the floor of the Mozambique Basin rises, at first gently, then more steeply near latitude 25°S, where it merges into the floor of the Mozambique Channel at an average depth of 3 km. Turbidity currents flowing down the great Zambesi Canyon and its tributaries effectively transport large volumes of terrigenous sediment from south-central Africa and southwestern Madagascar across the Mozambique Channel into the northern part of the Mozambique Basin.

Very little geological and geophysical data on the Mozambique Basin have been published. A seismic refraction profile measured in the western part of the basin adjacent to the Mozambique Ridge near latitude 30°S (Ludwig et al., 1968) shows the following approximate layer thicknesses and velocities: Layer 1 (sediments) 0.5 km (V_p = 2.00 km/sec); Layer 2, 2 km (V_p = 5.02 km/sec); Layer 3, 7 km (V_p = 6.62 km/sec); M-layer (V_p =8.17 km/sec) at a subbottom depth of 9.5 km. More recently, based upon his interpretation of a series of east-west airborne magnetic profiles, Green (1972) has suggested that east-west sea floor spreading about the Mozambique Ridge from Late Triassic until Late Cretaceous/early Tertiary has caused the separation of Madagascar and the Madagascar Ridge from Africa by development of the Mozambique Basin and Mozambique Channel.

Airgun reflection profiles were obtained in the near-site area by *T. B. Davie* in 1971 (Cruise 267) as shown on Figure 1 and yielded useful information for selection of Site 248 (Figure 2).

Flexotir reflection data were also obtained, just prior to *Glomar Challenger* Leg 25 cruise, by *Gallieni* in May 1972 (Cruise 6) along a profile almost east-northeast-west-southwest starting at a depth of about 5000 meters in the Mozambique Basin and crossing the Mozambique Ridge at a latitude of about 30°S (Figure 1). Site 248, in the Mozambique Basin, was selected on the basis of the results of this survey. The flexotir reflection profile obtained in the Mozambique Basin shows an uppermost transparent layer which pinches out abruptly towards the Mozambique Ridge at a longitude of about 37°25'E. Below this transparent layer is a series of well-stratified sediments which thin towards the Mozambique Ridge. A clear acoustic basement reflector rising slowly towards the ridge can be seen at about 0.5 sec DT (Figure 3).

The main objectives of drilling this hole in the Mozambique Basin were (a) to sample, identify, and date

---

[1] Roland Schlich, Institut de Physique du Globe, Saint-Maur-des-Fossés, France; E. S. W. Simpson, University of Capetown, Rondebosch, South Africa; Joris Gieskes, Scripps Institution of Oceanography, La Jolla, California; W. A. Girdley, Mesa College, Grand Junction, Colorado; Lucien Leclaire, Muséum National d'Histoire Naturelle, Paris, France; B. Vaughn Marshall, U. S. Geological Survey, Menlo Park, California; Casey Moore, University of California, Santa Cruz, California; Carla Müller, Johann-Wolfgang-Goethe-Universität, Frankfurt, Germany; Jacques Sigal, Institut Français du Pétrole, Rueil-Malmaison, France; T. L. Vallier, Scripps Institution of Oceanography, La Jolla, California; Stan M. White, California State University, Fresno, California; Barbara Zobel, Bundesanstalt für Bodenforschung, Hannover, Germany.

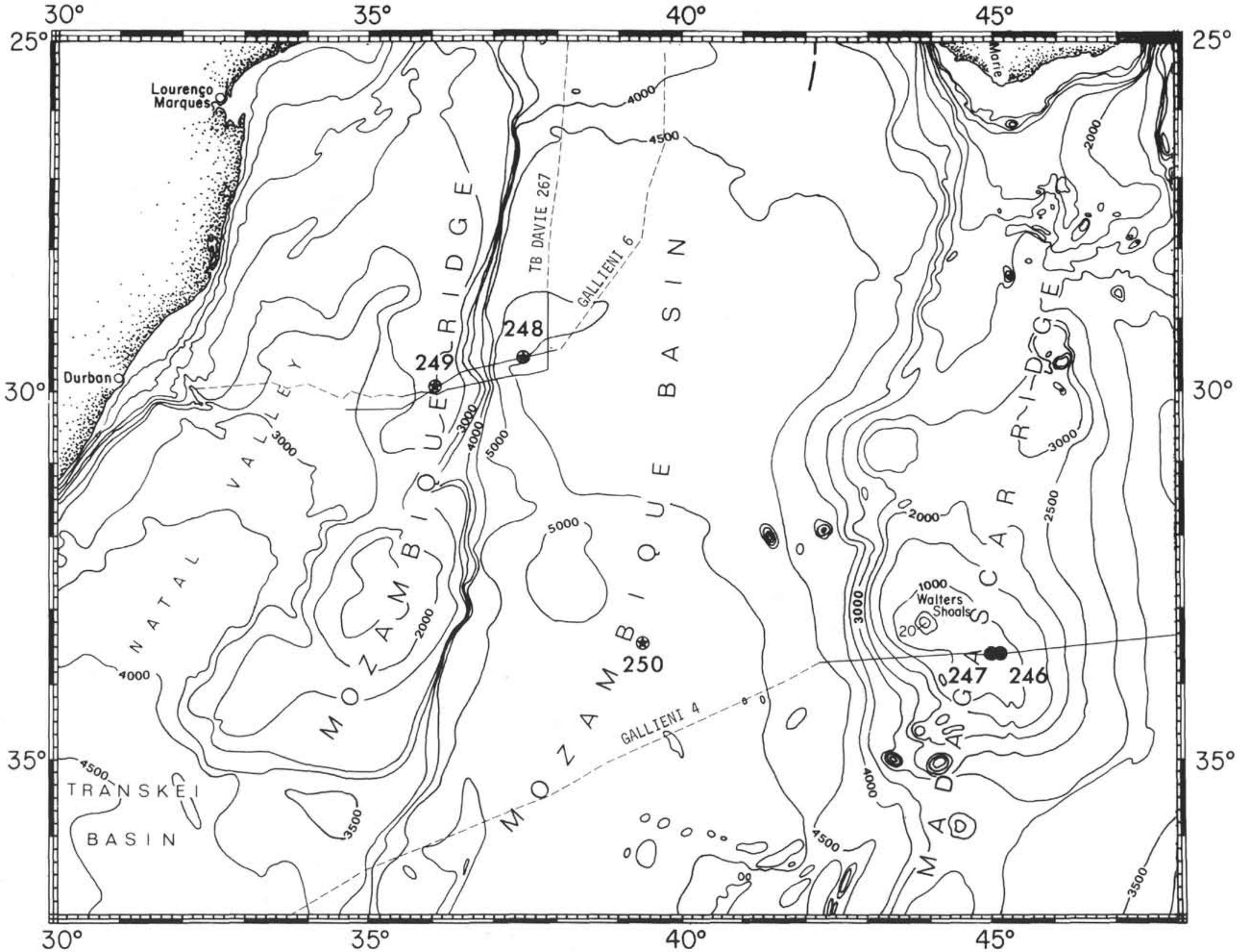


Figure 1. *Bathymetric chart showing major morphological features and deep-sea drilling site locations between Madagascar Ridge and southeast Africa. Isobaths are drawn at 500-meter intervals. Tracks of ships providing survey data for Sites 248, and 249 are indicated (solid lines).*

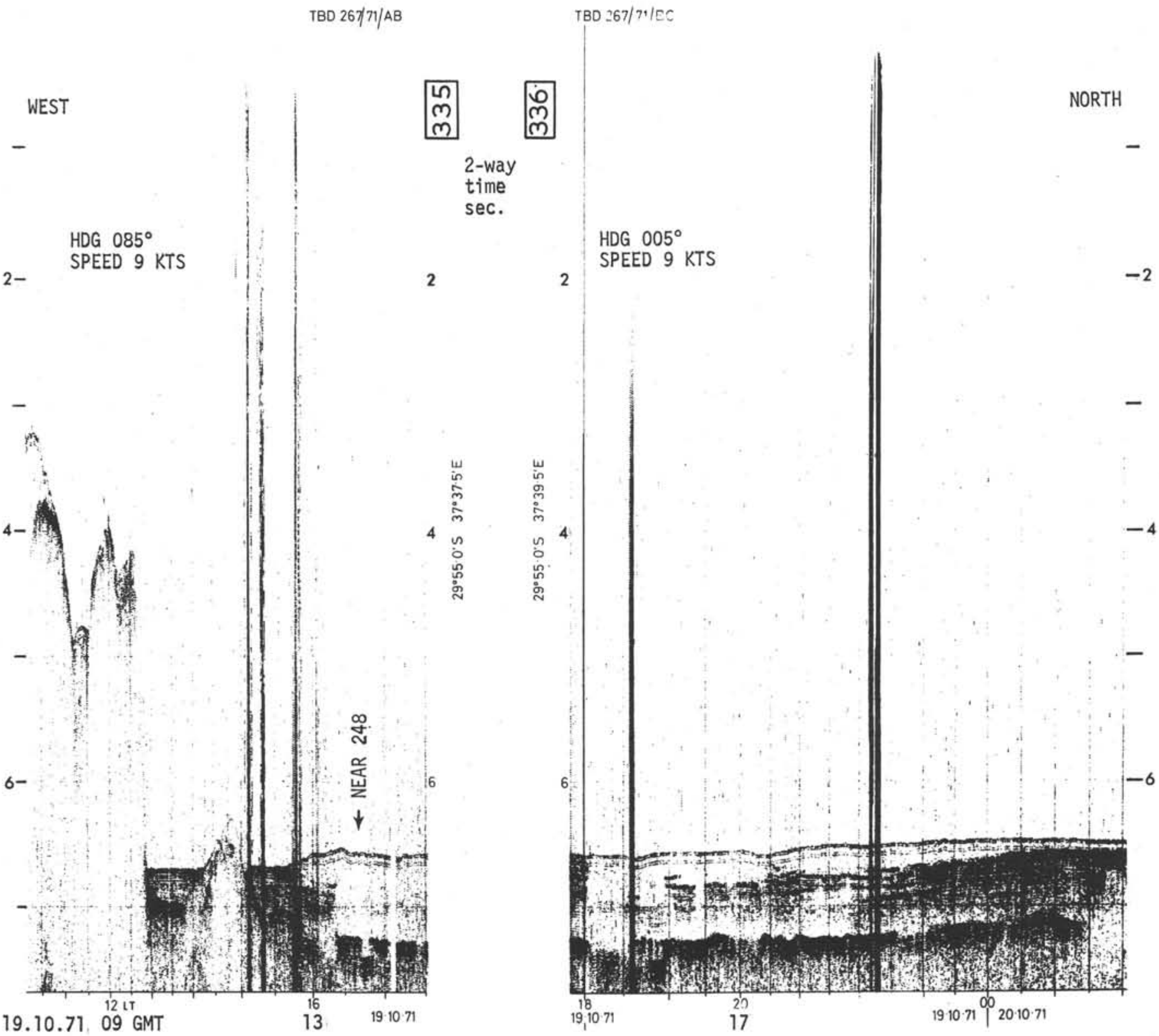


Figure 2. Thomas B. Davie *267 airgun seismic reflection profile across the Mozambique Basin near Site 248 (location shown in Figure 1). Unpublished data provided by E. S. W. Simpson.*

the basement to provide critical data in an area where no magnetic lineations have been recognized, and (b) to establish the stratigraphic sequence.

SURVEY DATA AND OPERATIONS

Glomar Challenger departed from Site 247 at 0800 hours LT (local time) (0500 GMT) on 11 August 1972, and after 2 days and 5 hours of steaming in a northwesterly direction over the Madagascar Ridge and across the northern part of the Mozambique Basin, reached the area surveyed by *T. B. Davie* in 1971 (Cruise 267) and by *Gallieni* in May 1972 (Cruise 6). The selected site (29°32′S, 37°28′E), at a water depth of about 4990 meters, was approached along a course of 258° and crossed at about 1315 LT (1115 GMT) on 13 August 1972. The airgun reflection profile was continued in the same direction at a speed of 8 knots for about 25 miles. At 1550 LT (1350 GMT), *Glomar Challenger* reversed course to 075°. Based on a satellite fix (1540 GMT) this course was slightly altered to 092° at 1805 LT (1605 GMT). At 1831 LT (1631 GMT), the speed was reduced to about 5 knots to enhance the clarity of the seismic reflection profile. At 1856 LT (1656 GMT), the site was identified from the airgun records and the 16-kHz beacon was dropped immediately. The airguns, hydrophones, and magnetometer were retrieved and *Glomar Challenger* reversed course to take up station over the beacon. The geographical coordinates of Site 248 are: 29°31.78′S, 37°28.48′E (Figure 4).

The *Glomar Challenger* airgun reflection profile obtained in the near-site area almost coincides with the *Gallieni* flexotir reflection profile from which the site was selected. Both records show an uppermost transparent layer which

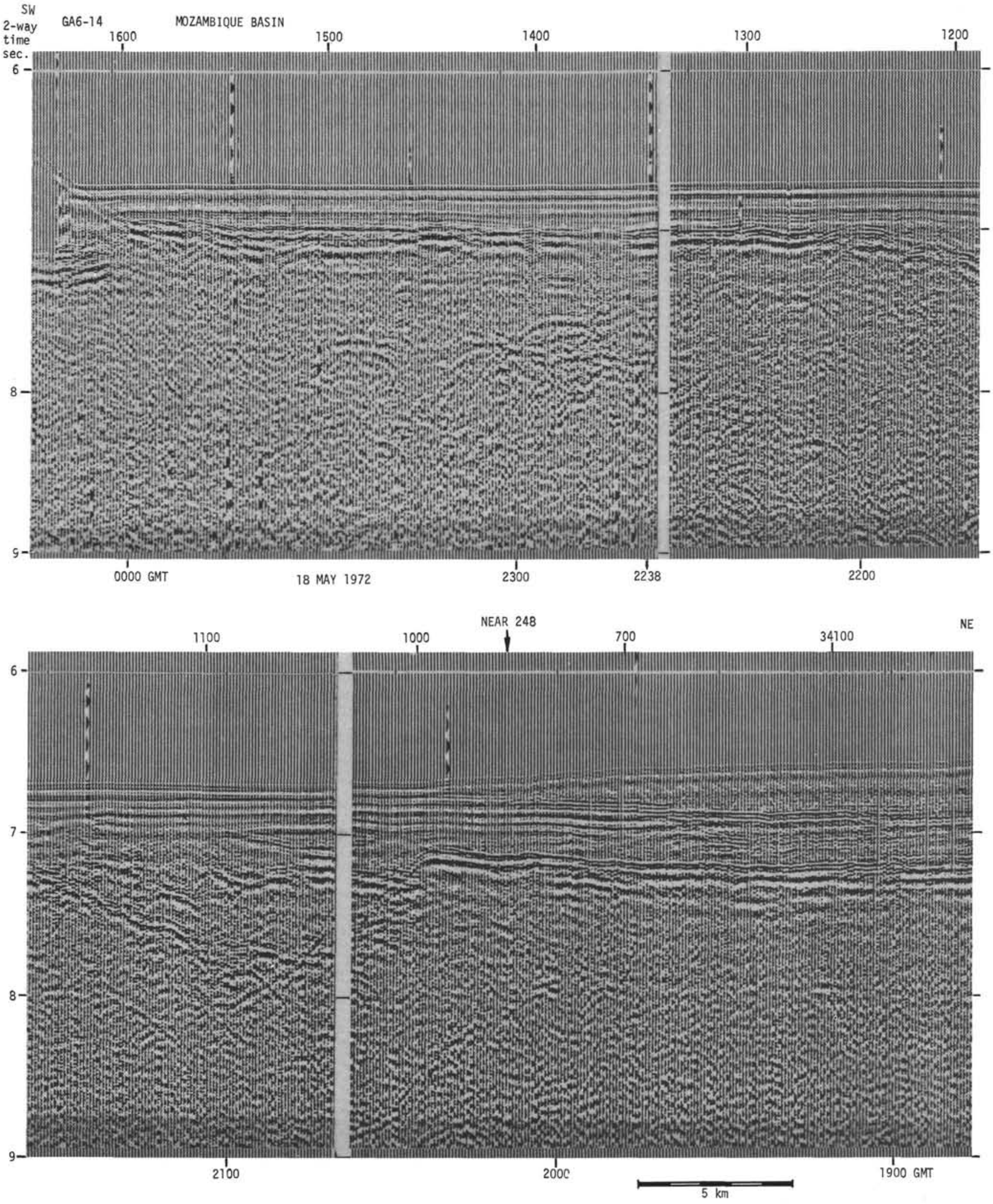


Figure 3. Gallieni *6 flexotir seismic reflection profile across the Mozambique Basin near Site 248 (location shown in Figure 1).* Gallieni *6 records are from unpublished Institut de Physique du Globe de Paris and Comité d'Études Pétroliéres Marines data (Schlich, personal communication).*

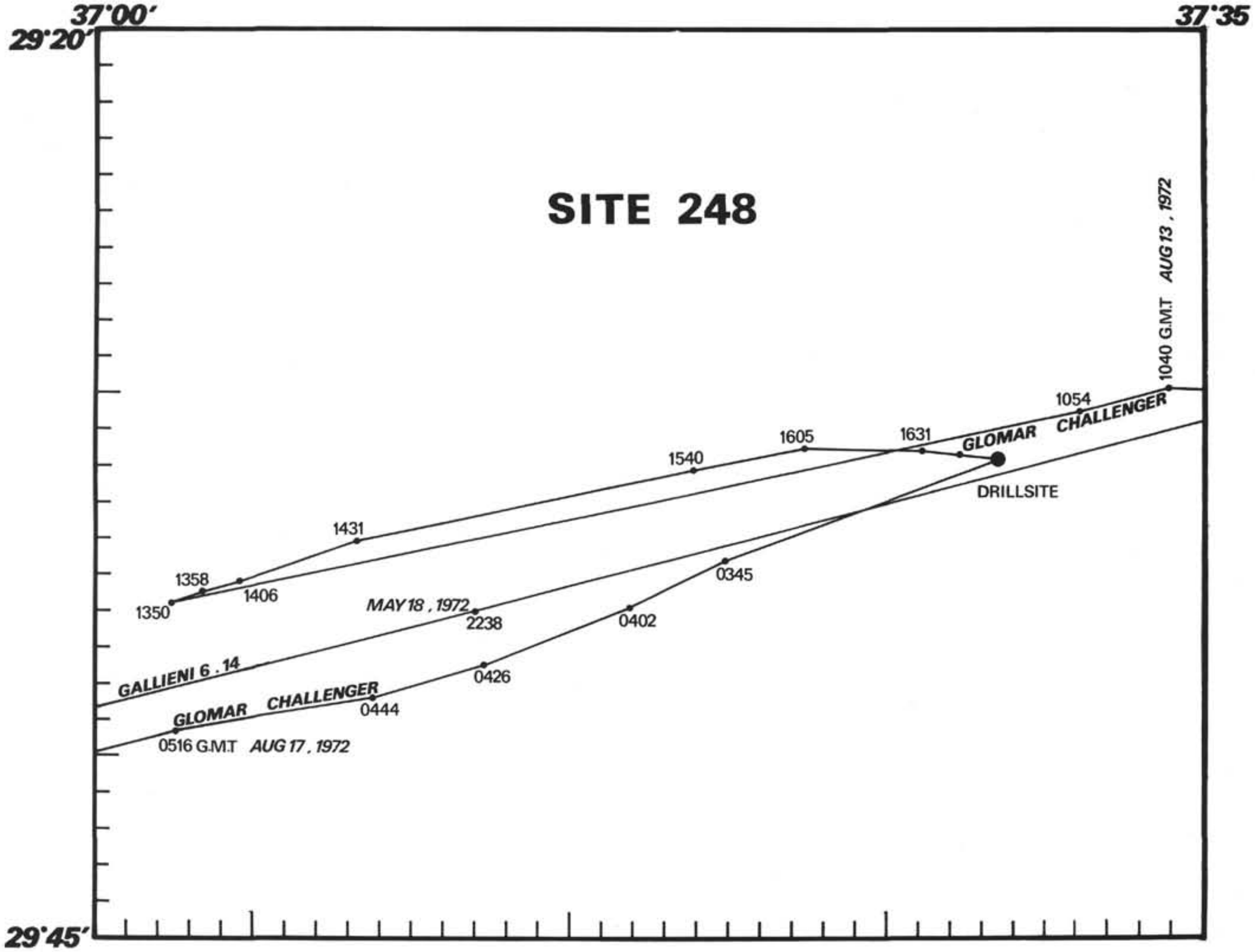


Figure 4. *Details of the* Glomar Challenger *site approach.*

pinches out abruptly about 2 miles west of the site towards the Mozambique Ridge, underlain by a series of well stratified layers. At Site 248, the acoustic basement is at 0.48 sec DT (Figure 5).

The major site objective was to sample, date, and identify the basement and also to establish the stratigraphic sequence. The observed seismic acoustic basement was expected at a depth of about 400 meters; consequently, a program of intermittent coring was planned between 0-370 meters and continuous coring from 370 meters to basement. The basement was reached at a depth of 422 meters and penetrated to a depth of 434 meters.

Drilling and coring at this site started at 1400 (LT) on 14 August 1972 and ended at 1545 (LT) on 16 August 1972. Seventeen cores were taken; the total cored section being 136 meters and the total core recovered 40.8 meters (Table 1). Sea conditions at the time of spud-in prevented adequate sampling of the sedimentary sequence above 120 meters, and the poor recovery observed between 130 and about 300 meters depth may be explained by the type of formation encountered. It consists mainly of unconsolidated silty sand, coarse quartz sand, and clayey sandy silt. This material caused severe problems (such as hole caving, reduced drilling water pressure, failure of the core barrel to seat and of the core barrel retrieving tool to latch on, which nearly precipitated a decision to abandon the site on technical grounds). The last core, (17) which penetrated 3 meters of basalt, came up empty, but about 2 meters of basalt were recovered later on in the bottom hole assembly and at a variety of levels in the drill pipe. This material has been, of necessity, haphazardly stored in two sections, and the different pieces are consequently not in sequence nor correctly oriented. After Core 4, at 130 meters depth, heat flow measurements were successfully conducted; downhole inclinometer tests made at the same time indicated that the hole was 3° off the vertical.

The total time spent at the site was 3 days and 9 hours. In addition to the problems mentioned above, the operations were somewhat delayed (8 hours) due to positioning difficulties in a 4-knot current and swells from three different directions and malfunctioning of the computer. The average drilling rate was 85 m/hr, and the average coring rate was 25.7 m/hr. After completion of drilling and coring, the three-cone bit was in poor condition.

Glomar Challenger departed from Site 248 at about 0400 LT (0200 GMT) on 17 August 1972 in a southeasterly direction while the airguns, hydrophones, and

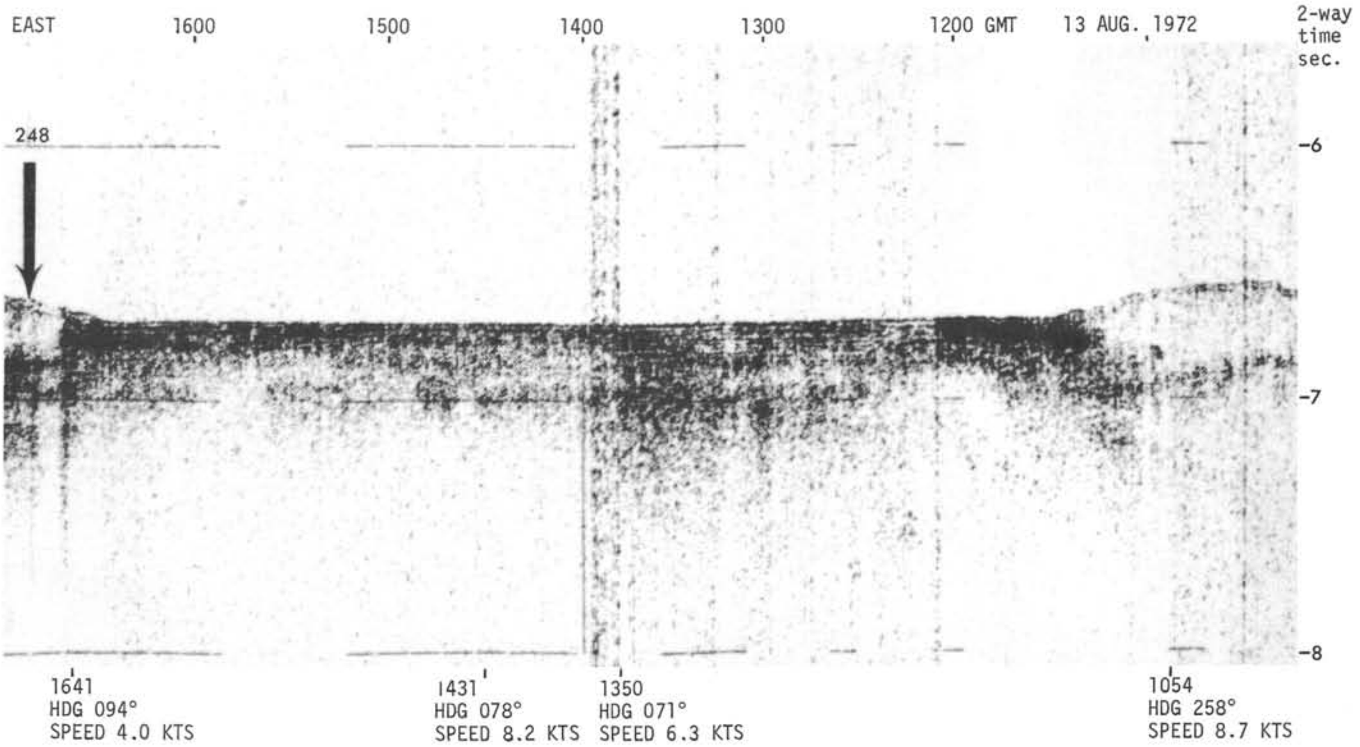


Figure 5. Glomar Challenger *seismic reflection profile on approach to Site 248.*

TABLE 1
Coring Summary, Site 248

Core	Depth Below Sea Floor (m)	Cored (m)	Recovered (m)	Recovery (%)
1	0-1	1	CC	0
2	1-10	9	3.3	37
3	47-56	9	CC	0
4	121-130	9	7.1	79
5	142-151	9	CC	0
6	151-160	9	0.9	10
7	199-208	9	CC	0
8	227-236	9	1.3	14
9	265-274	9	2.4	27
10	312-321	9	2.2	24
11	360-369	9	3.5	39
12	389-398	9	6.8	76
13	398-407	9	1.1	12
14	407-416	9	8.6	96
15	416-425	9	1.3	14
16	425-431	6	0.3	5
17	431-434	3	2.0	67
Total		136	40.8	30

Note: Echo sounding depth (to drill floor) = 5004 meters; drill pipe length to bottom = 5013 meters.

magnetometer were streamed. At 0448 LT (0248 GMT), the course was changed to 250°, and at 0457 LT (0257 GMT), the beacon was passed at a speed of about 9 knots. A sonobuoy for wide-angle reflection was launched over the site, but the signal was lost about 1 hour later. At 0545 LT (0345 GMT), the speed was increased to maximum and the ship steamed away in the direction of the Mozambique Ridge (Site 249), following the *Gallieni* 1972 track.

LITHOLOGY

Introduction

At Hole 248, 422 meters of sediment and 12 meters of basalt were drilled and cored. Seventeen cores were attempted between the sea floor and the bottom of the hole at 434 meters. Sediment ages range from probable late Paleocene to Pleistocene. After preliminary studies of lithologies, the sediment and rock column is divided into four major units which reflect changing conditions on the sea floor (Table 2, Figure 6). Unit IV, composed of porphyritic basalt, forms the acoustic basement. It is successively overlain by a pelagic Unit III, a volcanic hemipelagic Unit II, and Unit I which shows a strong terrigenous influence.

Description of Lithologic Units

UNIT I: Silts, Clays, and Coarse Sands
(Cores 1 through 9)

The division of Unit I into three subunits is based mainly on the relative abundances of sand, silt, and nannofossils. Subunit IA has both sandy silt and clay-rich nanno ooze as major lithologies. Subunit IB consists predominantly of clayey silt and silty clay. Silty sand, coarse quartz sand, and clayey sandy silt comprise most of subunit IC. Age of Unit I is Miocene to Pleistocene.

Subunit IA (Cores 1 and 2): This subunit is of Pleistocene age, between 10 and 47 meters thick (see Table 2), and consists of about equal amounts of clayey sandy silt

TABLE 2
Lithologic Units and Subunits, Site 248

Depth (m)	Lithologic Units	Lithologic Subunits	Thickness (m)
	(I) Greenish-gray clayey sandy silt, clayey silt, silty clay, silty sand, and quartz sand	A) Greenish-gray clayey sandy silt; olive-gray silt/clay-rich nanno ooze	300[d]
30[a]		B) Greenish gray clayey silt and silty clay	
130[b]		C) Dark greenish-gray silty sand; clayey sandy silt; coarse quartz sand	
300[c]	(II) Greenish-gray laminated silt-bearing and silt-rich volcanic clay; volcanic silty clay		107[d]
407	(III) Brown clay and brown silt-bearing clay		15
422	(IV) Dark gray porphyritic basalt		12
434			

[a] Boundary falls between Cores 2 and 3 (10-47 m), here estimated at 30 m.

[b] Boundary in core catcher of Core 4.

[c] Boundary falls between Cores 10 and 11 (274-312 m), here estimated at 300 m.

[d] Thicknesses approximate because exact depths to most boundaries are unknown.

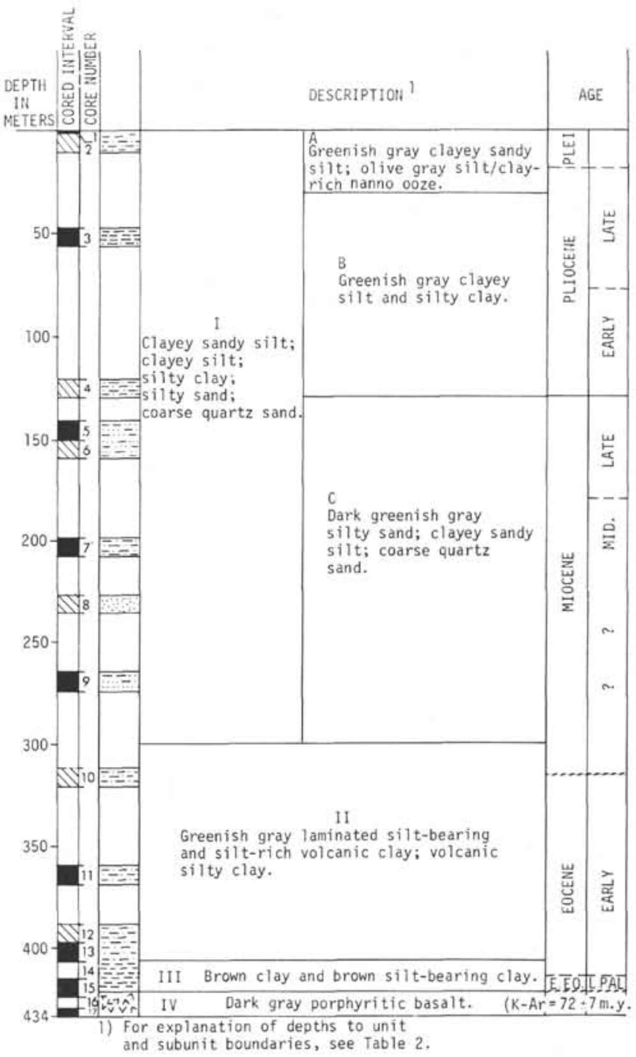


Figure 6. *Stratigraphic column, Site 248. Dashed lines indicated uncertain boundaries and wavy lines indicate hiatuses.*

and silt/clay-rich nanno ooze which are interlayered, respectively, in beds of greenish gray and olive gray colors. Clayey sandy silt beds range in thickness between 1 and 30 cm. Although grading is not obvious, burrow mottling near the top of some silt beds and sharp basal contacts suggest a turbidite origin. Heavy minerals include hornblende, zircon, garnet, sphene, and biotite. These, plus the abundant quartz and potash feldspar and the less common granitic rock fragments, indicate a granitic/metamorphic terrane as a source rock area. Glauconite is a rare contributor to the coarser grained sand fractions in the silt beds.

The olive gray nanno ooze beds are clay and silt rich. Apparently, an abundance of land-derived sediment was deposited in an area of high nannoplankton productivity.

Subunit IB (Cores 3 and 4): This subunit is of Pliocene age and composed mostly of dark gray and greenish-gray silty clay and clayey silt. Near the base (Core 4, Section 6), rare beds of nanno ooze occur. Heavy minerals within the silts are similar to those in the silts of subunit IA and include hornblende, biotite, garnet, pyrite, and chlorite. Pyrite is common and occurs in blebs, streaks, and burrow casts.

Subunit IC (Core Catcher Core 4 through Core 9): This subunit is of middle and late Miocene age and is dominated by the presence of coarse quartz sand. In addition to the quartz sand, other lithologies are silty sand and clayey sandy silt. Because of the drilling and coring process, no primary sedimentary textures and structures were recovered with sands, and core recovery in this coarse unconsolidated sediment was extremely low (average 10%). In the coarse sands, grains are subangular to subrounded. Diameters are as large as 7 mm although most are in the 1-3 mm range. Quartz, which comprises as much as 75 percent, and potash feldspar are the dominant components. Shell fragments and granitic rock fragments also are common. Heavy minerals are blue green and brown hornblende, biotite, garnet, zircon, sphene, tourmaline, epidote, pyrite, and chlorite which, together with the light mineral fractions, reflect a source area of granitic and metamorphic rocks.

UNIT II: Volcanic Clay and Volcanic Silty Clay (Cores 10 through 13)

Unit II, of Eocene age, has lithologies in marked contrast to the overlying silt and sand of Unit II and underlying brown clay of Unit III. Major lithologies in Unit II are greenish-gray silt-rich and silt-bearing volcanic clay and volcanic silty clay. Near the top of the unit (Core 10), colors are alternating greenish gray, olive gray, blue gray, and moderate brown. With increasing depth, colors become predominantly alternating greenish gray and dark greenish gray with some thin beds of olive gray and brownish gray.

An outstanding characteristic of this unit is the laminated nature of the bedding. Alternating thin beds (laminae) are 0.5 to 10 cm thick. Rare, white laminae consist of silt-sized carbonate grains (rhodochrosite) and brownish-gray, clay-rich laminae mark layers of devitrified volcanic ash.

Radiolaria occur in some samples of Cores 10, 11, and 12. Tests are surprisingly well preserved. The only observed calcareous biogenic sediment, a nanno-rich clay, is near the base of Core 13 (Section 6).

A typical volcanic silty clay consists of 60 percent clay and 40 percent silt-sized grains that are composed predominantly of cristobalite, tridymite, quartz, feldspar, heavies, and opaques. The heavy mineral assemblage near the top of the unit is very similar to that of Unit I (hornblende, zircon, garnet, epidote, hematite, pyrite, and chlorite). Heavy minerals are more abundant and show a greater diversity near the top of the unit than near the base where mostly hornblende, hematite, and chlorite occur.

Penecontemporaneous deformation, indicated by small-scale slumping, occurs within some thinly laminated (3-5 cm) sequences. Many silty clay beds may be graded as indicated by sharp basal contacts and darker colors near the base. Silicified mudstone clasts are rare contributors, but pyrite is common and occurs as concentrations along bedding planes and as irregular segregations.

UNIT III: Brown Clay and Brown Silt-Bearing Clay (Core 14)

Unit III of late Paleocene(?) age, consists of brown silt-bearing clay and brown clay. Near the top, in Section 1, moderate brown, dark reddish brown, and blackish red laminations give the sediments a banded appearance. The red and blackish-red laminations are iron rich. The dominant lithology is brown silt-bearing clay. Some smear slides have as much as 10 percent silt that includes not only the ubiquitous quartz and feldspar, but also a small assemblage of heavy minerals (goethite, magnetite, hematite, and chlorite). Gypsum and foraminifera occur near the base in small amounts.

UNIT IV: Porphyritic Basalt (Cores 15 through 17)

Basalt forming the acoustic basement at Site 248 was encountered at 422 meters below the sea floor in Core 15. Unfortunately, the 6 meters directly overlying the basement were not recovered. In three cores (15, 16, 17), between 422 and 434 meters, 3.6 meters of basalt were recovered.

The uppermost zone in Core 15 is amygdaloidal; vesicles are filled with calcite and chlorite. Irregular veins filled with chlorite, calcite, goethite, and a little prehnite occur throughout the entire core. Submarine weathering is slight and restricted to narrow reddish-brown zones adjacent to fractures in the uppermost zone. The basalt is distinctly porphyritic with large (5-12 mm) prismatic phenocrysts of pale gray plagioclase mostly set in an aphanitic nonvesicular groundmass. Other smaller and less common phenocryst minerals are clinopyroxene and olivine.

Microscopic examination revealed a gradual change in texture from vitrophyric at the top of the column (Core 15) to porphyritic diabasic towards the bottom (Core 17). The vitrophyric basalt contains prismatic phenocrysts of plagioclase together with smaller equant subhedral phenocrysts of colorless clinopyroxene and altered olivine set in a glassy matrix sprinkled with a few slender microlites of second-generation plagioclase. Proceeding down the core, the groundmass becomes progressively more crystalline and coarser grained. Groundmass textures can be described as changing from hyaline through hyalopilitic, intersertal, and intergranular to subophitic (diabasic). The lowest sample examined in Core 17 (a porphyritic diabasic basalt) contained sparse interstitial voids filled with green chlorite. All samples contain varying amounts of phenocryst plagioclase, clinopyroxene, and olivine (pseudomorphed by chlorite, goethite, and carbonate) with plagioclase being by far the most abundant.

The clinopyroxene in the upper section of Core 15 is colorless but becomes faintly colored (clove brown) towards the bottom in Core 17. Modal composition does not vary markedly with plagioclase phenocrysts, 22-32 percent, clinopyroxene, phenocrysts, 0.4-6 percent, and olivine phenocrysts 0 to 5 percent. In samples containing a crystalline groundmass, the modal range is plagioclase, 27-34 percent, clinopyroxene, 30-42 percent, chlorophaeite (including other secondary minerals and opaque grains), 4-6 percent. Many of the plagioclase phenocrysts show evidence of a complex history of crystallization and resorption suggesting that either they are xenocrysts or the magma has experienced a multistage history of crystallization. This particular feature is discussed in more detail by Erlank and Reid (this volume).

Samples analyzed from Site 248 show a distinctive major and trace element composition. The basalt is enriched in Ti, Ba, Nb, Zr, and Sr relative to the low K tholeiites recovered from the mid-ocean ridges and all other basalts recovered from Leg 25. The concentration levels of the above mentioned elements in fact fall within the range we have observed for Karroo (Stromberg) Basalts from the Lebombo Monocline and for tholeiites from Iceland and Hawaii. Geochemically and petrographically, the Site 248 basalts are the most interesting recovered from Leg 25.

Lithologic Interpretations

Based upon shipboard studies of the basement rocks and overlying sediments at Site 248, the following preliminary interpretations can be made.

1) The basalts probably were extruded onto the sea floor as lava flows.

2) The brown clays of Unit III are pelagic sediments and were deposited below the regional CCD. Red and blackish-red iron-rich clays suggest submarine hydrothermal iron enrichment similar to that suggested for basal iron-rich sediments of Hole 245.

3) The laminated sequence in Unit II was deposited mostly in deep water below the regional CCD. The sediments are mainly volcanogenic silts and clays. The

volcanogenic sediments probably are mostly epiclastic in origin, eroded from a volcanic terrane, and transported to the deep ocean by turbidity currents. However, some beds may represent submarine pyroclastic flows and volcanic ash and dust which were transported mainly by wind to the site of deposition. Granitic/metamorphic terranes contributed more detritus to Unit II in the upper layers, thereby probably reflecting the unroofing of the older rocks.

4) A strong terrigenous influx began in the middle Miocene when coarse turbidites, derived from the African continent and/or Madagascar, reached this part of the basin. The coarse-grained sediments suggest large-scale epeirogenic uplift of the provenance areas during the middle Miocene-Pleistocene interval.

PHYSICAL PROPERTIES

Core recovery was low at this site, and therefore, the physical properties data are sparse. The changes in these data often correlate with lithology but are of limited value in determining depths of the boundaries between these physical changes.

The first significant change of the velocity data occurs with Core 6 at 152 meters. The values are for clayey sandy silt (1.69 km/sec) and sand (1.83 km/sec). Each represents an increase of velocity over values at shallower depths. No other important changes occur until basement is reached at 422 meters.

Bulk density and acoustic impedance values in the interval 122-130 meters (Core 4) are higher than the previous data set from 4-6 meters. There is a fairly sharp increase of acoustic impedance between 130-152 meters associated with the increase of sonic velocity. One other high value for bulk density and acoustic impedance at about 268 meters is associated with sand. The remaining values for both these physical properties are probably scatter in the values for clay. One lower value for both at about 363 meters is from silt-rich clay.

The data suggest a decrease of water content and porosity values with depth to about 152 meters. The lowest value for each is from disturbed sand at approximately 268 meters. From about 268-400 meters, the data are scattered for the laminated silt-bearing clay and silt-rich clay. From roughly 407-416 meters there is a decrease in water content that may be more typical of the brown clay of Core 14.

Only nine thermal conductivity tests were run. Their values show a gradual increase in value with depth except for the large increase for the thermal conductivity of sand at 268 meters. The sand was disturbed by drilling, but the spectacular change indicates that in situ values may also have a significant rise.

BIOSTRATIGRAPHY

Calcareous Nannoplankton

Quaternary

The nannoplankton assemblage of the core catcher of Core 1 consists of species of the *Gephyrocapsa oceanica* Zone (NN20) and of the *Emiliania huxleyi* Zone (NN21) (Figure 7). It was not possible to determine *Emiliania huxleyi* in the light microscope. The most frequent species are *Gephyrocapsa oceanica, Rhabdosphaera clavigera, Thoracosphaera heimi, Cyclococcolithus leptoporus,* and *Ceratolithus cristatus.* Core 2 belongs to the *Pseudoemiliania lacunosa* Zone (NN19) with the same species as in Core 1 but with frequent *Pseudoemiliania lacunosa.*

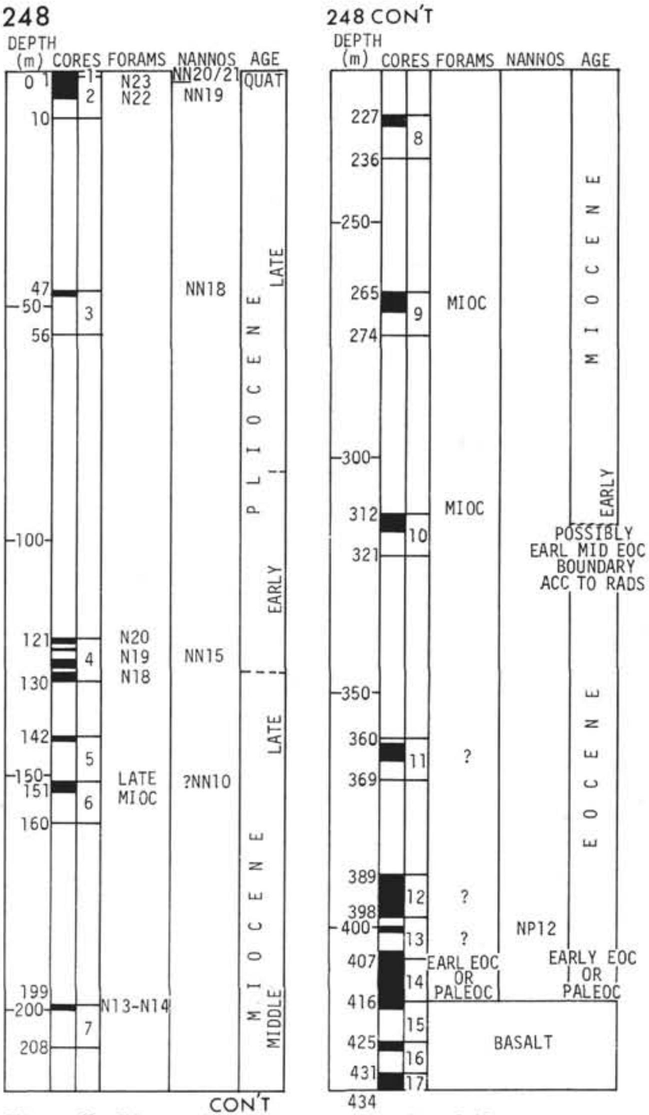


Figure 7. *Biostratigraphic summary, Site 248.*

Neogene

Zone NN18, *Discoaster brouweri* Zone of the late Pliocene, was observed in the core catcher of Core 3 with *Discoaster brouweri, Ceratolithus rugosus,* and *Pseudoemiliania lacunosa.* The coccoliths are slightly dissolved or replaced by pyrite.

The nannoplankton assemblage of Core 4 belongs to the *Reticulofenestra pseudoumbilica* Zone (NN15) with the typical species *Discoaster asymmetricus, Discoaster surculus, Discoaster variabilis,* and *Discoaster brouweri* and only a few specimens of *Reticulofenestra pseudoumbilica.*

The assemblage in the core catcher of Core 5 consists of species of both Eocene and Miocene ages. The determination of a zone is impossible. The *Discoaster calcaris* Zone (NN10) was determined in Core 6 with *Discoaster calcaris,* *Discoaster neohamatus, Discoaster challengeri,* and *Reticulofenestra pseudoumbilica.*

The core catcher of Core 7 contains only very few species indicating a Miocene age. Cores 8 to 12 are without nannoplankton.

Paleogene

Sample 13-1, 130 cm and 13, CC contain a nannoplankton assemblage of the *Marthasterites tribrachiatus* Zone (NP12) with *Marthasterites tribrachiatus, Discoaster lodoensis, Discoaster binodosus, Chiasmolithus grandis, Discoaster kuepperi,* and *Cyclococcolithus formosus.* In Sample 14-5 only very few specimens of *Cyclococcolithus formosus* and *Discoaster* sp. were found which indicate an Eocene age.

Foraminifera

Quaternary and Neogene

The sea floor at this site is situated at about the CCD. Except for the uppermost sample of Core 2 (Core 1 was without sediment recovery), all cores contain only small, more or less dissolved, and consequently incomplete foraminiferal associations.

The core catcher of Core 1 and the uppermost sample from Core 2 contain late Quaternary temperate planktonic foraminifera which are only slightly affected by dissolution. The bulk of the fauna is represented by *Globorotalia inflata; G. truncatulinoides truncatulinoides* and *G. truncatulinoides pachytheca* are relatively common. Also, there are *G. tumida tumida, G. tumida flexuosa, Pulleniatina obliquiloculata obliquiloculata,* and *P. obliquiloculata finalis*, whereas less dissolution-resistant genera like *Globigerina* and *Globigerinoides* are rare. Beginning with Section 2, Core 2, age is already early Quaternary. The age is given mainly by the presence of *Globorotalia truncatulinoides pachytheca* tending to *Globorotalia tosaensis* and the absence of true *G. truncatulinoides truncatulinoides.* This, and the samples following down the hole, show an ever-increasing influence of calcium carbonate dissolution.

The very few foraminifera of the core catcher of Core 3 (there is no sediment recovery in the core itself) give a maximum age of early Pliocene but it might be younger because the material is mixed. Benthonic foraminifera all are from deep-water environment. The presence of many, very small, well-preserved foraminifera in the grain-size fraction 177μ-63μ is striking because the planktonic foraminifera >177μ are worn. These small foraminifera did not yield characteristic species. They were all of about the same size, leading to the assumption that they are allochthonous. Benthonic foraminifera of small grain size are extremely rare and all are of deep-water origin. So the material, if allochthonous, cannot be traced to a shallow-water origin. On the other hand, the presence of abundant quartz and mica does not point to deep-water origin. Possibly, the material was first deposited somewhere on the continental slope in oxygen-poor conditions. Core 4 material is extremely poor in foraminifera because of heavy dissolution. It seems to indicate an early late Pliocene age. The lowermost samples (4-6, 140 cm and 4, CC) might already be late Miocene (Blow Zone N.18) because *Globigerinoides conglobatus*, which according to the range chart of Blow (1969) starts at the base of N.18, occurs there together with *Globorotalia tumida plesiotumida* and *Globorotalia merotumida*. Both of these latter become extinct in this same zone. Thus, the boundary between Pliocene and Miocene lies in the lower part of Core 4.

Also late Miocene in age are the very rare but well-preserved planktonic foraminifera of Core 6 (*Globigerina apertura, G. nepenthes, Globigerinoides trilobus trilobus, G. trilobus immaturus, G. obliquus, Globorotalia menardii, Globoquadrina altispira altispira, G. altispira globosa, Orbulina universa, O. suturalis, Sphaeroidinellopsis subdehiscens subdehiscens,* and *S. seminulina.* The core catcher of Core 7, the only material left from that core, is of middle Miocene age because there are found *Globigerina* cf. *falconensis, G. druryi, G. nepenthes, Globigerinoides bollii, G. subquadratus, Globorotalia cultrata limbata, G. mayeri, Globoquadrina dehiscens advena, Orbulina universa,* and *O. suturalis.* All agree with Blow Zones N.13/N.14. In the quartz sands of Cores 8 and 9, age determinations by means of foraminifera are impossible. The few specimens found are still of Miocene age. The same is true for the upper part of Core 10. The material from these cores contains large foraminifera of different age which are inhabitants of shallow water. They are *Amphistegina, Heterostegina, Alveolinids,* and *Miogypsina.*

Paleogene

Foraminifers cannot be used to determine the chronostratigraphy of the Paleogene sediments at this site. When assemblages are found, which is only rarely, they are excessively impoverished and poorly preserved (inside molds for the scarce planktonic species, and fragmented or valueless tests of agglutinated species). It is to be noted that faunas are described from older to younger in this section.

Planktonic species were found solely in Core 14. Despite extremely dense sampling throughout the six sections of this core, only about a dozen specimens in all were found in the form of molds in four levels (14-6, 20-22 cm; 14-5, 15-17 cm; 14-4, 130-132 cm; and 14-1, 30-32 cm). It is not possible to use them to determine the exact age of these levels. We cannot determine the exact stratigraphic position of these levels in Core 14 (early Eocene or Paleocene) even guided by its position (under Core 13 where nannoplankton [Zone NP12] show that it belongs to the early Eocene in its middle part, if we are to believe Berggren's correspondence table [Zones P.7 and P.8], or in its middle and upper parts if we use Martini's table [Zones P.7 to P.9]).

The extremely scarce benthonic species belong to a restricted number of genera such as *Ammodiscus, Haplophragmoides, Spiroplectoides, ?Dorothia,* and *Trochammina.* This is quite probably a residual bathyal assemblage. Besides Radiolaria, which are often very abundant and well preserved, only a few resistant forms remain after solution of the calcareous tests.

Samples examined from Core 14 include:

14, CC
14-6, 136-138 cm
14-6, 90-92 cm
14-4, 130-132 cm
14-4, 30-32 cm
14-3, 130-132 cm

14-6, 75-77 cm
14-6, 50-52 cm
14-6, 20-22 cm
14-5, 140-142 cm
14-5, 15-17 cm
14-3, 15-17 cm
14-2, 140-142 cm
14-1, 110-112 cm
14-1, 30-32 cm

The Core 14 washed residues also reveal varying amounts of fish teeth and skeleton fragments. Quartz and mica in fine grains are rare. Radiolaria are mostly few in number and are in the form of glauconitic molds.

In Core 13, samples are: 13, CC; 13-6, 130-132 cm; and 13-1, 130-132 cm. Residues are comparable to the preceding ones, with relatively frequent and well-preserved Radiolaria. There are no foraminifers.

Core 12 samples include:

12, CC
12-6, 120-122 cm (+)
12-6, 15-17 cm (*)
12-5, 100-102 cm (+)
12-4, 90-92 cm (+)
12-3, 110-112 cm
12-1, 120-122 cm (+)

The residues are still comparable and foraminifers very scarce (*). On the contrary, Radiolaria are in general abundant and very well preserved (+). Fish remains have disappeared.

From Core 11, only two samples were taken: 11, CC and 11-2, 88-90 cm. Residues are comparable, with abundant and poorly preserved Radiolaria and no foraminifers.

From Core 10, four samples were selected. These are: 10, CC; 10-2, 134-136 cm (x); 10-2, 80-82 cm; and 10-1, 94-96 cm. Very sandy residue beginning at the top of Section 2, coincides with the disappearance of Radiolaria. No foraminifers occur here and only one has rare fish teeth (x).

An extremely important change in the lithology of the residue (quartz, various other minerals, manganese) is found beginning with level 10-2, 80-82 cm. It is possible that the levels involved belong to the next sedimentary cycle (as can be seen in Core 9). A few Miocene planktonic species are present which might not be the result of "pollution per descensum". Scarce Radiolaria also are present and can be compared with those in the underlying levels from which they could have come through reworking.

Biostratigraphic Summary

In Hole 248, an incomplete sequence of Quaternary to early Eocene or Paleocene was drilled. Cores 1 (CC only) and 2 are rich in calcareous microfossils, indicating a middle to early Pleistocene age. During the Quaternary, the rate of sedimentation was very small. This is partly due to calcite dissolution, but in addition, there seems to be a loss of sediment material in the uppermost part of the core.

Upper Pliocene sediments occur within Cores 3 and 4. Foraminiferal associations and nannoplankton assemblages of these cores have been impoverished by dissolution processes. The possibility cannot be excluded that the Pliocene faunal and floral elements are in Quaternary cores because of technical mixing. This would explain the striking discrepancy between Pliocene and Quaternary sediment thicknesses.

In a continuous series from upper Pliocene down to middle Miocene, the sedimentation rate decreases from an average of 35 m/m.y. in the late Pliocene to 12 m/m.y. in the late middle to early late Miocene. From Core 5 to the upper part of Core 10, a silty sand contains few fossils. There are reworked species from both the Eocene and the lower Miocene. In this sequence, some of the large foraminifera belong to a shallow-water environment. In the upper part of Core 10, Miogypsinas have been found, which indicate an early Miocene age. This Miocene is directly underlain by late early Eocene according to the Radiolaria. Calcareous nannoplankton, found only in Core 13, indicate an early Eocene age. Foraminifera either are missing or are rare, with the exception of Core 14 where a residual bathyal assemblage of agglutinated benthonics was found; nannoplankton in Core 14 are very rare and do not give an age. If the age determination by means of Radiolaria, which is a provisional one, is correct, there would be a gap of ~34 million years in Core 10. The sedimentation during early Eocene would then be 100 meters. The authors think it more likely, that, if there is a gap at all, it would be much smaller. If uninterrupted sedimentation occurred, the rate would be ~2.5 m/m.y. for the time in question. This value seems reasonable.

CORRELATION OF REFLECTION PROFILES AND LITHOLOGIES

The characteristics of the airgun reflection profile run by *Glomar Challenger* in the near-site area are quite similar to the data obtained by *Gallieni* in 1972 (Cruise 6). Both records show, at the site, a transparent layer 0.17 to 0.18 sec DT thick which pinches out abruptly towards the Mozambique Ridge. Below this transparent layer, is a series of well-stratified layers which rest upon a strong acoustic basement reflector at a depth of 0.48 sec DT. Minor reflectors can be identified in the stratified sequence at 0.23 sec DT and 0.33 sec DT (Figures 5 and 8).

The lithologic description shows that the whole cored section above basement can be subdivided into three main lithostratigraphic units. Unit I is divided into three subunits: (A) sandy silt with silt/clay-rich nanno ooze (Cores 1 and 2, thickness 10 to 47 m, lower boundary between Cores 2 and 3, i.e., 10 and 47 m depth), (B) clayey silt and silty clay (Cores 3 and 4, thickness 83 to 120 m; lower boundary well established at 130 m depth), (C) silty sand, coarse quartz sand and clayey sandy silt (Cores 5 to 9, thickness 144-182 m; lower boundary between Cores 9 and 10, i.e., 274 and 312 m depth). Unit II is mainly laminated silt-bearing and silt-rich clay (Cores 10 to 13, thickness 95 to 134 m; lower boundary well established at 407 m depth). Unit III, which directly overlies the basement, is brown clay and brown silt-rich clay (Core 14, thickness 15 m; the lower boundary well established at 422 m depth).

The boundary between subunit IA and subunit IB (10-47 m depth) does not correspond to any clear reflector. The first clear reflector at 0.17 to 0.18 sec DT, which corresponds to the interface between the transparent layer and the stratified series, can be correlated with the boundary between subunit IB and subunit IC at 130 meters depth. This boundary also corresponds to a sudden change of the measured sonic velocity. Between Core 4 and Core 6, the measured sonic velocity increases abruptly from 1.53 km/sec to 1.65 km/sec and a simultaneous increase of acoustic impedance and decrease of water content and porosity is observed at this same depth (130-150 m). If this

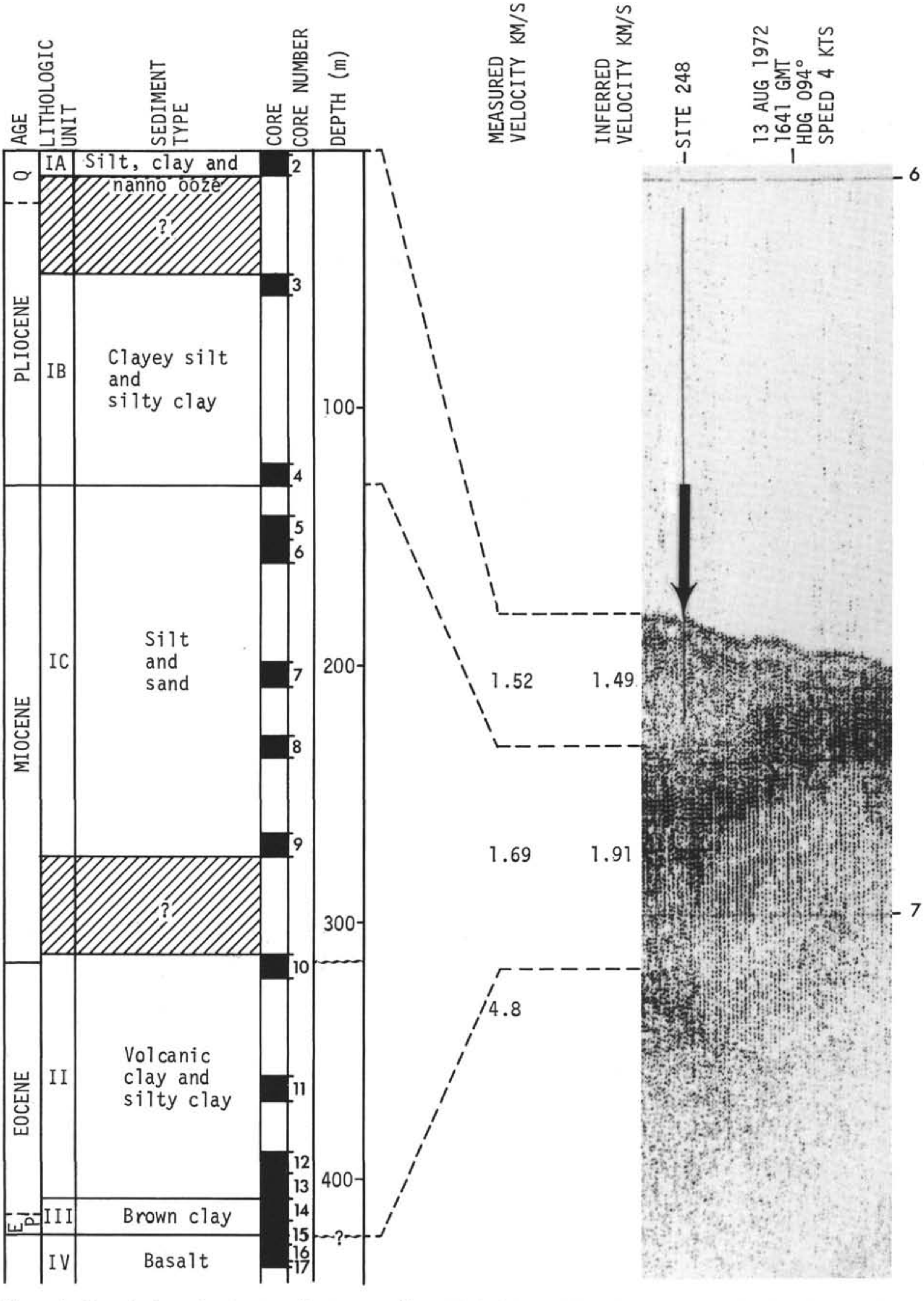


Figure 8. *Correlation of seismic reflection profile with lithology. Wavy lines in the depth column indicate hiatuses.*

correlation is valid, then the interval velocity for the acoustically transparent sediments is 1.49 ± 0.04 km/sec. The average measured velocity for this layer is 1.52 km/sec.

The minor reflectors, which can be seen in the stratified series at 0.23 sec DT and 0.33 sec DT, cannot be correlated with a specific lithologic change. The interval velocity for the stratified layers is 1.91 ± 0.04 km/sec and the corresponding average measured velocity is about 1.69 km/sec.

The overall interval velocity for the sedimentary sequence from the sea floor down to the basement reflector, calculated by reflection time and measured drill distance, is 1.76 km/sec, while the average mean velocity for the same interval is about 1.65 km/sec. Figure 8 shows the correlation which can be established between the airgun reflection profile and the lithology.

SUMMARY AND CONCLUSIONS

Site 248, with a water depth of 4994 meters, is located in the northwestern Mozambique Basin, about 30 miles from the very steep eastern boundary scarp of the Mozambique Ridge, which rises 3000 meters above the basin floor. The single hole penetrated 422 meters of Pleistocene to middle Paleocene sediments and 12 meters into the underlying basaltic basement. The scientific results are summarized in Figure 9.

The *Glomar Challenger* airgun seismic reflection profile is similar in all essential respects to those of *Thomas B. Davie* 267 in 1971 and *Gallieni* 6 in 1972. It shows (at the site) an uppermost transparent layer, 0.17 to 0.18 sec DT thick, overlying a stratified to acoustically opaque layer which is 0.30 sec DT and directly overlies acoustic basement at a depth of 0.48 sec DT. Minor reflections can be recognized in the stratified sediments at 0.23 sec DT and 0.33 sec DT. The *Glomar Challenger* airgun profile from east to west shows that the uppermost transparent layer is of restricted lateral extent, pinching out progressively towards the east and abruptly to the west about 25 miles east of the Mozambique Ridge. The *Davie* profile from south to north indicates that it has a much more extensive meridional distribution, thinning gradually towards the north over about 100 miles.

The main objectives of drilling this site were (a) to sample, identify, and date the basement and (b) to establish the nature and origin of the lithostratigraphic and biostratigraphic succession.

In spite of technical and position-holding difficulties in a 4-knot current with strong swells from three directions and a consequent low core recovery rate, the section was sampled sufficiently to establish the general stratigraphic succession.

Basaltic basement, at a subbottom depth of 422 meters, is successively overlain by a pelagic sediment Unit III (15 m), a volcanic hemipelagic Unit II (about 115 m) and the uppermost Unit I (about 300 m) which comprises mostly terrigenous sediments and is subdivided into three subunits.

The acoustically transparent sediment comprises subunits IA and IB of the lithostratigraphic succession which together are 130 meters thick, giving an interval velocity of 1.49 km/sec (average measured velocity = 1.52 km/sec) for this upper acoustic layer. Subunit IA consists of early to middle Pleistocene greenish-gray sandy silt and olive-gray silt- or clay-rich nanno ooze with well-preserved foraminiferal and nannofossil assemblages, between 10 and 47 meters thick (the lower boundary lies between Cores 2 and 3). Abundant quartz and potash feldspar, less abundant fragments of granite, and accessory hornblende, zircon, garnet, sphene, and biotite indicate a granitic/metamorphic provenance area. Subunit IB is late to early Pliocene greenish-gray clayey silt and silty clay showing progressive downward impoverishment of calcareous fauna and flora due to dissolution, and deep water benthonic foraminifera near the bottom. The thickness is between 83 and 120 meters. The mineralogy is similar to that of subunit IA, with pyrite and chlorite as additional accessories.

The underlying acoustically stratified sediments are made up of the following:

1) Subunit IC consists of unconsolidated silty sand, coarse quartz sand, and clayey sandy silt of middle to late Miocene age, with shallow-water benthonic foraminifera, few planktonic fossils, and reworked species from the early Miocene and Eocene. The mineralogy is again similar to that of subunit IA, with additional shell fragments, tourmaline, and epidote among the accessories.

2) Unit II which consists of 95 to 134 meters of greenish-gray volcanic laminated silt-bearing and silt-rich clay that shows graded bedding. Calcareous fossils are absent but well-preserved fish teeth and radiolarians, and a nanno-rich clay are at the base, for which an early Eocene age is indicated. The heavy mineral assemblage is similar to that of Unit I.

3) Unit III which consists of early Eocene or possible Paleocene brown clay and brown silty clay, 15 meters thick, with thin reddish and black beds, rich in manganese and iron oxides near the top. Clay is dominant, with subordinate quartz-feldspar silt and gypsum near the base. Calcareous fossils are absent, but an early Eocene age was derived from one very small foraminiferal assemblage.

An unconformity, which represents the whole Oligocene and possibly also the earliest Miocene and latest Eocene, marks the boundary between Units I and II.

Dark gray prophyritic basalt forms the basement which was cored between 422 and 434 meters. Nannoplankton gave an age not older than Paleocene to small amounts of unmetamorphosed sediment recovered from a joint plane in the basalt. A single measurement gave a heat flow value of 1.03 μ cal cm^2 sec. In summary, it is concluded that:

1) The basalts recovered were extruded onto the sea floor as lava flows in pre-Danian time.

2) The brown clays of Unit III are pelagic sediments deposited below the regional CCD, and the presence of red and black iron-rich layers suggests submarine hydrothermal iron-enrichment similar to that suggested for the basal iron-rich sediments at Site 245.

3) The laminated sequence in Unit II was deposited mostly in deep water below the regional CCD, the sediments being mainly hemipelagic silts and clays.

4) A strong and rapid terrigenous influx began in the middle Miocene when coarse turbidites, almost certainly derived from both Africa and Madagascar, reached the Mozambique Basin via the Zambesi Canyon.

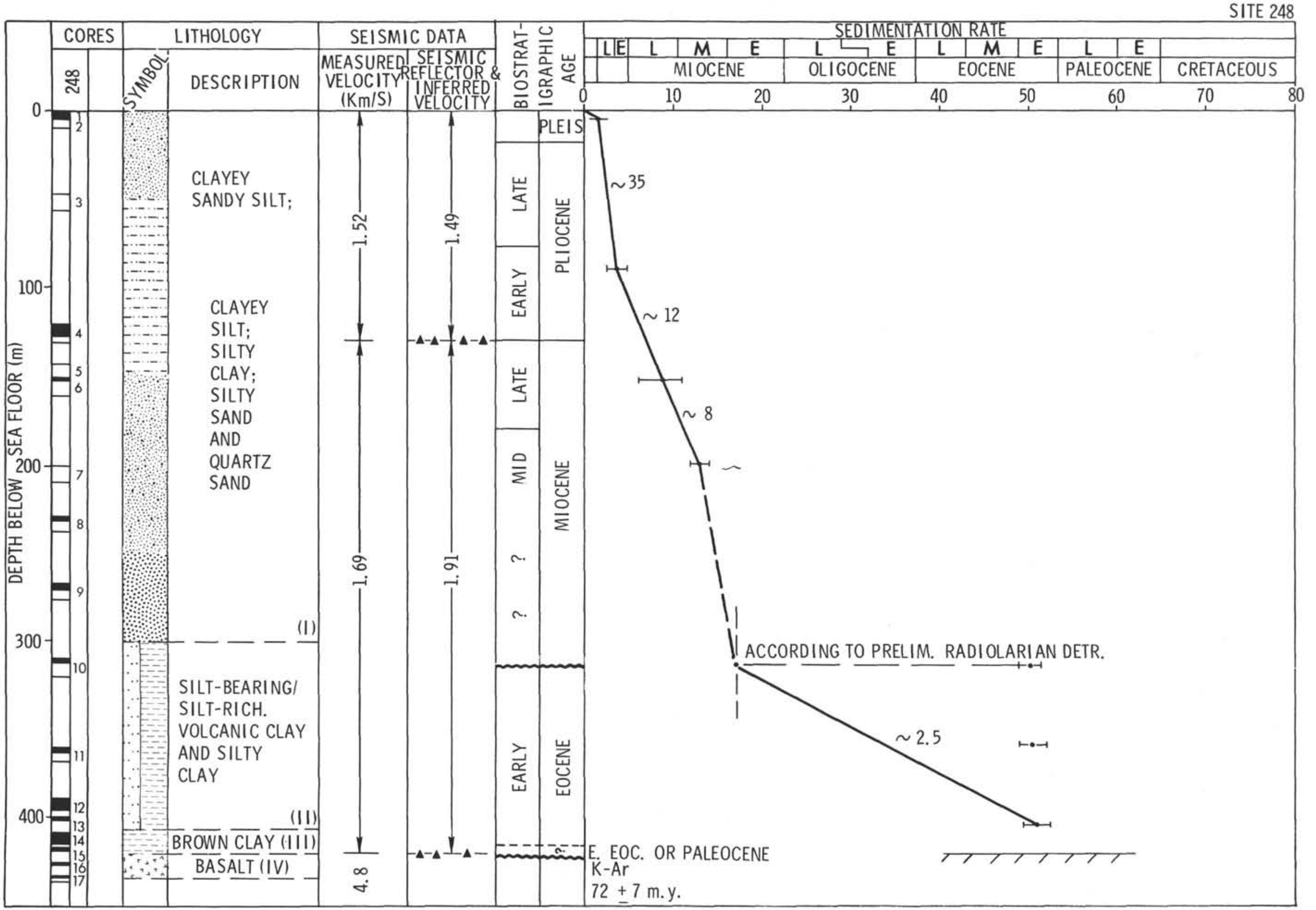


Figure 9. *Summary diagram, Site 248.*

5) The coarse-grained sediments suggest large-scale epeirogenic uplift of the provenance areas during the middle Miocene-Pleistocene interval.

REFERENCES

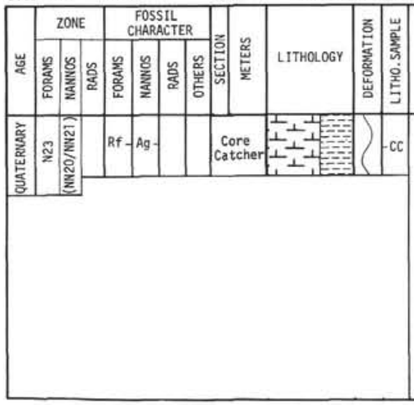
Blow, W. H., 1969. Late middle Eocene to Recent planktonic foraminiferal biostratigraphy: Internatl. Conf. Plankt. Microfossils, 1st, Geneva (1967), Proc., v. 1, p. 199.

Ewing, M., Ettreim, S., Truchan, M., and Ewing, J. I., 1969. Sediment distribution in the Indian Ocean: Deep Sea Res., v. 16, p. 231-248.

Green, A. G., 1972. Sea-floor spreading in the Mozambique Channel: Nature, v. 236, p. 19-21.

Ludwig, W. J., Nafe, J. E., Simpson, E. S. W., and Sacks, S., 1968. Seismic refraction measurements on the southeast African continental margin: J. Geophy. Res., v. 73, p. 3707-3719.

Site 248 Hole Core 1 Cored Interval: 0-1 m



LITHOLOGIC DESCRIPTION

Core Catcher only. Color is light olive gray (5Y6/1).

FORAM/SILT-BEARING CLAY-RICH NANNO OOZE

Composition

forams	5%
qtz. & feld.	8%
clay	20%
calc. nannos	65%
rads & diatoms	1%
sp. spic.	1%

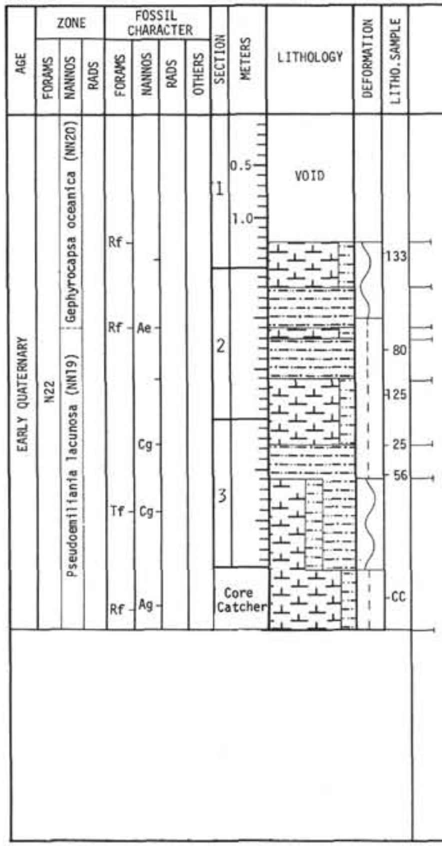
NANNO/FORAM-BEARING SAND-RICH CLAYEY SILT

Texture

(10-50-40)

Heavy minerals include:
hornblende, epidote, glauconite, hematite, garnet, chlorite

Site 248 Hole Core 2 Cored Interval: 1-10 m



10YR6/4

5G4/1

5B5/1

5G4/1

5Y5/2

5G4/1

5G4/1,
5Y5/2,
&
5B5/1
interlayered

LITHOLOGIC DESCRIPTION

Core is intensely deformed in Section 1, at the top of 2, and the bottom of 3. The remainder is moderately deformed. Colors are dark green gray (5G4/1), light olive gray (5Y5/2), moderate yellow brown (10YR6/4), and medium blue gray (5B5/1). Burrow mottling 2-75 to 2-80.

Interlayered Dominant Lithologies:
1) Green gray clayey sandy silt, and
2) light olive and yellow brown foram-bearing clay/silt-rich nanno ooze.

Major silt beds at 2-20 to 60 cm, 2-70 to 112 cm, and 3-28 to 60 cm.

CLAYEY SANDY SILT
Smear 2-80

Texture	Composition	
(25-40-35)	clay in silt-sized clumps	50%
	det. clay	20%
	qtz. & feld.	30%
	heavies	Tr.

Heavy minerals include hornblende, zircon, garnet, sphene, biotite, and glauconite.

FORAM-BEARING CLAY/SILT-RICH NANNO OOZE
Smear 1-133

Composition

calc. nannos	65%	forams	3%
qtz. & feld.	20%	micarb	2%
det. clay	10%	glauc.	Tr.

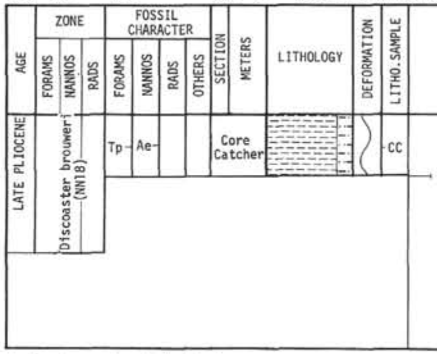
Grain Size
2-90 (4-33-63) silty clay
3-54 (4-38-58) silty clay

Carbon-Carbonate
2-95 (2.6-0.3-19)

X-ray 2-120

calc.	P	kaol.	P
qtz.	P	mica	P
k-feld.	P	mont.	P
plag.	P		

Site 248 Hole Core 3 Cored Interval: 47-56 m



LITHOLOGIC DESCRIPTION

5GY4/1
dark green gray

Core catcher only

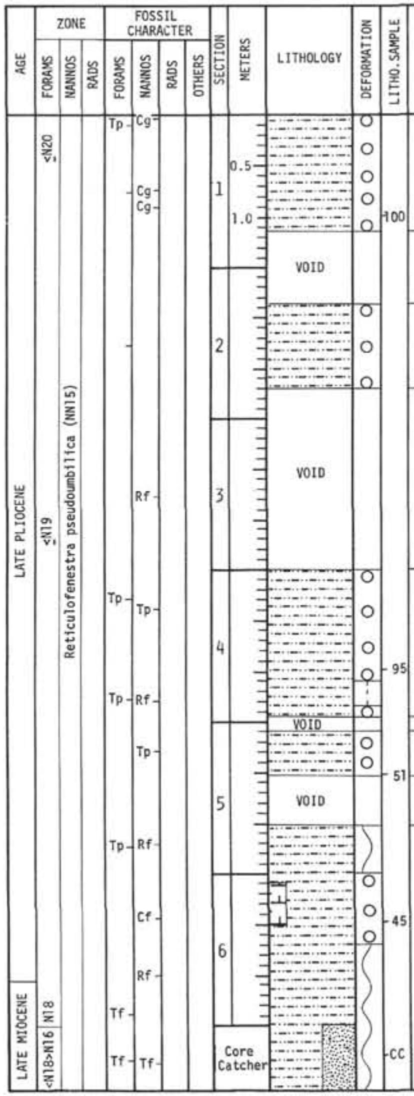
CLAY (silt-rich)

Texture	Composition	
(1-20-79)	silt-sized clay particles	15%
	det. clay	79%
	calc. nannos	3%
	qtz.	3%
	mica	Tr.
	heavies	Tr.

pyrite burrow cast 2 cm long and 0.8 cm in diameter

Explanatory notes in chapter 1

Site 248 Hole Core 4 Cored Interval: 121-130 m



LITHOLOGIC DESCRIPTION

N4 & 5GY4/1

Core is deformed throughout. Mostly a drilling breccia. Colors are medium dark gray (N4), dark gray (N3), and dark green gray (5GY4/1). Entire core is mostly medium dark gray (N4) SILTY CLAY and CLAYEY SILT.

N4 with N3 streaks

SILTY CLAY
Smear 4-95

Texture	Composition	
(0-30-70)	det. clay	65%
	qtz. & feld.	30%
	heavies	2%
	mica	2%
	pyrite	1%
	calc. nannos	Tr.

Heavies include hornblende, chlorite, biotite, opaques.

Pyrite-rich zones occur throughout the core.

Minor lithology contained in clasts is CLAY-RICH NANNO OOZE
Smear 6-45

Composition	
calc. nannos	80%
det. clay	15%
qtz. & feld.	5%

Sieved sample from core catcher includes quartz (65%), feldspar (15%), carbonates (15%), micas (2%), heavies (3% incl. hornblende and garnet).

Grain Size
5-50 (0-31-69) silty clay

pyritized worm burrow

Carbon-Carbonate
1-6 (2.7-0.4-19)

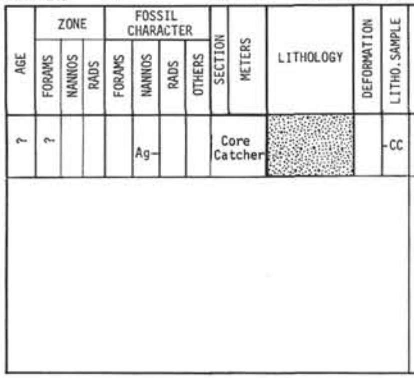
N4 with N3 streaks

X-ray 1-1

calc.	A	K-feld.	P
mica	P	mont.	P
qtz.	P	kaol.	T
plag.	P	pyrite	T

Explanatory notes in chapter 1

Site 248 Hole Core 5 Cored Interval: 142-151 m



LITHOLOGIC DESCRIPTION

5GY4/1
dark green gray

Core catcher only

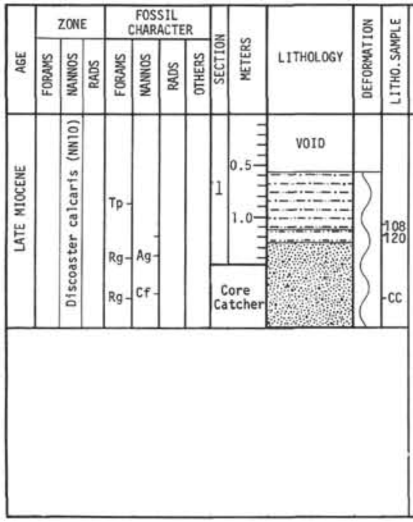
SILTY SAND

Texture	Composition	
(75-20-5)	qtz.	75%
	feld	8%
	opaques	10%
	heavies	7%
	forams	Tr.

Heavies include: hornblende, garnet, zircon, epidote, chlorite.

Sand is medium grained, subangular to subrounded.

Site 248 Hole Core 6 Cored Interval: 151-160 m



LITHOLOGIC DESCRIPTION

Core is moderately deformed. Color is dark green gray(5GY4/1).

CLAYEY SANDY SILT
Smear 1-108

Texture	Composition	
(30-40-30)	qtz.	55%
	feld.	15%
	det. clay	25%
	heavies	3%
	mica	1%
	pyrite	1%

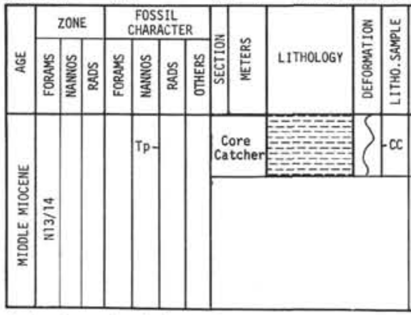
No grading; grains subangular to subrounded; poorly sorted.

SILTY SAND (probably washed during coring)
Smear CC

Texture	Composition	
(60-40-0)	qtz.	65%
	feld.	20%
	mica	5%
	heavies	5%
	forams	5%

Benthonic forams are shallow water (10 m) species.

Site 248 Hole Core 7 Cored Interval: 199-208 m



LITHOLOGIC DESCRIPTION

5GY4/1
dark green gray

Core catcher only

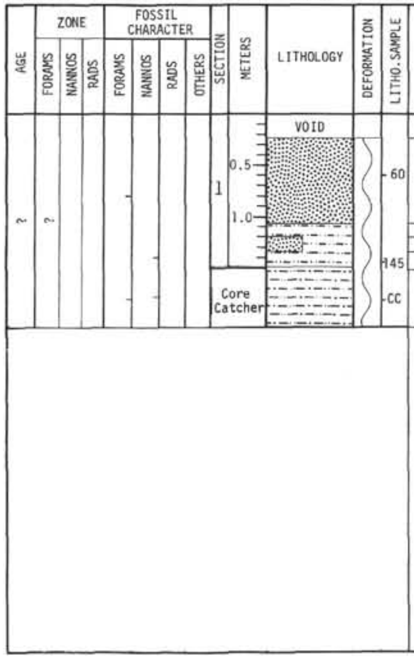
CLAY (silt-bearing)

Texture	Composition	
(0-5-95)	det. clay	95%
	qtz. & feld.	5%
	heavies	Tr.

Some tourmaline in the heavy mineral fraction.

Explanatory notes in chapter 1

Site 248 Hole Core 8 Cored Interval: 227-236 m



LITHOLOGIC DESCRIPTION

Sands washed; clays and silty clays are moderately deformed. Colors are green black (5G2/1) and dark green gray (5GY4/1).

5GY4/1

5G2/1
5G2/1 & 5GY4/1
5G2/1
5GY4/1

QUARTZ SAND
Smear 1-60

Texture	Composition	
(95-0-5)	qtz. & feld.	90%
	det. clay	5%
	calc. nannos	3%
	heavies	1%
	others	1%
	forams	Tr.

Heavies include: zircon, garnet, epidote, hornblende, and hypersthene.

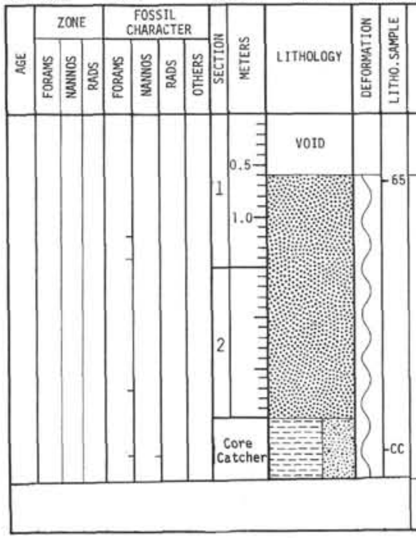
DETRITAL CLAY (silt-rich)
Smear 1-145

Texture	Composition	
(5-15-85)	qtz. & feld.	15%
	det. clay	85%
	others	5%

Sands are coarse to very coarse grained. Roundness varies with size; poorly sorted. Benthonic forams from shallow water.

Grain Size
1-40 (99-0-1) sand
1-90 (99-0-1) sand
1-143 (3-13-84) clay

Site 248 Hole Core 9 Cored Interval: 265-274 m



LITHOLOGIC DESCRIPTION

thin bedding

Top part of Section 1 has thin beds; other parts are relatively homogeneous, probably because of mixing and washing during the coring process.

QUARTZ SAND
Smear 1-65

Texture	Composition	
(95-5-0)	qtz.	65%
	feld.	25%
	heavies	5%
	opaques	5%

5GY4/1
dark green gray

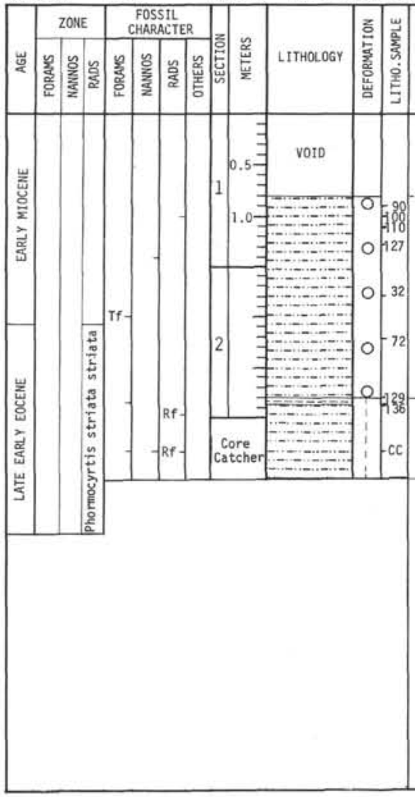
Heavies in relative order of abundance: green hornblende, brown hornblende, garnet, epidote, tourmaline (some rounded), zircon, pyrite, biotite-chlorite

CLAY (SAND/SILT-RICH)
Smear CC

Texture	Composition	
(10-15-75)	det. clay	75%
	qtz.	18%
	feld.	6%
	heavies	1%

Grain Size
2-80 (98-0-2) sand

Site 248 Hole Core 10 Cored Interval: 312-321 m



LITHOLOGIC DESCRIPTION

Core is deformed; mostly a drilling breccia except for last 20 centimeters in Section 2.
VOLCANIC SILTY CLAY
Smear 1-90

Texture	Composition	
(0-40-60)	clay minerals	60%
	qtz., cris., trid.	33%
	feld.	3%
	mica	2%
	heavies	2%
	rads	Tr.

variegated core includes:
5YR4/4 moderate brown (dom.)
5G4/1 dark green gray
5Y4/1 olive gray
5B5/1 medium blue gray

Heavies include hematite, pyrite, hornblende, chlorite, zircon, and epidote.

Silicified mudstone clasts at 16-20 and 71-72 cm. Small (1 cm) Mn nodule at 95 cm.

5G4/1 dark green gray with some 5G2/1 green black

Minor lithology DEVITRIFIED VOLCANIC ASH
Smear 2-129

Composition	
clay	95%
qtz. & feld.	5%
opaques	Tr.

Mostly silty clay, all colors, green black streaks and thin laminations near base of Section 2 may be partly devitrified volcanic ash. The bottom part of Core 10 (silty clay) is very similar to Core 11. The upper part of Core 10 probably consisted of thin (2-10 cm) bedded brown and gray volcanic silty clays.

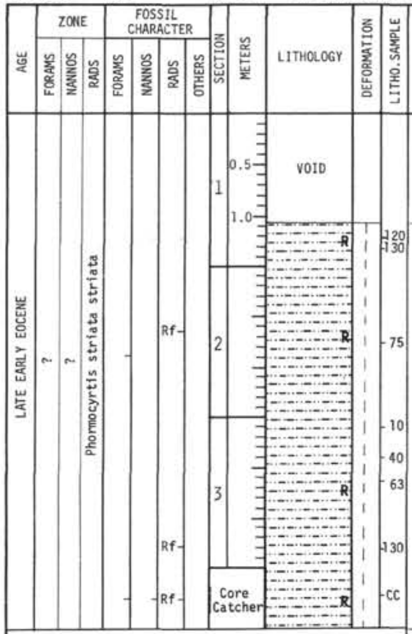
Carbon-Carbonate
2-130 (0.1-0.2-0)

X-ray 2-129

paly.	A	mica	P
cris.	P	plag.	P
qtz.	P	k-feld.	T
mont.	P	trid.	T

Explanatory notes in chapter 1

Site 248 Hole Core 11 Cored Interval: 360-369 m



LITHOLOGIC DESCRIPTION

Core is only slightly deformed; very stiff. Colors are mainly dark green gray and green black with minor brown gray and gray red.

VOLCANIC SILTY CLAY

Smear 2-75

Texture	Composition	
(0-45-55)	clay minerals	55%
	qtz., cris., trid.	38%
	feld.	4%
	opaques	2%
	others	1%
	rads	Tr.

5GY4/1 dark green gray with thin laminations of green black (5GY2/1)

minor fine laminae of brown gray (5YR4/1) & grayish red (5R4/2) in Section 2

Minor lithology (smears 3-10, 3-41) CARBONATE SILT AND CLAY with abundant carbonate rhombs (rhodochrosite).

color same as Section 1 with thin laminae white carbonate streaks

Penecontemporaneous deformation of bedding in Section 3, 125-150 cm; also in Section 2.

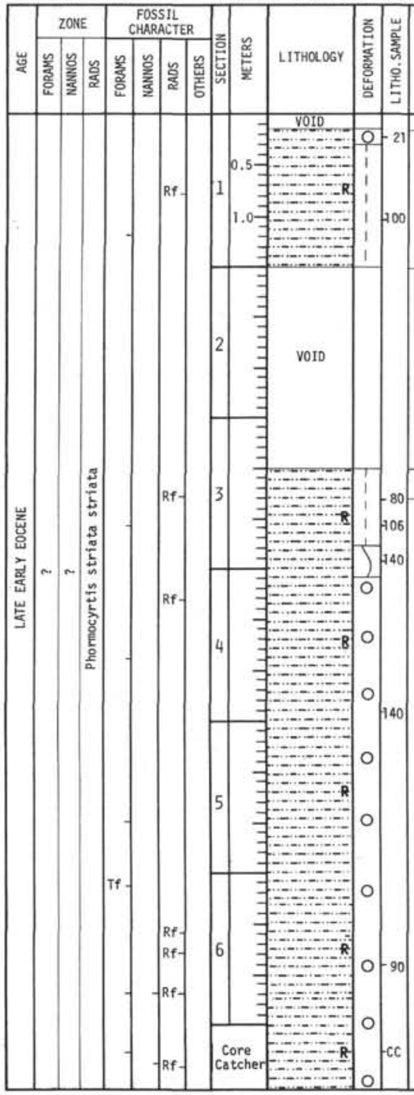
Thinly laminated to laminated silty clay with thin brown gray laminae of clay which probably are devitrified ash beds. The white, very thin laminae, are rhodochrosite in this core. However, in Core 12 the white laminae are composed of a low birefringent mineral (cristobalite?) and clay.

Grain Size
1-127 (0-31-69) silty clay

Carbon-Carbonate
1-142 (0.2-0.3-0)

X-ray 1-144		X-ray 3-30		X-ray 3-44	
paly.	A	cris.	A	rhod.	A
qtz.	P	qtz.	P	cris.	P
cris.	P	k-feld.	P	qtz.	P
plag.	P	plag.	P	k-feld.	P
mica	P	mica	P	plag.	P
mont.	P	mont.	P	paly.	P
k-feld.	T	paly.	P	mont.	P
pyrite	T	trid.	T	mica	P
trid.	T				

Site 248 Hole Core 12 Cored Interval: 389-398 m



LITHOLOGIC DESCRIPTION

5GY4/1
dark green gray
with 5GY2/1 green black
and thin N7 white laminae

Core is mostly deformed; predominantly a drilling breccia with soupy parts, particularly in Section 3. Section 1 is least deformed; some good laminae.

VOLCANIC SILTY CLAY

Most smears

Texture	Composition	
(0-25-75)	clay minerals	75%
	qtz., cris., trid.	20%
	feld.	4%
	others	1%
	rads	Tr.

Entire core probably a volcanic silty clay, now devitrified.

Increase in pyrite content may account for darker laminae.

5Y4/1
olive gray

5GY4/1 dark green gray
& 5GY2/1 green gray
Rare white streaks.

Some 5YR4/1 brown gray
& 5Y4/1 olive gray

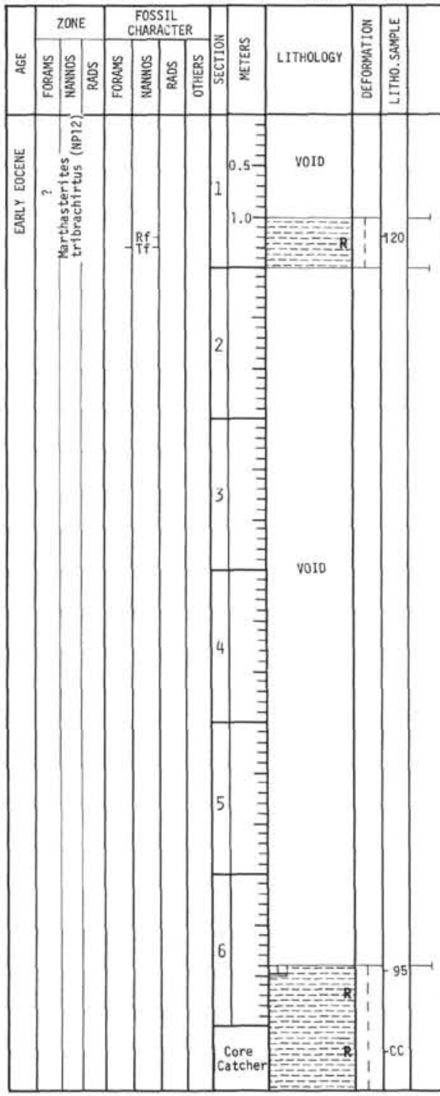
Some carbonate rhombs in clay at Section 3, 140 cm and zeolite (clinoptilolite) occurs in Section 3.

Possible devitrified volcanic ash at Section 3, 81 cm. Composition: 96% clay, 3% qtz. and feldspar, 1% pyrite.

X-ray 3-100	
qtz.	A
cris.	P
k-feld.	P
plag.	P
mont.	P
mica	P
paly.	P
clin.	T

Explanatory notes in chapter 1

Site 248 Hole Core 13 Cored Interval: 398-407 m



LITHOLOGIC DESCRIPTION

5G6/1
5GY4/1

5G6/1 dom., some 5GY2/1

Core is mostly void. Recovered segments are moderately deformed. Colors are green gray (5G6/1), dark green gray (5GY4/1), and green black (5GY2/1).

VOLCANIC CLAY (SILT-RICH)
Smear 1-120

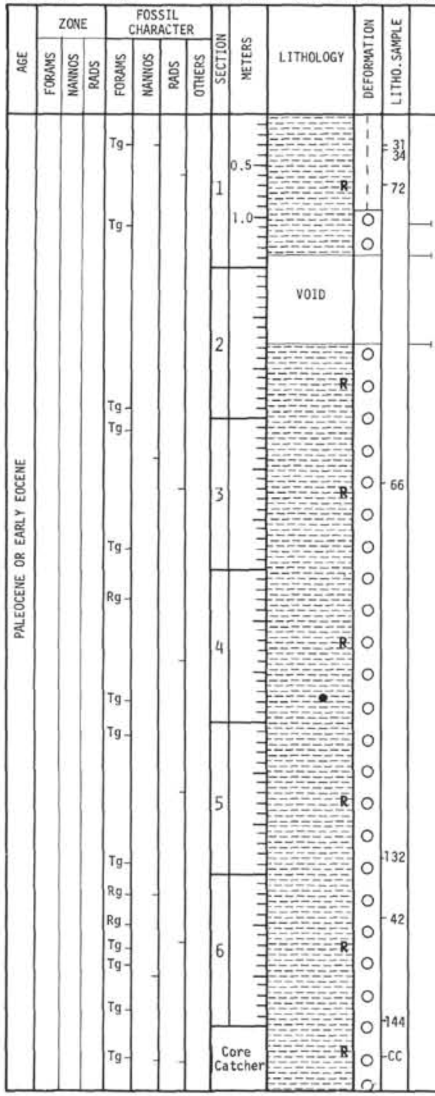
Texture	Composition	
(0-18-82)	clay minerals	80%
	qtz., cris., trid.	15%
	feld.	3%
	opaques	2%
	rads	Tr.

NANNO-RICH CLAY
Smear 6-95

Composition	
clay minerals	73%
calc. nannos	25%
micarb.	2%

X-ray 1-132 (devitrified ash)	
paly.	M
mont.	P
qtz.	P
mica	T

Site 248 Hole Core 14 Cored Interval: 407-416 m



LITHOLOGIC DESCRIPTION

5YR3/4
moderate
brown with
thin beds
of 10R3/4
& 5R2/2

5YR3/4
moderate
brown

Core is deformed only moderately in Section 1, 0-95 cm. Remainder is a drilling breccia. Colors are moderate brown (5YR3/4), with some dark red brown (10R3/4) and black red (5R2/2).

BROWN CLAY (SILT-BEARING)
Smear 1-34

Texture	Composition	
(0-10-90)	clay minerals	90%
	qtz. & feld.	6%
	opaques	4%
	rads	Tr.

Some smear slides contain 15% silt-sized grains.

Heavy minerals included in smear slides are: goethite, hematite, augite, magnetite, chlorite, biotite.

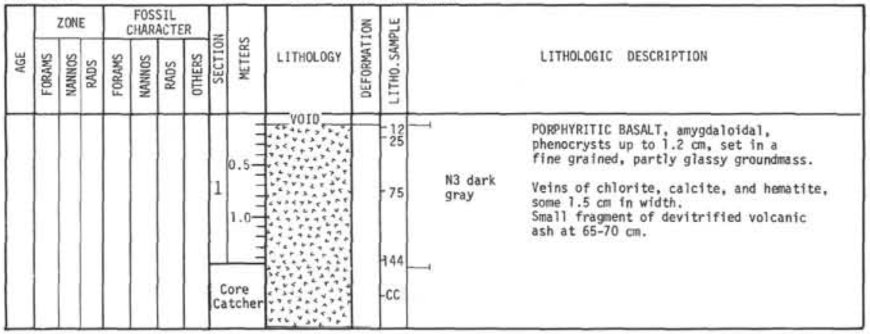
Benthonic forams from deep water.

Small Mn nodule (1 cm) at Section 4, 134 cm. Extreme hematite staining at Section 6, 42 cm. Core is iron-rich; some banding.

X-ray 1-70		X-ray 6-149	
paly.	A	paly.	A
qtz.	P	k-feld.	P
k-feld.	P	qtz.	P
mica	P	mica	P
mont.	P	mont.	P
hem.	P	mont.	P
plag.	T	kaol.	T

Explanatory notes in chapter 1

Site 248 Hole Core 15 Cored Interval: 416-425 m

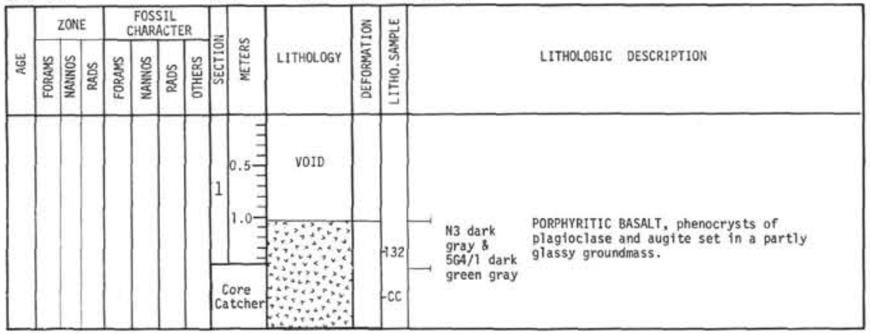


N3 dark gray

PORPHYRITIC BASALT, amygdaloidal, phenocrysts up to 1.2 cm, set in a fine grained, partly glassy groundmass.

Veins of chlorite, calcite, and hematite, some 1.5 cm in width.
Small fragment of devitrified volcanic ash at 65-70 cm.

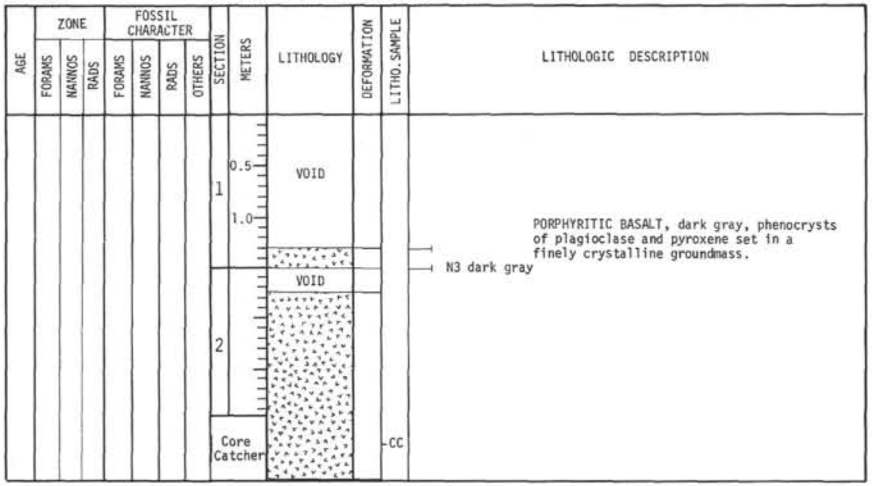
Site 248 Hole Core 16 Cored Interval: 425-431 m



N3 dark gray & 5G4/1 dark green gray

PORPHYRITIC BASALT, phenocrysts of plagioclase and augite set in a partly glassy groundmass.

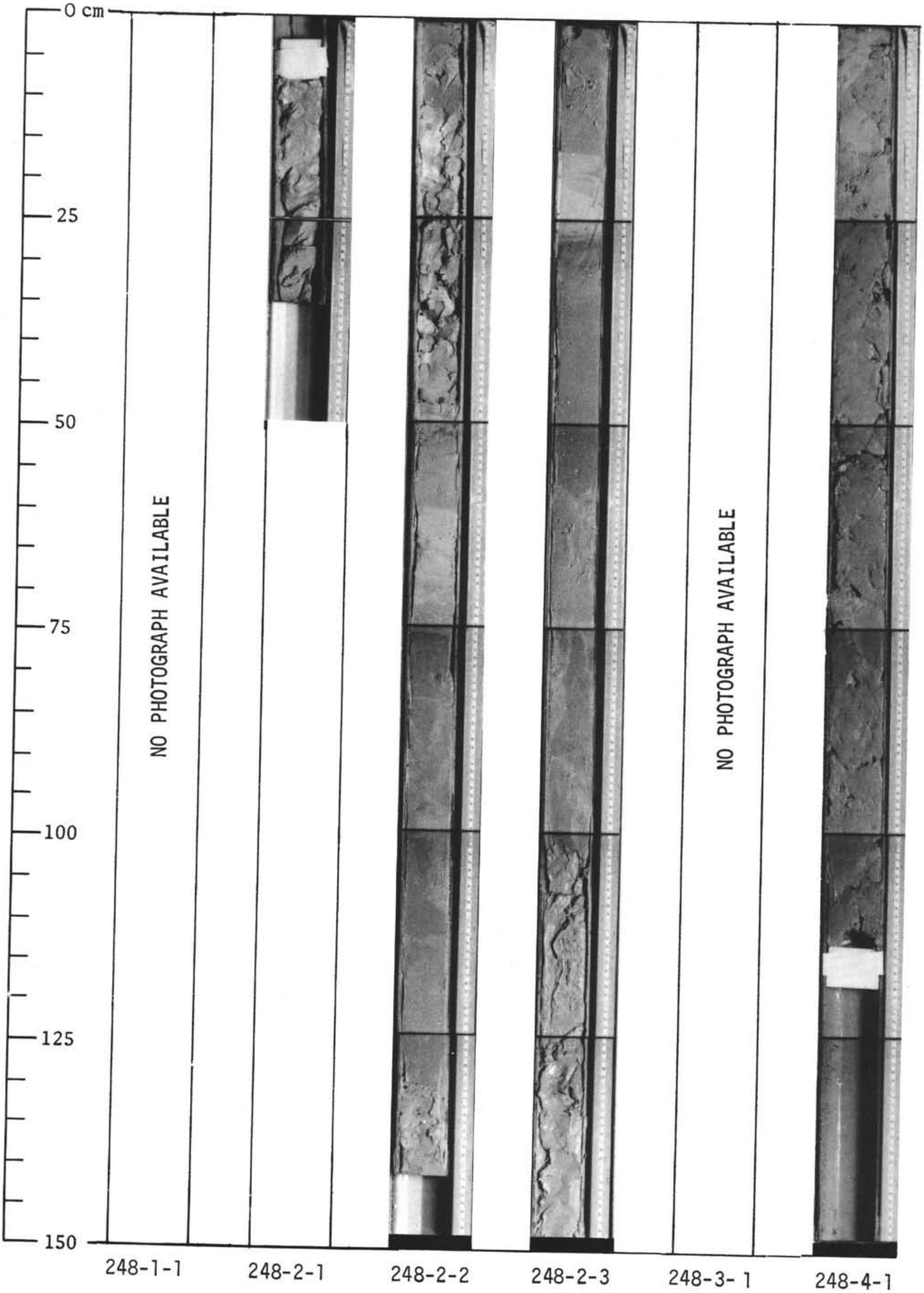
Site 248 Hole Core 17 Cored Interval: 431-434 m

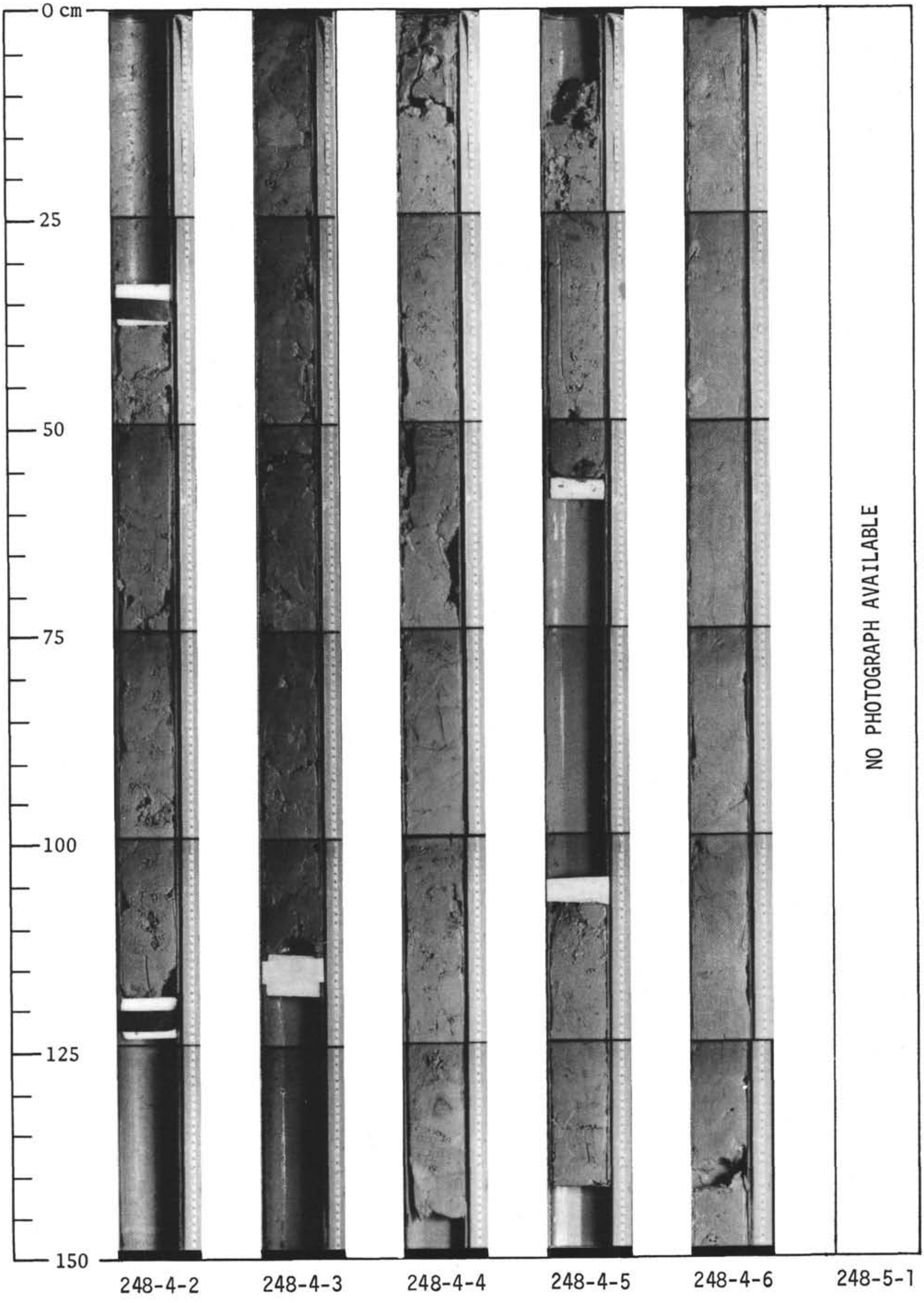


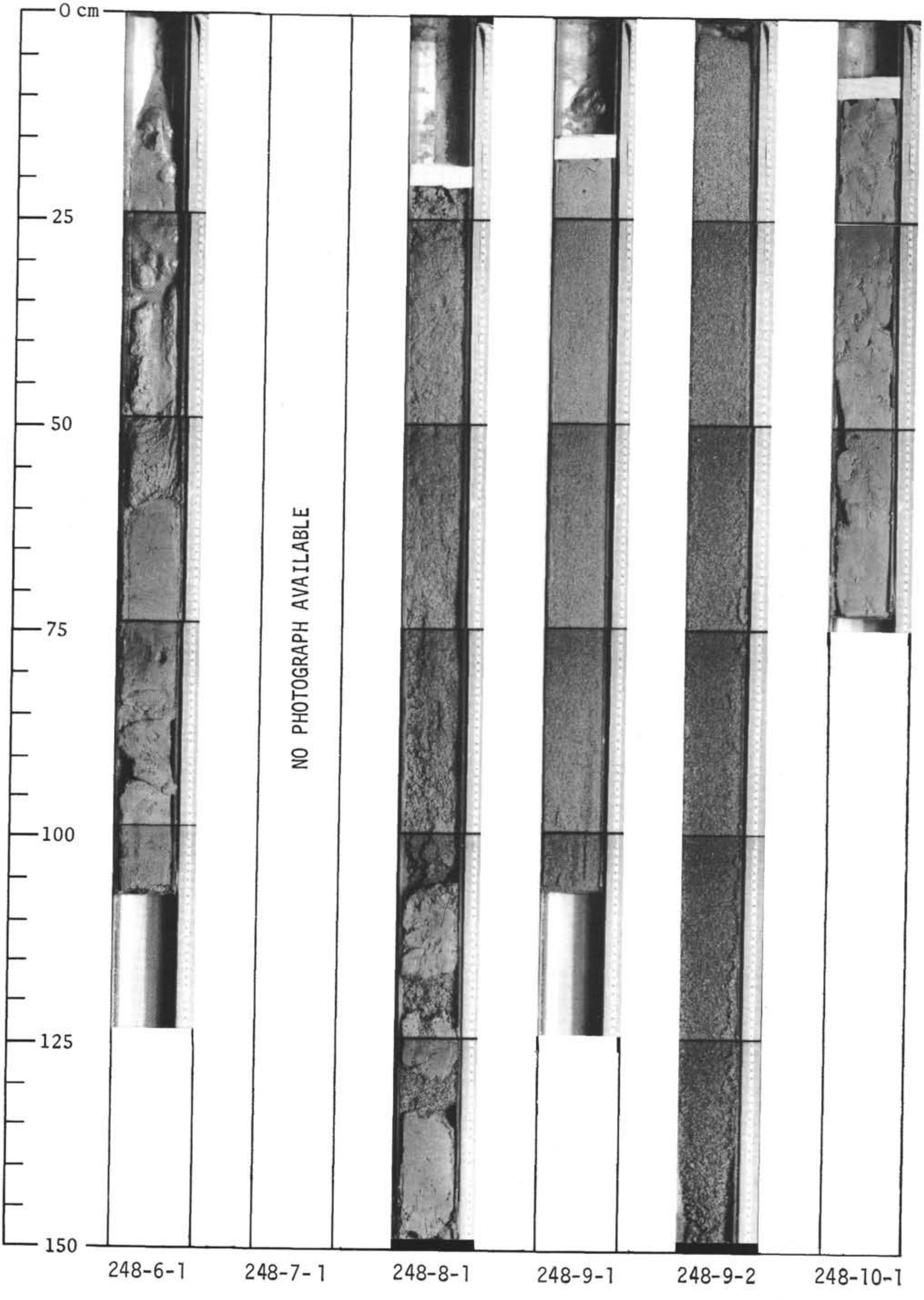
N3 dark gray

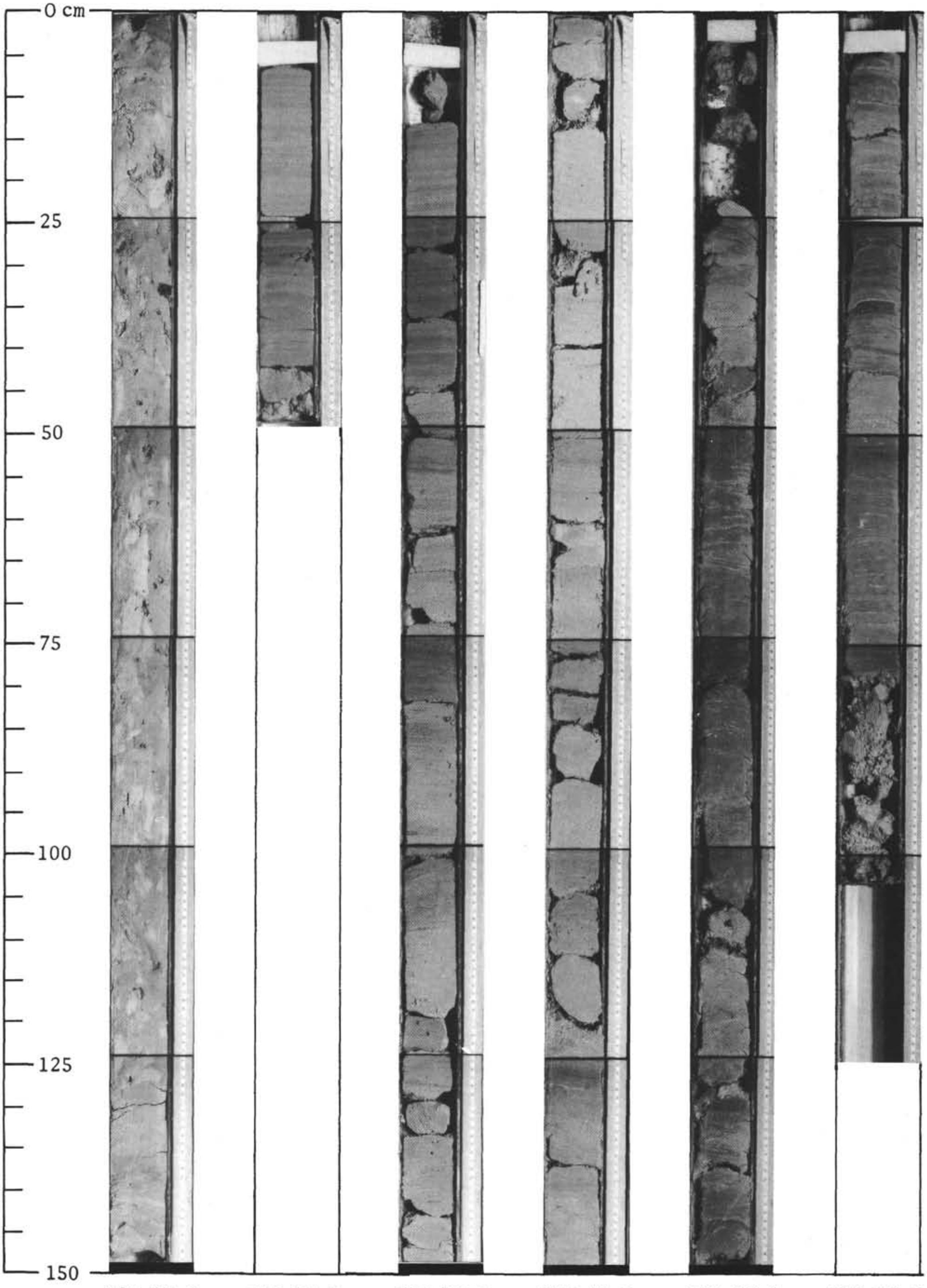
PORPHYRITIC BASALT, dark gray, phenocrysts of plagioclase and pyroxene set in a finely crystalline groundmass.

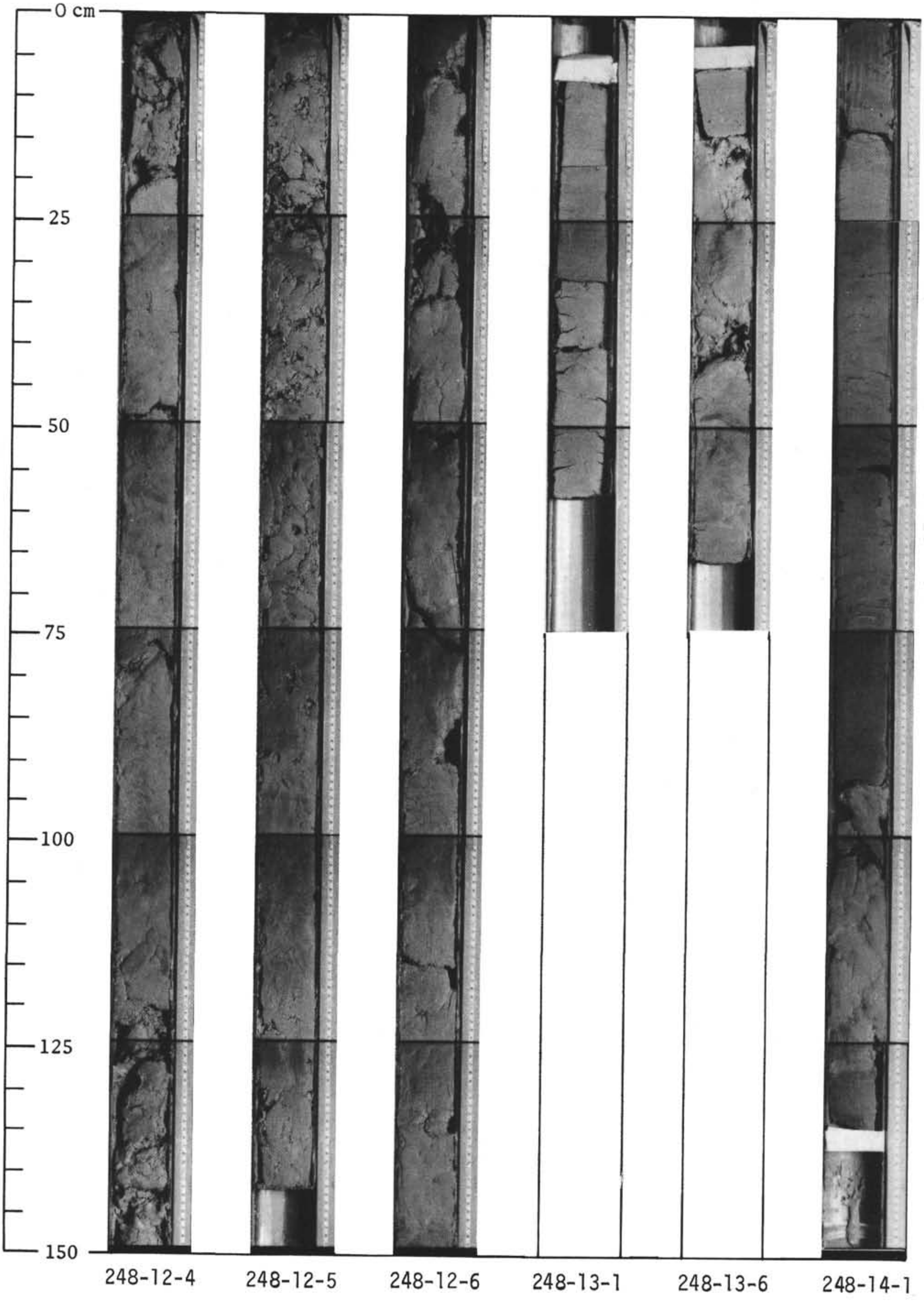
Explanatory notes in chapter 1

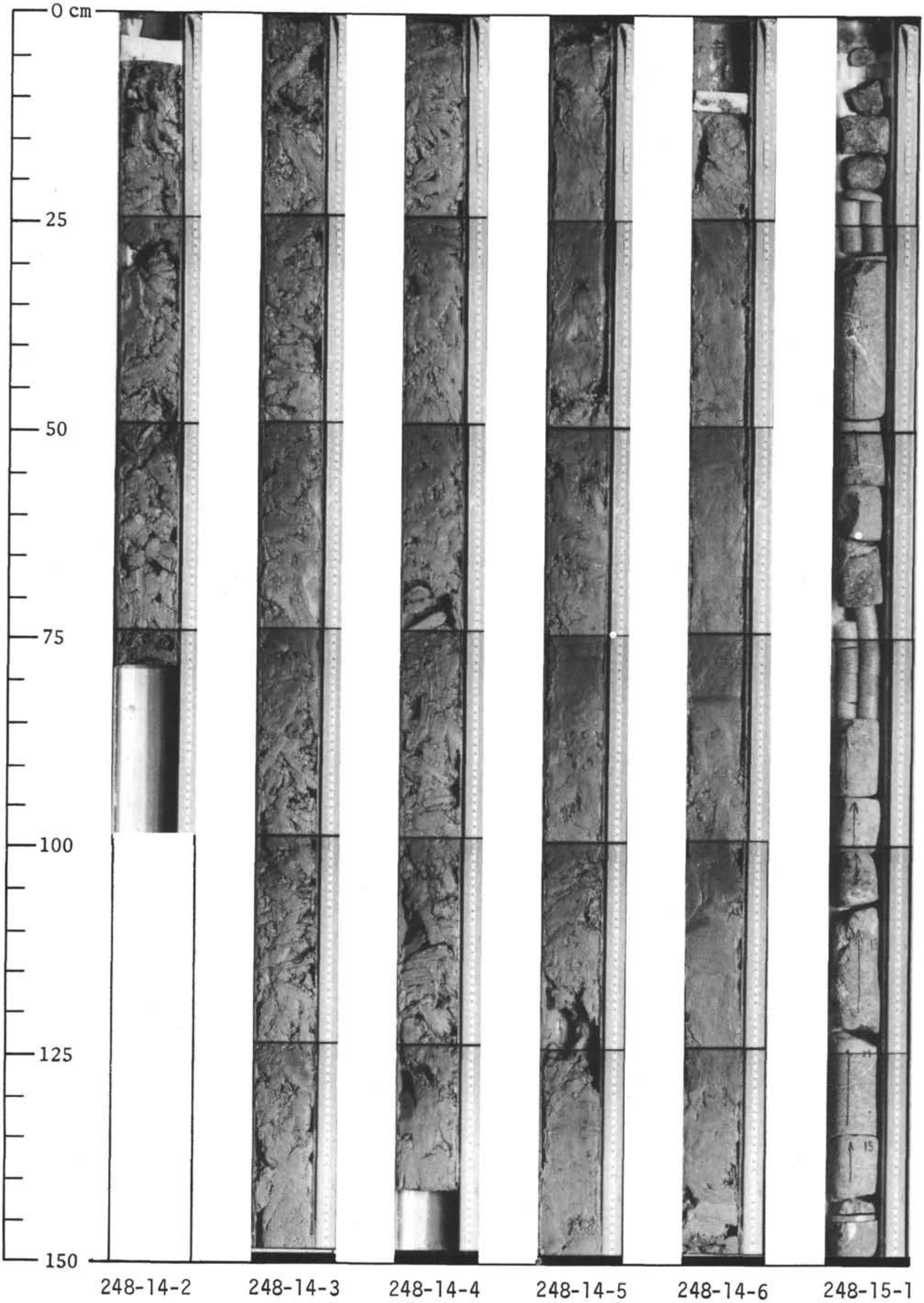

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
NO PHOTOGRAPH AVAILABLE
248-1-1
248-2-1
248-2-2
248-2-3
248-3- 1
248-4-1

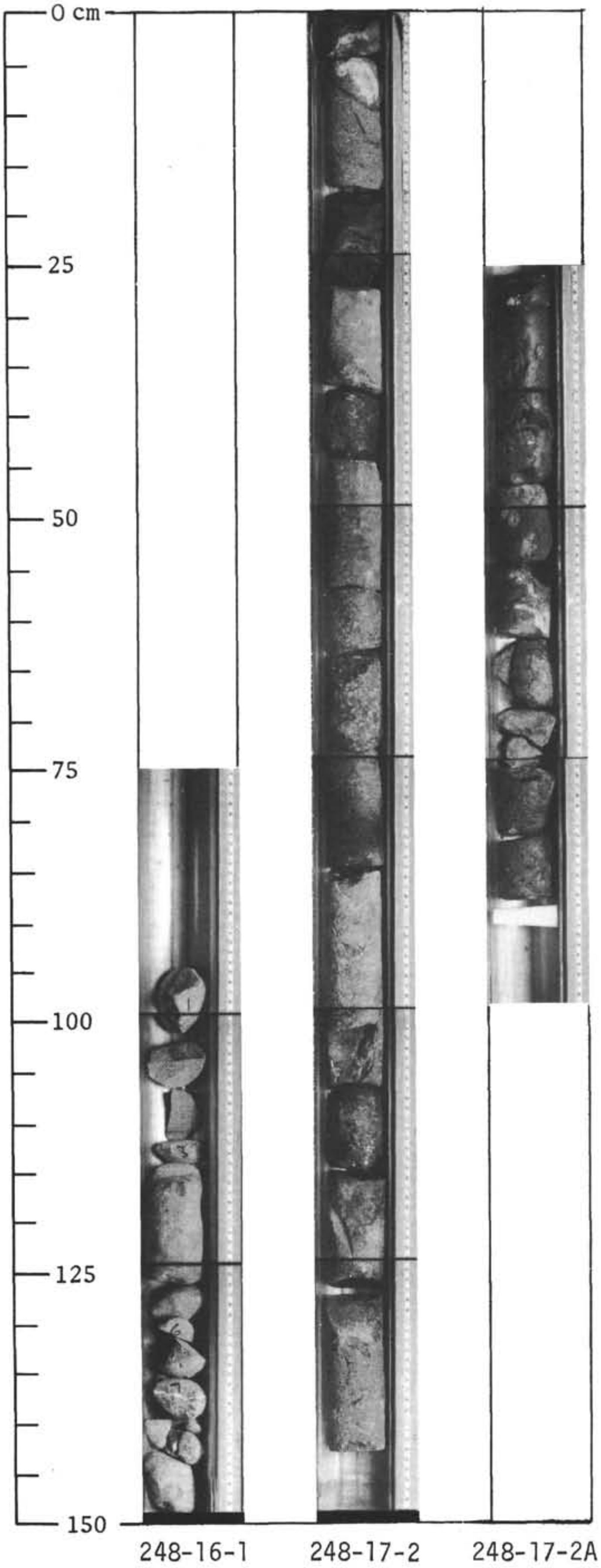

0 cm
25
50
75
100
125
150
248-4-2
248-4-3
248-4-4
248-4-5
248-4-6
248-5-1
NO PHOTOGRAPH AVAILABLE


0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
248-6-1
248-7-1
248-8-1
248-9-1
248-9-2
248-10-1


0 cm
25
50
75
100
125
150
248-10-2
248-11-1
248-11-2
248-11-3
248-12-1
248-12-3


0 cm
25
50
75
100
125
150
248-12-4
248-12-5
248-12-6
248-13-1
248-13-6
248-14-1


0 cm
25
50
75
100
125
150
248-14-2
248-14-3
248-14-4
248-14-5
248-14-6
248-15-1


0 cm
25
50
75
100
125
150
248-16-1
248-17-2
248-17-2A