8. SITE 581[1]

Shipboard Scientific Party[2]

HOLE 581

Date occupied: 10 June 1982

Date departed: 13 June 1982

Time on hole: 3 days, 8 hr.

Position (latitude; longitude): 43°55.62′N; 159°47.76′E

Water depth (sea level; corrected m, echo-sounding): 5476

Water depth (rig floor; corrected m, echo-sounding): 5486

Bottom felt (m, drill pipe): 5487.5

Penetration (m): 352.5

Number of cores: 19

Total length of cored section (m): 172.0

Total core recovered (m): 77.59

Core recovery (%): 45

Oldest sediment cored:
Depth sub-bottom (m): 343.0
Nature: Chert
Age: Unknown
Measured velocity (km/s): 5.4

Basement:
Depth sub-bottom (m): 344
Nature: Basalt
Velocity range (km/s): 4.8–5.3

Principal results: Because of the limited time available and the need to drill to basement to allow participants on Leg 88 to plan their casing program, hydraulic piston core (HPC) sampling of the softer sediments at Site 581 was deferred until Leg 88 (which, unfortunately, did not accomplish this objective). Apart from a mud line core, we did not sample the interval above 181.5 m.

From 181.5 to 223.6 m, section is reduced (gray and green) late Miocene to earliest Pliocene biosiliceous clay to ooze, similar to but less ashy and pyritic than the sections at Sites 579 and 580. Presumably, the uncored section above is similar, but with more ash and pyritic layers toward the surface.

From 223.6 to 244.8 m, the sediment is oxidized (yellow brown) latest middle Miocene to late Miocene biosiliceous clay, which accumulated at about one fifth the rate of the overlying sediments.

From 244.8 to 276.6 m, the sediment is "slick," fine-grained pelagic clay of presumed middle Miocene age and older, which grades down from brown to very dark brown in color. From 276.6 to 343.0 m, we recovered nothing but chert fragments, even though the drilling rate suggests that most of the section is soft sediment (?clay). The chert ranges from off-white to bright reds and yellows and dark brown in color. Most of it looks like silicified dark brown pelagic clay. Diatoms from a small vug in a fragment near the top of the sequence are early late Miocene in age (younger than the overlying sediments), and, therefore, may have been introduced during the coring process.

The hole was terminated after drilling from 343 to 352.5 m in medium gray aphyric basalt containing calcite and iron oxide-lined fractures and alteration rinds. Because no soft sediment was recovered below 276.6 m, the age of the basalt is unknown.

BACKGROUND AND OBJECTIVES

Site 581 (target Site MSS-82C) was a late selection for this leg. It was designed to meet the goals of Site NW-6 (which was too close to Soviet territory for PCOM approval) for a very high resolution late Neogene record, as well as to serve as a pilot hole for the Defense Advance Research Projects Agency (DARPA) downhole seismometer experiment to be carried out on Leg 88.

Our operational objectives were to carry out a brief site survey to define further the area of smooth terrain crossed by *Vema*-21 profiler records 872 and 873 and then to drill to basalt to establish the section to be cased on Leg 88. Because of time constraints, the original plan to HPC the upper part of the section had to be deferred to Leg 88, which did not, in fact, accomplish this objective. Our drilling program involved collection of a mud line core, washing without rotation to establish the surface casing program, washing as far as possible with rotation (estimated to be about 170 m sub-bottom), and then continuous rotary coring to basalt.

The scientific objectives that remained after deletion of the HPC coring were

1. To date the transition from oxic to anoxic deposition (if deeper than washed depth) for comparison with Site 578.

2. To date the transition from pelagic clay to biosiliceous clay, again for comparison with Site 578.

3. To collect the Cretaceous–Neogene pelagic clay section above chert for geotechnical and geochemical comparisons with Sites 576 and 578. Geotechnical comparison was of particular interest because the clay sections at Sites 576, 578, and 581 should be of comparable age, but have been subjected to progressively greater overburden loads from Sites 576 to 578 to 581.

[1] Heath, G. R., Burckle, L. H., et al., *Init. Repts. DSDP*, 86: Washington (U.S. Govt. Printing Office).

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Geologic and Topographic Setting

The only data for the region were the echo character map of Damuth et al. (1983) and a *Vema*-21 air-gun profile. The regional topography is irregular, with about 300 m of relief at a length scale of 10–20 km. The proposed site lies in a 40-km section of smoother topography that forms a broad depression with about 100 m of relief. This depression may be part of the Hokkaido Fracture Zone. The profiler section shows about 300 m of layered sediment (ash-bearing siliceous clay overlying pelagic clay, based on the lithologic sections recovered at our earlier sites) above about 60 m of presumed chert-carbonate, resting on basalt.

OPERATIONS

From Site 580, we steamed northeast to Site 581 (target Site MSS-82C). The quality of the air-gun records, particularly approaching Site 581, was not as good as those collected earlier in the leg, because of adverse sea conditions and minor equipment problems. Because the DARPA downhole-seismometer experiment required an area of about 10 km by 30 km of fairly smooth and level topography, we had been asked by the Deep Sea Drilling Project (DSDP) to supplement the existing north–south *Vema*-21 track by one or two east–west lines to define further the structure and topography of the site. Unfortunately we did not have underway data from Scripps' *Zetes*-3 cruise track across the area, which would have helped us lay out a more effective survey. We began the survey at 1552Z, 9 June and completed an east–west cross line of the V-21 track before running west and selecting the drill site (Fig. 1). Neither of our crossings show the smooth topography seen in the V-21 crossing. The site appears to lie within a fracture zone trending west-northwest across the "M" series of magnetic anomalies. The area drilled is fairly smooth for more than 10 km east-west, but the northwest-southeast extent (along the inferred fracture zone) is not well defined. We were forced by time constraints to limit our survey. Basement appears to be faulted parallel to the fracture zone trend with a relief of 1 or 2 km.

The beacon was dropped at 2052Z, 9 June 1982. After retrieving the geophysical gear and running pipe, we spudded in at 1120Z, 10 June. Because time was running short, we elected to take a mud line core and then wash as far as possible before beginning to rotary core. HPC sampling of the softer sediments for studies of Neogene paleoceanography, one of our prime objectives, had to be deferred to Leg 88, which ran out of time before they could accomplish this goal.

From 181.5 to 267 m sub-bottom (Cores 1-10), the quality of the cores was good (for rotary drilling), and the recovery was fair to good (Table 1). From Core 11 on, however, the increased circulation required to penetrate the stiff clay from 267 to 276.5 m and the chert from 276.5 to 343 m washed away any unconsolidated sediment; we recovered nothing but chert for an interval of 66.5 m. The hole was terminated at 1204Z, 12 June at a depth of 352.5 m, after penetrating about 8 m into basalt.

Retrieval and securing of the drill string was completed at 0632Z on 13 June. We then headed east to stream the gear before running west across the beacon and for an additional 10 miles prior to heading for Yokohama and the conclusion of the leg.

LITHOSTRATIGRAPHY

The sediments recovered at Site 581 can be divided into four units based on macroscopic descriptions of the split cores and on smear slide analyses with a petrographic microscope. These units are (I) biogenic siliceous clay, (II) pelagic brown clay, (III) chert, and (IV) basalt. The first unit is divided into two subunits on the basis of color and abundance of biogenic siliceous material (Fig. 2, Table 2).

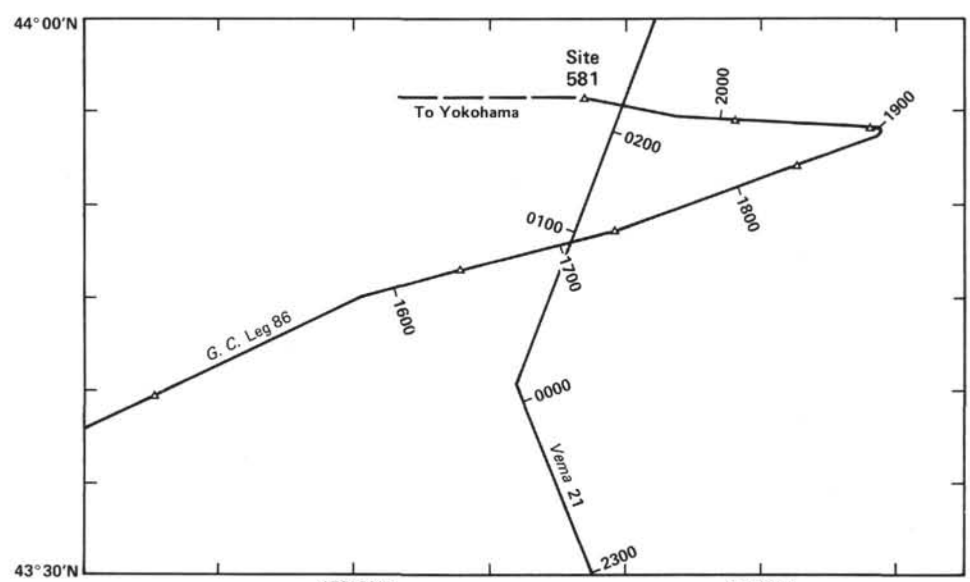

Figure 1. Track line map showing locations of north–south *Vema*-21 track and east–west *Glomar Challenger* Leg 86 track in vicinity of Site 581. Open triangles on *Challenger* track represent satellite fixes.

Table 1. Site 581 coring summary.

Core	Date (June 1982)	Local Time	Depth from drill floor (m)	Depth below seafloor (m)	Length cored (m)	Length recovered (m)	Percent recovered
1	11	0017	5487.5–5488.5	0.0–1.0	1.0	0.93	93
Wash			5488.5–5669.0	1.0–181.5			
2	11	0547	5669.0–5678.5	181.5–191.0	9.5	6.38	67
3	11	0740	5678.5–5688.0	191.0–200.5	9.5	8.52	90
4	11	0945	5688.0–5697.5	200-5–210.0	9.5	9.45	99
5	11	1135	5697.5–5707.0	210.0–219.5	9.5	5.32	56
6	11	1339	5707.0–5716.5	219.5–229.0	9.5	9.44	99
7	11	1543	5716.5–5726.0	229.0–238.5	9.5	8.98	95
8	11	1750	5726.0–5735.5	238.5–248.0	9.5	7.59	80
9	11	1953	5735.5–5745.0	248.0–257.5	9.5	5.48	58
10	11	2216	5745.0–5754.5	257.5–267.0	9.5	8.52	90
11	12	0022	5754.5–5764.0	267.0–276.5	9.5	0.40	4
12	12	0430	5764.0–5773.5	276.5–286.0	9.5	0.35	4
13	12	0758	5773.5–5783.0	286.0–295.5	9.5	0.16	2
14	12	1002	5783.0–5792.5	295.5–305.0	9.5	0.27	3
15	12	1220	5792.5–5802.0	305.0–314.5	9.5	0.55	6
16	12	1423	5802.0–5811.5	314.5–324.0	9.5	0.18	2
17	12	1632	5811.5–5821.0	324.0–333.5	9.5	1.07	11
18	12	1843	5821.0–5830.5	333.5–343.0	9.5	0.35	4
19	12	2304	5830.5–5840.0	343.0–352.5	9.5	3.65	38
					172.0 (total)	77.59 (total)	45 (avg.)

Unit I: Biogenic Siliceous Clay

This unit is a biosiliceous clay characterized by a high percentage of diatoms and radiolarians. It is divided into two subunits as follows.

Subunit IA

This subunit is dark gray to greenish gray (5Y and 5GY) biosiliceous clay characterized by abundant (up to 65%) diatoms and radiolarians. It extends from the top of Section 581-1-1, through Sample 581-6-3, 108 cm. Diatoms (20–60%) and radiolarians (5–15%) are the primary biosiliceous components with subordinate amounts of silicoflagellates (0–2%). Clay (30–65%) and quartz (3–5%) constitute the terrigenous component. Volcanic glass never reaches abundances greater than 5%, except in ash layers. Subunit IA contains four ash layers that range in thickness from 3 to 16 cm. Although this subunit is very similar in color and composition to the siliceous clay found at Sites 579 and 580, only ten indurated dark greenish gray layers were seen in Hole 581. In comparison, several hundred of these layers are found at both Sites 579 and 580.

Subunit IB

This subunit is a light yellowish brown to yellowish brown (10YR) biosiliceous clay with diatoms and radiolarians comprising up to 25% of the sediment. It extends from Samples 581-6-3, 108 cm to 581-8-5, 30 cm. Diatoms (7–20%) and radiolarians (7–20%) are the primary siliceous components, together with minor amounts of silicoflagellates (TR-5%). Clay (65–85%) and quartz (3–5%) comprise the terrigenous fraction of this subunit. Volcanic glass is present in abundances of 2% or less. Subunit IB contains only one ash layer, which is approximately 8 cm thick.

Unit II: Pelagic Brown Clay

This unit is characterized by a brown to dark brown (10YR) nonbiogenic clay extending from Samples 581-8-5, 30 cm to 581-12-1, 10 cm. The clay is moderately to heavily mottled in Cores 8 and 9 and moderately to lightly

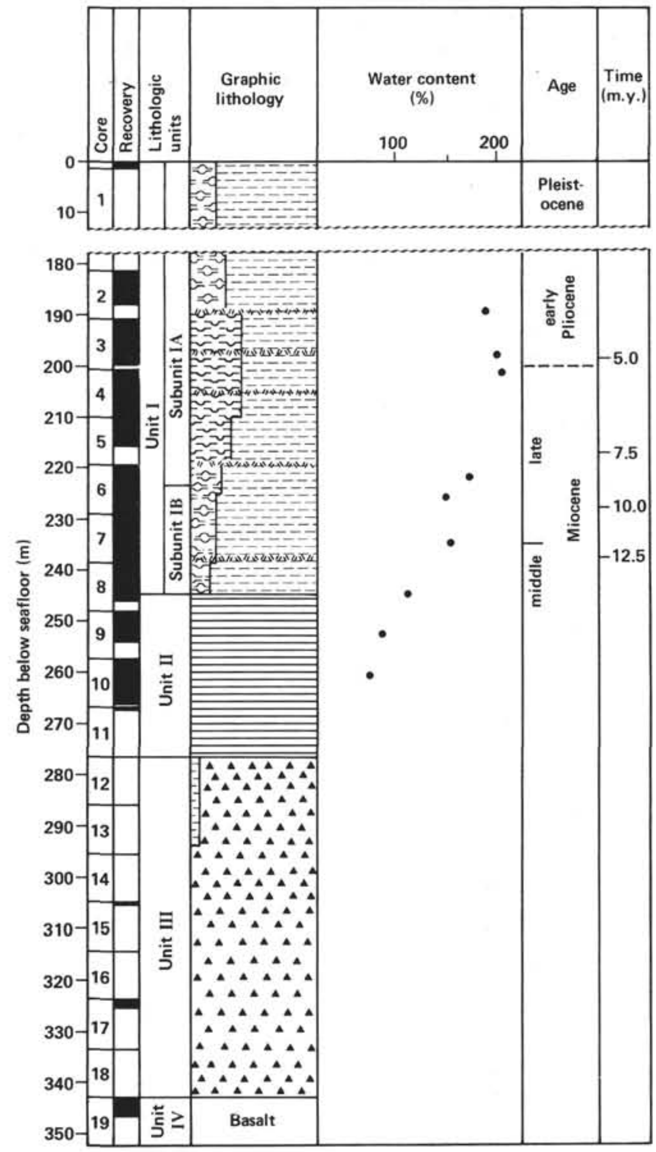

Figure 2. Site summary diagram showing Site 581 core numbers, core recovery, lithologic units, graphic lithology, water content (%), and age. Symbols used in graphic lithology column are defined in Introduction and Explanatory Notes (this volume).

Table 2. Site 581 lithostratigraphic units.

	Lithologic unit	Cored interval	Sub-bottom depth (m)
I	Biogenic siliceous clay	1-1,0 cm to 8-5,30 cm	0.0–1.0 and 181.5–244.8
	Subunit 1A: Dark gray to greenish gray siliceous clay.	1-1,0 cm to 6-3,108 cm	0.0–1.0 and 181.5–223.6
	Subunit 1B: Light yellowish brown to yellowish brown siliceous clay	6-3,108 cm to 8-5,30 cm	223.6–244.8
II	Pelagic brown clay	8-5,30 cm to 12-1,10 cm	244.8–276.6
III	Chert	12-1,10 cm–18,CC	276.6–343.0
IV	Basalt	19-1,0 cm–19-4,60 cm	343.0–348.1

mottled in Cores 10, 11, and 12. Clay is the dominant component of this unit, generally comprising more than 90% of the sediment. Biogenic siliceous material is absent. Quartz (2–3%), volcanic glass (0–3%), opaques (0–3%), and micronodules (0–7%) comprise the remaining fraction of the sediment.

Unit III: Chert

This unit consists of chert and comprises Sample 581-12-1, 10 cm through Core 581-18. Recovery never exceeded 11% of the cored interval and only chert fragments were obtained. These fragments vary in size from several millimeters up to 7 cm across the longest axis. Colors range from grayish and yellowish brown to yellowish red, pink, reddish black, and black. Most chert fragments exhibit conchoidal surface fractures. Quartz veins and laminations of porcellanite are common in the larger fragments.

Unit IV: Basalt

Unit IV consists of aphyric medium gray basalt. Coring was terminated following recovery of 3.65 m of this material in Core 19. Iron oxide coatings were found along most cracks. Calcite veins up to 0.5 cm thick and vugs up to 2 cm across were present in several of the fragments. Talc and altered glass were common in cracks and in several veins in the basalt fragments. Several fragments revealed a transition from unaltered glass exteriors to slightly altered glass to fine-grained aphyric basalt interiors. This alteration rind also included interlayered calcite, talc, and possible chlorite. These basalts, and those drilled at Holes 581A, 581B, and 581C on Leg 88, are described in detail in the Leg 88 Site 581 chapter (see Duennebier, Stephen, et al., in press).

SEISMIC CORRELATION

High-resolution seismic reflection profiles (3.5 and 12 kHz) and 100-Hz reflection profiles were recorded at Site 581. Only a hull-mounted 3.5-kHz sound source was utilized. The 3.5-kHz echograms reveal a fairly uniform seismic section of parallel sub-bottom reflectors near Site 581 and a three-part sequence based on transparent sections at the site (Fig. 3). Because the upper 181.5 m were not cored at this site, these 3.5-kHz reflectors cannot be correlated with lithologic units.

The uppermost unit (seismic Unit 1) at Site 581 consists of a generally transparent section extending to about 0.0095 s below the seafloor (14.2 m, 1500 m/s). The top reflector of the unit is a slightly prolonged, weak to strong echo. The morphology of this unit and its echo character suggest that it is a debris flow deposit.

Seismic Unit 2 extends to 0.0195 s below the seafloor (29.25 m, 1500 m/s) and is composed of six parallel and equally spaced reflectors. Drilling results from earlier sites on Leg 86 suggest that most of these reflectors correspond to volcanic ash layers. Seismic Unit 3 is a transparent zone and may represent another debris flow.

The 100-Hz reflection profiles over Site 581 reveal a four-part seismic section (Fig. 4). The uppermost unit (seismic Unit 1) extends to 0.1 s depth below the seafloor (75 m at 1500 m/s) and consists of strong, multiple, and parallel reflectors. Near the site, seismic Unit 1 also contains local transparent sections that probably represent buried debris flows. At these localities the reflectors above the transparent section are divergent from those below the transparent section.

Seismic Unit 2 is of variable thickness: at Site 581 it extends to 0.362 s below the seafloor (271.5 m at 1500 m/s). Unit 2 consists of parallel reflectors of weak to intermediate strength. Relatively transparent intervals occur between 0.17 and 0.2 s below the seafloor (127.5 m and 150 m at 1500 m/s) and between 0.295 and 0.362 s below seafloor (271 and 271.5 m at 1500 m/s). Varying thicknesses of the section of Unit 2 above the upper transparent interval accounts for the variable thickness of the unit as a whole. The lower transparent interval is conformable with the underlying seismic Unit 3 and has a constant thickness in the area immediately surround-

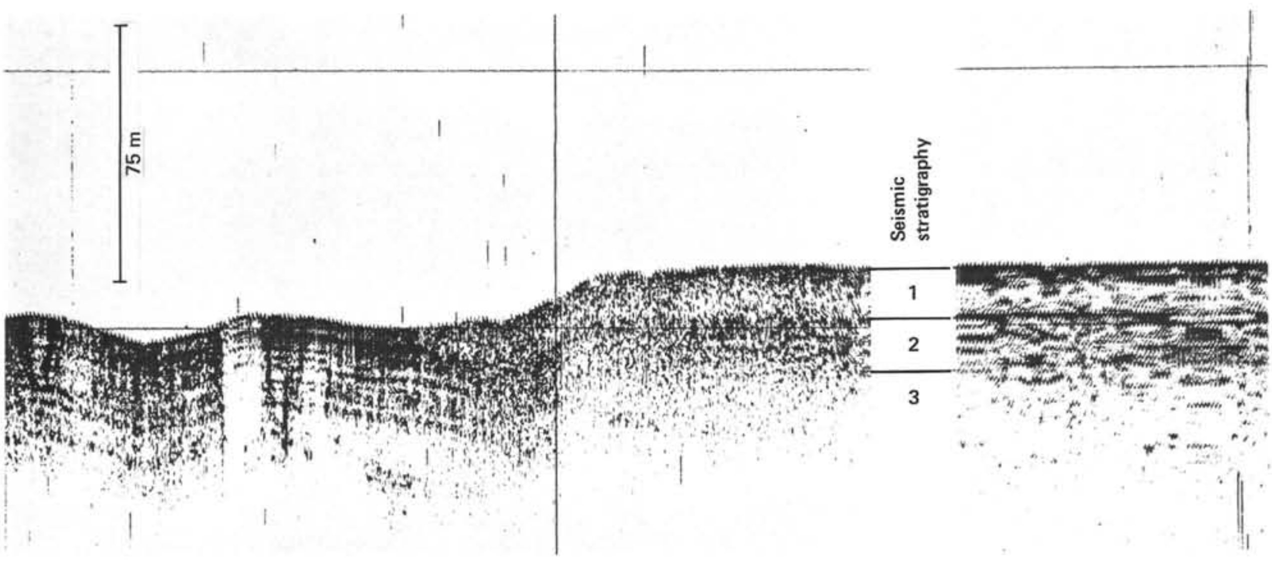

Figure 3. 3.5-kHz echogram near Site 581 showing the three seismic units described in the text.

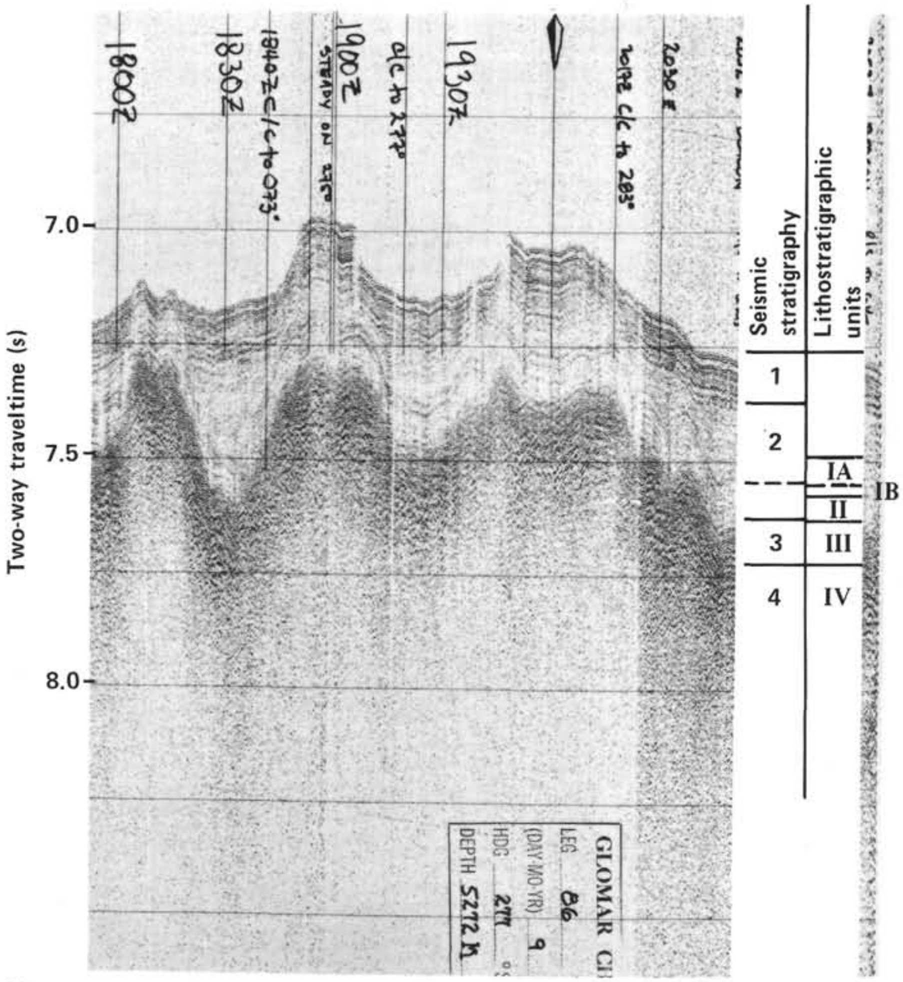

Figure 4. 100-Hz reflection profile over Site 581 showing the four seismic units described in the text.

ing Site 581. The lower transparent interval in Unit 2 correlates with lithostratigraphic Units IB and II (yellowish brown siliceous clay and pelagic brown clay, respectively). Seismic Unit 2 above the lower transparent interval correlates in part with lithostratigraphic Unit IA (gray to greenish gray siliceous clay).

Seismic Unit 3 is of constant thickness and extends from 0.362 s to about 0.46 s below the seafloor (345 m at 1500 m/s). This unit is characterized by a strong, incoherent echo. Unit 3 correlates with lithostratigraphic Unit III (chert and interbedded sediments).

Seismic Unit 4 is difficult to distinguish from Unit 3; it consists of a slightly stronger, less prolonged echo typical of "basement" and correlates with lithostratigraphic Unit IV (basalt).

BIOSTRATIGRAPHY

After Core 1 of late Quaternary age was recovered at the mud line (0–1.0 m sub-bottom), an interval of 180.5 m of sediment was washed at Site 581. Cores 2 through 9 (181.5–257.5 m below the seafloor) are early Pliocene through middle Miocene in age. No calcareous microfossils were found in any of the core-catcher samples. However, common to abundant siliceous microfossils consisting of radiolarians, diatoms, and silicoflagellates were found in Cores 1 through 8. In Core 9, radiolarians are rare in abundance, but diatoms and silicoflagellates are very rare. No siliceous microfossils were found below Core 9.

The biostratigraphic summary for Site 581, based on two groups of siliceous microfossils, is shown in Figure 5. Based on radiolarian biostratigraphy, the Miocene/Pliocene boundary falls within Core 3 with the boundary between middle and late Miocene occurring within Core 7. A sediment sample taken from a vug in the uppermost chert layer contained early late Miocene diatoms.

Radiolarians

Late Quaternary through middle Miocene radiolarians occur in sediments recovered at Site 581. The abundant Pleistocene radiolarian fauna is well preserved, but the preservation decreases from good in the early Pliocene to poor in the middle Miocene. Sediments older than middle Miocene (Samples 581-10,CC and 581-11,CC) do not contain radiolarians. The radiolarian biostratigraphy for Site 581 is shown in Figure 5.

Sections 581-1-1 and 581-1,CC contain radiolarians representative of the *Stylatractus universus* Zone (Hays, 1970). The fauna in Sections 581-2-1 and 581-2,CC is representative of the *Sphaeropyle langii* Zone (Foreman,

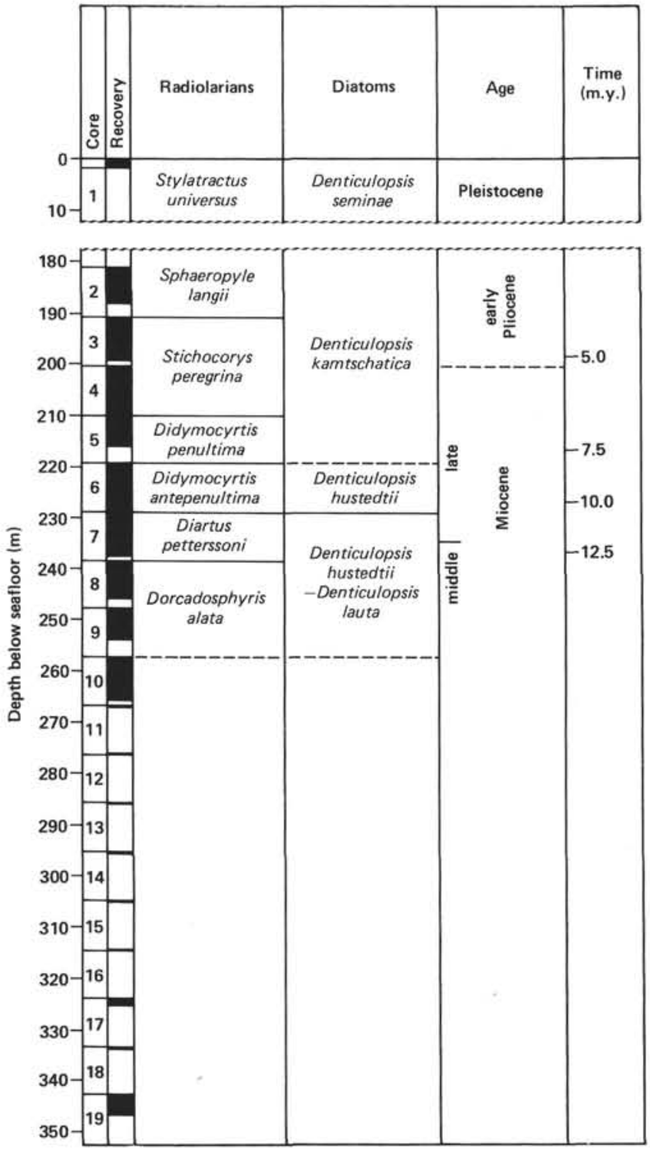

Figure 5. Site 581 biostratigraphic summary.

1975) with both *S. langii* and *Lamprocyrtis heteroporos* present in the assemblage. The sediment sequence in Sections 581-3,CC and 581-4,CC is assigned to the *Stichocorys peregrina* Zone (Riedel and Sanfilippo, 1970; Foreman, 1975), based on the presence of *S. peregrina* and *S. delmontensis* and the absence of *L. heteroporos* and *Sphaeropyle langii*. Examination of this sequence indicates that the Miocene/Pliocene boundary occurs in Core 3. The presence of *Didymocyrtis penultima* in Section 581-5,CC places this sediment within the late Miocene *D. penultima* Zone (Riedel and Sanfilippo, 1970). The radiolarian assemblage in Section 581-6,CC is representative of the *D. antepenultima* Zone (Riedel and Sanfilippo, 1970; Riedel and Sanfilippo, 1978) since *D. laticonus, D. antepenultima*, and *Diartus hughesi* are present whereas *Cyrtocapsella cornuta* and *C. tetrapera* are absent. The sediment sequence in Section 581-7,CC is assigned to the *D. petterssoni* Zone (Riedel and Sanfilippo, 1970; Riedel and Sanfilippo, 1971) based on the presence of *D. petterssoni* and the absence of *Didymocyrtis penultima, D. antepenultima*, and *C. cornuta*. The middle Miocene/late Miocene boundary occurs within Core 7. The oldest radiolarian-bearing sediment recovered at this site is middle Miocene in age (*Dorcadospyris alata* Zone [Riedel and Sanfilippo, 1970; Riedel and Sanfilippo, 1971]) based on the presence of *C. cornuta* and *C. tetrapera* and the absence of *Diartus petterssoni*.

Diatoms

A late to middle Miocene diatom biostratigraphy typical of the subarctic region was recovered at Site 581. Diatoms are abundant and well preserved in Cores 1 through 8. In Core 9, they are rare and only solution-resistant valves were recovered. Diatoms are absent below Core 9.

Core 1 belongs to the late Quaternary *Denticulopsis seminae* Zone. Cores 2 through 5 are assigned to the early Pliocene to latest Miocene *D. kamtschatica* Zone. Core 6 is placed in the late Miocene *D. hustedtii* Zone. Cores 7 and 8 are correlated with the late middle Miocene Subzone C of the *D. hustedtii-D. lauta* Zone by the presence of *D. dimorpha*.

PALEOMAGNETICS

Paleomagnetic analyses of a limited number of sediment and basalt samples have been carried out to determine the paleolatitudinal history of this site. Results are reported by Bleil (this volume).

SEDIMENT ACCUMULATION RATES

Radiolarian zonal boundaries and the boundaries of time-rock units are used to estimate the sediment accumulation rates for Site 581 (Fig. 6). Late Miocene rates are about 5 m/m.y. Assuming no stratigraphic breaks in the uncored section, the average Pliocene–Pleistocene accumulation rate was about 40 m/m.y., very close to the value at Sites 579 and 580.

PHYSICAL PROPERTIES

Physical properties measurements at Site 581 were performed using mainly standard DSDP methods (Boyce, 1976a, b; see Introduction and Explanatory Notes, this volume). Table 3 summarizes the properties measured at Site 581.

These measurements were taken approximately once per core in the unconsolidated sediments. A number of compressional wave velocity measurements were taken on the chert and basalt samples.

Figures 7, 8, and 9 show profiles of shear strength, compressional wave velocity, and water content and bulk density profiles, respectively. Shear strength measurements were hampered by the brittle nature of the semi-indurated sediments. This resulted in major cracks developing either upon initial insertion of the vane or during the test. If this happens the test is invalid because the failure plane is no longer a cylinder described by the vane blades.

In an attempt to overcome this problem, a minimum amount of confining pressure was applied by using two strips of angle aluminum held together by G clamps on either side of the split core. This eliminated the gap be-

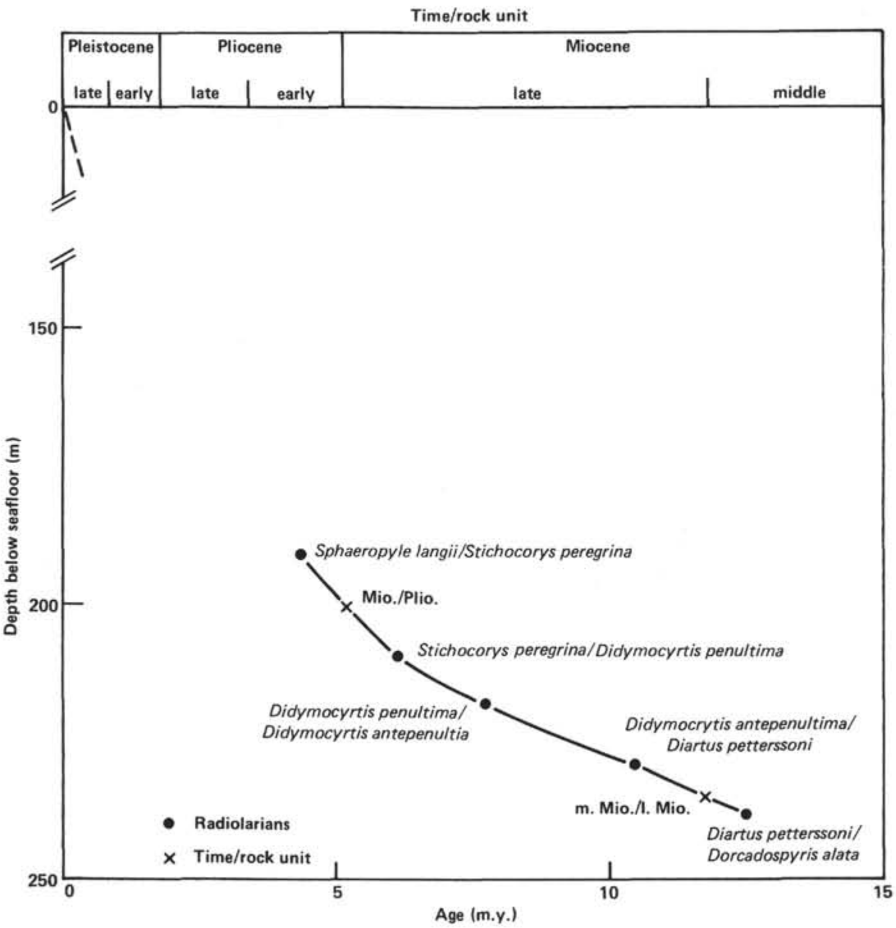

Figure 6. Site 581 sediment accumulation rates.

Table 3. Physical properties measurements made at Hole 581.

	Hole 581
Shear strength:	
Hand operated vane	x
Motorized vane	x
Compressional wave velocity	x
Water content/bulk density:	
Shipboard analysis	x
Shore-based analysis	x
Bulk density by 2-min. GRAPE	x

tween the liner and the sediment and prevented the cracking described earlier.

A full discussion of the physical properties of the recovered sediments, including tables of the data, is given by Schultheiss (this volume). However, some of the more interesting features of the data are highlighted here:

1. The shear strength measurements (Fig. 7) should be viewed with even more caution than usual. Rotary coring causes significantly more structural disturbance than the HPC. This is true even when the stratigraphic sequence looks undisturbed. Much of the material in Cores 1–7 consisted of alternating layers of soft and stiff sediments, probably a result of intermittent "rotation" and "punch" coring (rotation causing the most disturbance and hence the softer layers). Measurements were made in the largest sections of stiff material that could be found in each core. The first few readings were taken without the G-clamp modification and show comparatively low strengths. In the remaining sections of unconsolidated sediments, the shear strengths lie between 600 and 1300 g/cm^2.

2. Compressional wave measurements (Fig. 8) show a small decrease in velocity below 240 m which correlates with the boundary of lithologic Units I and II (biosiliceous clay–pelagic brown clay). Some measurements were made on selected chert and basalt samples and these varied between 4000 and 5500 m/s.

3. The water content and bulk-density profiles (Fig. 9) show a rapid change below 200 m. Water contents drop abruptly from 200 to 75% at 262 m. This corresponds to a rapid increase in clay content through lithologic Units IA, IB, and II. The water content in the pelagic brown clay (lithologic Unit II) is 75% at a sub-bottom depth of 262 m, whereas at Sites 576 and 578 water contents as low as 60% were found in similar sediment at sub-bottom depths of 60 and 170 m, respectively.

INORGANIC GEOCHEMISTRY

Only two samples from Hole 581 were squeezed and analyzed for the standard suite of components: pH, alkalinity, salinity, calcium, magnesium, and chlorinity (Table 4). No *in situ* samples were taken.

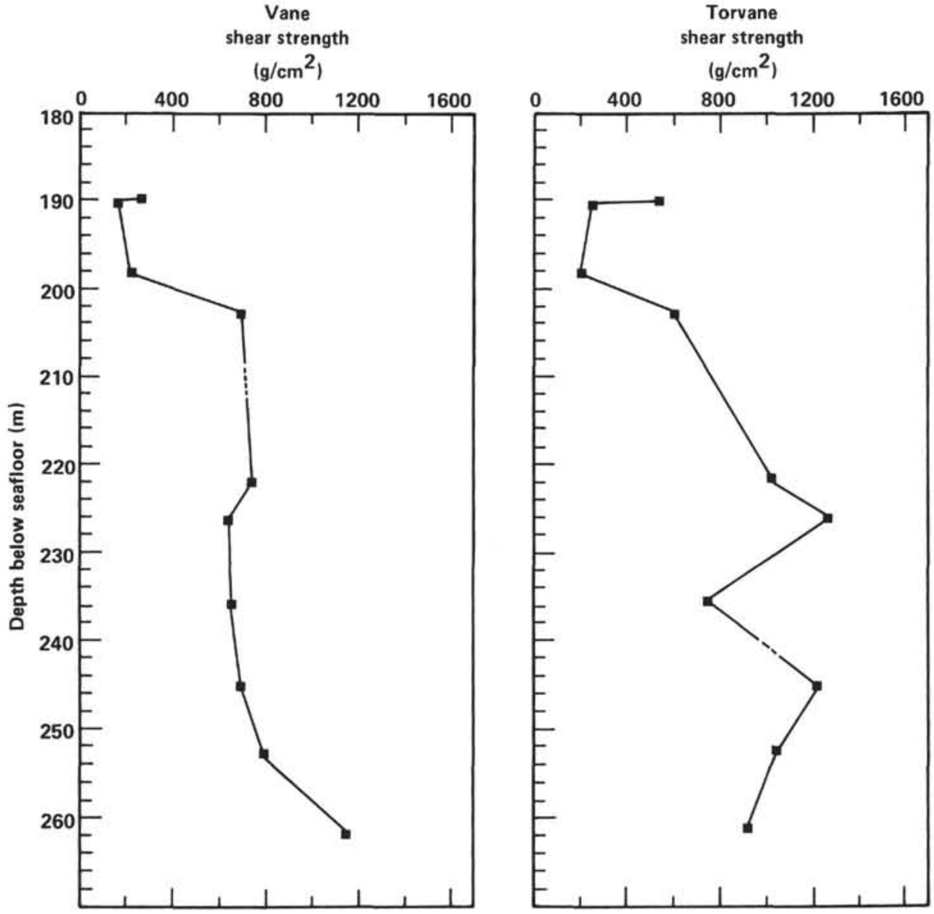

Figure 7. Plot of shear strength versus sub-bottom depth at Site 581.

The squeezed samples show the calcium and alkalinity increases and magnesium decrease (Fig. 10) evident at Sites 579 and 580, presumably for the same reasons (diffusion of calcium from a deeper source, oxidation of organic matter by sulfate reduction, and alteration of volcanic ash, respectively). However, the absence of samples above 181 m and the failure to recover sediment from the chert-bearing section below 276 m preclude any serious attempt to unravel the diagenetic processes at this site.

HEAT FLOW

No heat-flow measurements were made at this site, as the decision to defer HPC sampling to Leg 88 precluded use of the Woods Hole Oceanographic Institution (WHOI) core-nose temperature probe.

SUMMARY AND CONCLUSIONS

The stratigraphic section and major lithologic units recovered at Site 581 are described below.

0–223.6 m

Gray green reduced biosiliceous clay of late Miocene to late Quaternary age. By analogy with Sites 579 and 580, we infer that similar sediment, with ash beds and pyrite-indurated layers, makes up the washed interval from 1 to 181.5 m. Four ash beds were recovered between 181.5 and 224 m. The average accumulation rate for this unit was about 34 m/m.y.

223.6–244.8 m

Yellow brown oxidized biosiliceous clay, with common moderately preserved diatoms, radiolarians, and silicoflagellates of middle to late Miocene age, and a single ash layer.

244.8–276.6 m

Brown grading down to dark brown "slick" pelagic clay of middle Miocene age based on radiolarians in the top of the unit and diatoms in the underlying chert.

244.8–343 m

Chert and porcellanite, mostly brown to dark brown (looking like silicified pelagic clay), but with intervals of bright yellows and reds near 285 and 305 m. From the behavior of the drill, it appears that the chert forms layers a few centimeters thick separated by tens of centimeters of soft sediment. From the color of the chert, we infer that much, if not all, of the intervening sediment is pelagic brown clay, but none was recovered because of the circulation required to keep the hole clear of chert cuttings. A small vug in a chert fragment at about 286 m sub-bottom contained diatoms of early late Miocene age

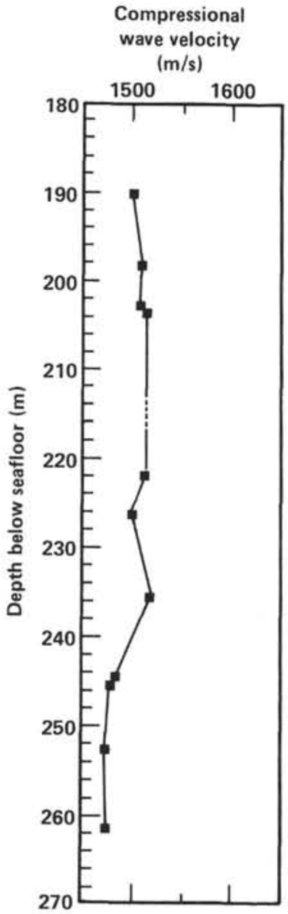

Figure 8. Plot of compressional wave velocity versus sub-bottom depth at Site 581.

(younger than the overlying sediment), but otherwise this unit is unfossiliferous.

343-352.5 m

Medium gray somewhat altered aphyric basalt with veins and fracture fillings of calcite and iron oxide. Minor amounts of fairly fresh-looking glass were recovered. From the linear magnetic anomalies, the crust at Site 581 should be Barremian (115 m.y., between Anomalies M-3 and M-4). We have no data to confirm or oppose this age.

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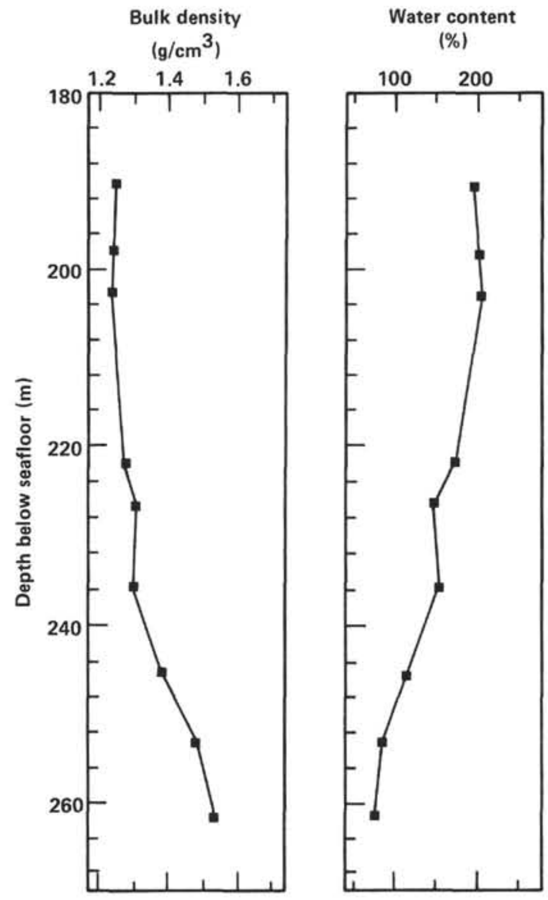


Figure 9. Profiles of saturated bulk density and water content versus sub-bottom depth at Site 581.

Table 4. Inorganic geochemistry measurements at Site 581.

Sample	pH	Alkalinity (mEq/l)	Salinity (‰)	Calcium (m*M*)	Magnesium (m*M*)	Chlorinity (‰)
IAPSO	7.86	2.43	35.2	10.55	53.99	19.38
SSW	7.81	2.32	33.6	10.05	50.76	18.48
581-5-3, 140-150 cm	7.72	4.14	35.2	11.91	46.83	19.33
581-8-4, 140-150 cm	7.00	3.26	35.2	12.25	47.26	19.22

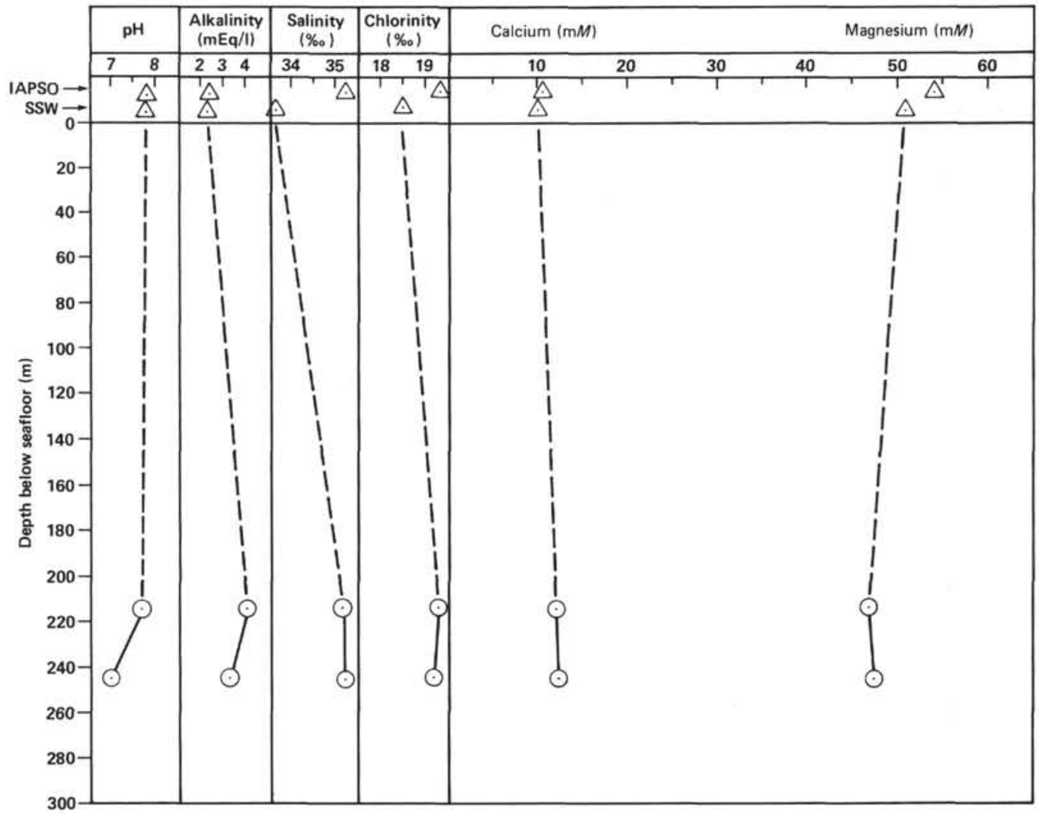
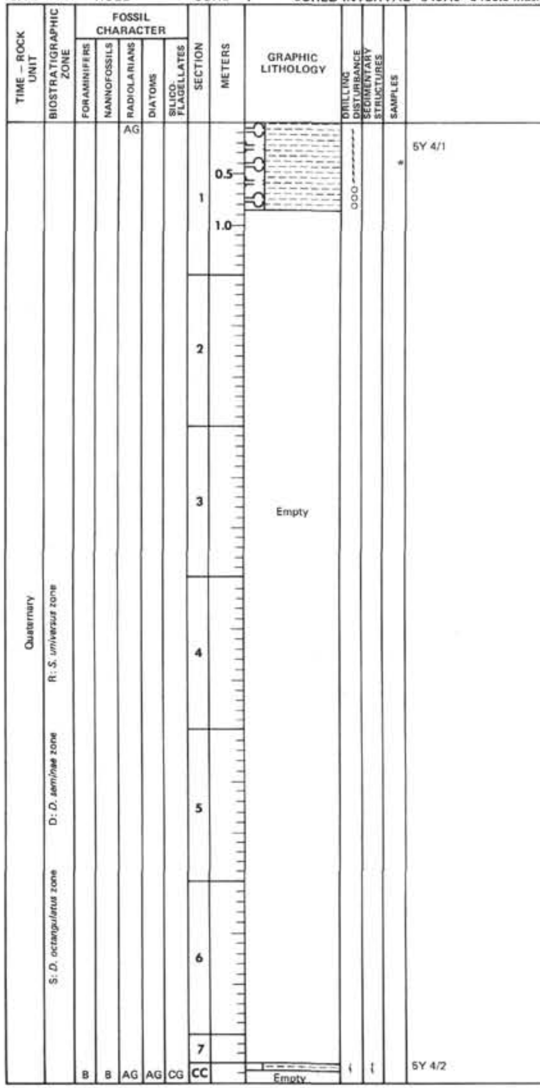


Figure 10. Profiles of pH, alkalinity, salinity (‰), chlorinity (‰), calcium (m*M*), and magnesium (m*M*), versus sub-bottom depth from interstitial water samples analyzed at Site 581. Symbols are as follows: △ = IAPSO and SSW standards; ⊙ = samples from Hole 581.

SITE 581 HOLE CORE 1 CORED INTERVAL 5487.5–5488.5 mbsl; 0.0–1.0 mbsf



LITHOLOGIC DESCRIPTION

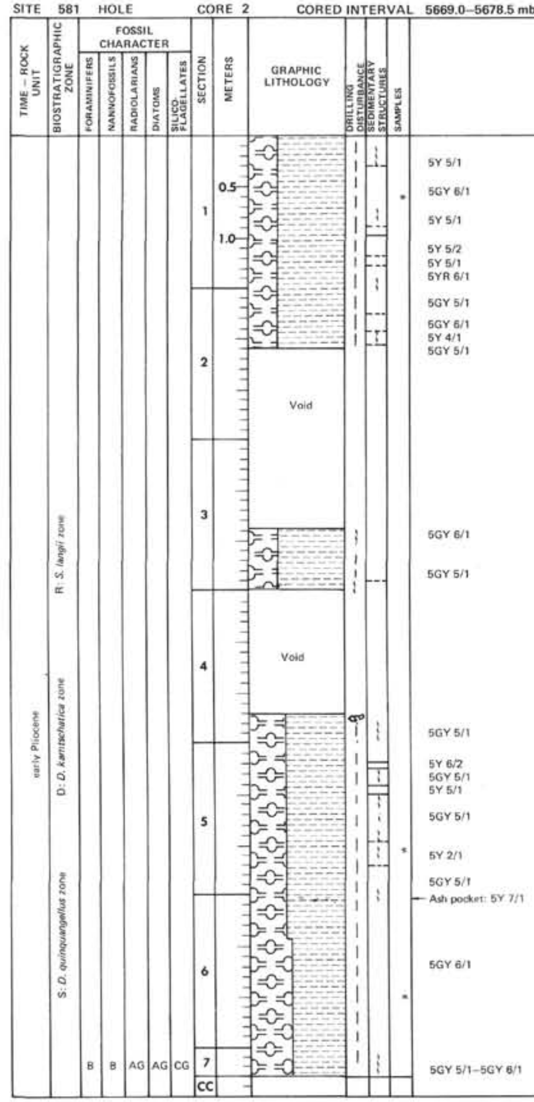
SILICEOUS CLAY

- Dominant colors: dark gray (5Y 4/1). Core Catcher is olive gray (5Y 4/2).
- Entire core is soupy or very deformed by drilling.
- This core consists of homogeneous siliceous clay. The Core Catcher is mottled.

SMEAR SLIDE SUMMARY (%):

	1, 40
	D
Texture:	
Sand	5
Silt	30
Clay	65
Composition:	
Quartz	7
Feldspar	1
Clay	65
Volcanic glass	5
Diatoms	15
Radiolarians	7

SITE 581 HOLE CORE 2 CORED INTERVAL 5669.0–5678.5 mbsl; 181.5–191.0 mbsf



LITHOLOGIC DESCRIPTION

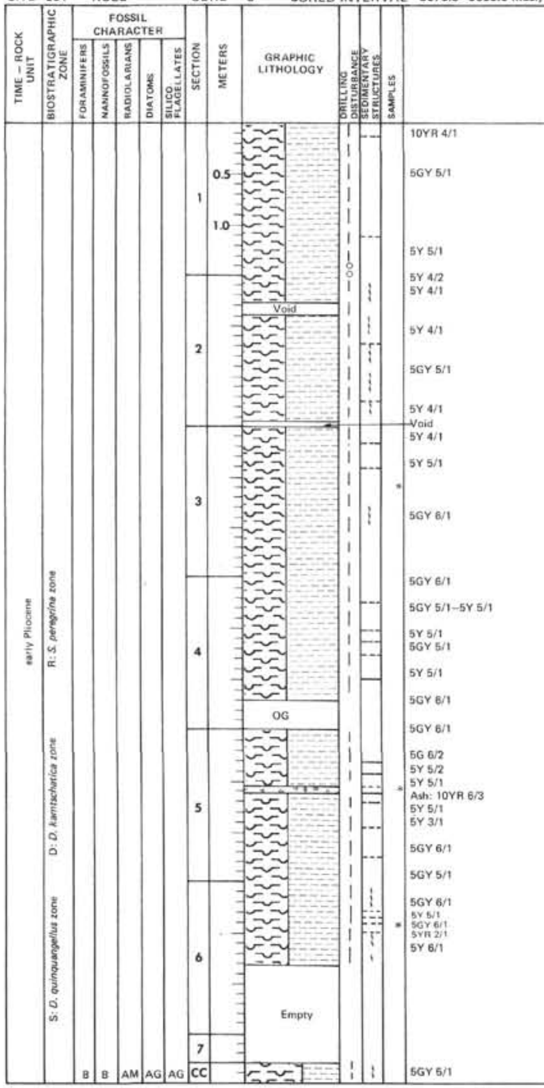
SILICEOUS (DIATOMACEOUS) CLAY

- Dominant colors: greenish gray (5GY 5/1–5GY 6/1) and gray (5Y 5/1). Minor colors: local intervals of black (5Y 2/1), dark gray (5Y 4/1), gray (5Y 5/1), olive gray (5Y 5/2), light olive gray (5Y 6/2), and greenish gray (5YR 6/1). Minor zones and mottles of dark gray (10YR 4/1), very dark gray (5Y 3/10, and dark greenish gray (5G 5/1–5GY 4/1). One light gray (5Y 7/1) ash pocket.
- This core is slightly to very deformed by drilling. Large void spaces occur at 2, 60 cm to 3, 88 cm and 4, 0–120 cm.
- This core consists of homogeneous to lightly mottled siliceous (diatomaceous) clay. A small ash pocket occurs at 6, 0–3 cm.

SMEAR SLIDE SUMMARY (%):

	1, 60	5, 110	6, 100
	D	D	D
Texture:			
Sand	5	15	15
Silt	30	35	35
Clay	65	50	50
Composition:			
Quartz	5	3	5
Clay	63	50	47
Volcanic glass	2	5	3
Diatoms	20	30	35
Radiolarians	10	10	10
Silicoflagellates	–	2	–

SITE 581 HOLE CORE 3 CORED INTERVAL 5678.5–5688.0 mbsl; 191.0–200.5 mbsf



LITHOLOGIC DESCRIPTION

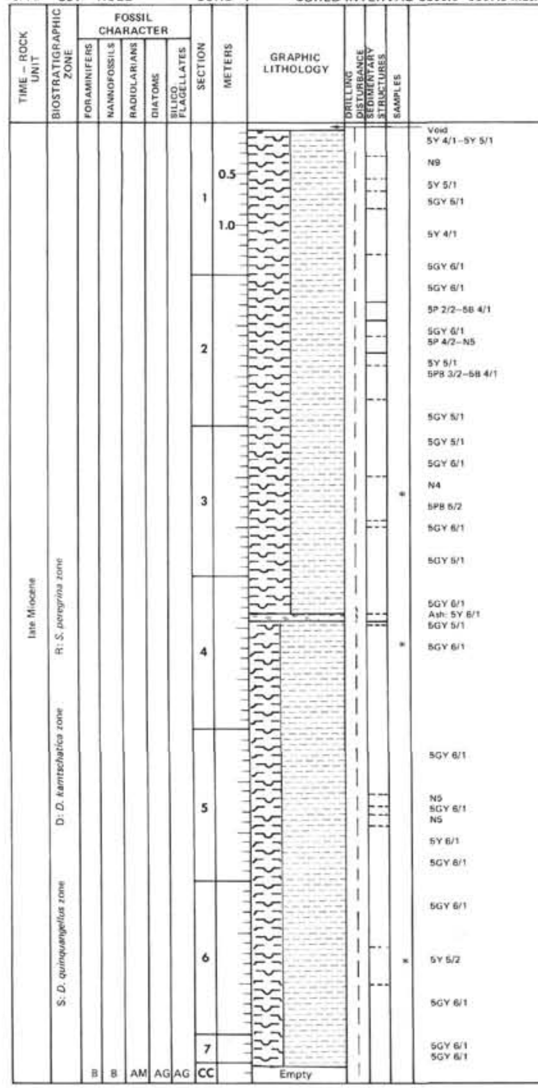
CLAYEY DIATOM OOZE

- Dominant colors: greenish gray (5GY 5/1–5GY 6/1), gray (5Y 5/1), and dark gray (5Y 4/1). Minor colors: intervals of dark gray (10YR 4/1), olive gray (5Y 5/2), very dark gray (5Y 3/1), pale green (5G 6/2), and gray (5Y 6/1). Minor faint dark greenish gray (5G 4/1–5GY 4/1) zones and mottles. Altered ash layer in Section 5 is pale brown (10YR 6/3).
- Except for the small soupy interval at the base of Section 1, this core is slightly deformed by drilling.
- This core consists of homogeneous to very lightly mottled clayey diatom ooze. An ash layer (now mostly altered to phillipsite) occurs at 5, 55–61 cm.

SMEAR SLIDE SUMMARY (%):

	3, 60 D	5, 60 M	6, 45 D
Texture:			
Sand	25	20	30
Silt	24	50	37
Clay	51	30	33
Composition:			
Quartz	3	–	3
Clay	51	30	33
Volcanic glass	Tr	–	Tr
Zeolite (phillipsite)	–	57	–
Diatoms	40	10	60
Radiolarians	5	3	3
Silicoflagellates	1	–	1

SITE 581 HOLE CORE 4 CORED INTERVAL 5688.0–5697.5 mbsl; 200.5–210.0 mbsf



LITHOLOGIC DESCRIPTION

SILICEOUS (DIATOMACEOUS) CLAY

- Dominant colors: greenish gray (5GY 5/1–5GY 6/1). Minor colors: intervals of dark gray (N4), dark gray (5Y 4/1), gray (5Y 5/1), gray (N5), olive gray (5Y 5/2), very dusky purple (5P 2/2), dark bluish gray (5B 4/1), grayish purple (5P 4/2), dusky blue (5PB 3/2), and grayish blue (5PB 5/2). Ash layer in Section 4 is gray (5Y 6/1).
- Majority of this core is slightly deformed by drilling, with minor very deformed portion in Secton 4.
- This core consists of homogeneous to lightly mottled (in Sections 1 and 2) siliceous (diatomaceous) clay. An ash layer occurs at 4, 37–42 cm.

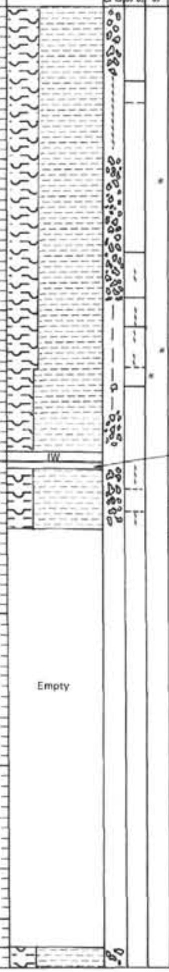
SMEAR SLIDE SUMMARY (%):

	3, 70 D	4, 70 D	6, 80 D
Texture:			
Sand	25	20	15
Silt	28	22	26
Clay	47	58	59
Composition:			
Quartz	5	5	3
Feldspar	–	Tr	Tr
Clay	47	58	59
Volcanic glass	1	1	–
Zeolite (phillipsite)	–	Tr	–
Diatoms	40	30	30
Radiolarians	5	5	7
Silicoflagellates	2	1	1

SITE 581 HOLE CORE 5 CORED INTERVAL 5697.5–5707.0 mbsl; 210.0–219.5 mbsf

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SILICO-FLAGELLATES	SECTION	METERS
late Miocene	R: *D. penultima* zone; D: *D. kamtschatica* zone; S: *Mesocena circulus* var. *apiculata* zone; F: ?	*Ammobaculites* sp. (agglut.) RG	B	AM	AG	AG	1, 2, 3, 4, 5, 6, 7, CC	0.5, 1.0

GRAPHIC LITHOLOGY / DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / SAMPLES



5GY 6/1
5Y 5/1
5GY 6/1
5GY 6/1
5GY 6/1
5GY 4/1
5Y 5/1–5GY 5/1
5GY 5/1
5PB 3/2–5B 5/1–5B 4/1
5GY 6/1
Void
5GY 6/1
5GY 5/1
5GY 6/1
Ash: 5Y 6/3
5GY 6/1

LITHOLOGIC DESCRIPTION

SILICEOUS (DIATOMACEOUS) CLAY

- Dominant colors: greenish gray (5GY 5/1)5GY 6/1). Minor colors: intervals of gray (5Y 5/1), dark greenish gray (5GY 4/1), dusky blue (5PB 3/2), bluish gray (5B 5/1), dark bluish gray (5B 4/1). Several mottles of white (5Y 8/1) diatom ooze in Sections 2 and 4. Ash in the Core Catcher is pale olive (5Y 6/3).
- Most of the core is very deformed to brecciated by drilling. The upper portion of Section 3 is slightly deformed.
- This core consists of homogeneous to lightly mottled siliceous clay. A discontinuous ash layer occurs in the Core Catcher from 12–13 cm. Section 1, 0–6 cm contains two greenstone pebbles and one indurated clay lump.

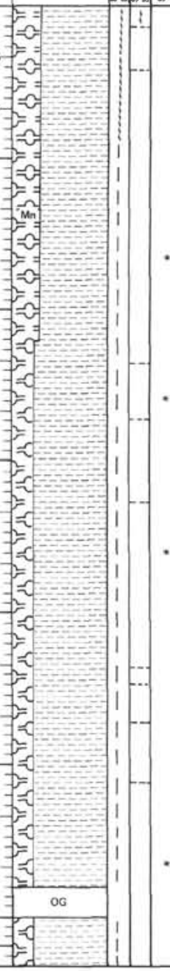
SMEAR SLIDE SUMMARY (%):

	2, 22	3, 40	3, 68
	D	D	D
Texture:			
Sand	0	20	15
Silt	65	27	23
Clay	35	53	62
Composition:			
Quartz	3	5	3
Feldspar	–	–	Tr
Clay	35	53	62
Volcanic glass	–	2	–
Diatoms	60	30	25
Radiolarians	2	7	7
Silicoflagellates	Tr	3	3

SITE 581 HOLE CORE 6 CORED INTERVAL 5707.0–5716.5 mbsl; 219.5–229.0 mbsf

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SILICO-FLAGELLATES	SECTION	METERS
late Miocene	R: *D. antepenultima* zone; D: *D. hustedtii* zone; F: ?; S: *Mesocena circulus* var. *apiculata* zone	One fragment of *Ammobaculites* sp. R	B	AM	AG	AG	1, 2, 3, 4, 5, 6, 7, CC	0.5, 1.0

GRAPHIC LITHOLOGY / DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / SAMPLES



5GY 6/1
5Y 6/2
5Y 5/2
5Y 6/2
5Y 5/2
5Y 5/2
2.5Y 6/2
2.5Y 6/4
10YR 6/4
10YR 6/4
7.5YR 6/6
10YR 6/6
10YR 6/4
10YR 6/4
10YR 5/4
10YR 5/6–10YR 6/4

LITHOLOGIC DESCRIPTION

SILICEOUS CLAY

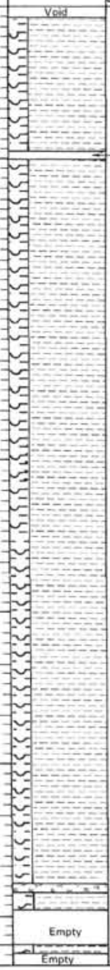
- Dominant colors: olive gray (5Y 5/2), light olive gray (5Y 6/2), and greenish gray (5GY 6/1) in Sections 1, 2, and 3, 0–50 cm. Below 3, 50 cm grades to light brownish gray (2.5Y 6/2) and light yellowish brown (2.5Y 6/4). Below 4, 38 cm grades to light yellowish brown (10YR 6/4) with intervals of yellowish brown (10YR 5/4–10YR 5/6), reddish yellow (7.5YR 6/6), and brownish yellow (10YR 6/6). Minor colors: top of Section 1 is lightly mottled with very dark gray (5Y 3/1).
- Section 1, 0–130 cm is very deformed; rest of the core is slightly deformed by drilling.
- This core consists of homogeneous siliceous clay changing from greenish gray to light yellowish brown in color downcore. Small grapestone manganese nodule at 2, 67–68 cm.

SMEAR SLIDE SUMMARY (%):

	2, 100	3, 40	4, 90	6, 100
	D	D	D	D
Texture:				
Sand	15	10	15	15
Silt	19	20	15	19
Clay	66	70	70	66
Composition:				
Quartz	3	3	2	3
Feldspar	Tr	–	Tr	–
Clay	66	70	70	66
Volcanic glass	Tr	1	1	1
Diatoms	25	20	15	7
Radiolarians	5	5	7	20
Silicoflagellates	1	1	5	3

SITE 581 HOLE CORE 7 CORED INTERVAL 5716.5–5726.0 mbsl; 229.0–238.5 mbsf

TIME-ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SILICO-FLAGELLATES	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES
middle Miocene	R: *D. petterssoni* zone; D: *D. hustedtii–D. lauta* zone; S: *M. circulus* var. *apiculata* zone	B	B	AM	AG	FM	1, 2, 3, 4, 5, 6, 7, CC	0.5, 1.0				



Section 1: 10YR 6/4
Void
Section 2: 10YR 6/4
Section 3: 10YR 6/4
2 bands of 10YR 4/1
2 bands of 10YR 4/1
10YR 6/4
10YR 4/1 and
10YR 6/4
Section 4: 10YR 6/4
Section 5: 10YR 6/4
10YR 4/1 bands
10YR 6/2 with patchy 10YR 4/1 zones
Section 6: Ash: 2.5Y 5/2
10YR 6/2
CC: 10YR 6/4

LITHOLOGIC DESCRIPTION

SILICEOUS CLAY WITH ONE VOLCANIC ASH LAYER

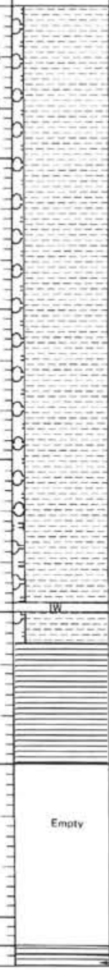
- Dominant colors: light yellowish brown (10YR 6/2–10YR 6/4). Minor colors: Sections 3 through 6 have thin bands and patchy zones of dark gray (10YR 4/1). Ash in Section 6 is grayish brown (2.5Y 5/2).
- Entire core is slightly deformed by drilling.
- This core consists of homogeneous siliceous clay. A normally graded ash layer occurs at 6, 118–126.5 cm.

SMEAR SLIDE SUMMARY (%):

	2, 90	4, 70	6, 70
	D	D	D
Texture:			
Sand	15	10	10
Silt	19	20	20
Clay	66	70	70
Composition:			
Quartz	5	5	3
Feldspar	Tr	Tr	–
Mica	Tr	Tr	–
Clay	66	69	68
Volcanic glass	1	1	2
Diatoms	15	10	15
Radiolarians	10	10	10
Silicoflagellates	3	5	2
Opaques	–	Tr	–

SITE 581 HOLE CORE 8 CORED INTERVAL 5726.0–5735.5 mbsl; 238.5–248.0 mbsf

TIME-ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SILICO-FLAGELLATES	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES
middle Miocene	R: *D. alata* zone; D: *D. hustedtii–D. lauta* zone; S: *C. triacantha* zone	B	B	CP	AM	CG	1, 2, 3, 4, 5, 6, 7, CC	0.5, 1.0				



Section 1: 10YR 6/4
10YR 5/4
10YR 5/4
Section 2: 5Y 4/1 band
10YR 6/4
10YR 5/4
10YR 6/4
Section 3: 10YR 5/4
10YR 5/4
10YR 6/4
Section 4: 10YR 5/4
Section 5: 10YR 5/4
7.5YR 5/4
10YR 5/4
CC: 10YR 5/4
Empty

LITHOLOGIC DESCRIPTION

SILICEOUS CLAY GRADING DOWNCORE TO PELAGIC CLAY

- Dominant colors: yellowish brown (10YR 5/4) and light yellowish brown (10YR 6/4) grading at 5, 30 cm to brown (7.5YR 5/4). Minor colors: local thin bands and mottles of dark gray (10YR 4/1).
- Section 5, 125–150 cm and the Core Catcher are very deformed, resulting from flow-in. The rest of the core is slightly deformed.
- This core consists of homogeneous to lightly mottled yellowish brown siliceous clay grading to mottled brown pelagic clay at 5, 30 cm.

SMEAR SLIDE SUMMARY (%):

	2, 30	3, 90	5, 90
	D	D	D
Texture:			
Sand	0	5	0
Silt	15	15	6
Clay	85	80	94
Composition:			
Quartz	2	3	2
Feldspar	Tr	Tr	Tr
Clay	84	80	94
Volcanic glass	Tr	Tr	1
Diatoms	7	7	Tr
Radiolarians	7	10	1
Sponge spicules	–	–	Tr
Silicoflagellates	Tr	Tr	Tr
Opaques	–	–	2

SITE 581 HOLE CORE 9 CORED INTERVAL 5735.5–5745.0 mbsl; 248.0–257.5 mbsf

TIME – ROCK UNIT: middle Miocene

BIOSTRATIGRAPHIC ZONE: R: *D. alata* zone; D: ?; S: ?

FOSSIL CHARACTER: Foraminifers B; Nannofossils B; Radiolarians RP; Diatoms RP; Silicoflagellates RP

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

METERS: 0.5, 1.0

GRAPHIC LITHOLOGY

Colors: 7.5YR 5/4; 7.5YR 5/4; 7.5YR 4/4; 10YR 4/3; 10YR 3/3; 10YR 3/2; 10YR 3/2

LITHOLOGIC DESCRIPTION

PELAGIC CLAY

Dominant colors: brown (7.5YR 5/4) and dark brown (7.5YR 4/4) grading to dark brown (10YR 4/3), dark brown (10YR 3/3) below 2, 89 cm and very dark grayish brown (10YR 3/2) below 3, 53 cm. Minor colors: Section 1 has dark grayish brown (10YR 4/2) patches. Sections 2 through 4 are mottled with light brown (7.5YR 6/4) and yellowish brown (10YR 5/4–10YR 6/4).

Sections 1 and 2 have brecciated intervals; rest of the core is slightly deformed by drilling.

This core consists of mottled brown pelagic clay. There is a pebble at 1, 0–1 cm.

SMEAR SLIDE SUMMARY (%):

	2, 104	4, 90
	D	D
Texture:		
Sand	3	1
Silt	7	8
Clay	90	91
Composition:		
Quartz	2	2
Feldspar	Tr	–
Mica	–	Tr
Clay	90	91
Volcanic glass	Tr	Tr
Micronodules	7	7
Radiolarians	1	–

SITE 581 HOLE CORE 10 CORED INTERVAL 5745.0–5754.5 mbsl; 257.5–267.0 mbsf

TIME – ROCK UNIT: Miocene

FOSSIL CHARACTER: Foraminifers B; Nannofossils B; Radiolarians B; Diatoms B; Ichthyoliths B

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

METERS: 0.5, 1.0

GRAPHIC LITHOLOGY

Colors: 10YR 3/2; 10YR 3/2; 10YR 3/2; 10YR 3/2; 10YR 3/2; 10YR 3/2; 10YR 3/2; 10YR 3/2; 10YR 3/2

LITHOLOGIC DESCRIPTION

PELAGIC CLAY

*Dominant color: very dark grayish brown (10YR 3/2). Minor colors: Section 1 has light reddish brown (5YR 6/4) mottles. Section 3 has very minor brown (7.5YR 5/4) mottles. Sections 4 through 6 have minor brownish yellow (10YR 6/6) mottles.

*Section 3, 136 cm through the Core Catcher are moderately to very deformed. The rest of the core is slightly deformed by drilling.

*This core consists of homogeneous to lightly mottled very dark grayish brown pelagic clay. There is a small (0.5 cm diameter) manganese nodule at 3, 59 cm.

SMEAR SLIDE SUMMARY (%):

	1, 100	6, 40
	D	D
Texture:		
Sand	0	0
Silt	10	20
Clay	90	80
Composition:		
Quartz	3	3
Clay	92	91
Volcanic glass	–	3
Opaques (hematite and goethite)	5	3

SITE 581 HOLE CORE 11 CORED INTERVAL 5754.5–5764.0 mbsl; 267.0–276.5 mbsf

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SILICO-FLAGELLATES	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES	LITHOLOGIC DESCRIPTION
							1	0.5, 1.0					10YR 3/2
							2						
							3		Empty				
							4						
							5						
							6						
							7						
		B	B	B	B	B	CC						

*This core contains 30 cm of very dark grayish brown (10YR 3/2) pelagic clay. It has been slightly to very deformed by drilling.

SITE 581 HOLE CORE 12 CORED INTERVAL 5764.0–5773.5 mbsl; 276.5–286.0 mbsf

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SILICO-FLAGELLATES	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES	LITHOLOGIC DESCRIPTION
							1	0.5, 1.0				*	7.5YR 3/2 10YR 5/3, 4/3, 3/3 10YR 3/2 5YR 5/6
							2		Empty				
							3						

PELAGIC CLAY, CLAYSTONE PEBBLES, AND CHERT PEBBLES

*The upper 10 cm of this core consists of moderately deformed dark brown (7.5YR 3/2) pelagic clay.

*Section 1, 10–25 cm contains several small brown (10YR 5/3), dark brown (10YR 4/3), and dark brown (10YR 3/3) claystone pebbles.

*Section 1, 25–33 cm contains two very dark grayish brown (10YR 3/2) chert pebbles with conchoidal fractures and light brownish gray (10YR 6/2) claystone pockets.

*Section 1, 33–45 cm contains five yellowish red (5YR 5/6) chert pebbles with conchoidal fractures and light gray (2.5Y 7/2) quartz veins.

SMEAR SLIDE SUMMARY (%):

	1, 5
Texture:	
Sand	5
Silt	15
Clay	80
Composition:	
Quartz	3
Clay	77
Volcanic glass	5
Carbonate unspec.	Tr
Diatoms	Tr
Chert fragments	15

SITE 581 HOLE CORE 13 CORED INTERVAL 5773.5–5783.0 mbsl; 286.0–295.5 mbsf

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SILICO-FLAGELLATES	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES	LITHOLOGIC DESCRIPTION
							1	0.5, 1.0					5Y 4/4 and 10YR 5/6 10YR 3/1 10YR 3/2
							2		Empty				
							3						

CHERT PEBBLES AND PELAGIC CLAY

*Section 1, 0–4 cm contains two reddish brown (5Y 4/4) and yellowish brown (10YR 5/6) chert pebbles with conchoidal fractures.

*Section 1, 5–13 cm contains two very dark gray (10YR 3/1) chert pebbles wtih conchoidal fractures.

*Section 1, 15–20 cm consists of very dark grayish brown (10YR 4/3) very deformed pelagic clay with included small chert chips.

SITE 581 HOLE CORE 14 CORED INTERVAL 5783.0–5792.5 mbsl; 295.5–305.0 mbsf

TIME – ROCK UNIT | BIOSTRATIGRAPHIC ZONE | FOSSIL CHARACTER: FORAMINIFERS, NANNOFOSSILS, RADIOLARIANS, DIATOMS, SILICO-FLAGELLATES | SECTION | METERS | GRAPHIC LITHOLOGY | DRILLING DISTURBANCE | SEDIMENTARY STRUCTURES | SAMPLES | LITHOLOGIC DESCRIPTION

7.5YR 4/4 and 7.5YR 7/4
10YR 3/1–2/1
10YR 7/4

CHERT AND CLAYSTONE PEBBLES

*Section 1, 0–6 cm contains a medium brown (7.5YR 4/4) and pink (7.5YR 7/4) banded chert cobble with conchoidal fractures.

*Section 1, 7–10 cm contains a very dark gray (10YR 3/1) to black (10YR 2/1) chert cobble with clear quartz veins and conchoidal surface fractures.

*Section 1, 11–13 cm contains a very pale brown (10YR 7/4) soft banded claystone pebble (see smear slide summary below).

*Section 1, 15–28 cm contains a mixture of small pebbles, including banded medium brown (7.5YR 4/4) and pink (7.5YR 7/4) banded chert, very dark gray (10YR 3/1) chert, and very pale brown (10YR 7/4) claystone.

SMEAR SLIDE SUMMARY (%):

	1, 12
	D
Texture:	
Sand	0
Silt	10
Clay	90
Composition:	
Quartz	3
Clay	90
Volcanic glass	7
Diatoms	Tr

SITE 581 HOLE CORE 15 CORED INTERVAL 5792.5–5802.0 mbsl; 305.0–314.5 mbsf

LITHOLOGIC DESCRIPTION

CHERT PEBBLES AND FRAGMENTS

*This core is 55 cm long (including ethafoam spacers) and contains dull to vitreous chert pebbles and fragments.

*The chert pebbles range in size from 2 to 7 cm in diameter. They are of various colors, including: dusky red (10R 3/2), dark reddish gray (10R 3/1), reddish black (10R 2.5/1), black (10YR 2.5/1), very dark gray (10YR 3/1), and very dark grayish brown (10YR 3/2).

*Some of the chert pebbles are laminated. Some contain quartz-filled veins and/or blebs of yellowish brown (10YR 5/4) to very pale (10YR 8/4) porcellanite.

SITE 581 HOLE CORE 16 CORED INTERVAL 5802.0–5811.5 mbsl; 314.5–324.0 mbsf

LITHOLOGIC DESCRIPTION

CHERT PEBBLES AND FRAGMENTS

•This core is 19 cm long (including ethafoam spacers) and contains dull to vitreous chert pebbles and fragments.

•The chert pebbles range in size from 2 to 6 cm in diameter. They are of various colors, including: very dark gray (10YR 3/1), very dark grayish brown (10YR 3/2), and black (10YR 2.5/1).

Several of the chert pebbles are laminated with yellowish brown (10YR 5/4–10YR 5/6).

SITE 581 HOLE CORE 17 CORED INTERVAL 5811.5–5821.0 mbsl; 324.0–333.5 mbsf

LITHOLOGIC DESCRIPTION

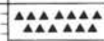
CHERT PEBBLES AND FRAGMENTS

*This core is 107 cm long (including ethafoam spacers) and contains dull to vitreous chert pebbles and fragments.

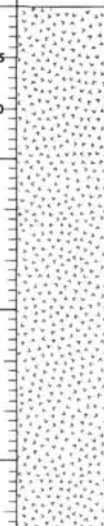
*The chert pebbles range in size from 4 to 7 cm in diameter. They are of various colors, including: yellowish brown (10YR 5/8); banded red (10YR 4/6), yellowish brown (10YR 5/8), and dark yellowish brown (10YR 4/4); red (10YR 4/6); brown (10YR 4/3) or brown (7.5YR 4/4) with yellow (10YR 7/8), reddish yellow (5YR 6/8), weak red (10R 4/4), and/or dusky red (10R 3/4) patches; dark red (2.5Y 3/6); dark brown (10YR 3/3) with very dark gray (10YR 3/1) laminations and dusky red (10Y 3/2) patches; black (10YR 2.5/1); very dark grayish brown (10YR 3/2); and, very dark gray (10YR 3/1).

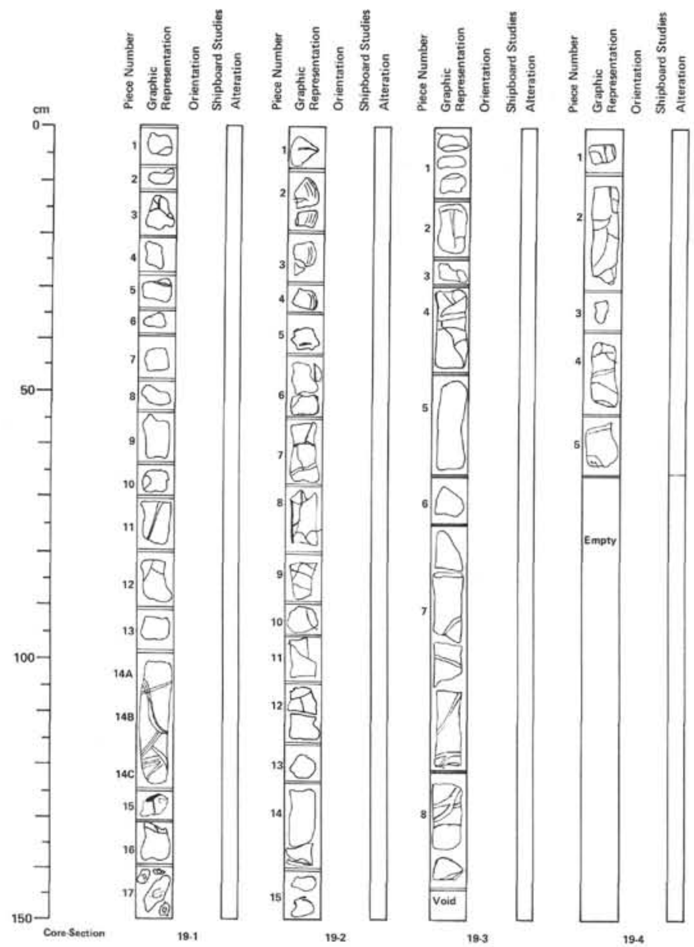
Some of the black, dark gray, and very dark grayish brown chert pebbles have brownish yellow (10YR 6/6) to dark yellowish brown (10YR 4/4) to yellow (10YR 7/8) indurated clay patches and/or laminations. The yellowish brown and red chert pebbles have small brownish yellow (10YR 6/8) to yellow (10YR 7/8) burrows. Fractures in the pebbles are filled with clear to weak red (10YR 4/4) quartz. Some of the quartz is well crystallized.

SITE 581 HOLE CORE 18 CORED INTERVAL 5821.0–5830.5 mbsl; 333.5–343.0 mbsf

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER: FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS	SILICO-FLAGELLATES	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES	LITHOLOGIC DESCRIPTION
							1	0.5 1.0	 Empty				CHERT PEBBLES AND FRAGMENTS •This core is 35 cm long (including ethafoam spacers) and contains chert pebbles and fragments. •The chert pebbles range in size from 3 to 7 cm in diameter. They are of various colors, including: black (2.5Y N2), black (10YR 2/1), and very dark gray (10YR 3/1). These chert pebbles contain yellowish brown (10YR 5/4) patches of porcellanite.
							2						

SITE 581 HOLE CORE 19 CORED INTERVAL 5830.5–5840.0 mbsl; 343.0–352.5 mbsf

TIME – ROCK UNIT	BIOSTRATIGRAPHIC ZONE	FOSSIL CHARACTER: FORAMINIFERS	NANNOFOSSILS	RADIOLARIANS	DIATOMS		SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	SAMPLES	LITHOLOGIC DESCRIPTION
							1	0.5 1.0					BASALT • Aphyric to sparsely phyric, medium gray (N5) basalt with about 5% phenocrysts in all pieces. Veins and vugs contain hematite, clay (smectite?), calcite, chlorite, and altered glass. •These basalts and those drilled in Holes 581A, 581B and 581C on Leg 88, are all described in detail in the Leg 88 Site 581 Site Chapter (see Duennebier, Stephen, et al., *Init. Repts.* DSDP, v. 88).
							2						
							3						
							4		Empty				
							5						
							6						
							7						
							CC						



86-581-19-1 Depth: 5830.5–5832.0 mbsl; 343.0–344.5 mbsf

Aphyric to sparsely phyric basalt medium gray (N5) with ≈ 5% phenocrysts in all pieces.

Hematite veins in Pieces 3, 11, 12, 14, 15, 16, and 17 along small cracks.

Veins in Pieces 3, 14, 15, and 16 contain clay (smectite?) (+ alteration products).

Piece 3 contains a calcite vein cross cutting the hematite vein.

Piece 14B also contains a calcite vein.

Pieces 1, 2, and 10 contain calcite and alterations of chlorite and serpentine?

Pieces 17A, B, and C contain calcite and similar alterations as Pieces 1 and 2 plus some glass alteration.

Uncut surfaces show minor alteration to chlorite.

86-581-19-2 Depth: 5832.0–5833.5 mbsl; 344.5–346.0 mbsf

Medium gray (N5) predominantly aphyric to sparsely phyric basalt with < 5% phenocrysts.

Pieces 13 and 15 are unsplit, so internal structure and alteration are unknown. Show minor external alteration to chlorite.

Fe_2O_3 alteration products in veins in Pieces 1, 5, 6B, 7, 8, 9, 10, 11, and 13.

Dark green chlorite/altered glass(?) veins in Pieces 2, 3, 5, 7, 9 (very large vein across top of piece), 12, and 14.

Smectite(?) – brownish, soft alteration material – included in the green veins in Pieces 2A and 14.

Pieces 2, 3, 4, and 5 all show transition from external glass/slightly altered glass to fine-grained and aphyric basalt interior, but all pieces were rotated during recovery, so basalt top (glassy surface) is not pointed upwards. Alteration rind includes interlayered calcite and chlorite and slightly altered glass.

86-581-19-3 Depth: 5833.5–5835.0 mbsl; 346.0–347.5 mbsf

Aphyric to sparsely phyric basalt, medium gray (N5) with < 5% visible phenocrysts in all pieces.

Hematite alteration along small cracks and in veins in Pieces 1, 2, 3, 4, 7B, 7C, 7D, 8A, and 8B.

Calcite veins in Pieces 2, 4, 7B, and 7C.

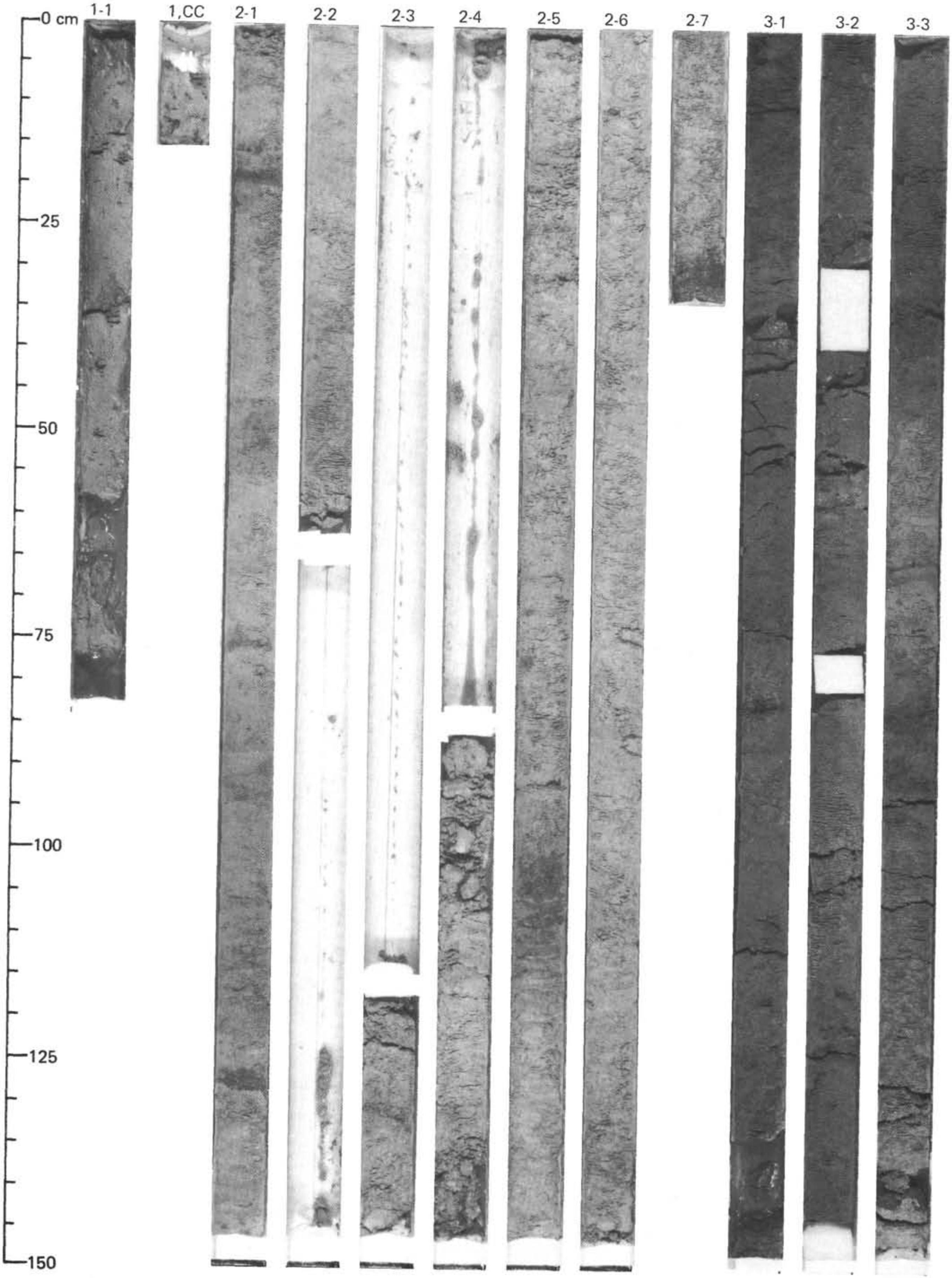
Chlorite(?) – dark green veins – in Pieces 2, 4, 7B, 7C, 7D, and 8A – perhaps altered glass.

86-581-19-4 Depth: 5835.0–5835.6 mbsl; 347.5–348.1 mbsf

Aphyric to sparsely phyric basalt medium gray (N5) with 3–5% phenocrysts in all pieces.

Hematite filling in cracks in Pieces 1, 2, 4, and 5.

Calcite vugs in Pieces 3 and 4 with chlorite (serpentine?) and hematite in Piece 3 with chlorite in Piece 4.


0 cm
25
50
75
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125
150
1-1
1,CC
2-1
2-2
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2-4
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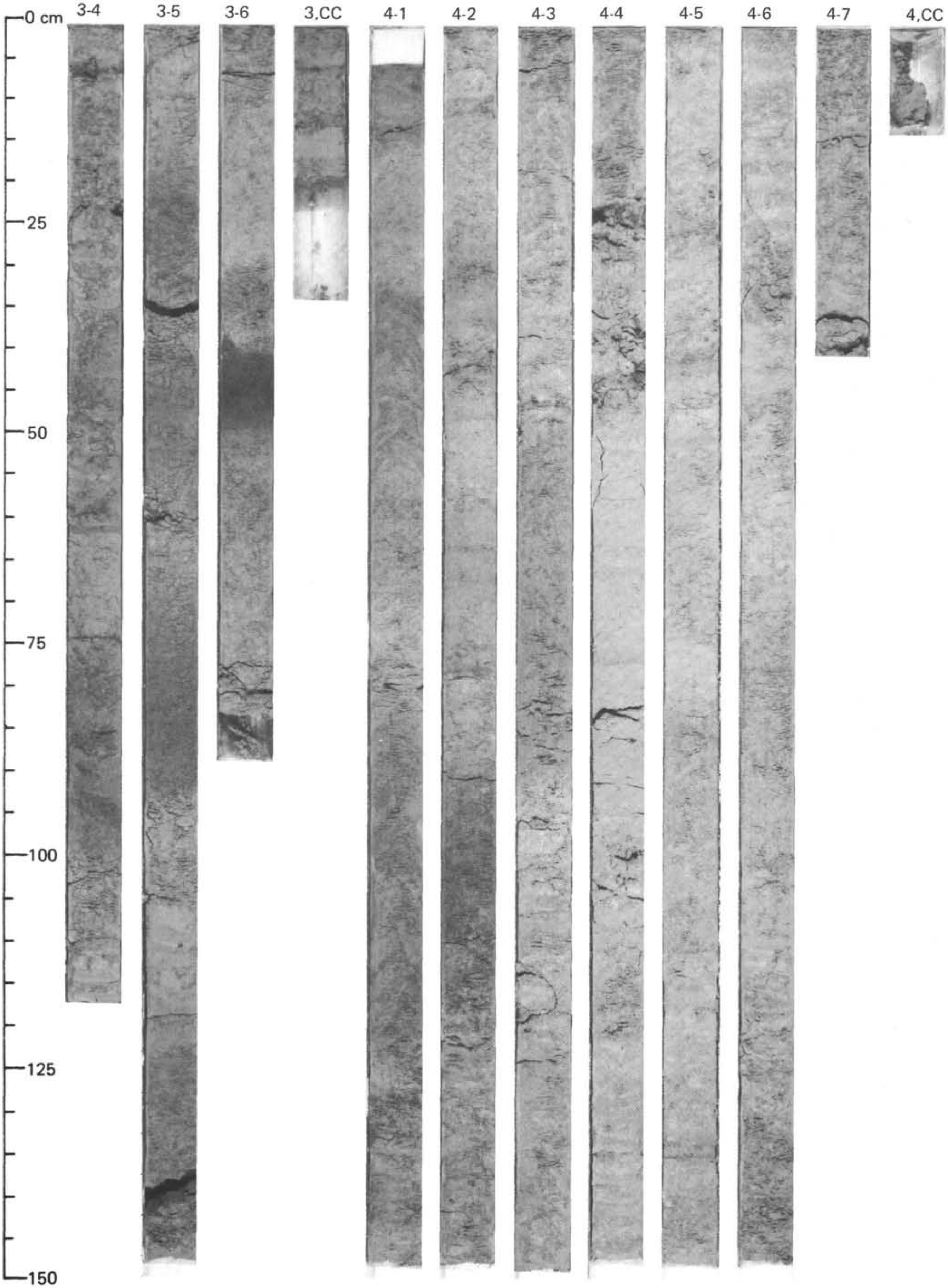
3-3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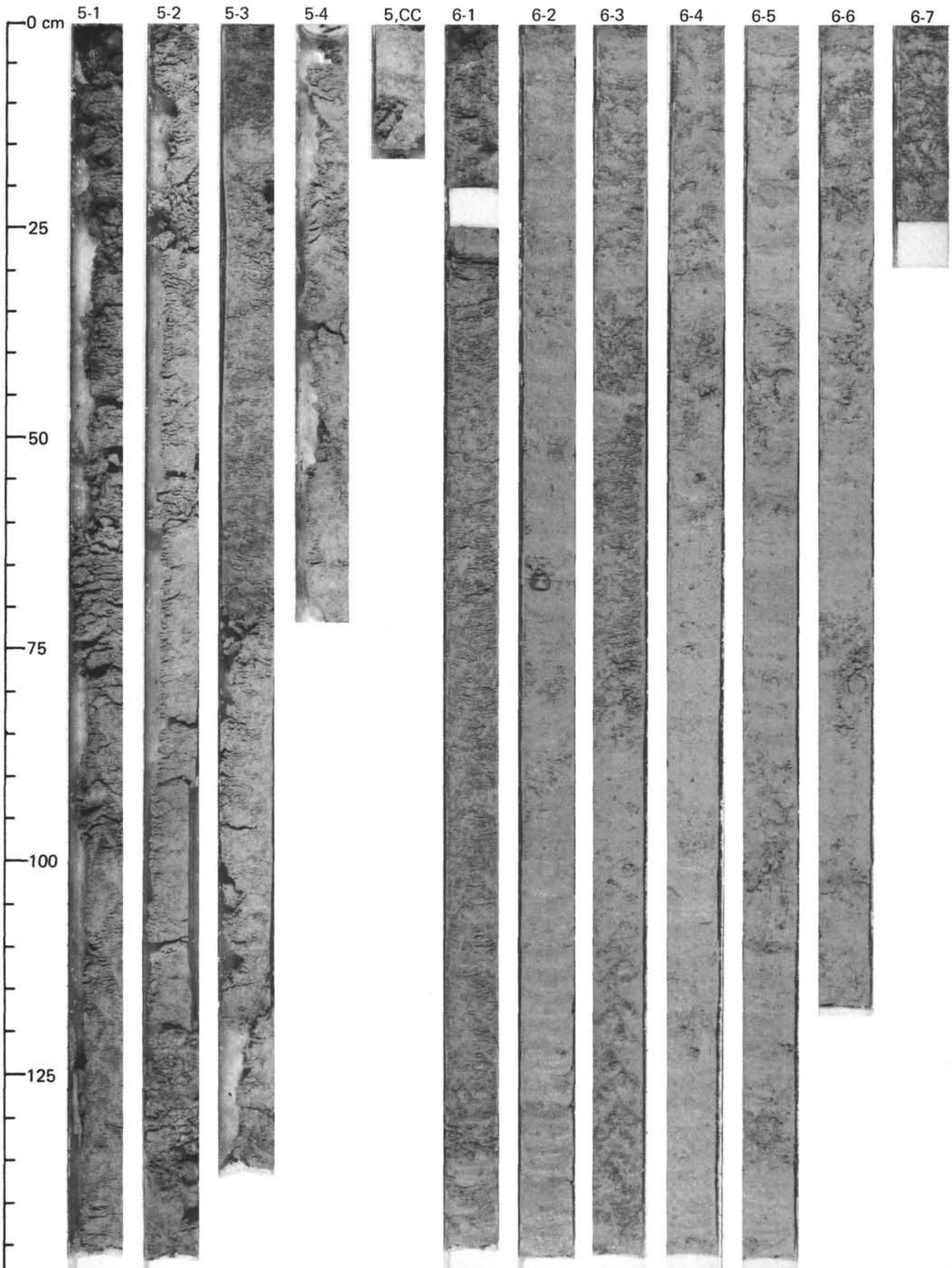
4-4
4-5
4-6
4-7
4,CC


0 cm
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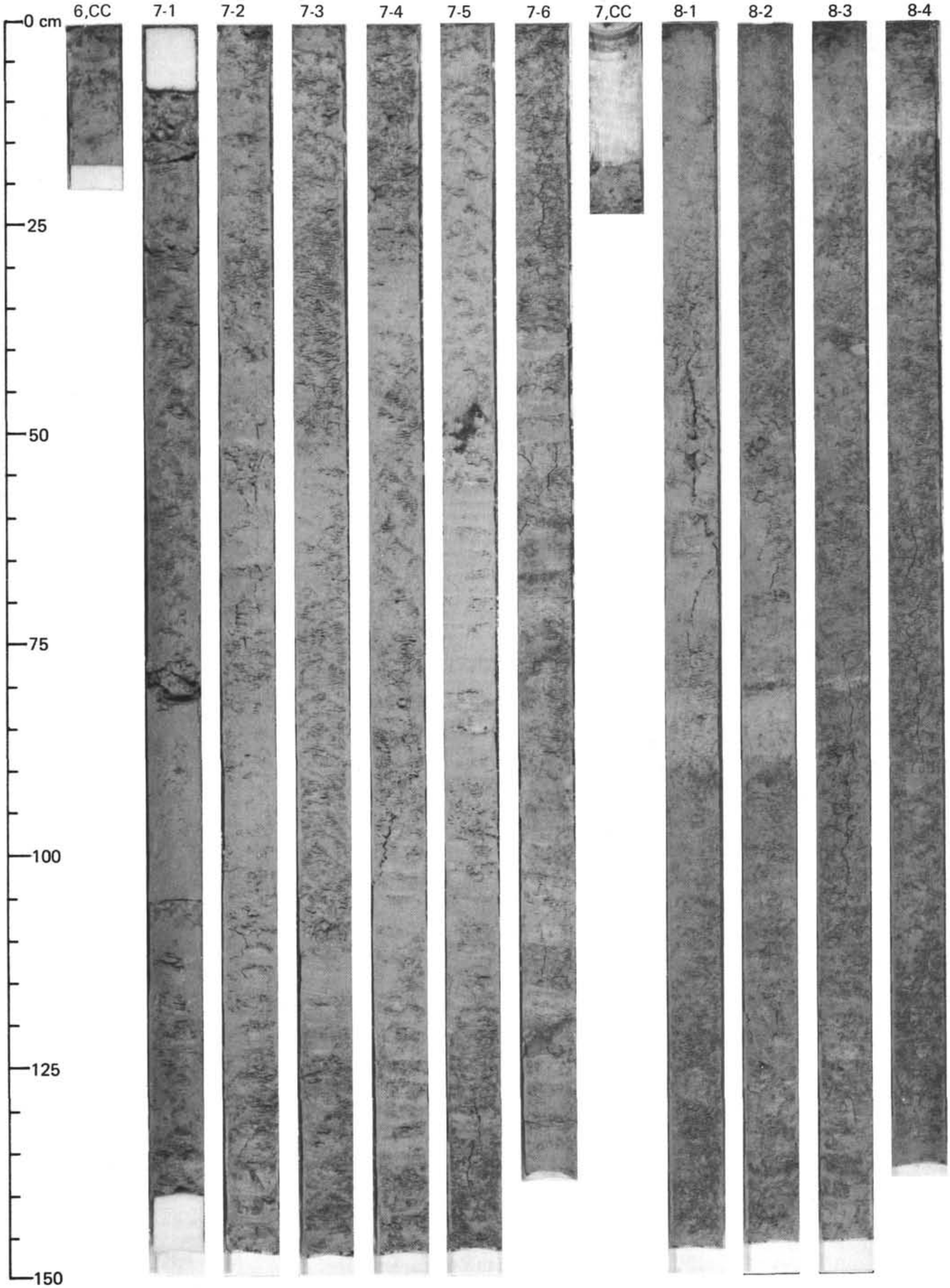
6-5
6-6
6-7


0 cm
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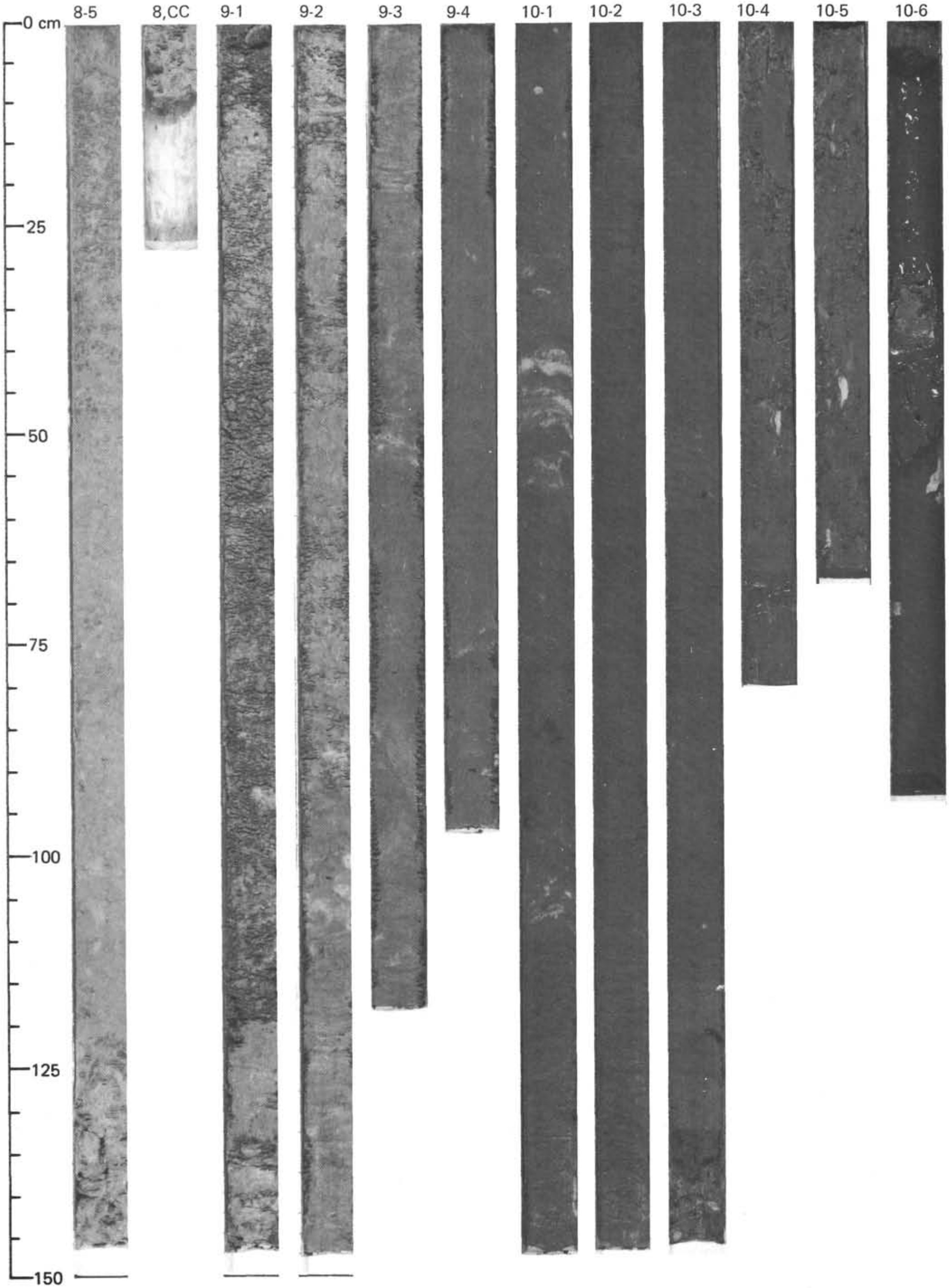
8-4


8-5
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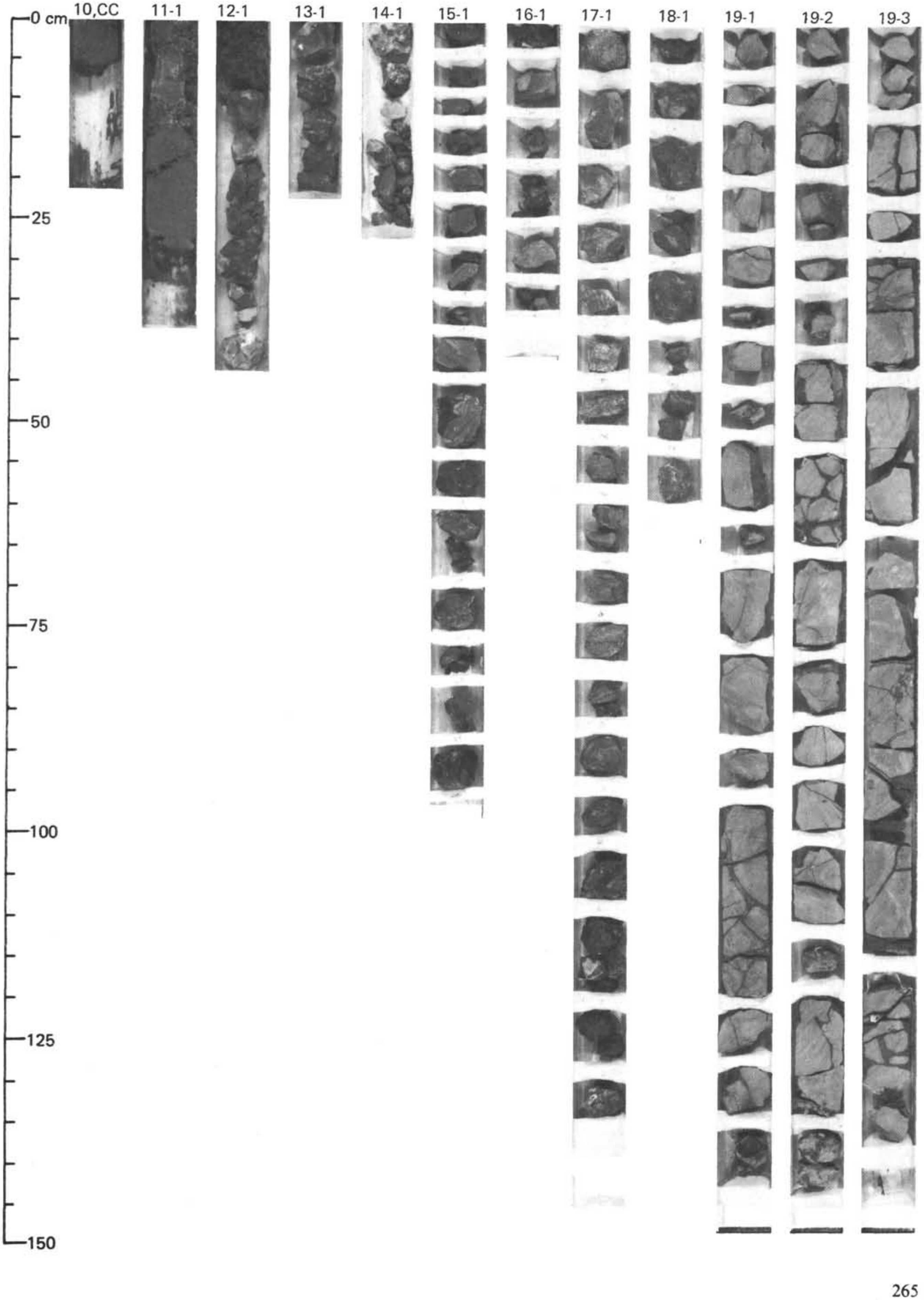
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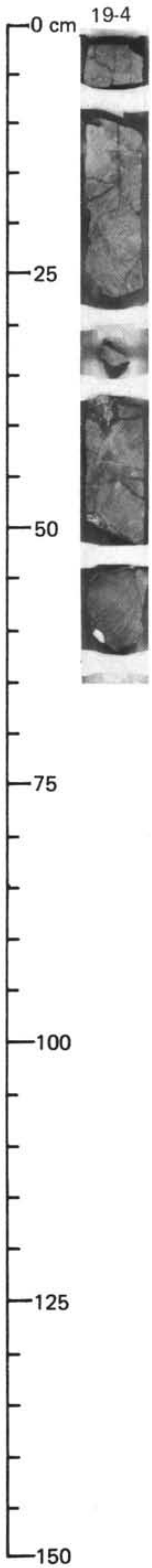
15-1
16-1
17-1
18-1
19-1
19-2
19-3


19-4
0 cm
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