6. SITE 434: THE LOWER TRENCH SLOPE, LEG 56

Shipboard Scientific Party[1]

HOLES 434, 434A, AND 434B

Dates Occupied: 12 September 1977 (1800); 22 September 1977 (1300)

Dates Departed: 18 September 1977 (1010); 30 September 1977 (1720)

Total Time on Site: 13 days 20.5 hours

Position: Hole 434—39°44.76′N; 144°06.12′E
Hole 434A—39°44.76′N; 144°06.12′E
Hole 434B—39°44.87′N; 144°06.08′E

Water Depth (sea level): Holes 434 and 434A—5985.8 meters; Hole 434B—5986 meters

Water Depth (rig floor): Holes 434 and 434A—5995.8 meters; Hole 434B—5996 meters

Bottom Felt (rig floor): Hole 434—6000.5 meters; Hole 434A—5998 meters; Hole 434B—5996 meters

Penetration: 637.5 meters

Number of Cores: 72

Total Length of Cored Section: 662 meters

Total Core Recovery: 133.35 meters

Oldest Sediment Cored: Late Miocene

Principal Results:

Three holes were drilled at this site; the deepest penetrated to 637.5 meters sub-bottom. The drilled section consisted of a very uniform hemipelagic deposit. The oldest sediments sampled were late Miocene. The major constituents are terrigenous silty clay, biogenic silica, and vitric ash. These sediments are similar in nearly every aspect to the Neogene sediments at the other transect sites. Below 100 meters significant induration of the sediments begins. The mudstones recovered are highly fractured with slickensiding commonly discernible on fractured faces. This fracturing is no doubt the main cause of drilling and coring difficulties encountered at this site. These fissile sediments were found only in Holes 434, 440, and 441 on the lower slope of the inner trench wall.

The early Pleistocene sediments are missing from the section. Pliocene sediments begin in Core 2 of Hole 434 at 10 meters. Benthonic foraminiferal assemblages are similar to those at shallower sites on the landward trench slope and do not contain the taxa that characterize the oceanic biofacies at Site 436. Although the foraminiferal evidence does not identify sediments at Site 434 as belonging to an accretionary prism of oceanic sediments, there is biostratigraphic evidence suggesting considerable structural complexity: All fossil groups show anomalous vertical distributions. Diatom data in particular identify several repetitions of assemblages that form an undisturbed succession elsewhere. Possible causes for these distributions, other than downhole contamination, include slumping, sliding, faulting, and/or climatic oscillations.

Below 300 meters there are calcitic concretions and pods, and fractures are often healed. The concretions are thought to be diagenetic products, because some contain diatoms that are also found in the surrounding mudstone and some contain vitric shards showing the same range in values of the refractive index as shards in the surrounding mudstone. The alkalinity of the interstitial water is high, which would favor carbonate precipitation.

The sediments at Site 434 were anoxic, as evidenced by high interstitial water alkalinities, a strong H_2S odor to about 200 meters, and biogenic methane gas pockets from 130 meters to the bottom of the hole. Geochemical analyses indicate that the hydrocarbons are immature and have experienced only low temperatures.

The highly disturbed condition of most of the core materials made representative physical properties measurements difficult to obtain. The seismic velocities showed small but significant variations that may correspond to changes in the degree of fracturing along the section.

BACKGROUND

Site 434 is located on the lower slope of the landward wall of the Japan Trench. It has been known for several years from refraction seismic studies that the lower slope was underlain by a wedge of sediments with a relatively low seismic velocity, in the range of 1.6 to 2.5 km/s (e.g., Ludwig et al., 1966). These low velocity deposits extend from the midslope terrace to the floor of the trench. Beneath this sedimentary wedge is a layer

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with velocities typical of oceanic basement, and recent multichannel seismic profiles (see Figure 1) show that the top of this layer is continuous with the oceanic basement surface seaward of the trench. This sedimentary wedge has been described by some authors as identical with scraped off sediments found on the overthrusted leading edge of many oceanic subduction sites (see, for example, Karig and Ingle, 1975; Kulm et al., 1973). Sediments in the accreting prism show a strong degree of deformation in response to the compressive and shear stress resulting from ongoing subduction of the oceanic lithosphere. Apparently, sediments that lie on the subducting oceanic crust are scraped off and plastered onto the base of the accreting prism. Underthrusted layers must be uplifted and compressed to accommodate the continuous input of new material at the foot of the slope. The resulting style of deformation has been studied by means of multichannel seismic techniques over similar deposits along the western Central American Margin (Seely et al., 1974) and analogous deposits now exposed on land. Typically, the sedimentary layers are positioned in sheetlike overthrusted units, forming an imbricate stack. The shearing plane steepens noticeably landward from the foot of the slope.

OBJECTIVES

A primary objective for Site 434 was to penetrate as deeply as possible into the accretionary wedge at the foot of the Japan Trench landward slope to sample sediments involved in the accreting tectonics. The geophysical surveys of the Japan Trench, which include 24-channel digital reflection profiling, provide only a vague indication of the configuration of the sedimentary layers in the accretionary zone, owing in large part to the enormous complexity of the acoustic stratigraphy and lack of large velocity contrasts. Penetrating the wedge with a drill might reveal the style of deformation through such features as fracturing, folding, slickensiding, orientation of bedding plane, and so forth. A direct confirmation of the hypotheses of formation and evolution of accretionary wedges would be the discovery of sediments irrefutably identified with the sediments on the Pacific Plate seaward of the Trench.

During Leg 56 the maximum penetration capacity of the *Glomar Challenger* was approximately 6800 meters; thus it was impossible, as would have been desirable, to drill into the toe of the accretionary wedge. Site 434 was at 5986 meters water depth on the last well-defined terrace before the Trench floor. The goal was to drill and core 800 meters sub-bottom.

Although no clear acoustical stratigraphy can be discerned below the selected site, nearly horizontal discontinuous reflectors can be followed over short distances in a zone 0.3 to 0.5 second of two-way travel time subbottom (Figure 2). Below 0.5 second, other vague reflectors with a perceptible landward dip can be traced. Further description and discussion of the geophysics in the vicinity of Site 434 are in the Site 441 site chapter.

OPERATIONS

We approached Site 434 on a west-to-east line that closely followed earlier geophysical lines made during site surveys. The *Glomar Challenger* obtained geophysical data at about seven knots along the line, and the morphological features and sub-bottom acoustic stratigraphy defined by the surveys were easily identified. The site was a small terrace on the steep lower slope on the landward wall of the Trench. Seismic reflection profiles across this feature suggested that the terrace may be underlain by slumped material (Figure 2). We decided, therefore, to place Site 434 a little farther downslope on another, deeper, terrace at about 5990 meters.

The bottom beacon was dropped on the second pass over this terrace in a water depth of 5986 meters. The drill pipe was lowered and touched bottom with 6000.5 meters of pipe out. The first hole at 434 was drilled and cored to a depth of 301 meters sub-bottom. Over the entire length of this hole recovery was only about 18 per cent. Of the 33 cores cut, 9 contained 0.5 meter or less of sample. In many of these the sediment was highly disturbed by drilling, and very few contained original structures.

Initial hole angle surveys yielded ambiguous results. A survey on Core 33 showed an angle of 20° to 25° from vertical; as a consequence we decided to pull up and respud a new hole, 434A, about 50 feet from the first site without retrieving the drill string.

Hole 434A was spudded in on 17 September at 0615 hours at a water depth of 5988.5 meters. A mudline core was taken and the hole deepened with the center bit in place to about 150 meters, where an angle survey was made and a second core taken. The indicated departure from vertical was low, so we continued drilling. However, tropical storm Emma, which had been stalled about 300 miles due south of us, began to move northward at increasing speed. By evening the northern edge of the storm reached us, and we decided to recover the drill string after only 185 meters penetration subbottom. The pipe was hauled up under extremely difficult sea and wind conditions.

On 22 September, after completing drilling at Site 435, we returned to Site 434 to begin Hole 434B. The beacon we had dropped on 12 September was still operating, so we located over it and began running in. A mudline core was cut at 5996 meters below the drill deck, and then the center bit was inserted and we drilled to 295.5 meters sub-bottom. The solid bit drilling went very slowly. A second core was cut at 295.5 meters and an angle survey made. The survey showed only a 4° departure from vertical.

As with Holes 434 and 434A, drilling and coring conditions were difficult, with low penetration and low recovery rates. We assume the extremely fractured and fissile nature of the semilithified sediments to be the principal cause of the difficulties. What sections of intact core were obtained were highly fractured mudstone. We also noted a cyclic variation in the core recovery: Relatively good recovery was obtained for two or three

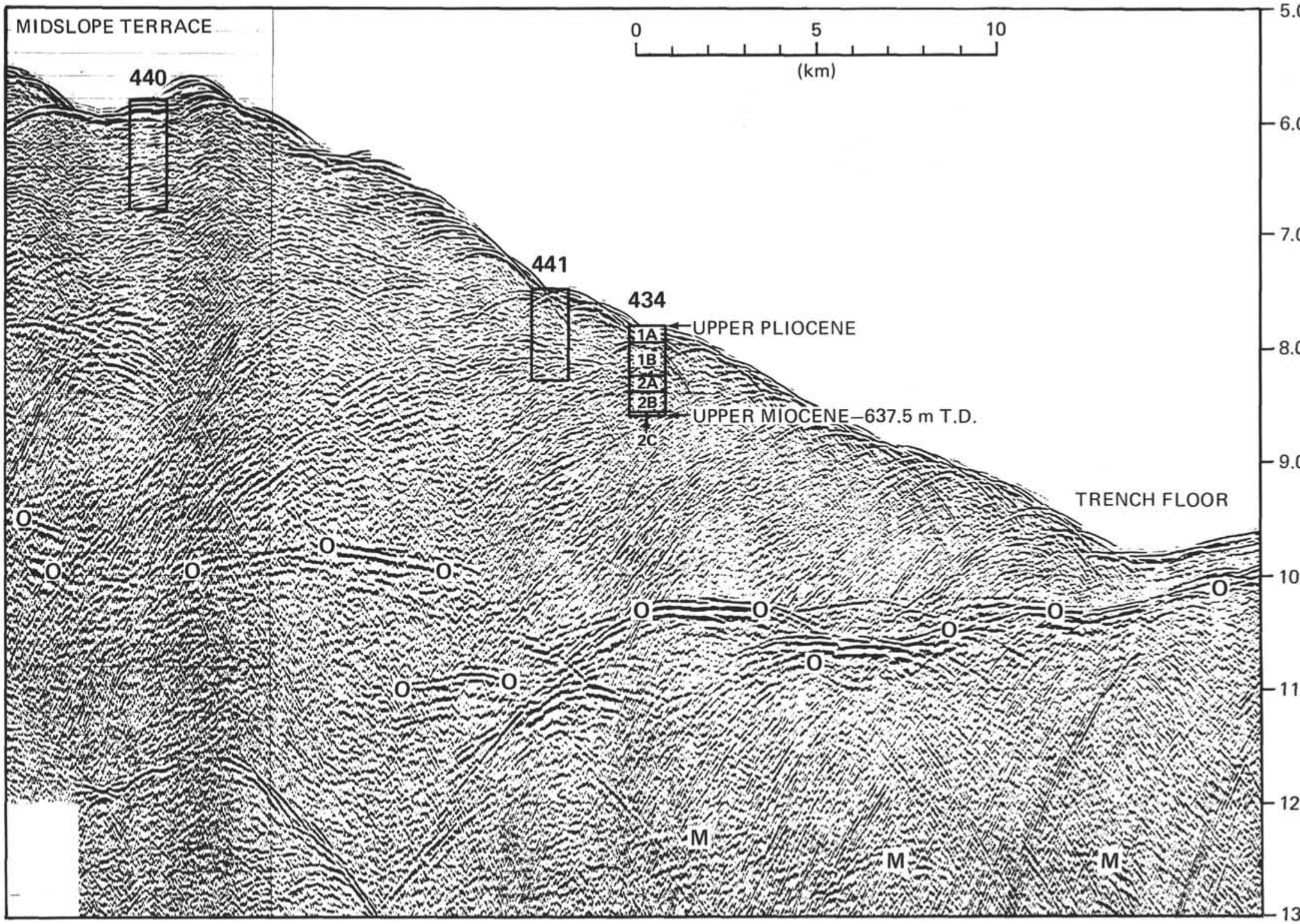

Figure 1. *Multichannel seismic profile across Sites 434, 440, and 441 extending from the trench floor to the midslope terrace. Lithologic subdivision is superimposed on Site 434. O designates the oceanic basement reflector and M the Mohorovicic discontinuity. The multichannel profile was provided courtesy of JNOC.*

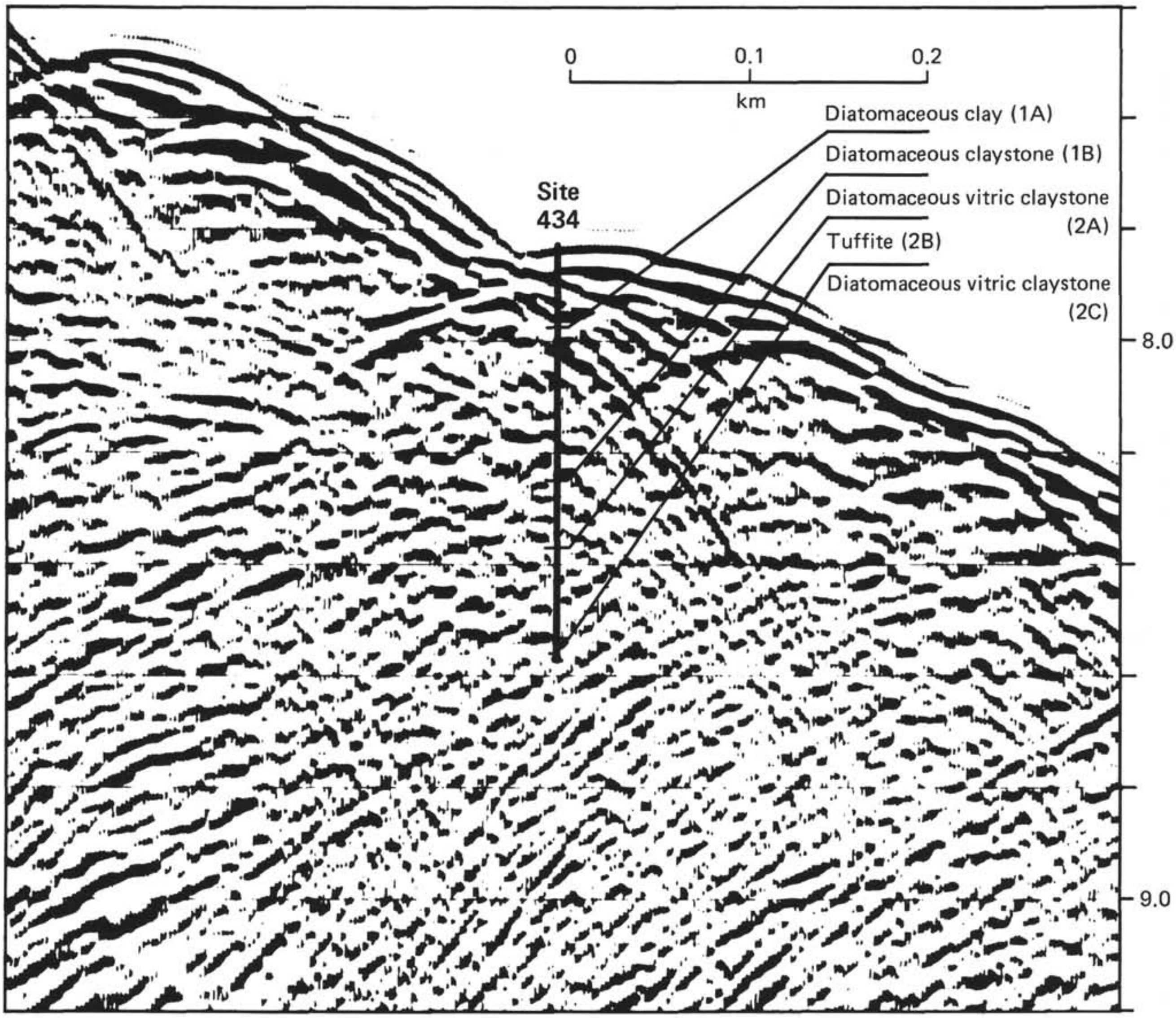

Figure 2. *Enlargement from Figure 1 of the multichannel seismic profile at Site 434.*

cores in succession, then recovery dropped to nearly zero for three or four cores in a row. This performance suggests that we penetrated alternating zones of relatively competent material and highly fractured material, respectively. Sometimes when the bit was raised free of the bottom, sediment would sluff from the hole walls and fill the hole below the bit.

After achieving a total of 637 meters sub-bottom we began retrieving the string on the evening of 28 September. The bottom hole assembly became stuck after we had pulled up approximately 300 meters of pipe, and we spent nearly 16 hours trying to free the pipe. Apparently the hole had caved above the bottom hole assembly. Finally, we decided to sever the pipe just below the mudline with an explosive charge. This was done successfully on the first attempt. We left the bottom hole assembly and about 150 meters of pipe in the hole.

LITHOLOGY

The sediments at Site 434 are dominantly a uniform diatomaceous clay. Variation in ash content is the only principal change downhole. Two units are differentiated on the basis of ash content as determined by smear slide descriptions: The sediment changes from an overlying section with less than 10 per cent ash (Unit 1) to an underlying section with over 10 per cent ash (Unit 2). Two sub-units are recognized within Unit 1: diatomaceous clay (Sub-unit 1A) overlying diatomaceous claystone (Sub-unit 1B). Unit 2 is subdivided into three sub-units differentiated by the abundance of virtic ash: Sub-unit 2A is diatomaceous vitric claystone with between 10 and 30 per cent ash, Sub-unit 2B is tuffite with over 30 per cent ash, and Sub-unit 2C, like 2A, is diatomaceous vitric claystone with 10 to 30 per cent ash (see Figure 3).

Unit 1, Sub-unit 1A (Cores 434-1-11; 434A-1; 434B-1, 0–101.5 m sub-bottom, Pleistocene–lower Pliocene)

Sub-unit 1A is a very uniform grayish-olive-green diatomaceous clay. X-ray diffraction data (Mann and Müller, this volume) shows that proportions of all mineral components in the sediment are relatively constant throughout the dominant lithology in this unit—much more constant than the smear slide descriptions suggest. Amorphous biogenic silica ranges approximately between 10 and 20 per cent; clays, between 40 and 60 per cent; volcanic glass is less than 10 per cent; quartz, about 10 per cent; feldspar, about 4 per cent; and there are minor and trace amounts of mica, heavy minerals, palagonite, glauconite, pyrite, forams, and lithic ash. The biogenic silica is dominantly diatoms, with varying amounts of radioloarians and spicules. Patches of ash and some ash beds are present in Cores 4 and 9. There are whispy laminae, convoluted by drilling disturbance, in much of the sediment, some dark pyritized spots, and a few small pumice fragments.

The texture of the sediments ranges from dominantly clayey silt at the top of the unit to dominantly silty clay at the base. As a result of the extreme disturbance by the drilling process there are no sedimentary structures preserved in Sub-unit 1A; the sediments are dominantly soupy to intensely disturbed, with a few sections moderately disturbed.

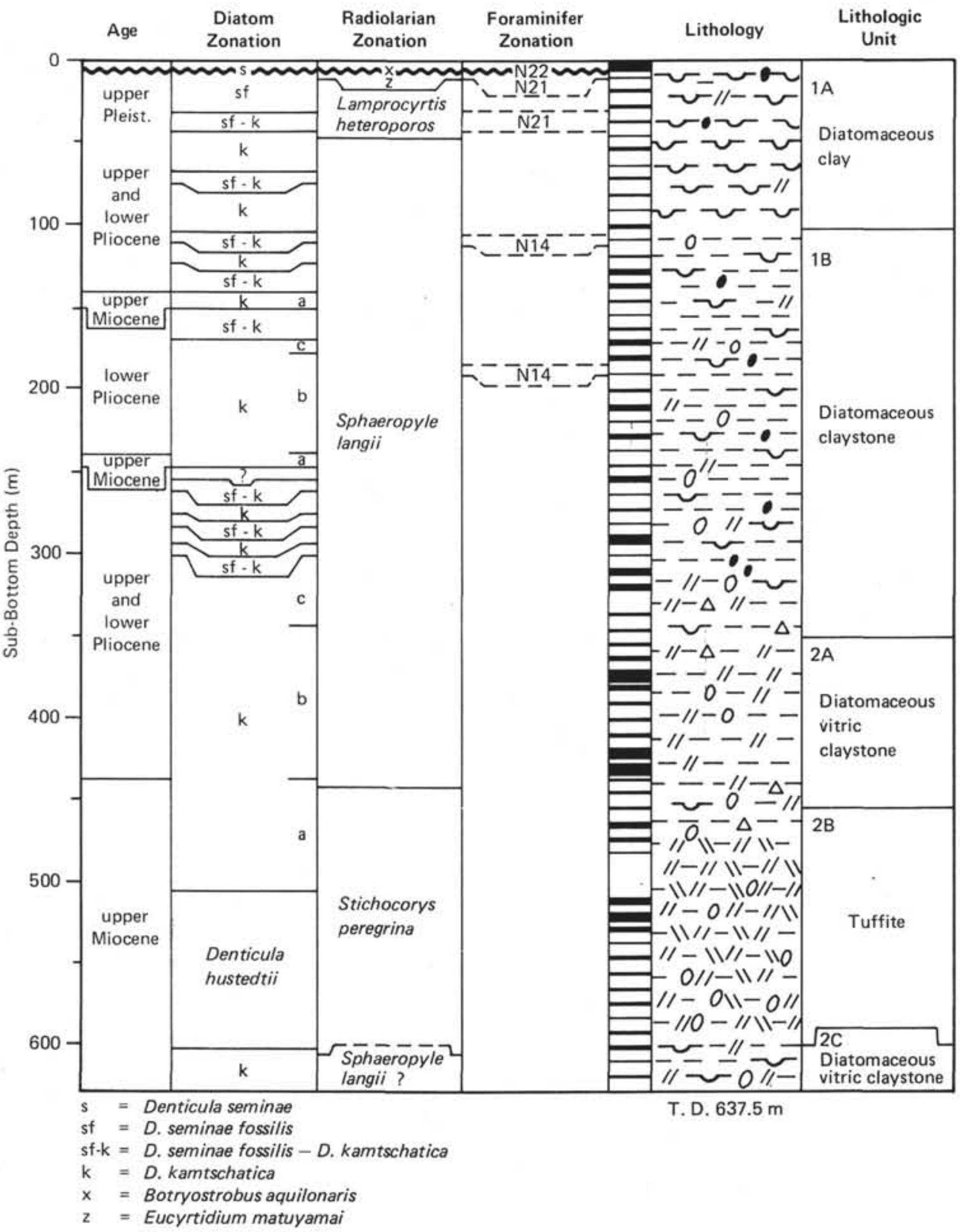

Figure 3. *Lithologic and biostratigraphic zonation of Site 434.*

The boundary between Sub-units 1A and 1B is a gradual transition from unconsolidated clays to claystone. The boundary was pinpointed between Cores 11 and 12 because there appeared to be a significant difference in the degree of lithification. This change is apparently supported by the physical properties data (see Carson and Bruns, this volume).

Unit 1, Sub-unit 1B (Cores 435-12–435-33; 434A-2; 434B-2–435B-7, 101.5 - 352.5 m sub-bottom, lower Pliocene)

The dominant sediment in Sub-unit 1B is compositionally the same as Sub-unit 1A but differs in being more lithified (see Figure 3). Proportions of all components remain relatively constant downcore in the dominant lithology. The amount of amorphous biogenic silica is slightly higher than in Sub-unit 1A but still ranges between only 10 and 20 per cent. Clays range from 40 to 60 per cent; volcanic glass is less than 10 per cent; quartz, about 10 per cent; feldspar, about 4 per cent; and there are rare to trace amounts of mica, heavy minerals, pyrite, glauconite, forams, carbonate unspecified, and lithic fragments. The biogenic opal is dominantly diatoms, with varying amounts of radiolarians and sponge spicules. The sediment is grayish-olive-green, dusky yellow green, grayish-green, and light olive gray. Ash patches and layers are present in Cores 18, 20, 24, 27, 28, and 33 in Hole 434 and in Cores 2, 3, 4, and 7 of Hole 434B. These are compositionally acidic—that is, in the silica range from dacite to rhyolite. Pebbles and cobbles, angular to subrounded and dominantly dacite with some marlstone, were found throughout the section. (The petrology of the pebbles is discussed in a subsequent section.) Cores 25 and 32 in Hole 434 contain layers of silty sand enriched with rounded to subrounded grains of quartz, feldspar, lithic fragments, and diatomaceous claystone fragments. A strong odor of H_2S was present in all cores to a sub-bottom depth of 250 meters.

The texture of these sediments is dominantly silty clay with many intervals of clayey silt. The sediment is moderately to intensely disturbed by drilling, with some soupy zones; thus no structures are preserved. Zones of shearing may be indicative of *in situ* shearing and faulting, but because of similarities to drilling-induced shearing it is difficult to be definitive about their origin.

Transition from Sub-unit 1B to Sub-unit 2A is pinpointed on the basis of an increase in the abundance of ash to over 10 per cent.

Unit 2, Sub-unit 2A (Cores 434B-8–434B-18, 352.5 - 456 m sub-bottom, lower Pliocene)

The dominant sediment in Sub-unit 2A is diatomaceous vitric claystone. It differs from Unit 1 only in increased ash content. The ash content varies but generally increases downsection in Sub-unit 2A, ranging from 10 to 30 per cent; thus the sediment type actually changes from vitric diatomaceous claystone at the top to diatomaceous vitric claystone at the base of the unit. Coincidentally, biogenic silica decreases, ranging from 20 to 10 per cent; quartz is about 9 per cent; feldspar, about 4 per cent; and there are rare and trace amounts of mica, heavy minerals, glauconite, carbonate unspecified, and calcareous nannos. The biogenic opal is dominantly diatoms with varying abundances of sponge spicules and rare amounts of radiolarians and silicoflagellates. The color ranges between dark greenish-gray, greenish-black, grayish-olive-green, and olive gray. There is only one patch of dacitic ash in Sub-unit 2—in Core 16. Marlstone, limestone, and pumice pebbles are found in Cores 8, 11, 13, 15, and 17. Patches of marlstone are present in Core 9, and there are diatomaceous marlstone patches in Core 16. A vitric siltstone layer is present in Core 9.

The texture of the sediment is dominantly silty clay with many intervals of clayey silt. The sediment is moderately disturbed to soupy with a few zones that are relatively undisturbed in Cores 8 and 9. There are some sedimentary structures preserved within Cores 8, 9, 10, 15, and 16 which show healed areas of microfaulting, what may be bedding, and some shear planes. There is a weakly graded zone of volcanoclastic sand in Core 8 and intervals that may indicate bioturbation in Core 16.

Transition from Sub-unit 2A to Sub-unit 2B is based on an increase in the abundance of ash to over 30 per cent. The boundary is designated between Cores 18 and 19, arbitrarily pinpointed on a trend of increasing ash which has significant short period variation.

Unit 2, Sub-unit 2B (Cores 434B-19–434B-34-1, 456 - 601 m sub-bottom, upper Miocene)

Compared to the remainder of the section at Site 434, Sub-unit 2B is particularly enriched in vitric ash. The sediment is tuffite and over 30 per cent olive gray, dark greenish-gray, greenish-black, and grayish-olive-green ash. Ash content ranges between 30 and 60 per cent; amorphous biogenic silica is less than 10 per cent; clay ranges from 20 to 60 per cent; quartz is about 8 per cent; feldspar, about 3 per cent; and there are rare and trace amounts of mica, heavy minerals, pyrite, carbonate unspecified, and calcareous nannos. The biogenic silica is dominantly diatoms, with sponge spicules and radiolarians commonly present.

There are no patches or layers of ash in Sub-unit 2B. Limestone and marlstone pebbles and fragments are common. The texture of the sediments is either clayey silt or silty clay. They are intensely disturbed to soupy and contain no preserved structures.

Transition from Sub-unit 2B to Sub-unit 2C is defined by the volcanic ash content decreasing to less than 30 per cent. The transition is relatively distinct and the boundary has been placed between Sections 1 and 2 of Core 34.

Unit 2, Sub-unit C (Cores 434B-34-2–434B-36, 601 - 628 m sub-bottom, upper Miocene)

Sub-unit 2C is dominantly diatomaceous vitric claystone, compositionally defined by the decrease in ash content from that of the overlying unit. The relative composition of the other components remains the same. The vitric ash ranges between 10 and 25 per cent in abundance but averages 20 to 25 per cent. Amorphous biogenic silica makes up about 10 per cent of the sediment; clay ranges from 25 to 50 per cent; quartz is about 9 per cent; feldspar, about 4 per cent; and there are trace and rare amounts of mica, heavy minerals, pyrite, and carbonate unspecified.

There are limestone and marlstone pebbles in Cores 35 and 37. The texture of the sediment is silty clay. No sedimentary structures are observed because the recovered section was soupy.

Petrology of Pebbles

Pebbles of andesite, dacite, volcanic breccia, gabbro, marlstone, and calcareous vitric tuff were recovered. Most of the igneous rock pebbles are subrounded to well-rounded and occur isolatedly.

Among andesitic pebbles, Sample 434-25-2, 86–90 cm, is hornblende–augite andesite. The phenocryst consists of plagioclase, augite, and hornblende. Plagioclase is euhedral to subhedral, generally 0.8 mm × 1.5 mm in size, An 35–37 per cent in composition, and replaced mainly by kaolinite and partly by epidote. Augite, about 0.6 mm long, is euhedral to subhedral and is altered to epidote and chlorite. Hornblende, 0.9 mm long, is also mostly altered to epidote. The groundmass, composed of plagioclase laths (<0.2 mm), magnetite, chlorite, and augite, shows mostly hyalopilitic and partly intergranular texture. Small apatite crystals are common as accessories.

Sample 434-27-1, 65 cm, is hypersthene–augite (Figure 4). Phenocrystal plagioclase, 0.7 × 1.3 mm at the maximum, is sporadic in occurrence and mostly replaced by kaolinite. The composition of plagioclase falls in at 35 per cent. Pyroxene phenocrysts (0.3 - 0.6 mm) are altered to chlorite. The groundmass consists of plagioclase laths (< 0.2 mm), magnetite, augite, and glass, showing hyalopilitic texture. It is as a whole intensely silicified and marked by chalcedony veinlets which are partly replaced by calcite.

Sample 434-25-2, 86–90 cm—from the same interval as the aforementioned andesite pebble—is intensely altered dacite (Figure 5). Phenocrysts include plagioclase,

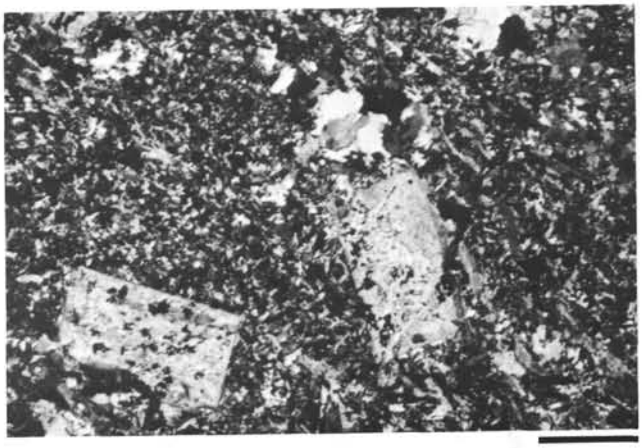

Figure 5. *Photomicrograph of altered dacite pebble (Sample 434-25-2, 86–90 cm) crossed Nichols. Bar scale equals 0.1 mm.*

hornblende, and biotite, of which plagioclase (0.6–1 mm) is altered to kaolinite and hornblende is replaced by magnetite and biotite along the margin. The intensely silicified groundmass may have been originally vitreous, in which plagioclase laths (0.2 mm) are rarely traceable, though much altered.

A pebble of volcanic breccia—again at the same level as the andesite and dacite (Sample 434-25-2, 86–90 cm [3]; Figure 6) consists of fragments of basalt (2–4 mm), pumice (0.6–3 mm), and dacite (6 mm), in that order of abundance. Basalt bearing plagioclase phenocrysts (0.5–1 mm long) shows pilotaxitic texture with augite, magnetite, and olivine. Some of the olivine grains are altered to serpentine and magnetite; pumice contains brown hornblende (0.3 mm) and augite (0.2–0.6 mm); dacite has fluidal subvitreous texture containing oligoclase microlites, in which a few phenocrysts of plagioclase (0.6 mm) and augite (0.2–0.6 mm) are set.

Tuff breccia (Sample 434B-24-1, 87–90 cm) shows that dark-colored fragments of diatom-rich, vitric tuff are cemented by sparry calcite with lots of coarse glass

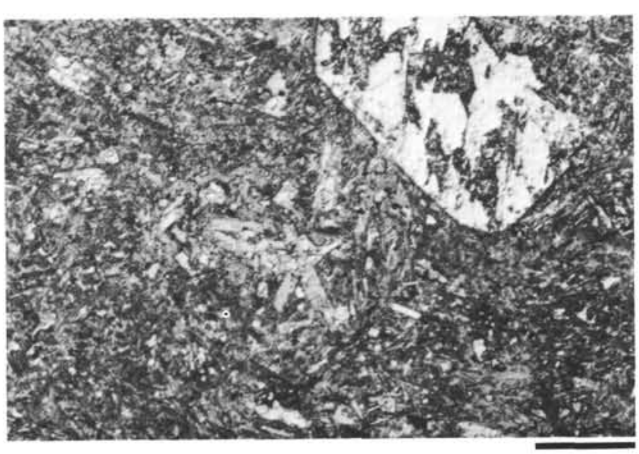

Figure 4. *Photomicrograph of hypersthene–augite andesite pebble (Sample 434-27-1, 65 cm) plane-polarized light. Bar scale equals 0.1 mm.*

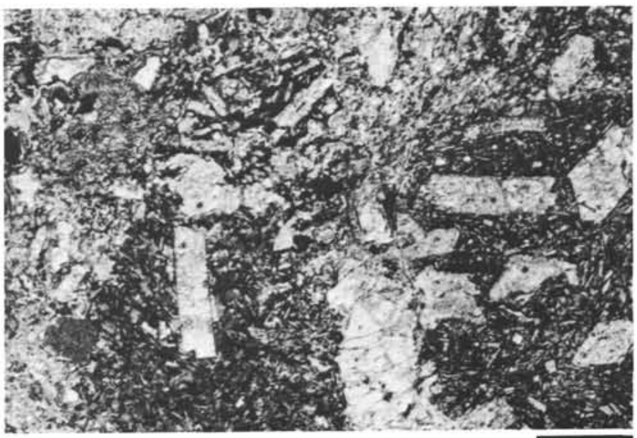

Figure 6. *Photomicrograph of volcanic breccia (Sample 434-25-2, 86–90 cm) plane-polarized light. Bar scale equals 0.1 mm.*

shards. Sparry calcite veins are developed. Another tuff breccia sample (434B-31,CC, 16–17 cm) shows that large and small fragments of vitric tuff are set in micrite .

Pebbles of tuff consist of hornblende-biotite dacitic tuff (Sample 434-15-1, 120–124 cm), plagioclase vitric tuff (434-19,CC), augite-plagioclase-biotite tuff (434A-1-4, 62–64 cm), and diatom-bearing, calcareous vitric tuff (434B-25-1, 97–104 cm; 434B-28-1, 115–117 cm; 434B-29,CC, 0–3 cm; 434B-34-1, 7–8 cm).

We detected a well-rounded pebble of augite gabbro (Sample 434B-34-1, 6–8 cm). It shows fresh ophitic texture (Figure 7). Plagioclase consists of euhedral to subhedral, prismatic crystals (larger ones 1.8 mm × 2.1 mm; on average 1 mm long). They are An 51 per cent in composition and present simple and complex forms of twinning. Augite is subhedral to anhedral and is partly replaced by chlorite. Magnetite occurs as accessories in close association with augite.

BIOSTRATIGRAPHY

Site 434 is dominated by diatom remains and contains a lesser amount of radiolarians and very scarce foraminifers. The composite section of Holes 434 and 434B (0 - 610 m) is Pleistocene to late Miocene. All three fossil groups identify a hiatus in Hole 434 between the late Pleistocene (Core 1) and the late Pliocene (Core 2). The vertical distribution of different fossil assemblages below 54 meters displays a cyclicity which the diatom data identify as a complex repetition of early Pliocene to late Miocene age sediments. The low abundance and low age resolution of the foraminifers and radiolarians in this interval do not permit conclusive support for the diatom data. The possible causes for the assemblage repetition are discussed in the diatom section. Mineralogical data on the crystallinity of montmorillonite are discussed in Mann and Müller (this volume). Harper (this volume) also supports the cyclical nature of the sediments at Site 434, with the major breaks in crystallinity trends matching major breaks in the diatom assemblages.

Figure 7. *Photomicrograph of augite-gabbro pebble (Sample 434B-34-1, 6–8 cm) crossed Nichols. Bar scale equals 0.1 mm.*

Diatoms

The samples studied for diatom biostratigraphy from the composite section of Holes 434 and 434B reveal a complex distribution of zonal assemblages. The diatoms are abundant to common and well preserved in the upper 200 meters and become scarce and poorly preserved below. The low abundance and poor preservation of diatoms in the deeper samples lessen the possibility of accurate biostratigraphic assignment.

In Hole 434, Cores 1 through 12 are a normal sequence of progressively older diatom datum levels from late Pleistocene to early Pliocene, with a hiatus of about 1.5 m.y. between Cores 1 and 2; in the latter the *Rhizosolenia curvirostris* and *Actinocyclus oculatus* zones of early Pleistocene age are absent. The *Denticula seminae fossilis, D. seminae fossilis–D. kamtschatica, D. kamtschatica,* and *D. hustedtii* zones represent a continuous diatom sequence from late Pliocene to late Miocene. Beginning in Core 13, the vertical distribution of diatom zonal taxa is complex and difficult to interpret unambiguously throughout the rest of Hole 434 and Hole 434B. The normal age sequence of diatom zones does not occur. Below 54 meters the main zonal taxa show a repetitive alternation, as indicated in Table 1.

Because of these alternations it is impossible to locate geologic time boundaries with any meaning without assuming the cause for the repetitions. There are four probable causes: (1) downhole contamination; (2) faulting (thrusting); (3) slumping or sliding, and (4) climatic cycles. Figure 8 gives the time versus depth relations of the different probable explanations. Cause (1) places the zonal boundaries at the highest occurrence of the marker datums, whereas (3) and (4) place the younger zonal boundaries at their lowest occurrences. Cause (2) involves a complex reconstruction of each repetitive rock package. Continuous sequences of diatom marker datums occur from late to early Pliocene (8 - 54 m), early Pliocene to late Miocene (158 - 253 m), and early Pliocene to late Miocene (300 - 609 m). From 54 to 158 meters and from 253 to 300 meters, instead of continuous sequence there is an alternation between two early Pliocene assemblages on a scale of a few tens of meters.

Radiolaria

The sediments recovered from Site 434 contain few to scarce and moderately to poorly preserved radiolarians, except for Core 1 of Hole 434, which has abundant and well-preserved specimens.

TABLE 1
Diatom Zones in Cores from Hole 434

Core	Zone
13	*Denticula seminae fossilis–D. kamtschatica*
14	*D. kamtschatica*
15–16	*D. seminae fossilis–D. kamtschatica*
17	*D. kamtschatica*
18–19	*D. seminae fossilis–D. kamtschatica*
20–27	*D. kamtschatica*

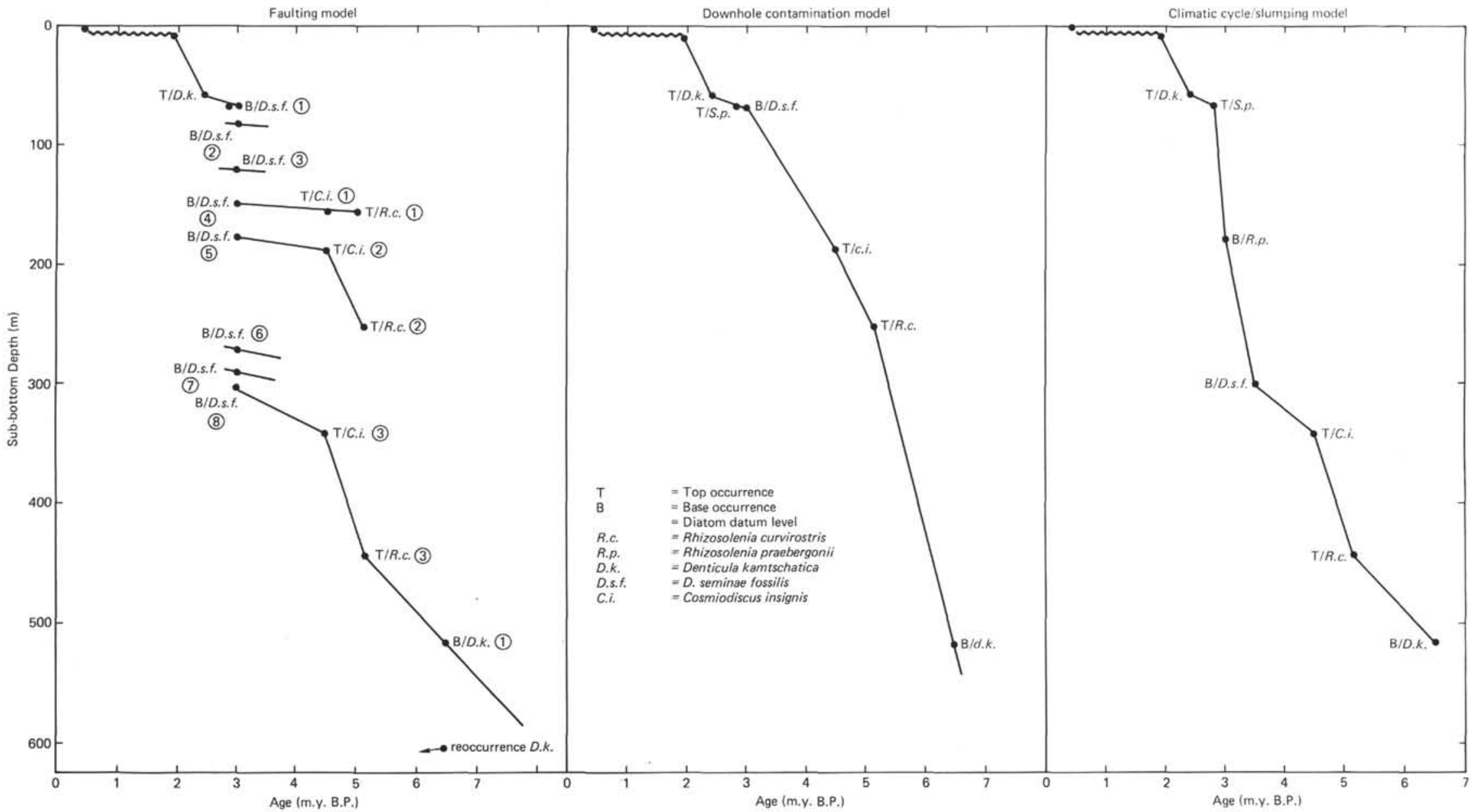

Figure 8. *Plots of age versus sub-bottom depth for four models to explain the repetition of diatom zones. (Circled numerals refer to the number of repetitions of a particular biostratigraphic datum.)*

Hole 434, Core 1 contains *Lamprocyrtis haysi* and lacks both *Stylacontarium acquilonium* and *Axoprunum angelinum*, indicating that the sediments are younger than 0.4 m.y.B.P. (*Botriostrobus aquilonaris* Zone). Core 2, yielding *Eucyrtidium matuyamai*, and underlying Cores 3 to 6 and 7 to 33 are assigned to the *Eucyrtidium matuyamai, Lamprocyrtis heteroporus*, and *Sphaeropyle langii* zones, respectively. Thus there is a hiatus between Cores 1 and 2 encompassing the upper part of the *Eucyrtidium matuyamai* and *Axoprunum angelinum* zones.

Only two cores were obtained from Hole 434A. The upper, Core 1, is assigned to the *Axoprunum angelinum* Zone and contains many radiolarian specimens, but in the lower, Core 2, they are rare and without any indication of age.

The sediments recovered from Hole 434B contain only scarce radiolarians. In the upper and lower thirds (Cores 2 through 9 and 24 through 36) radiolarian specimens are especially rare.

Stichocorys peregrina is a predominant species throughout the cores; the lowermost occurrence of *Sphaeropyle langii* is in Core 35 and co-occurs with *Stylacontarium acquilonium*. Above this core, from Cores 17 to 34, both *Sphaeropyle langii* and *Stylacontarium acquilonium* are absent, and *Ommatartus avitus* (Core 15), *O. penultimus* (Cores 15,CC and 26-1), and *O. hughesi* (Cores 26-1 and 28,CC) are present. Therefore, Cores 2 to 16 and 17 to 34 are assigned to the *Sphaeropyle langii* and *Stichocorys peregrina* zones, respectively, and Cores 35 to 37 to the *Sphaeropyle langii* Zone again, although it is possible that the presence of *S. langii* and *Stylacontarium acquilonius* is due to downhole contamination.

Except for the interval between Cores 34 and 35 of Hole 434B, the distinct repetitions evident from the diatom analysis are absent from the radiolarian biostratigraphy. However, the radiolarian stratigraphy seems to agree with the scheme of the diatom data insofar as Cores 13, 18, and 19 contain more specimens with better preservation, typical of units higher in Hole 434. Other interval breaks revealed by analysis of diatoms and foraminifers are also absent.

Foraminifera

There are three groups of foraminifers at Site 434. (1) Planktonic and middle bathyal calcareous benthonic foraminifera typically occur together, suggesting slumping, since the site is below the CCD (3500 m); (2) *Saccammina* and/or *Reophax* occur rarely near the top of the site; and (3) *Martinottiella communis* disappears at the top of Core 7 in Hole 434 near the early/late Pliocene boundary.

According to diatom and radiolarian data and a single specimen of *Neogloboquadrina eggeri*, Core 1 is late Pleistocene. Cores 2 and 5 are late Pliocene and contain *Neogloboquadrina asanoi* and *Globorotalia inflata praeinflata*. Cores 6 through 11 are barren of planktonic foraminifers. Core 13 has fauna similar to Core 2. Cores 14 and 15 are barren, and Core 16 is late Pliocene. Cores 19 through 31 are barren, and Cores 32 and 33 are late Pliocene. Although these data lend support to the hypothesis of repeated sections, the extremely low frequencies of foraminifers adds very little by way of conclusive evidence. Hole 434A is barren of foraminifers, and Hole 434B contains little more than stained and very poorly preserved specimens from Core 10.

PHYSICAL PROPERTIES

At Site 434, compressional sound velocity, wet bulk density, water content, porosity, undrained shear strength, and thermal conductivity were measured on the majority of the cores recovered. A summary of the shipboard techniques for determining these parameters is included in the introduction to this volume, and a more detailed discussion (except for thermal conductivity) is presented by Boyce (1976). A listing of all data is in the appendix to Part 1, this volume.

Data from Holes 434, 434A, and 434B are considered together. In general, the condition of the cores at this site did not allow for frequent or high-quality determinations of physical properties. Recovery was sparse because of the fissile nature of the sediment. Many cores consisted primarily of drill cuttings and sediment slurry, and most were highly disturbed. Velocity determinations may be inaccurate, because even when samples were suitable for analysis, they frequently shattered during preparation for velocity measurements or from the slight pressure of the transducer heads during measurement. Velocity determinations were further affected by severe attenuation of the sonic signal through the sediment, except on samples less than about two centimeters thick — probably because of microfractures. Similarly, gravimetric techniques may be affected by voids due to hairline fractures that create errors in the volume determination or that allow influx of water prior to measurement of water content. Much of the GRAPE data measured on cores still in liners may also be degraded because of fracturing and the highly disturbed nature of the cores. In addition, most samples for velocity and gravimetric determinations were less than optimum size.

Plots of the physical properties data with depth are shown on the Site 434 Site Summary Chart (back pocket), and average values for each lithologic unit are given in Table 2. Although the data may not be representative of *in situ* values, some changes in physical properties with depth are apparent.

TABLE 2
Correlation of Physical Property Data with Lithology at Site 434

Lithologic Subunit	Depth Interval (m)	Interval Velocity (km/s)	Density (Mg/m^3)	Porosity (%)	Cumulative Two-Way Travel Time (s)
1A	0–101.5	1.53 + 0.02	1.42 + 0.02	64 ± 6	0.132
1B	101.5–352.5	1.69 ± 0.07	1.59 ± 0.13	56 ± 10	0.429
2A	352.5–456	1.64 ± 0.07	1.62 ± 0.07	59 ± 5	0.555
2B	456.0–601	1.89 ± 0.14	1.82 ± 0.11	45 ± 7	0.708
2C	601.0–628	1.92 ± 0.12	1.92 ± 0.12	51 ± 1	0.736

Note: Values for velocity, density, and porosity are averages of measured values over each lithologic unit. The two-way travel time is calculated from the interval velocity and indicates the seismic reflection time to the base of the lithologic unit.

Velocity

From a sub-bottom depth of 0 to 80 meters, few measurements were possible; the measured velocity is between 1.50 and 1.55 km/s. Between 80 and 100 meters, there is an abrupt increase in velocity, to about 1.65 km/s, and velocity ranges from 1.65 to 1.70 km/s up to 290 meters sub-bottom. The velocity increase between 0 and 290 meters is probably due to increasing consolidation within Sub-units 1A and 1B. The second core of Hole 434B, at 300 meters, shows an abrupt increase to 2.27 km/s. The increase is suspect, however, because only material from the core catcher was recovered, and the samples measured may be erratics rather than formation sediment. However, the increase does correspond to changes in density, water content, and porosity in adjacent cores from Holes 434 and 434A and thus may indicate the presence of a relatively thin higher velocity layer. Below this layer, velocities average 1.64 km/s in Sub-unit 2, which may indicate underconsolidation of the sediment with respect to depth and reflect either the change in lithology or the effects of increasing fracturing in sediment. Velocity increases markedly, to about 1.82 km/s in Sub-unit 2B, and reaches a maximum of 1.8 to 2 km/s at the bottom of the hole. If the apparently low velocities between 352 and 456 meters are due to fracturing of the sediment, the rapid increase to velocities of 1.8 to 2.0 km/s may indicate healing of fractures with increasing overburden pressure.

Wet Bulk Density

GRAPE and gravimetrically determined wet bulk densities are plotted together on the Site 434 Site Summary Chart, (back pocket). Continuous GRAPE data were generally obtained on only one or two sections of a core and are highly interpretative averages of the maximum densities indicated on the analog records. Considerable variation is present on the GRAPE analog records, and the plotted values may be significantly in error.

In spite of the foregoing problems, there is moderately good agreement between the continuous GRAPE and the gravimetric densities; the former generally show lower density values, which probably reflects the fissile nature of the sediment and the disturbed nature of most of the cores. Only limited determinations by the two-minute GRAPE method were made because of the small size of most of the available samples; these data also compare moderately well with the gravimetric data.

In general, the data show a gradual increase in wet bulk density from about 1.4 Mg/m^3 at the surface to about 1.85 Mg/m^3 at the base of the cored section, and variations from this trend correlate well with changes in velocity. There is a poorly defined increase in density from 1.4 to 1.6 Mg/m^3 corresponding to increasing consolidation from Sub-unit 1A to 1B and an increase between 280 and 320 meters corresponding to the possible thin high velocity zone. The average density in Sub-unit 2A between 350 and 450 meters is only slightly higher than in Sub-unit 2B, suggesting that the velocity low is accompanied by densities that are low with respect to depth. An abrupt density increase in Sub-unit 2B between 450 and 600 meters corresponds to the velocity increase. The apparent scatter between about 1.7 and 1.95 Mg/m^3 below 520 meters may indicate lithologic variations within Sub-units 2B and 2C.

Porosity and Water Content

Scatter in the porosity and water content data is rather large, but the data generally show an inverse correlation with velocity and wet bulk density. The water content decreases gradually from 55 per cent at the surface to 20 per cent at the base of the cored section, and porosities decrease from around 70 per cent to around 40 per cent. The porosity values derived from the continuous GRAPE techniques are markedly higher than those measured by gravimetric techniques — probably because of the pervasive fissility, which imparts a secondary porosity to the sediments.

Vane Shear Strength

Only five vane shear strength determinations were made because of poor recovery in the upper part of the holes. They show an increase from 4 kPa to 54 kPa.

Thermal Conductivity

Thermal conductivity determinations were made on cores that allowed a valid measurement. The objective of this work was to learn more about the thermal properties of earth materials that make up the accretionary wedge of a subduction zone and to correlate these measurements with other physical properties such as seismic velocity and density. Measurements were made with both a standard heated line source needle probe device and a Showa Denko QTM (Quick Thermal Meter) device.

Most of the cores from Hole 434 had been so mechanically disrupted that it was impossible to make measurements. Nonetheless some measurements were attempted, and the results are shown in Figure 9. In the upper 10 meters, values were obtained that are typical for deep sea oozes. In general, because we had not solved some of the problems of making reliable measurements with the QTM device on water-saturated sediment, the results with this device are not as reliable as at Sites 435 or 436 and at the Leg 57 holes. The needle probe measurements are considered accurate to about ±5 per cent.

The cored material was in such broken condition that no needle probe measurements could be made at Hole 434B. Although the sawed faces of some of the cores could be measured by the QTM device, these measurements are sparse and very little can be said about their variation with depth or correlation with lithology. The conductivity of these fractured vitric mudstones and tuffites falls within the range of most surface sediments. The lithification indicated by the increased hardness of the rocks at depth has little detectable effect on the thermal conductivity values.

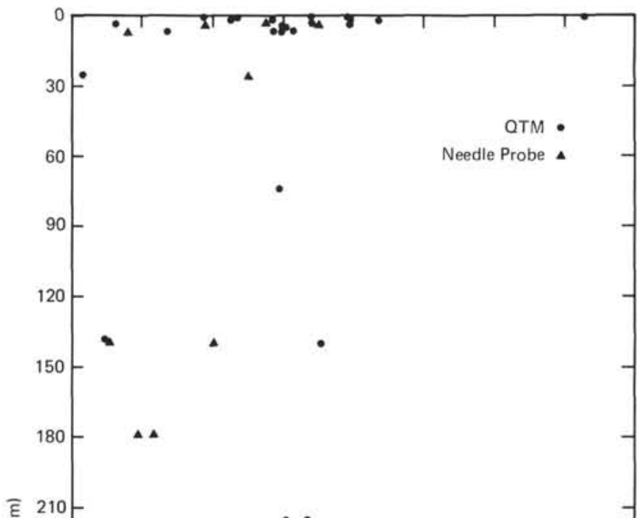

Figure 9. *Thermal conductivity versus sub-bottom depth, Site 434.*

Discussion

Because of the poor core recovery and disturbed condition of the cores, measurements are sparse, scatter is large, and the similarity to *in situ* physical properties is suspect. The physical properties correlate well internally; increases in velocity are generally matched by increases in density and decreases in porosity and water content. Physical properties in the top 350 meters of the section are affected primarily by increasing consolidation. Below 350 meters, velocity and density values that are apparently low for their depth of burial may reflect either the change in lithology or the disturbed nature of the sediment. However, the abrupt increase in average density and velocity from Sub-unit 2A to 2B, with no marked change in lithology, suggests that the low average values may be due primarily to fracturing of the sediment, with the increase below 450 meters suggesting a return to normal consolidation processes or healing of the fractures with increasing overburden pressure.

The generally good internal correlation of the data suggests that, given the very low recovery, future drilling in similar conditions should utilize coring techniques that cause less disruption. Logging the holes would also aid the lithologic interpretation and is strongly advised.

Table 2 gives the lithologic units and average velocity values used to calculate two-way reflection times to lithologic boundaries. Figure 2 shows the correlation of these boundaries with the multichannel seismic line over Site 434. There is a discontinuous series of short, nearly horizontal reflectors that can be traced through Site 434, but there is no clear correlation of these reflections with changes in the physical properties.

GEOCHEMISTRY

Inorganic Chemistry

Shipboard interstitial water measurements of salinity, chlorinity, magnesium, calcium, and alkalinity are shown in Figure 10. Also shown are levels of methane in core gas pockets, percentage of calcium carbonate in sediments, and an estimate of hydrogen sulfide—determined qualitatively by odor.

Carbonate levels in these sediments are generally very low (1–3%), as is expected at this water depth. The paleontologists also noted a general absence of calcareous fossils in the sediments. There are irregular zones of higher values throughout the core which may represent precipitated carbonate. This hypothesis is supported by high interstitial water alkalinity values which decrease slightly with depth but remain between 7 and 5 times higher than surface sea water value.

There is some question about the reliability of the interstitial water chlorinity values for the holes at Site 434, since the values for surface sea water are low (see Figure 10). A normal surface sea water chlorinity value was obtained just before Hole 434B interstitial water values were determined.

It is not clear why such abrupt changes in interstitial water alkalinity should occur in the upper part of Hole 434. Considering the doubt concerning the chlorinity data, we must question whether these fluctuations are real or whether they represent a measurement problem. However, the trends shown in the Site 434B values are very clear. The high alkalinity levels (7 to 5 times surface sea water values) together with methane gas pockets and evidence of black iron sulfide minerals are consistent with the activities of sulfate-reducing bacteria and methane-producing bacteria (see Organic Chemistry section and Whelan and Sato, this volume).

Trace elements analyzed in these sediments include lead, tin, copper, nickel, zinc, silver, boron, iron, manganese, and titanium (see Kurnosov et al., this volume, and Murdmaa, this volume). The same authors also measured SiO_2 both in the amorphous state and in the clay matrix.

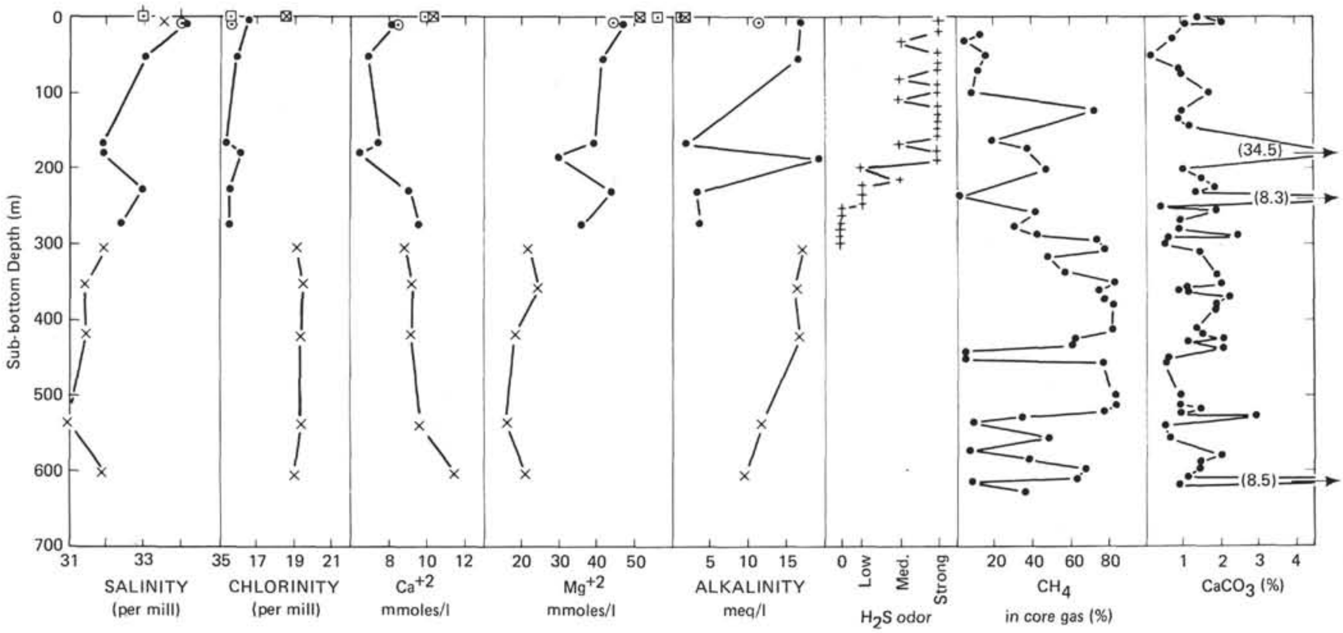

Figure 10. *Some chemical parameters of interstitial water analysis plotted versus depth, Site 434. (• = Hole 434, ⊙ = Hole 434A, × = Hole 434B, ⊡ surface sea water values — Hole 434 — ⊠ = surface sea water values — Hole 434B.)*

Organic Chemistry

The sediments were anoxic, as indicated by a strong H_2S odor present to a depth of about 180 meters, high interstitial water alkalinity despite absence of calcareous minerals, and the presence of methane in core gas pockets below 100 meters. The methane and associated traces of C_2-C_5 hydrocarbons are discussed later in this volume (Whelan and Sato). The methane is presumed to be biogenic for the following reasons:

1) Methane level increases at the approximate depth at which H_2S decreases. It is known that bacterial methane production normally occurs below the zone of bacterial $SO_4^=$ to H_2S reduction (see, for example, Claypool and Kaplan, 1974).

2) Organic carbon levels in the sediment—generally 0.5 per cent to 1.0 per cent (see Site Summary Chart, back pocket)—are sufficient to support bacterial growth.

3) C_1/C_2 ratios of 1000 to 300,000 are typical of C_2 accompanying biogenic methane (Claypool, 1976). Below 130 meters, log C_1/C_2 plotted as a function of depth shows a general linear decrease similar to that of biogenic methane found in many other anoxic DSDP cores (see Claypool, 1975, and Whelan and Sato, this volume).

4) The general behavior of log (C_2/C_5) level plotted as a function of depth is similar to that at other DSDP sites where these compounds accompanied biogenic methane (see Whelan and Sato, this volume).

5) C_{13} values of -67.6 to -80.9 are typical of biogenic methane (see Whelan and Sato, this volume).

6) The high interstitial water alkalinities are typical of regions where bacterial sulfate reduction and methane production have occurred. Depletion of $SO_4^=$ in interstitial water as a result of bacterial reduction to sulfide with concurrent oxidation of organic matter can be represented simply as:

$$2\,CH_2O + SO_4^= \rightarrow H_2S + HCO_3^-.$$

(Sayles and Manheim, 1975)

7) The low geothermal gradient throughout this area and the immaturity of the sediments (see Sato and Whelan, this volume) make petrogenic methane production unlikely.

8) Occurrence of rapid deposition at this site (about 80 m/m) is favorable to preservation of reduced organic matter and, thus, to anaerobic bacterial activity.

Pyrolysis-fluorescence was measured by a method described previously (Ryan and von Rad et al., 1978). Briefly, it involves heating the sediment in an open test tube over a flame, allowing the sediment to cool, extracting with trichloroethane, and measuring the fluorescence of the resulting solution. Low fluorescence values with moderate amounts of organic carbon (0.5%–2.0%) indicate a sediment with low petroleum-generating potential. Generally, values only slightly above blank values were obtained at this site. In spite of the low values, there does seem to be a rough correlation with organic carbon, particularly in the lower part of the hole, as shown in Figure 11. Moderate pyrolysis–fluorescence values representing immature sediments capable of some hydrocarbon generation were obtained from some of the shallower samples from Site 434—namely 434-4,CC, 434-20,CC, 434-21,CC, and 434-23,CC.

A general decrease of pyrolysis–fluorescence values with depth occurs at this site. This decrease occurs in spite of a fairly constant organic carbon content. In the

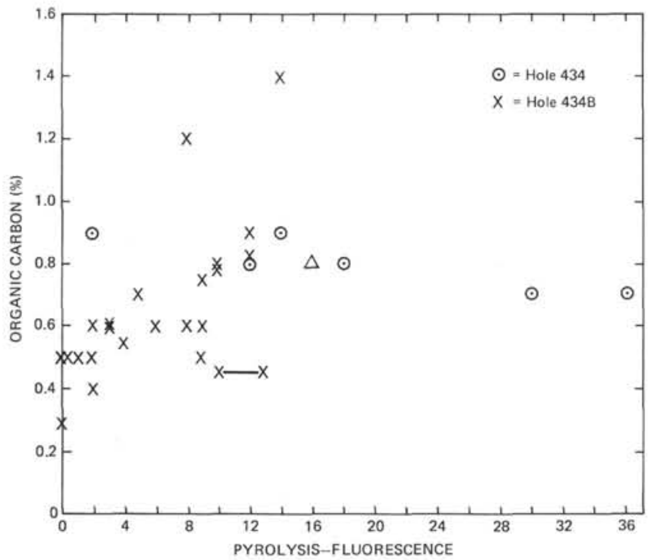

Figure 11. *Pyrolysis–fluorescence versus organic carbon for Holes 434 and 434B. (Pyrolysis–fluorescence is measured in fluorescence units per 3 ml per 0.2 g sediment.)*

lower parts of the hole, pyrolysis–fluorescence minima seem to correlate to some extent with maximum neopentane levels. A possible explanation is that the fractured nature of the sediments has allowed movement of water and bacteria resulting in removal of reduced organic carbon (see Whelan and Sato, this volume).

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SITE 434 HOLE CORE 1 CORED INTERVAL: 0.0-6.5 m

TIME-ROCK UNIT: PLEISTOCENE

BIOSTRAT ZONE: F(N22) D(*Denticula seminae* Zone) R(*Botryostrobus aquilonaris* zone)

FOSSIL CHARACTER (FORAMS, NANNOS, RADS, DIATOMS): B; B; B; B; CC: CG AG

SECTION: 1, 2, 3, 4, CC

METERS: 0.5, 1.0

GRAPHIC LITHOLOGY: VOID; VOID; Organic geochemistry sample

DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / LITHOLOGIC SAMPLE: WC; WC; WC; WC; GZ CC; CC GZ

5GY 3/2; 5GY 2/1; 5GY 3/2; 5GY 4/2; 5GY 3/2

LITHOLOGIC DESCRIPTION

MUDDY DIATOMACEOUS OOZE: dominantly greyish olive green (5GY 3/2 and 5GY 4/2) with rare dark spots and streaks. Intensely disturbed. Some of the sediment is semi-lithified and forms coarser layers and lenses. The darker spots and streaks are higher in pyrite. A 1.5 cm piece of siltstone *(grey in color)* is at 3 cm depth in Sect. 2. Small pumice fragments are scattered throughout the core.

CARBON CARBONATE (%)

	3-70	4-54
Carbonate	1.0	2.0
Organic Carbon:	0.8	0.9

CARBONATE BOMB: 0%, 1-70

GRAIN SIZE (%)

	Sand	Silt	Clay
3-38	20	40	40
4-55	7	55	38

SMEAR SLIDES (%)

	Summary of Major Lithology	1-74†	2-51†	3-33†
Quartz	TR-3	TR	10	TR
Feldspar	5-20	10	20	5
Mica	TR-2	TR	2	TR
Heavy mins.	TR	TR	TR	TR
Clay	20-40	40	TR	50
Volcanic glass	5-10	10	60	20
Palagonite	TR	TR	—	—
Glauconite	TR	TR	—	—
Pyrite	TR	TR	—	TR
Forams	0-5	5	—	—
Diatoms	20-40	30	—	15
Radiolarians	TR-10	TR	—	5
Sponge spicules	5-10	5	—	5
Lithic Ash	—	—	8	—

SITE 434 HOLE CORE 2 CORED INTERVAL: 6.5-16.0 m

TIME-ROCK UNIT: UPPER PLIOCENE

BIOSTRAT ZONE: D(*Denticula seminae fossilis* Zone) R(*Eucyrtidium matuyamai* zone) F(N21)

FOSSIL CHARACTER (FORAMS, NANNOS, RADS, DIATOMS): B; B; CC: FG FM AG

SECTION: 1, 2, CC

METERS: 0.5, 1.0

GRAPHIC LITHOLOGY: I.W.

DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / LITHOLOGIC SAMPLE: CC GZ WC; WC; WC

5GY 3/2 with mottles of 5GY 5/2

LITHOLOGIC DESCRIPTION

MUDDY RADIOLARIAN DIATOMACEOUS OOZE: Dominantly grayish olive green (5GY 3/2) with some faint dusky yellow green (5GY 5/2) mottles.

CARBON CARBONATE (%)

	1-69
Carbonate:	1.0
Organic carbon:	0.8

CARBONATE BOMB: 0%, 1-150

GRAIN SIZE (%)

	Sand	Silt	Clay
1-70	2	45	53

SMEAR SLIDES (%)

	1-90	2-26
Quartz	3	TR
Feldspar	10	30
Mica	2	TR
Heavy Mins.	TR	TR
Clay	50	40
Volcanic glass	—	TR
Palagonite	TR	—
Glauconite	TR	—
Pyrite	TR	TR
Diatoms	15	10
Radiolarians	15	10
Sponge spicules	5	10

SITE 434 HOLE CORE 3 CORED INTERVAL: 16.0-25.5 m

TIME-ROCK UNIT: UPPER PLIOCENE

BIOSTRAT ZONE: D *Denticula seminae fossilis* Zone) R(*Lamprocyrtis heteroporos* zone)

FOSSIL CHARACTER (FORAMS, NANNOS, RADS, DIATOMS): CC: RM AG

SECTION: CC

5GY 3/2

LITHOLOGIC DESCRIPTION

CLAYEY DIATOMACEOUS OOZE: greyish olive green (5GY 3/2) in color; highly disturbed.

SMEAR SLIDE (%)

	3-CC
Quartz	5
Feldspar	10
Mica	TR
Heavy mins.	TR
Clay	50
Volcanic glass	4
Pyrite	1
Carb. unspec.	TR
Foraminifera	TR
Calc. nannos	TR
Diatoms	10
Radiolarians	5
Sponge spicules	15

SITE 434 HOLE CORE 4 CORED INTERVAL: 25.5-35.0 m

TIME-ROCK UNIT: UPPER PLIOCENE

BIOSTRAT ZONE: D (*Denticula seminae fossilis* Zone) R (*Lamprocyrtis heteroporos* Zone)

FOSSIL CHARACTER: FORAMS B, B, B; RADS FM; DIATOMS CM

SECTION: 1, 2, CC — METERS: 0.5, 1.0

LITHOLOGIC SAMPLE: WC

LITHOLOGIC DESCRIPTION

10Y 4/2

CLAYEY DIATOMACEOUS OOZE: uniform greyish olive (10Y 4/2) with a strong odor of H_2S. Section is badly contaminated by rust from the core barrel.

CARBONATE BOMB: 0%, CC-1

SMEAR SLIDES:

	1-42	2-35
Quartz	5	5
Feldspar	10	10
Mica	1	2
Heavy mins.	TR	TR
Clay	50	50
Volcanic glass	5	5
Glauconite	1	1
Diatoms	20	20
Radiolarians	5	5
Sponge spicules	15	20

SITE 434 HOLE CORE 5 CORED INTERVAL: 35.0-44.5 m

TIME-ROCK UNIT: UPPER PLIOCENE

BIOSTRAT ZONE: D(*Denticula seminae fossilis*–*D. kamtschatica* zone); F(N21)

FOSSIL CHARACTER: FORAMS RM, B; RADS FM; DIATOMS GA

SECTION: 1, 2, CC — METERS: 0.5, 1.0

LITHOLOGIC SAMPLE: WC, CC, GZ

LITHOLOGIC DESCRIPTION

5GY 3/2

10Y 4/2

MUDDY DIATOMACEOUS OOZE–CLAYEY DIATOMACEOUS OOZE: greyish olive green (5GY 3/2) sediment. Highly disturbed ooze mixed with semi-lithified pebbles and grains of the same lithology. Rare fragments of a diatomaceous mudstone, light olive grey in color (5Y 5/2: smear slide 1-142) are present.

CARBON-CARBONATE (%)

	1-8
Carbonate:	1.0
Organic carbon:	0.7

CARBONATE BOMB: 0%, 1-5

GRAIN SIZE (%)

	Sand	Silt	Clay
1-33	18	36	46

SMEAR SLIDES (%)

	1-62	1-75	1-142	2-13
Quartz	5	5		3
Feldspar	10	10	75	5
Mica	TR	2		1
Heavy mins.	TR	TR	—	TR
Clay	20	40	5	55
Volcanic glass	5	—	—	3
Glauconite	TR	—	—	1
Diatoms	20	20	5	20
Radiolarians	5	5	—	5
Sponge spicules	15	15	10	15

SITE 434 HOLE CORE 6 CORED INTERVAL: 44.5-54.0 m

TIME-ROCK UNIT: UPPER PLIOCENE-LOWER PLIOCENE

BIOSTRAT ZONE: D–(*Denticula seminae fossilis*-*D. kamtschatica* Zone)

FOSSIL CHARACTER: FORAMS B; RADS RM; DIATOMS AG

SECTION: CC

LITHOLOGIC DESCRIPTION

10Y 4/2

CLAYEY DIATOMACEOUS OOZE: greyish olive (10Y 4/2) fine sediment with some fine dark streaks, olive grey in color (5Y 3/2). Uniform lithology throughout. The dark 'stringers' are enriched in pyrite.

CARBONATE BOMB: 0%, 1-20

SMEAR SLIDE (%)

	CC
Quartz	2
Feldspar	5
Mica	1
Heavy mins.	TR
Clay	50
Volcanic glass	3
Glauconite	TR
Diatoms	15
Radiolarians	5
Spongespicules	15

SITE 434 HOLE CORE 7 CORED INTERVAL: 54.0-63.5 m

TIME-ROCK UNIT: LOWER PLIOCENE

BIOSTRAT ZONE: D(*Denticula kamtschatica* Zone)

FOSSIL CHARACTER: FORAMS RM, B, B; RADS RM; DIATOMS AG

SECTION: 1, 2, CC — METERS: 0.5, 1.0

GRAPHIC LITHOLOGY: I. W.

LITHOLOGIC SAMPLE: GZ, CC, WC

LITHOLOGIC DESCRIPTION

10Y 4/2

CLAYEY DIATOMACEOUS OOZE: greyish olive (10Y 4/2) ooze to semi-lithified. Fracturing of the semi-lithified material and mixing during drilling has distributed pebbles and smaller grains throughout the core. Composition of the ooze and pebbles are the same.

CARBON-CARBONATE (%)

	1-18
Carbonate:	0.0
Organic carbon	0.9

CARBONATE BOMB: 0%, 1-17

GRAIN SIZE (%)

	Sand	Silt	Clay
1-31	4	50	46

SMEAR SLIDES (%)

	1-15	2-40
Quartz	2	3
Feldspar	5	6
Mica	1	1
Heavy mins.	TR	TR
Clay	50	55
Volcanic glass	2	TR
Glauconite	TR	TR
Diatoms	10	10
Radiolarians	3	3
Sponge spicules	25	20

SITE 434 HOLE CORE 8 CORED INTERVAL: 63.5-73.0 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS
LOWER PLIOCENE	D(*Denticula kamtschatica* Zone)			RM	AG	1	0.5, 1.0

LITHOLOGIC DESCRIPTION

10Y 4/2 **CLAYEY DIATOMACEOUS OOZE:** fragments of greyish olive (10Y 4/2) semi-lithified sediment contaminated by rust from the core barrel.

SITE 434 HOLE CORE 9 CORED INTERVAL: 73.0-82.5 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS
UPPER–LOWER PLIOCENE	D(*Denticula kamtschatica* zone)/D (*D. seminae fossilis–D. kamtschatica* zone)	B			AG	1	0.5, 1.0
		RM				2	
		B		RM	AG	CC	

LITHOLOGIC DESCRIPTION

GZ CC 10Y 4/2

WC 5GY 3/2 ASH BED

GZ CC 5BG 3/2 and 10Y 4/2

5Y 4/4 and 10Y 4/2

CLAYEY DIATOMACEOUS OOZE: Dominantly greyish olive (10Y 4/2). The first 70 cm contains pebbles of the same lithology mixed with the ooze. An ash bed is at 9 cm, Section 2, and a patch of ash is at 38 cm, Section 2.

CARBON-CARBONATE (%)

	1-75	2-32
Carbonate:	1.0	1.0
Organic carbon:	0.8	0.8

CARBONATE BOMB: 0%, CC

GRAIN SIZE (%)

	Sand	Silt	Clay
1-72	6	47	47
2-29	1	43	56

SMEAR SLIDES (%)

	1-92	2-9f	2-25
Quartz	3	2	2
Feldspar	6	5	4
Mica	TR	3	TR
Heavy mins.	TR	TR	TR
Clay	40	TR	50
Volcanic glass	8	90	2
Glauconite	TR	—	TR
Diatoms	15	TR	15
Radiolarians	5	TR	5
Sponge spicules	10	TR	15

SITE 434 HOLE CORE 10 CORED INTERVAL: 82.5-92.0 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS
LOWER PLIOCENE	D(*Denticula kamtschatica* Zone)			RM	AG	1	0.5, 1.0

LITHOLOGIC DESCRIPTION

5GY 3/2 **CLAYEY DIATOMACEOUS OOZE:** one disturbed lump of greyish olive green (5GY 3/2) ooze.

SMEAR SLIDE (%)

	CC
Quartz	3
Feldspar	8
Mica	TR
Heavy mins.	TR
Clay	45
Volcanic glass	5
Glauconite	TR
Diatoms	15
Radiolarians	5
Sponge spicules	15

SITE 434 HOLE CORE 11 CORED INTERVAL: 92.0-101.5 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS
LOWER PLIOCENE	D(*Denticula kamtschatica* Zone)	RM		RM	AG	CC	

LITHOLOGIC DESCRIPTION

10Y 4/2 **CLAYEY DIATOMACEOUS OOZE:** Uniform composition and color, greyish olive (10Y 4/2).

SMEAR SLIDE (%)

	CC
Quartz	3
Feldspar	8
Mica	TR
Heavy mins.	TR
Clay	45
Volcanic glass	8
Glauconite	1
Diatoms	20
Radiolarians	5
Sponge spicules	15

SITE 434 HOLE CORE 12 CORED INTERVAL: 101.5-111.0 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS
LOWER PLIOCENE	D(*Denticula kamtschatica* Zone)	RP				1	0.5, 1.0
		RM		RM	AG	CC	

LITHOLOGIC DESCRIPTION

5Y 3/2

CC GZ

5GY 5/2 with some

WC 5Y 3/2

DIATOMACEOUS CLAYSTONE: dominantly olive grey (5Y 3/2) but below 130 cm dominantly dusky yellow green (5GY 5/2): sheered and fractured in coring.

CARBON-CARBONATE (%)

	1-110
Carbonate	2.0
Organic carbon	0.7

GRAIN SIZE (%)

	Sand	Silt	Clay
1-111	0	43	57

SMEAR SLIDES (%)

	1-50	1-142	CC
Quartz	3	2	1
Feldspar	10	8	5
Mica	2	TR	TR
Heavy mins.	TR	TR	TR
Clay	50	55	60
Volcanic glass	10	5	5
Palagonite	TR	—	—
Glauconite	TR	—	—
Pyrite	TR	TR	TR
Carb. unspec	—	TR	1
Calc. nannos.	—	TR	3
Diatoms	15	10	12
Radiolarians	5	5	5
Sponge spicules	5	15	8

SITE 434 HOLE CORE 13 CORED INTERVAL: 111.0-120.5 m

TIME-ROCK UNIT: UPPER PLIOCENE-LOWER PLIOCENE

BIOSTRAT ZONE: D(Denticula seminaefossilis-D. kamtschatica Zone); R(Sphaeropyle langii Zone); F(N19)

FOSSIL CHARACTER: FORAMS FG; RADS FM; DIATOMS AG

SECTION: CC

5GY 3/2

SILICEOUS VITRIC CLAYSTONE–SILICEOUS VITRIC CLAY: greyish olive green (5GY 3/2) in color with light olive grey (5Y 5/2) spots rich in carbonate. Fragments of marlstone are found at the bottom of the core catcher.

CARBONATE BOMB: 0%, CC-1

SMEAR SLIDES (%)

	CC-12†	CC-21
Quartz	2	TR
Feldspar	3	5
Mica	TR	TR
Heavy mins.	—	TR
Clay	25	50
Volcanic glass	5	30
Glauconite	TR	—
Pyrite	—	TR
Carb. unspec	45	3
Calc. nannos.	—	TR
Diatoms	10	5
Radiolarians	5	2
Sponge spicules	5	5

SITE 434 HOLE CORE 14 CORED INTERVAL: 120.5-130.0 m

TIME-ROCK UNIT: LOWER PLIOCENE

BIOSTRAT ZONE: D(Denticula kamtschatica Zone)

FOSSIL CHARACTER: FORAMS RM; RADS RM; DIATOMS AG

SECTION: 1, 2; METERS: 0.5, 1.0

5GY 3/2

CLAYEY DIATOMITE: greyish olive green in color (5GY 3/2).

CARBONATE BOMB: 0%, CC-1

SMEAR SLIDE (%)

	CC-10
Quartz	TR
Feldspar	5
Mica	TR
Heavy mins.	TR
Clay	55
Volcanic glass	5
Pyrite	TR
Carb. Unspec.	TR
Diatoms	20
Radiolarians	5
Sponge spicules	10

SITE 434 HOLE CORE 15 CORED INTERVAL: 130.5-139.5 m

TIME-ROCK UNIT: UPPER PLIOCENE-LOWER PLIOCENE

BIOSTRAT ZONE: D(Denticula seminaefossilis-D. kamtschatica Zone)

FOSSIL CHARACTER: FORAMS RM, B, B; RADS RM; DIATOMS AG

SECTION: 1, 2, 3, CC; METERS: 0.5, 1.0

GRAPHIC LITHOLOGY: VOID; Organic geochemistry

LITHOLOGIC SAMPLE: GZ, CC, WC

10G 4/2; 5GY 4/2; 10G 4/2

DIATOMACEOUS CLAYSTONE: 0-64 cm. Greyish green in color with a patch of dusky yellow green (5GY 5/2) spicular claystone at 26 cm.

VITRIC DIATOMACEOUS CLAYSTONE: 64-348 cm. Greyish olive green in color (5GY 4/2) with a pebble at 121 cm. Patches of moderate blue green (5BG 3/2) at 86 cm and 160 cm.

CARBON-CARBONATE (%)

	1-66
Carbonate:	1.0
Organic carbon:	0.5

CARBONATE BOMB: 0%, CC-1

GRAIN SIZE (%)

	Sand	Silt	Clay
1-64	8	41	51

SMEAR SLIDES (%)

	1-26†	1-40	1-68	2-9†	2-61	2-139	CC-4
Quartz	TR	3	3	5	3	5	3
Feldspar	2	15	15	5	12	10	5
Mica	TR	TR	TR	TR	TR	TR	TR
Heavy mins.	TR	2	1	1	1	TR	TR
Clay	65	50	55	70	52	60	50
Volcanic glass	5	5	3	10	5	15	15
Pyrite	—	TR	TR	2	—	—	TR
Carb. unspec.	TR	—	TR	—	—	—	—
Diatoms	10	10	10	4	15	5	10
Radiolarians	TR	TR	2	1	2	—	2
Sponge spicules	18	15	10	5	10	5	15
Rock frags.	—	—	1	—	—	—	—
Glauconite	—	—	—	—	—	TR	TR

SITE 434 HOLE CORE 16 CORED INTERVAL: 139.5-149.0 m

TIME-ROCK UNIT: UPPER LOWER PLIOCENE

BIOSTRAT ZONE: D(Denticula seminaefossilis-D. kamtschatica Zone)

FOSSIL CHARACTER: FORAMS RG, RG; RADS RM; DIATOMS AG

SECTION: 1, CC; METERS: 0.5, 1.0

LITHOLOGIC SAMPLE: CC, GZ, WC, WC

5GY 3/2; 5GY 3/2 and 5GY 5/2; 5GY 5/2

DIATOMACEOUS CLAYSTONE: Greyish olive green in color (5GY 3/2) from 0-70 cm with mottles of dusky yellow green (5GY 5/2) from 50-70 cm. A uniform dusky yellow green below 70 cm (5GY 5/2).

CARBON-CARBONATE (%)

	1-50
Carbonate:	1.0
Organic carbon:	1.0

CARBONATE BOMB: 0%, 1-19

GRAIN SIZE (%)

	Sand	Silt	Clay
1-51	1	47	52

SMEAR SLIDES (%)

	1-12	1-91	CC-20
Quartz	3	3	2
Feldspar	10	10	5
Mica	TR	TR	TR
Heavy mins.	TR	TR	TR
Clay	60	50	50
Volcanic glass	3	4	1
Glauconite	TR	TR	—
Diatoms	10	8	25
Radiolarians	3	3	10
Sponge spicules	10	10	10
Pyrite	—	—	TR

SITE 434 HOLE CORE 17 CORED INTERVAL: 149.0-158.5 m

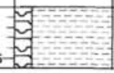
TIME-ROCK UNIT: LOWER PLIOCENE

BIOSTRAT ZONE: D(*Denticula kamtschatica* Zone)

FOSSIL CHARACTER: FORAMS B, B; RADS RM; DIATOMS AG

SECTION: 1, CC — METERS: 0.5

GRAPHIC LITHOLOGY



LITHOLOGIC SAMPLE: GZ, CC

LITHOLOGIC DESCRIPTION

5GY 3/2 **DIATOMACEOUS CLAYSTONE:** greyish olive green (5GY 3/2) showing hackly fracture. Dark grey (N3) ash layers at 15 cm, 24 cm, and 55 cm are thin beds, about 1 cm thick.

CARBONATE (%)

	1-42
Carbonate:	1.0
Organic carbon:	0.8

CARBONATE BOMB: 3%, CC-1

GRAIN SIZE (%)

	Sand	Silt	Clay
1-40	2	46	52

SMEAR SLIDE (%)

	1-10
Quartz	3
Feldspar	6
Mica	TR
Heavy mins.	TR
Clay	50
Volcanic glass	3
Glauconite	TR
Diatoms	10
Radiolarians	3
Sponge spicules	7

SITE 434 HOLE CORE 18 CORED INTERVAL: 158.5-168.0 m

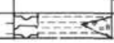
TIME-ROCK UNIT: UPPER PLIOCENE-LOWER PLIOCENE

BIOSTRAT ZONE: D(*Denticula seminae*fossilis-*D. kamtschatica* Zone)

FOSSIL CHARACTER: FORAMS RG; RADS FM; DIATOMS AG

SECTION: CC

GRAPHIC LITHOLOGY



LITHOLOGIC DESCRIPTION

5GY 3/2 **DIATOMACEOUS CLAYSTONE:** greyish olive green (5GY 3/2) in color. A patch of dark grey (N3) ash is located at 14-18 cm.

CARBONATE BOMB: 0%, CC-1

SMEAR SLIDES (%)

	CC-10	CC-16
Quartz	3	TR
Feldspar	5	5
Mica	TR	TR
Heavy mins.	TR	2-3
Clay	50	65-70
Volcanic glass	3	5-8
Glauconite	TR	TR
Diatoms	10	10
Radiolarians	3	5
Sponge spicules	8	10

SITE 434 HOLE CORE 19 CORED INTERVAL: 168.0-177.5 m

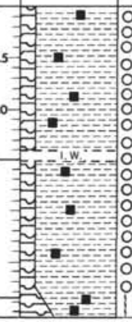
TIME-ROCK UNIT: UPPER PLIOCENE-LOWER PLIOCENE

BIOSTRAT ZONE: D(*Denticula seminae*fossilis-*D. kamtschatica* Zone)

FOSSIL CHARACTER: FORAMS B, B, RG; RADS RM; DIATOMS CM

SECTION: 1, 2, CC — METERS: 0.5, 1.0

GRAPHIC LITHOLOGY



LITHOLOGIC SAMPLE: GZ

LITHOLOGIC DESCRIPTION

5GY 3/2 **DIATOMACEOUS CLAYSTONE:** greyish olive green in color. Core is structureless with exotic pebbles and brecciated diatomaceous claystone distributed randomly in a soupy matrix. Pebbles include limestone, grey-green to greyish olive (10Y 4/2) in color, smooth rounded volcanic rocks, One of the limestones is a lithified burrow with a fecal pellet-like surface. fecal pellet-like surface.

CARBONATE BOMB: 0%, CC-20

GRAIN SIZE (%)

	Sand	Silt	Clay
2-18	25	31	44

SMEAR SLIDES (%)

	1-75	2-130	CC-7
Quartz	2	2	1
Feldspar	5	4	2-3
Mica	TR	TR	TR
Heavy mins.	TR	TR	TR
Clay	55	45	40
Volcanic glass	2	2	2
Glauconite	—	TR	—
Pyrite	—	—	TR
Diatoms	7	5	20
Radiolarians	2	1	5
Sponge spicules	6	6	5
Silicoflagellates	—	—	4

SITE 434 HOLE CORE 20 CORED INTERVAL: 177.5-187.0 m

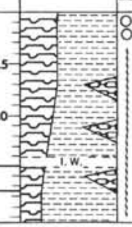
TIME-ROCK UNIT: LOWER PLIOCENE

BIOSTRAT ZONE: R(*Sphaeropyle langii* zone); D(*Denticula kamtschatica* Zone)

FOSSIL CHARACTER: FORAMS B, RG, B; RADS RM; DIATOMS AG

SECTION: 1, 2, CC — METERS: 0.5, 1.0

GRAPHIC LITHOLOGY



LITHOLOGIC SAMPLE: GZ, WC, CC

LITHOLOGIC DESCRIPTION

5GY 3/2 **MUDDY DIATOMITE–DIATOMACEOUS SILTY CLAY:** greyish olive green (5GY 3/2) and olive grey (5GY 4/2) in color. Micritic marlstone, dusky yellow (5Y 5/4) in color, is found in patches at 75 cm, 110-120 cm, and 165-180 cm.

5GY 4/2 and 5GY 3/2

CARBON-CARBONATE (%)

	1-114
Carbonate:	34.0
Organic carbon:	0.7

CARBONATE BOMB: 2%, CC-30

GRAIN SIZE (%)

	Sand	Silt	Clay
1-71	1	45	54

SMEAR SLIDES (%)

	1-59	1-111†	CC-15
Quartz	2	TR	5
Feldspar	20	TR	15
Mica	—	TR	TR
Heavy mins.	—	—	TR
Clay	29	33	50
Volcanic glass	3	2	5
Glauconite	TR	—	TR
Pyrite	1	TR	1
Carb. unspec.	—	50	—
Diatoms	20	8	12
Radiolarians	5	1	2
Sponge spicules	20	5	8
Rock frags.	—	—	2

SITE 434 HOLE CORE 21 CORED INTERVAL: 187.0-196.5 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS
LOWER PLIOCENE	D(*Denticula kamtschatica* Zone)	RG		RM	AG		

GRAPHIC LITHOLOGY / DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / LITHOLOGIC SAMPLE

LITHOLOGIC DESCRIPTION

5Y 3/2 + 5Y 5/2

DIATOMACEOUS CLAYSTONE: olive grey (5Y 3/2) in color with a zone of light olive grey (5Y 5/2) marl at 5 cm.

CARBONATE BOMB: 0%, CC-19

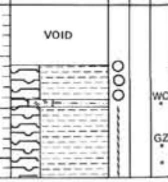
SMEAR SLIDE (%)

	CC-7
Quartz	2
Feldspar	10
Mica	TR
Heavy mins.	TR
Clay	55
Volcanic glass	3
Pyrite	1
Carb. unspec.	1
Diatoms	15
Radiolarians	3
Sponge spicules	10

SITE 434 HOLE CORE 22 CORED INTERVAL: 196.5-206.0 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS
LOWER PLIOCENE	D(*Denticula kamtschatica* Zone)	RM				1	0.5
							1.0
		B		RM	CM	CC	

GRAPHIC LITHOLOGY / DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / LITHOLOGIC SAMPLE



LITHOLOGIC DESCRIPTION

5Y 3/2
5Y 4/4
5Y 3/2
5Y 4/2

DIATOMACEOUS SILTY CLAYSTONE–DIATOMACEOUS CLAYSTONE: Olive grey (5Y 3/2) and moderate olive grey (5Y 4/2) in color with a layer of diatomaceous vitric silty clay from 92-98 cm.

GRAIN SIZE (%)

	Sand	Silt	Clay
1-138	1	49	50

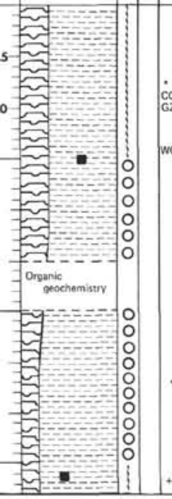
SMEAR SLIDES (%)

	1-95[†]	1-136	CC
Quartz	3	3	2
Feldspar	15	10	15
Mica	TR	TR	TR
Heavy mins.	TR	TR	TR
Clay	40	55	47
Volcanic glass	20	2	5
Pyrite	—	TR	1
Carb. unspec.	—	TR	—
Diatoms	10	15	15
Radiolarians	2	3	3
Sponge spicules	10	12	12

SITE 434 HOLE CORE 23 CORED INTERVAL: 206.0-215.5 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS
LOWER PLIOCENE	D(*Denticula kamtschatica* Zone)	RG		RM		1	0.5
							1.0
						2	
						3	
		RP					
		B			CM		

GRAPHIC LITHOLOGY / DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / LITHOLOGIC SAMPLE



LITHOLOGIC DESCRIPTION

5Y 3/2
5Y 4/2
5Y 3/2

CLAYEY DIATOMITE–DIATOMACEOUS CLAYSTONE: olive grey (5Y 3/2) and light grey (5Y 4/2) in color. Very uniform in appearance with marlstone pebbles at 203 cm and 476 cm. Brecciated to highly disturbed during drilling.

CARBON-CARBONATE (%)

	1-85
Carbonate:	1.0
Organic carbon	0.9

CARBONATE BOMB: 0%, CC-15

GRAIN SIZE (%)

	Sand	Silt	Clay
1-86	1	44	55

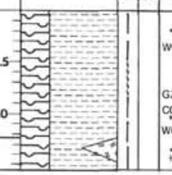
SMEAR SLIDES (%)

	2-77	3-70
Quartz	2	2
Feldspar	10	10
Mica	—	TR
Heavy mins.	—	TR
Clay	50	58
Volcanic glass	3	5
Pyrite	1	TR
Carb. unspec.	—	TR
Diatoms	20	12
Radiolarians	4	3
Sponge spicules	10	10

SITE 434 HOLE CORE 24 CORED INTERVAL: 215.5-225.0 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS
LOWER PLIOCENE	D(*Denticula kamtschatica* Zone)	B				1	0.5
							1.0
		B		RP	FP	CC	

GRAPHIC LITHOLOGY / DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / LITHOLOGIC SAMPLE



LITHOLOGIC DESCRIPTION

5Y 3/2
10Y 4/2

CLAYEY DIATOMITE: greyish olive green (5GY 3/2) to greenish olive (10Y 5/4) in color. A light olive (10Y 5/4) patch of ash is located at 140 cm. Entire core shows hackly fracturing.

CARBON-CARBONATE (%)

	1-99
Carbonate:	2.0
Organic carbon:	0.8

CARBONATE BOMB: 0%, CC-30

GRAIN SIZE (%)

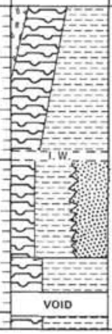
	Sand	Silt	Clay
1-77	0	46	54

SMEAR SLIDES (%)

	1-20	1-100	CC-15[†]
Quartz	5	4	2
Feldspar	8	6	2
Mica	TR	TR	TR
Heavy mins.	TR	TR	—
Clay	52	44	40
Volcanic glass	3	10	40
Pyrite	—	3	TR
Diatoms	15	20	15
Radiolarians	7	3	5
Sponge spicules	10	10	TR

SITE 434 HOLE CORE 25 CORED INTERVAL: 225.0-234.5 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS
LOWER PLIOCENE	D(*Denticula kamtschatica* Zone)	FG				1	0.5, 1.0
						2	
		B		RM	FP	CC	



Lithologic samples: CC, GZ

5GY 3/2, 5Y 3/2, 5GY 5/2, 5GY 3/2

LITHOLOGIC DESCRIPTION

CLAYEY DIATOMITE: 0-150 cm and 246-318 cm, greyish olive green (5GY 3/2) with angular pebbles of the same lithology brecciated during drilling.

SILTY SAND: from 150-246 cm, olive grey in color (5Y 3/2). Contains rounded to subrounded grains of quartz, feldspar, calcareous lithic fragments, and clayey diatomite. Highly disturbed by drilling; contaminated by core barrel rust. A partial void with large pebbles is present at 234-246 cm.

CARBON CARBONATE (%)

	1-36
Carbonate:	2.0
Organic carbon:	0.8

CARBONATE BOMB: 11%, 2-50

GRAIN SIZE (%)

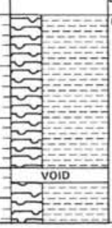
	Sand	Silt	Clay
1-37	10	44	46

SMEAR SLIDES (%)

	1-10	1-46	2-47	CC-10
Quartz	3	2	4	4
Feldspar	3	5	6	6
Mica	TR	TR	TR	TR
Heavy mins.	TR	TR	TR	TR
Clay	42	35	56	46
Volcanic glass	15	3	2	10
Pyrite	2	TR	2	2
Diatoms	25	35	20	20
Radiolarians	2	5	3	2
Sponge spicules	8	15	7	10

SITE 434 HOLE CORE 26 CORED INTERVAL: 234.5-244.0 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS
LOWER PLIOCENE	D(*Denticula kamtschatica* Zone)	RG				1	0.5, 1.0
		RG		RM	FP	2	
						CC	



Lithologic samples: CC, GZ, WC

5GY 3/2

LITHOLOGIC DESCRIPTION

DIATOMACEOUS CLAYSTONE: greyish olive green in color (5GY 3/2). Highly brecciated and disturbed by drilling near the top and bottom. Shows hackly fracturing throughout.

CARBON-CARBONATE (%)

	1-69
Carbonate:	1.0
Organic carbon:	0.7

CARBONATE BOMB: 0%, CC-22

GRAIN SIZE (%)

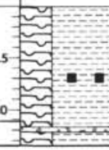
	Sand	Silt	Clay
1-70	1	45	54

SMEAR SLIDES (%)

	1-5	2-26
Quartz	5	2
Feldspar	8	2
Mica	TR	TR
Heavy mins.	TR	TR
Clay	52	60
Volcanic glass	5	5
Pyrite	TR	<5
Diatoms	20	15
Radiolarians	5	<5
Sponge spicules	5	5

SITE 434 HOLE CORE 27 CORED INTERVAL: 244.0-253.5 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS
UPPER MIOCENE	D(*Denticula kamtschatica* Zone)	FG				1	0.5, 1.0
		B		RM	CM		



Lithologic samples: GZ, CC

5GY 3/2, 10Y 4/2

LITHOLOGIC DESCRIPTION

CLAYEY DIATOMITE: greyish olive green (5GY 3/2) to greyish olive (10Y 4/2) in color. Two clasts are located at 70 cm. One is a marlstone, the other is a rounded andesite. Dark grey to olive grey (5Y 3/2) ash rich horizons are at 121 cm, and 126 cm. A darker zone from 132 to 136 cm is enriched in pyrite.

CARBON-CARBONATE (%)

	1-42
Carbonate:	8.0
Organic carbon:	1.0

CARBONATE BOMB: 2%, CC-25

GRAIN SIZE (%)

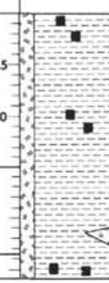
	Sand	Silt	Clay
1-40	42	26	32

SMEAR SLIDES (%)

	1-105	CC-22†	CC-24†
Quartz	3	8	5
Feldspar	5	10	10
Mica	TR	TR	TR
Heavy mins.	TR	TR	TR
Clay	55	37	48
Volcanic glass	5	—	25
Pyrite	—	—	2
Diatoms	25	5	5
Radiolarians	2	—	TR
Sponge spicules	5	40	5

SITE 434 HOLE CORE 28 CORED INTERVAL: 253.5-263.0 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS
MIOCENE	?	B				1	0.5, 1.0
		B				2	
		B		RP	RP	CC	



Lithologic samples: GZ, CC

5G 4/1, 5GY 4/1 and 5G 4/1, 5GY 3/2

LITHOLOGIC DESCRIPTION

VITRIC CLAYSTONE: dark greenish grey (5G 4/1) to greyish olive green (5GY 3/2) in color. A mottled zone is located from 150 to 222 cm. Marlstone pebbles are distributed throughout the core. A patch of ash is located at 213 cm.

CARBON-CARBONATE (%)

	2-41
Carbonate:	1.0
Organic carbon:	0.4

CARBONATE BOMB: 3%, CC-24

GRAIN SIZE (%)

	Sand	Silt	Clay
2-39	19	43	38

SMEAR SLIDES (%)

	1-130	2-70	2-80	CC-22
Quartz	2	7	2	5
Feldspar	15	10	10	5
Mica	—	TR	—	—
Heavy mins.	—	TR	—	TR
Clay	60	66	60	78
Volcanic glass	15	10	15	10
Pyrite	3	—	3	—
Carb. unspec.	—	—	TR	—
Foraminifera	—	—	TR	—
Calc. nannos.	—	—	TR	—
Diatoms	2	5	5	1
Radiolarians	—	TR	—	—
Sponge spicules	3	5	5	1

SITE 434 HOLE CORE 29 CORED INTERVAL: 263.0-272.5 m

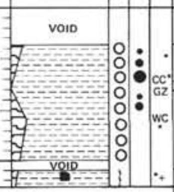
TIME-ROCK UNIT: UPPER PLIOCENE-LOWER PLIOCENE

BIOSTRAT ZONE: D(*Denticula seminae fossilis–D. kamtschatica* Zone)

FOSSIL CHARACTER: FORAMS: RG, B; RADS: RM; DIATOMS: CM

SECTION: 1, CC

METERS: 0.5, 1.0



DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / LITHOLOGIC SAMPLE: CC*, GZ, WC

5GY 3/2
5GY 2/1
5GY 3/2
5Y 3/2

LITHOLOGIC DESCRIPTION

CLAYSTONE–DIATOMACEOUS CLAYSTONE: greyish olive green (5GY 3/2) to olive grey (5Y 3/2) in color with an olive black (5GY 2/1) interval from 73-80 cm. Two graded beds are at 37-73 cm and 80-100 cm, but are probably formed by drilling disturbance. A large clast of light olive grey (5Y 5/2) sandy marlstone is found at 162 cm.

CARBON-CARBONATE (%)

	1-70
Carbonate:	2.0
Organic carbon:	0.5

CARBONATE BOMB: 2%, CC-6

GRAIN SIZE (%)

	Sand	Silt	Clay
1-78	4	48	48

SMEAR SLIDES (%)

	1-47	1-75	1-109	CC-1
Quartz	2	2	2	TR
Feldspar	10	7	11	15
Clay	58	69	70	75
Volcanic glass	3	5	1	5
Lithic frags.	15	15	—	—
Glauconite	TR	—	TR	—
Pyrite	2	1	1	1
Diatoms	5	1	10	2
Radiolarians	TR	—	TR	TR
Sponge spicules	5	TR	5	2

SITE 434 HOLE CORE 30 CORED INTERVAL: 272.5-282.0 m

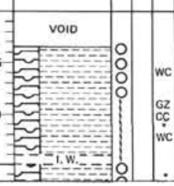
TIME-ROCK UNIT: LOWER PLIOCENE

BIOSTRAT ZONE: D(*Denticula kamtschatica* Zone)

FOSSIL CHARACTER: FORAMS: B, B; RADS: RM; DIATOMS: CM

SECTION: 1, CC

METERS: 0.5, 1.0



DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / LITHOLOGIC SAMPLE: WC, GZ, CC, WC

5Y 4/2

LITHOLOGIC DESCRIPTION

DIATOMACEOUS CLAYSTONE: moderate olive grey (5Y 4/2) in color. Uniform in appearance and lithology.

CARBON-CARBONATE (%)

	1-92
Carbonate:	1.0
Organic carbon:	0.9

CARBONATE BOMB: 2%, 1-101

GRAIN SIZE (%)

	Sand	Silt	Clay
1-90	1	51	49

SMEAR SLIDES (%)

	1-102	CC-6
Quartz	2	3
Feldspar	15	15
Clay	61	60
Volcanic glass	1	1
Glauconite	TR	TR
Pyrite	1	1
Diatoms	15	15
Radiolarians	TR	TR
Sponge spicules	5	5

SITE 434 HOLE CORE 31 CORED INTERVAL: 282.0-291.5 m

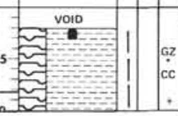
TIME-ROCK UNIT: UPPER–LOWER PLIOCENE

BIOSTRAT ZONE: D(*Denticula seminae fossilis–D. kamtschatica* zone)

FOSSIL CHARACTER: FORAMS: B; DIATOMS: CM

SECTION: 1, CC

METERS: 0.5, 1.0



DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / LITHOLOGIC SAMPLE: GZ, CC

5GY 3/2

LITHOLOGIC DESCRIPTION

DIATOMACEOUS CLAYSTONE: Greyish olive green in color. Highly brecciated. Uniform in color and lithology.

CARBON-CARBONATE (%)

	1-61
Carbonate:	1.0
Organic carbon:	0.8

CARBONATE BOMB: 0%, CC-14

GRAIN SIZE (%)

	Sand	Silt	Clay
1-55	1	52	47

SMEAR SLIDE (%)

	1-50
Quartz	3
Feldspar	10
Mica	TR
Heavy mins.	TR
Clay	45
Volcanic glass	4
Glauconite	TR
Pyrite	TR
Diatoms	10
Radiolarians	3
Sponge spicules	8

SITE 434 HOLE CORE 32 CORED INTERVAL: 291.5-294.5 m

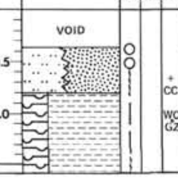
TIME-ROCK UNIT: LOWER PLIOCENE

BIOSTRAT ZONE: D(*Denticula kamtschatica* Zone)

FOSSIL CHARACTER: FORAMS: B, B; RADS: RM; DIATOMS: CM

SECTION: 1, CC

METERS: 0.5, 1.0



DRILLING DISTURBANCE / SEDIMENTARY STRUCTURES / LITHOLOGIC SAMPLE: CC*, WC, GZ

5GY 3/2

LITHOLOGIC DESCRIPTION

SILTY SAND: 35-80 cm. Greyish olive green in color. A mixture of sand size brecciated diatomaceous silty claystone, quartz, and feldspar highly disturbed by drilling.
DIATOMACEOUS CLAYSTONE: 80-160 cm- greyish olive green in color (5GY 3/2). Uniform in lithology.

CARBON-CARBONATE (%)

	1-79
Carbonate:	2.0
Organic carbon:	1.0

CARBONATE BOMB: 4%, 1-67

GRAIN SIZE (%)

	Sand	Silt	Clay
1-110	0	48	52

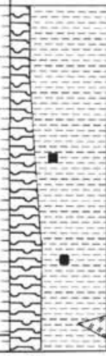
SMEAR SLIDES (%)

	1-72	1-103
Quartz	8	2
Feldspar	10	6
Mica	TR	TR
Heavy mins.	2	TR
Clay	40	50
Volcanic glass	1	3
Glauconite	—	TR
Pyrite	1	—
Carb. unspec.	3	TR
Diatoms	15	8
Radiolarians	1	2
Sponge spicules	10	8

SITE 434 HOLE CORE 33 CORED INTERVAL: 294.5-301.0 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS
UPPER–LOWER PLIOCENE	D(*Denticula seminae fossilis–D. kamtschatica* zone)	RG				1	0.5, 1.0
		RG				2	
		B		RP	RP	CC	

GRAPHIC LITHOLOGY



DRILLING DISTURBANCE · SEDIMENTARY STRUCTURES · LITHOLOGIC SAMPLE: •, •, GZ +

LITHOLOGIC DESCRIPTION

5GY 3/2

DIATOMACEOUS CLAYSTONE: greyish olive green in color with marlstone fragments at 156 and 252 cm. A greyish green (10G 4/2) patch rich in volcanic ash is located at 310 to 315 cm.

CARBONATE BOMB: 1%, CC-15

GRAIN SIZE (%)

	Sand	Silt	Clay
3-18	1	44	55

SMEAR SLIDES (%)

	1-60	2-80
Quartz	3	1
Feldspar	6	2
Mica	TR	TR
Heavy mins.	TR	TR
Clay	40	60
Volcanic glass	3	2
Glauconite	TR	—
Pyrite	TR	1
Carb. unspec.	TR	2
Diatoms	8	15
Radiolarians	1	5
Sponge spicules	10	10

SITE 434 HOLE A CORE 1 CORED INTERVAL: 0.0-8.5 m

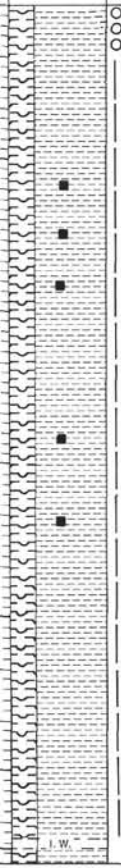
TIME–ROCK UNIT: PLEISTOCENE; UPPER PLIOCENE?

BIOSTRAT ZONE: R(*Axoprunum angelinum* Zone); D(*Denticula seminae fossilis* Zone)

FOSSIL CHARACTER: FORAMS B, B, B, B, B, B, B; RADS FM; DIATOMS AG, AG

SECTION: 1, 2, 3, 4, 5, 6, CC — METERS: 0.5, 1.0

GRAPHIC LITHOLOGY — DRILLING DISTURBANCE — SEDIMENTARY STRUCTURES — LITHOLOGIC SAMPLE



GZ, CC, GZ, CC

10Y 4/2; 10G 4/2; 10Y 4/2

LITHOLOGIC DESCRIPTION

DIATOMACEOUS CLAY: greyish olive in color (10Y 4/2) with a distinct sandy component of broken feldspar crystals. An interval from 433 to 450 cm is greyish green (10G 4/2) in color, higher in diatoms, and low in the abundance of broken feldspar crystals (Smear slide: 1-3-134). Pebbles occur which are tuffs and tuffaceous mudstones.

CARBON-CARBONATE (%)

	2-56	6-19
Carbonate:	1.0	0.0
Organic carbon:	0.7	0.6

GRAIN SIZE (%)

	Sand S	Silt	Clay
1-50	27	40	33
5-50	2	52	46

SMEAR SLIDES (%)

	1-75	2-75	3-75	3-134†	5-75	6-40
Quartz	2	2	2	1	1	2
Feldspar	7	8	8	1	10	10
Mica	TR	—	TR	TR	—	—
Heavy mins.	2	3	3	TR	TR	2
Clay	65	60	55	50	60	55
Volcanic glass	3	5	5	—	10	5
Glauconite	TR	—	—	—	—	—
Pyrite	—	TR	2	TR	TR	TR
Diatoms	12	20	20	30	15	20
Radiolarians	1	TR	TR	5	TR	1
Sponge spicules	8	5	5	10	5	3

SITE 434 HOLE A CORE 2 CORED INTERVAL: 151.0-160.5 m

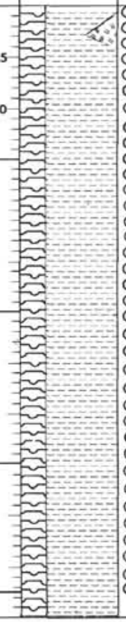
TIME–ROCK UNIT: UPPER PLIOCENE-LOWER PLIOCENE

BIOSTRAT ZONE: D(*Denticula seminae fossilis-D. kamtschatica* Zone)

FOSSIL CHARACTER: FORAMS B; RADS RP

SECTION: 1, 2, 3, 4, CC — METERS: 0.5, 1.0

GRAPHIC LITHOLOGY — DRILLING DISTURBANCE — SEDIMENTARY STRUCTURES — LITHOLOGIC SAMPLE



5GY 3/2

LITHOLOGIC DESCRIPTION

DIATOMACEOUS CLAYSTONE: *greyish olive green in* color with uniform lithology. At 25 cm is a greenish black (5GY 2/1) patch somewhat enriched in volcanic ash (Smear Slide: 2-1-25). Highly brecciated and intensely disturbed during drilling.

SMEAR SLIDES (%)

	1-25	1-75	2-75	3-75	4-75
Quartz	3	2	1	2	2
Feldspar	15	10	15	10	10
Mica	—	—	—	TR	TR
Heavy mins.	—	—	—	TR	TR
Clay	65	49	48	55	55
Volcanic glass	10	3	5	5	7
Glauconite	TR	—	—	—	—
Pyrite	1	1	1	TR	TR
Carb. unspec.	—	—	—	TR	TR
Diatoms	3	20	15	15	15
Radiolarians	—	—	—	3	1
Sponge spicules	3	15	15	10	10

SITE 434 HOLE B CORE 1 CORED INTERVAL: 0.0-1.0 m

LITHOLOGIC DESCRIPTION

10Y 5/4 **MUDDY DIATOMACEOUS OOZE:** light olive grey in color (10Y 5/4).

SITE 434 HOLE B CORE 2 CORED INTERVAL: 295.5-305.0 m

Fossil character: Forams B; Rads RP; Diatoms RP. Section 1, CC. Lithologic sample: CC, GZ.

LITHOLOGIC DESCRIPTION

5GY 4/1 **VITRIC CLAYSTONE:** dark greenish grey in color with brownish grey (5YR 4/1) vitric ash patches from 0-5 cm.

CARBON-CARBONATE (%)

	1-2
Carbonate:	1.0
Organic carbon:	0.3

CARBONATE BOMB: 0%, CC-5

GRAIN SIZE (%)

	Sand	Silt	Clay
1-12	39	41	20

SITE 434 HOLE B CORE 3 CORED INTERVAL: 305.0-314.5 m

TIME-ROCK UNIT: LOWER PLIOCENE

BIOSTRAT ZONE: D(*Denticula kamtschatica* Zone)

Fossil character: Section 1 — Forams B; Section 2 — Forams B, Rads B; Section 3 — Forams B; CC — Forams B, Rads RP, Diatoms RP.

LITHOLOGIC DESCRIPTION

5GY 4/1

CLAYSTONE: 0-150 cm. Dark greenish grey (5G 4/1) in color with brownish black mottles at 37-58 cm and 127-150 cm. 150-300 cm: greenish black (5GY 2/1) with light olive (10Y 5/4) micritic carbonate fragments at 163 cm. 300-450 cm: greenish black (5GY 2/1) with mottles of dark greenish grey (5G 4/1) and greyish olive (10Y 4/2) from 300 to 330 cm and 358 to 405 cm. A dark brownish black (5YR 2/1) ash rich zone is at 407-417 cm. A marl fragment is at 369 cm and a patch of ash is at 391 cm. 450-475 cm: dark greenish grey (5GY 4/1) in color.

CARBON-CARBONATE (%)

	1-62
Carbonate:	0.0
Organic carbon:	0.5

5GY 2/1

CARBONATE BOMB: 0%, CC-5

GRAIN SIZE (%)

	Sand	Silt	Clay
1-60	23	42	35

5GY 4/1
5GY 2/1
10Y 4/2
5GY 2/1

SMEAR SLIDES (%)

	1-147†	2-100	3-90†	3-110†
Quartz	—	1	1	—
Feldspar	—	7	15	42
Mica	—	TR	—	TR
Heavy mins.	—	TR	2	TR
Clay	10	76	—	22
Volcanic glass	—	7	80	30
Diatoms	—	6	—	2
Sponge spicules	—	3	—	2
Carb. unspec.	90	—	—	2
Glauconite	—	—	TR	TR

5GY 4/1
5GY 2/1
10Y 4/2

5GY 4/1

SITE 434 HOLE B CORE 4 CORED INTERVAL: 314.5-324.0 m

TIME-ROCK UNIT: LOWER PLIOCENE

BIOSTRAT ZONE: D(*Denticula kamtschatica* Zone)

Fossil character: Section 1 — Forams B; CC — Forams B, Rads RM, Diatoms CM.

LITHOLOGIC DESCRIPTION

5GY 4/2
5G 2/1
5GY 4/1

DIATOMACEOUS CLAYSTONE: dark greenish grey (5GY 4/1 and 5Y 4/1) in color. Fractured but relatively intact. A greenish grey (5GY 6/1) pumice fragment is at 3 cm. Greenish grey (5GY 6/1) and greenish black (5GY 2/1) ash patches are located from 24-40 cm. Many small pumice fragments are found in the interval from 90 to 120 cm. An ash patch is located at about 180 cm and carbonate rich burrows are located at about 210 cm.

CARBON-CARBONATE (%)

	2-36
Carbonate:	1.0
Organic carbon:	0.7

CARBONATE BOMB: 0%, CC-6

GRAIN SIZE (%)

5G 4/1

	Sand	Silt	Clay
2-34	1	49	50

SMEAR SLIDES (%)

	1-36†	1-75†	2-60†	2-75
Quartz	—	—	—	2
Feldspar	2	8	TR	8
Mica	TR	TR	—	—
Heavy mins.	TR	TR	—	—
Clay	—	70	29	71
Volcanic glass	97	8	5	7
Glauconite	—	TR	—	TR
Pyrite	—	TR	—	TR
Carb. unspec.	—	TR	60	—
Diatoms	—	8	3	6
Radiolarians	—	—	—	TR
Sponge spicules	—	6	3	6
Calc. nannos	—	—	1	—

Site 434, Hole B, Core 5 Cored Interval: 324.0-333.5 m: NO RECOVERY

SITE 434 HOLE B CORE 6 CORED INTERVAL: 333.5-343.0 m

TIME-ROCK UNIT: LOWER PLIOCENE

BIOSTRAT ZONE: D(*Denticula kamtschatica* Zone)

Fossil character: CC — Forams RP, Rads RM, Diatoms CP.

LITHOLOGIC DESCRIPTION

5Y 3/2 **DIATOMACEOUS CLAYSTONE:** olive grey in color (5Y 3/2) with no structures identifiable. A small pumice fragment occurs at 9 cm.

CARBONATE BOMB: 0%, CC-7

SMEAR SLIDE (%)

	CC-10
Quartz	1
Feldspar	8
Mica	TR
Heavy mins.	TR
Clay	70
Volcanic glass	7
Diatoms	8
Radiolarians	TR
Sponge spicules	6

SITE 434 HOLE B CORE 7 CORED INTERVAL: 343.0-352.5 m

TIME-ROCK UNIT: LOWER PLIOCENE
BIOSTRAT ZONE: D(*Denticula kamtschatica* Zone)
FOSSIL CHARACTER: FORAMS B; RADS RM; DIATOMS CM

LITHOLOGIC DESCRIPTION

5Y 3/2

DIATOMACEOUS CLAYSTONE: olive grey (5Y 3/2) in color with minor greenish black (5G 2/1) patches throughout. An ash rich zone is at 0-4 cm.

CARBONATE BOMB: 0%, 1-50

SMEAR SLIDES (%)

	1-1†	1-20
Quartz	—	TR
Feldspar	2	6
Heavy mins.	1	—
Mica	TR	TR
Clay	38	72
Volcanic glass	55	6
Glauconite	TR	—
Carb. unspec.	TR	TR
Diatoms	3	7
Radiolarians	—	TR
Sponge spicules	2	7

SITE 434 HOLE B CORE 8 CORED INTERVAL: 352.5-362.0 m

TIME-ROCK UNIT: LOWER PLIOCENE
BIOSTRAT ZONE: D(*Denticula kamtschatica* Zone)
FOSSIL CHARACTER: FORAMS B (top); FORAMS B, RADS B, DIATOMS CP (base)

LITHOLOGIC DESCRIPTION

5GY 3/2

VITRIC DIATOMACEOUS CLAYSTONE: 0-150 cm, Greyish olive green (5GY 3/2) in color with a weakly graded volcaniclastic silty sand from 25 to 46 cm. Small fragments of moderate yellowish brown (10YR 5/4) limestone and greyish green (10G 4/2) vitric diatomaceous mudstone are contained within the interval from 46 to 140 cm.
DIATOMACEOUS VITRIC SILTY CLAY: 150 to 300 cm. Greyish olive green (5GY 3/2) in color with a weakly graded bolcaniclastic sand interval from 225 to 235 cm. Small pumice fragments are found at 192 cm and 251 cm with fragments of moderate yellowish brown (10YR 5/4) marlstone at 85 to 90 cm.

CARBON-CARBONATE (%)

	1-61	2-61
Carbonate:	2.0	2.0
Organic carbon:	0.8	1.0

GRAIN SIZE (%)

	Sand	Silt	Clay
1-63	4	52	44
2-63	0	45	55

SMEAR SLIDES (%)

	1-20	1-20	1-33†	1-35†	2-34	2-82†
Quartz	TR	2	—	5	2	5
Feldspar	5	15	—	20	20	20
Mica	TR	—	—	TR	—	1
Heavy mins.	TR	—	—	3	—	3
Clay	65	54	—	10	46	15
Volcanic glass	5	10	1	45	15	40
Glauconite	—	TR	—	—	—	—
Pyrite	1	1	1	2	1	5
Carb. unspec.	2	3	8	—	—	2
Calc. nannos	1	5	90	TR	3	—
Diatoms	15	7	TR	5	10	1
Radiolarians	1	—	—	TR	—	TR
Sponge spicules	5	3	TR	—	3	TR
Rock fragments	—	—	—	10	—	8

SITE 434 HOLE B CORE 9 CORED INTERVAL: 362.0-371.5 m

TIME-ROCK UNIT: LOWER PLIOCENE
BIOSTRAT ZONE: D(*Denticula kamtschatica* Zone)
FOSSIL CHARACTER: FORAMS B; RADS RM; DIATOMS AM

LITHOLOGIC DESCRIPTION

5GY 4/1, 5Y 4/1, 5G 4/1, 5Y 4/1, 10Y 4/2, 5Y 4/1

DIATOMACEOUS VITRIC SILTY CLAY: 0-205 cm. Dark greenish grey (5GY 4/1 and 5G 4/1) and olive grey in color. An olive grey (5Y 4/1) vitric siltstone interval is found from 55 to 63 cm. Minute pellet-like structures are abundant in the intervals from 120-136 cm, 178 to 184 cm, and 198 to 202 cm. These are relatively enriched in carbonate and siliceous components (Smear Slide 9-2-50). From 150 to 205 cm, recemented shear zones are common.
VITRIC DIATOMACEOUS SILTY CLAY: 205 to 300 cm. Olive grey in color (5Y 4/1) with yellowish grey (5Y 7/2) marlstone patches which show small scale shearing at 242 and 253 cm.
VITRIC SILTY CLAY: 300-398 cm. Greyish olive in color (10Y 4/2). Uniform lithology.

CARBON-CARBONATE (%)

	1-43	1-85	3-43
Carbonate:	1.0	1.0	1.0
Organic carbon:	0.6	0.7	0.8

CARBONATE BOMB: 0%, CC-1

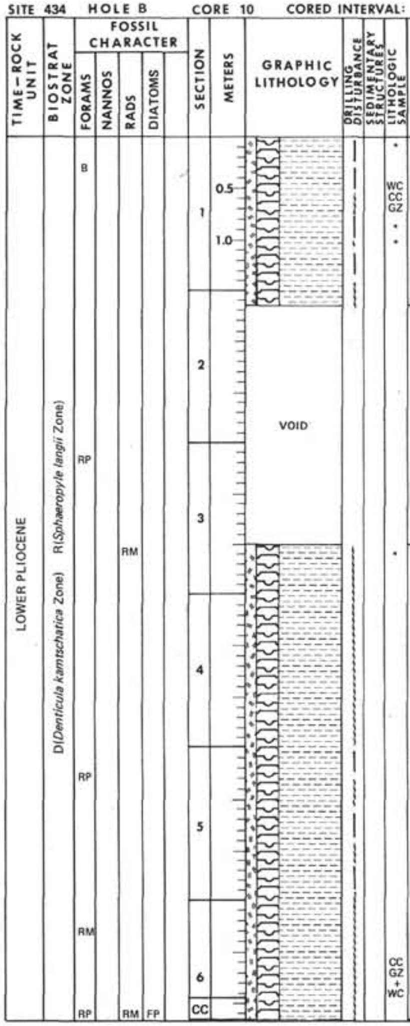
GRAIN SIZE (%)

	Sand	Silt	Clay
1-40	0	35	65
1-78	0	37	63

SMEAR SLIDES (%)

	1-59	1-65	1-112†	1-140	2-60	2-103	2-106†	3-50
Quartz	5	4	1	2	TR	TR	—	5
Feldspar	20	20	5	20	2	5	3	20
Mica	—	—	—	—	—	TR	—	—
Heavy mins.	—	—	—	—	TR	TR	—	—
Clay	48	50	12	45	55	55	45	40
Volcanic glass	12	12	15	15	3	10	3	20
Glauconite	TR	—	—	—	—	—	—	TR
Pyrite	1	2	1	1	TR	—	TR	2
Carb. unspec.	2	2	5	—	15	2	25	—
Calc. nannos	—	—	55	—	TR	—	5	3
Diatoms	10	8	5	15	15	25	15	8
Radiolarians	—	—	—	—	TR	TR	1	—
Sponge spicules	2	2	1	2	10	3	3	2

SITE 434 HOLE B CORE 10 CORED INTERVAL: 371.5-381.0 m



LITHOLOGIC DESCRIPTION

VITRIC DIATOMACEOUS CLAYSTONE: olive grey (5Y 3/2) in color. Highly fractured but dominantly undisturbed from 0 to 140 cm. Highly disturbed in the remainder of the core. 0-7 cm: have greyish olive (10Y 4/2) mottles (Smear Slide: 10-1-3). An olive black (5Y 2/1) pyritized patch is located at 90-94 cm. Below Section 1, the core is uniformly mixed due to disturbance. Some chips of marlstone, greyish olive in color (10Y 4/2) are present in low abundance.

CARBON-CARBONATE (%)

	1-55	6-55
Carbonate:	2.0	2.0
Organic carbon:	0.7	0.8

CARBONATE BOMB: 3.5%, 6-85

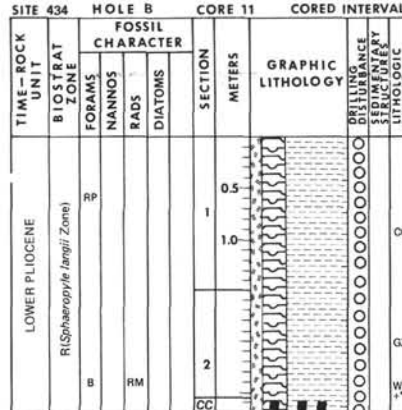
GRAIN SIZE (%)

	Sand	Silt	Clay
1-65	1	52	47
6-65	1	47	52

SMEAR SLIDES (%)

	1-3†	1-75	1-92	3-107
Quartz	3	4	3	2
Feldspar	12	10	14	12
Mica	TR	TR	TR	TR
Heavy mins.	TR	TR	TR	TR
Clay	51	50	58	55
Volcanic glass	8	12	8	11
Glauconite	TR	TR	TR	TR
Pyrite	—	—	3	—
Carb. unspec.	5	4	TR	5
Calc. nannos	TR	TR	—	TR
Diatoms	13	15	12	10
Radiolarians	TR	—	—	TR
Sponge spicules	6	5	3	5

SITE 434 HOLE B CORE 11 CORED INTERVAL: 381.0-390.5 m



LITHOLOGIC DESCRIPTION

VITRIC DIATOMACEOUS CLAYSTONE: light olive grey (5Y 5/2) in color. The grading of the breccia from 0 to 135 cm is an artifact of drilling. Marlstone pebbles, light olive grey (5Y 5/2) and medium grey (N5) in color, are distributed in the section, and large pebbles are present at 260 to 270 cm.

CARBON-CARBONATE (%)

	1-90
Carbonate:	2.0
Organic carbon:	0.9

CARBONATE BOMB: 10%, 2-101

GRAIN SIZE (%)

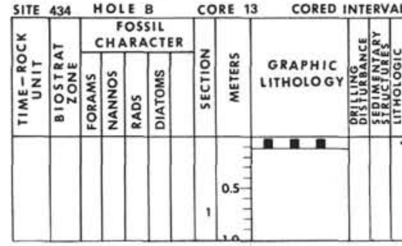
	Sand	Silt	Clay
2-50	6	48	46

SMEAR SLIDES (%)

	2-100	2-100†
Quartz	3	—
Feldspar	12	—
Mica	TR	—
Heavy mins.	TR	—
Clay	50	10
Volcanic glass	10	—
Glauconite	TR	—
Carb. unspec.	—	80-90
Calc. nannos	—	TR
Diatoms	12	TR
Sponge spicules	4	—
Silicoflagellates	—	TR

Site 434, Hole B, Core 12, Cored Interval: 390.5-400.0 m:
NO RECOVERY.

SITE 434 HOLE B CORE 13 CORED INTERVAL: 400.0-409.5 m



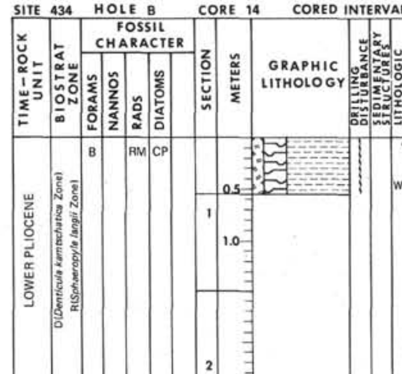
LITHOLOGIC DESCRIPTION

LIMESTONE PEBBLES: three pebbles, light grey (N6) and medium grey (N5). Mottled appearance.

SMEAR SLIDE (%)

	CC
Volcanic glass	4
Carb. unspec.	96

SITE 434 HOLE B CORE 14 CORED INTERVAL: 409.5-418.0 m



LITHOLOGIC DESCRIPTION

VITRIC DIATOMACEOUS CLAYSTONE: olive grey (5Y 3/2) in color with light grey (N8) specs of sponge spicules. Sample is brecciated and disturbed by drilling.

CARBONATE BOMB: 3%, CC-1

SMEAR SLIDE (%)

	1-20
Quartz	3
Feldspar	12
Mica	TR
Heavy mins.	TR
Clay	56
Volcanic glass	12
Glauconite	TR
Diatoms	13
Sponge spicules	4

SITE 434 HOLE B CORE 15 CORED INTERVAL: 418.0-427.5 m

TIME-ROCK UNIT: LOWER PLIOCENE

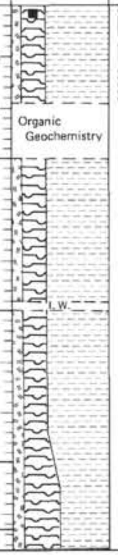
BIOSTRAT ZONE: R(*Sphaeropyle langii* Zone); D(*Denticula kamtschatica* Zone)

FOSSIL CHARACTER: FORAMS: B, B, B, B, B; RADS: RM; DIATOMS: RP

SECTION: 1, 2, 3, 4, CC

METERS: 0.5, 1.0

GRAPHIC LITHOLOGY:



LITHOLOGIC SAMPLE: CC, WC, CC, GZ

5Y 3/2, N3 & 5Y 5/2

5Y 3/2

5Y 3/2

Tectonic shear

LITHOLOGIC DESCRIPTION

VITRIC DIATOMACEOUS CLAYSTONE: olive grey (5Y 3/2) in color, with some light olive grey (5Y 5/2) zones which contain unspecified carbonate. These are at 12 cm, 34-38 cm, 215 cm, 231 to 238 cm, and 410 to 423 cm. A dark patch at 6-7 cm (N3) is probably pyritized. The core is highly sheared and fragmented but most pieces are in place.

CARBON-CARBONATE (%)

	1-34	4-34
Carbonate:	1.0	1.0
Organic carbon:	0.6	0.7

CARBONATE BOMB: 10%, CC-1

GRAIN SIZE (%)

	Sand	Silt	Clay
1-35	0	48	52
4-35	0	46	54

SMEAR SLIDES (%)

	1-10†	1-50	3-43	3-102	3-111	4-20	CC-10
Quartz	—	4	TR	TR	TR	TR	TR
Feldspar	1	12	5	8	5	2	3
Mica	—	TR	TR	TR	TR	TR	TR
Heavy mins.	TR	TR	TR	TR	TR	TR	TR
Clay	58	56	55	45	58	57	55
Volcanic glass	—	8	12	10	8	8	10
Glauconite	—	TR	—	—	—	—	—
Pyrite	—	TR	TR	TR	TR	—	TR
Carb. unspec.	30	—	3	12	8	5	2
Calc. nannos	—	—	TR	TR	1	TR	—
Diatoms	6	12	10	10	10	10	8
Radiolarians	—	—	TR	TR	TR	2	2
Sponge spicules	5	8	15	15	10	15	15

SITE 434 HOLE B CORE 16 CORED INTERVAL: 427.5-437.0 m

TIME-ROCK UNIT: LOWER PLIOCENE

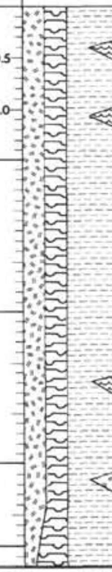
BIOSTRAT ZONE: R(*Stichocorys peregrina* Zone); D(*Denticula kamtschatica* Zone)

FOSSIL CHARACTER: FORAMS: B, B, B, B, B; RADS: RM; DIATOMS: FP

SECTION: 1, 2, 3, 4, CC

METERS: 0.5, 1.0

GRAPHIC LITHOLOGY:



LITHOLOGIC SAMPLE: WC, CC, GZ, WC, WC, CC, GZ, WC

5Y 3/2

LITHOLOGIC DESCRIPTION

VITRIC DIATOMACEOUS CLAYSTONE: olive grey in color with yellowish grey (5Y 7/2) and light olive grey (5Y 5/2) patches of diatomaceous marlstone at 45 cm, 110 cm, and 380 cm. A light bluish grey (5B 7/1) patch of ash is located at 465 cm.

CARBON-CARBONATE (%)

	1-59	4-59
Carbonate:	2.0	1.0
Organic carbon:	0.8	0.6

CARBONATE BOMB: 6.5%, CC-1

GRAIN SIZE (%)

	Sand	Silt	Clay
1-60	0	39	61
4-60	0	41	59

SMEAR SLIDES (%)

	1-80	1-110†	2-80	3-83†	4-16†	4-50	CC-10
Quartz	2	TR	TR	1	5	2	TR
Feldspar	10	2	10	—	20	20	9
Mica	TR	TR	TR	TR	—	—	TR
Heavy mins.	TR	TR	TR	TR	—	—	TR
Clay	40	50	50	13	—	28	50
Volcanic glass	20	5	15	20	70	20	10
Glauconite	—	—	—	—	—	TR	—
Pyrite	TR	TR	1	1	—	—	TR
Carb. unspec.	2	30	1	5	5	5	1
Calc. nannos	—	—	—	35	—	—	—
Diatoms	10	8	10	15	—	15	20
Radiolarians	1	TR	TR	—	—	—	TR
Sponge spicules	15	5	13	10	—	10	10

SITE 434 HOLE B CORE 17 CORED INTERVAL: 437.0-446.5 m

TIME-ROCK UNIT: UPPER MIOCENE

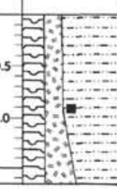
BIOSTRAT ZONE: R(*Stichocorys peregrina* Zone); D(*Denticula kamtschatica* Zone)

FOSSIL CHARACTER: FORAMS: RM, B; RADS: RM; DIATOMS: CM

SECTION: 1, CC

METERS: 0.5, 1.0

GRAPHIC LITHOLOGY:



LITHOLOGIC SAMPLE: CC, GZ

5Y 3/2

LITHOLOGIC DESCRIPTION

DIATOMACEOUS VITRIC SILTY CLAY: olive grey in color (5Y 3/2) with small fragments of diatomaceous marlstone. Highly brecciated and disturbed by drilling.

CARBON-CARBONATE (%)

	1-40
Carbonate:	2.0
Organic carbon:	0.8

CARBONATE BOMB: 5%, CC-16
13%, CC-1

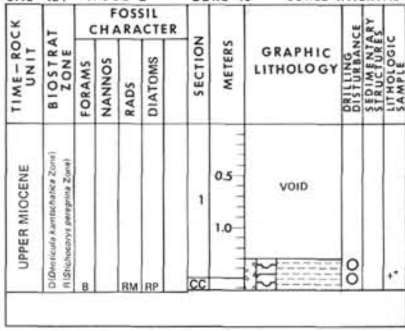
GRAIN SIZE (%)

	Sand	Silt	Clay
1-90	10	40	50

SMEAR SLIDES (%)

	1-42†	1-71	1-80	1-89†	CC-12
Quartz	2	—	3	TR	TR
Feldspar	10	2	20	TR	15
Mica	—	—	—	—	TR
Heavy mins.	—	—	—	—	TR
Clay	20	—	30	25	35
Volcanic glass	25	98	20	3	30
Glauconite	20	—	TR	—	—
Pyrite	1	—	2	TR	TR
Carb. unspec.	2	—	—	50	3
Calc. nannos	5	—	5	1	TR
Diatoms	10	—	15	15	12
Radiolarians	—	—	—	1	TR
Sponge spicules	5	—	5	5	5

SITE 434 HOLE B CORE 18 CORED INTERVAL: 446.5-456.0 m



LITHOLOGIC DESCRIPTION

5Y 3/2

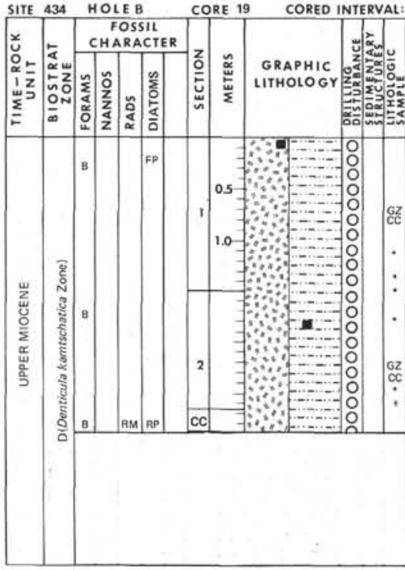
VITRIC DIATOMACEOUS CLAYSTONE: olive grey in color (5Y 3/2). Highly disturbed and brecciated by drilling.

CARBONATE BOMB: 2%, 1-144

SMEAR SLIDE (%)

	1-140
Quartz	1
Feldspar	1
Mica	1
Clay	60
Volcanic glass	10
Diatoms	15
Sponge spicules	5

SITE 434 HOLE B CORE 19 CORED INTERVAL: 456.0-465.5 m



LITHOLOGIC DESCRIPTION

5G 4/1

TUFFITE: dark greenish (5G 4/1) in color. Highly brecciated and disturbed with many different types of clasts. Tuffite makes up about 80%. Also have 5% olive grey (5Y 4/1) siltstone; 5% olive grey limestone; 2% brownish grey (5YR 4/1) clasts, and 5% light green (5G 6/1) tuff. Large limestone pebbles occur at 4-7 cm and 181-185 cm.

CARBON-CARBONATE (%)

	1-77	2-77
Carbonate:	1.0	1.0
Organic carbon:	0.3	0.3

CARBONATE BOMB: 3%, 2-101

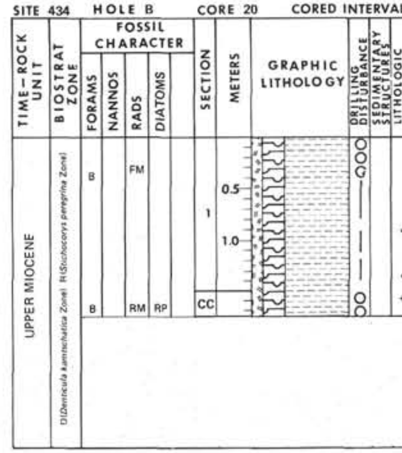
GRAIN SIZE (%)

	Sand	Silt	Clay
1-75	2	51	47
2-75	2	51	47

SMEAR SLIDES (%)

	1-104	1-133	1-145	2-25†	2-34	2-95
Quartz	1	5	1	—	—	1
Feldspar	1	5	1	2	—	1
Mica	TR	8	TR	—	—	2
Heavy mins.	—	1	—	—	—	—
Clay	50	55	85	8	10	50
Volcanic glass	35	8	10	90	1	40
Pyrite	—	TR	—	—	—	—
Carb. unspec.	—	—	—	—	88	—
Diatoms	10	7	—	—	1	10
Sponge spicules	5	3	1	—	—	TR

SITE 434 HOLE B CORE 20 CORED INTERVAL: 465.5-475.0 m



LITHOLOGIC DESCRIPTION

5G 6/1

5Y 3/2

VITRIC DIATOMACEOUS CLAYSTONE: olive grey (5Y 3/2) and light green (5G 6/1) in color. Highly fractured with some fine mottling by light olive grey calcareous tuff (Smear Slide: 20-1-130).

CARBONATE BOMB: 5%, CC-1

SMEAR SLIDES (%)

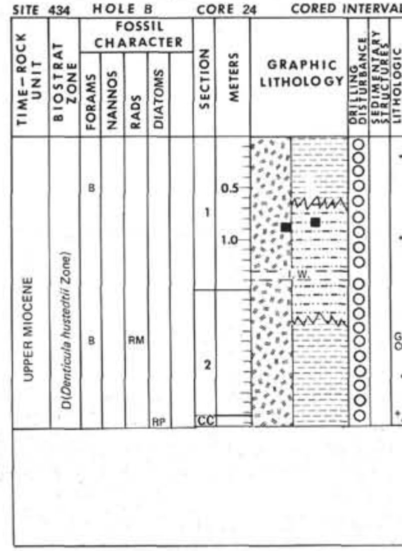
	1-90	1-130†
Quartz	1	—
Feldspar	1	—
Clay	65	15
Volcanic glass	10	65
Pyrite	TR	—
Carb. unspec.	—	15
Diatoms	20	5
Sponge spicules	5	1

Site 434, Hole B, Core 21, Cored Interval: 475.0-484.5 m, NO RECOVERY

Site 434, Hole B, Core 22, Cored Interval: 484.5-495.0 m, NO RECOVERY

Site 434, Hole B, Core 23, Cored Interval: 495.0-504.5 m, NO RECOVERY

SITE 434 HOLE B CORE 24 CORED INTERVAL: 504.5-514.0 m



LITHOLOGIC DESCRIPTION

CLAYEY TUFF–TUFFITE: dark greenish grey (5G 4/1) in color with light bluish grey (5B 7/1) pebbles of limestone at 90 cm. Sediment intensely fractured and disturbed by drilling.

CARBON-CARBONATE (%)

	2-49
Carbonate:	1.0
Organic carbon:	0.3

CARBONATE BOMB: 6%, CC-1

GRAIN SIZE (%)

	Sand	Silt	Clay
2-47	1	43	56

SMEAR SLIDES (%)

	1-20	1-100	2-84	CC-3
Quartz	2	5	TR	TR
Feldspar	8	15	5	8
Mica	TR	TR	TR	TR
Heavy mins.	TR	TR	TR	TR
Clay	55	36	56	40
Volcanic glass	30	40	25	40
Pyrite	TR	TR	TR	—
Carb. unspec.	TR	TR	10	5
Diatoms	3	3	1	5
Radiolarians	TR	TR	1	TR
Sponge spicules	2	1	2	2
Calc. nannos	—	—	TR	TR

SITE 434 HOLE B CORE 25 CORED INTERVAL: 514.0-523.5 m

Fossil character: Forams B, B, B, RP; Rads RM; Diatoms B. Sections 1, 2, 3, CC.

5GY 4/1 to 5GY 2/1

LITHOLOGIC DESCRIPTION

TUFFITE: dark greenish grey (5GY 4/1) to greenish black (5GY 2/1) in color. A greenish grey (5GY 6/1) calcite veined marlstone pebble is located at 96 to 101 cm. Small brecciated calcareous vitric tuff fragments are scattered throughout. The entire core is highly brecciated and disturbed throughout.

CARBON-CARBONATE (%)

	1-88	3-88
Carbonate:	1.0	1.0
Organic carbon:	0.5	0.4

CARBONATE BOMB: 6.5%, 1-91
7%, CC-1

GRAIN SIZE (%)

	Sand	Silt	Clay
1-86	1	48	51
3-86	1	58	41

SMEAR SLIDES (%)

	1-75	2-75	3-70†	3-75
Quartz	2	2	2	3
Feldspar	15	20	—	17
Clay	23	23	—	30
Volcanic glass	40	35	TR	45
Glauconite	—	TR	—	TR
Pyrite	2	2	1	1
Carb. unspec.	3	3	94	1
Calc. nannos	8	7		3
Diatoms	5	7	3	—
Radiolarians	—	—	TR	—
Sponge spicules	1	1	—	—

SITE 434 HOLE B CORE 26 CORED INTERVAL: 523.5-533.0 m

Fossil character: Forams B, B, B; Rads FM, RM; Diatoms RP. Sections 1, 2, CC. VOID.

5GY 2/1; 5GY 4/1

LITHOLOGIC DESCRIPTION

TUFFITE: greenish black (5G 2/1) and olive grey (5Y 4/1) with light olive grey (5Y 6/1) fragments of carbonate rich sediment scattered throughout. Highly brecciated and disturbed..

CARBON-CARBONATE (%)

	1-72	2-72
Carbonate:	1.0	3.0
Organic carbon:	0.6	0.6

CARBONATE BOMB: 3.5%, CC-1

GRAIN SIZE (%)

	Sand	Silt	Clay
1-70	2	47	51
2-70	3	50	47

SMEAR SLIDES (%)

	1-50	2-50	CC-5
Quartz	2	3	2
Feldspar	20	20	15
Clay	25	32	30
Volcanic glass	35	30	50
Glauconite	TR	—	—
Pyrite	1	2	1
Calc. nannos	10	3	1
Diatoms	5	10	1
Radiolarians	—	TR	—
Sponge spicules	2	—	—

SITE 434 HOLE B CORE 27 CORED INTERVAL: 533.0-542.5 m

Fossil character: Forams B; Rads RP; Diatoms RP. Section 1.

104 4/2

LITHOLOGIC DESCRIPTION

TUFFITE: greyish olive (10Y 4/2) in color. Intensely disturbed.

CARBONATE BOMB: 2%, CC-26

SMEAR SLIDE (%)

	CC-15
Quartz	4
Feldspar	20
Clay	32
Volcanic glass	35
Pyrite	2
Carb. unspec.	2
Diatoms	4
Radiolarians	TR
Sponge spicules	1

SITE 434 HOLE B CORE 28 CORED INTERVAL: 542.5-552.0 m

Fossil character: Forams B, B; Rads RP; Diatoms RP. Sections 1, CC.

5G 4/7 & 5G 3/1; 5GY 4/1; 5GY 6/1; 5GY 4/2; 5GY 3/1

LITHOLOGIC DESCRIPTION

VITRIC CLAYSTONE: 0-60 cm. Dark greenish grey (5GY 3/1 to 5G 4/7) in color. Highly disturbed by drilling.
CLAYEY TUFF: 60-110 cm. Dark greenish grey (5GY 4/1), dusky yellow green (5GY 4/2) and greenish grey (5GY 6/1) in color. In some pieces of the breccia, one can see fine dark and light colored parallel layers. The light layers are tuffite and the dark may be vitric mudstone. A calcareous vitric tuff pebble is found at 115 cm.
VITRIC CLAYSTONE: 160-163 cm. Dark greenish grey in color (5GY 3/1).

CARBONATE BOMB: 2%, CC-1

GRAIN SIZE (%)

	Sand	Silt	Clay
1-76	0	52	48

SMEAR SLIDES (%)

	1-51	CC-11	CC-17
Mica	TR	—	—
Clay	54	41	35
Volcanic glass	20	55	55
Pyrite	2	1	1
Carb. unspec.	15	TR	—
Diatoms	8	2	4
Radiolarians	TR	—	1
Sponge spicules	1	1	5

SITE 434 HOLE B CORE 29 CORED INTERVAL: 552.0-561.5

Section 1.

LITHOLOGIC DESCRIPTION

LIMESTONE AND CALCAREOUS VITRIC TUFF PEBBLES: The limestone pebbles are olive grey (5Y 4/1) with light greenish grey veinlets of calcite. The calcareous vitric tuffs are dark greenish grey (5G 4/1). One single fragment of micaceous gneiss was also found.

CARBONATE BOMB: 70%, CC-15

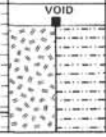
SMEAR SLIDE (%)

	CC-7
Heavy mins.	10
Volcanic glass	25
Carb. unspec.	60
Diatoms	5

SITE 434 HOLE B CORE 30 CORED INTERVAL: 561.5-571.0 m

TIME-ROCK UNIT: UPPER MIOCENE | BIOSTRAT ZONE: D(*Denticula hustedtii* Zone) | FOSSIL CHARACTER: FORAMS B, RADS RM, DIATOMS RP | SECTION: 1, CC | METERS: 0.5, 1.0

GRAPHIC LITHOLOGY



LITHOLOGIC SAMPLE: CC GZ — 5Y 3/2

LITHOLOGIC DESCRIPTION

TUFFITE: olive grey (5Y 3/2) in color, and very uniform. Highly disturbed and brecciated. One large limestone pebble at 15-20 cm.

CARBON-CARBONATE (%)

	1-71
Carbonate:	1.0
Organic carbon:	0.5

CARBONATE BOMB: 1%, CC-7

GRAIN SIZE (%)

	Sand	Silt	Clay
1-72	2	49	49

SMEAR SLIDES (%)

	1-40	CC
Quartz	2	2
Feldspar	10	15
Mica	TR	TR
Heavy mins.	TR	TR
Clay	28	28
Volcanic glass	60	55
Pyrite	TR	TR
Carb. unspec.	TR	1
Diatoms	TR	TR
Radiolarians	TR	TR
Sponge spicules	TR	TR

SITE 434 HOLE B CORE 31 CORED INTERVAL: 571.0-580.0 m

FOSSIL CHARACTER: FORAMS B | SECTION: 1, 2 | METERS: 0.5, 1.0

GRAPHIC LITHOLOGY

LITHOLOGIC SAMPLE: 5GY 3/2

LITHOLOGIC DESCRIPTION

TUFFITE–VITRIC SILTY CLAY: greyish olive green (5GY 3/2) in color. The bottom ten cm contains subrounded pieces of light greenish grey (5GY 6/1), calcareous tuff breccia.

CARBONATE BOMB: 2%, CC-1

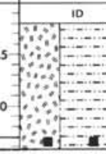
SMEAR SLIDES (%)

	CC-4	CC-16
Quartz	2	3
Feldspar	20	25
Clay	37	35
Volcanic glass	35	15
Glauconite	—	TR
Pyrite	2	1
Carb. unspec.	—	3
Calc. nannos	2	—
Diatoms	2	15
Sponge spicules	TR	3

SITE 434 HOLE B CORE 32 CORED INTERVAL: 580.5-590.0 m

TIME-ROCK UNIT: UPPER MIOCENE | BIOSTRAT ZONE: D(*Denticula hustedtii* Zone) | FOSSIL CHARACTER: FORAMS B, B; RADS RM; DIATOMS RP | SECTION: 1, CC | METERS: 0.5, 1.0

GRAPHIC LITHOLOGY



LITHOLOGIC SAMPLE: CC GZ — 5GY 3/2, 5GY 4/2, 5GY 5/2

LITHOLOGIC DESCRIPTION

TUFFITE: dusky yellow green (5GY 4/2) in color. Sediment is highly brecciated and disturbed. It contains fragments of greyish olive green (5GY 3/2) vitric diatomaceous silty clay and light olive grey (5Y 5/2) vitric limestone. Two pebbles of light olive grey (5Y 5/2) vitric limestone are present at the bottom of the core catcher.

CARBON-CARBONATE (%)

	1-100
Carbonate:	1.0
Organic carbon:	0.5

CARBONATE BOMB: 1%, CC-1

GRIAN SIZE (%)

	Sand	Silt	Clay
1-101	14	40	46

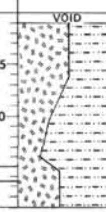
SMEAR SLIDES (%)

	1-70	1-72†	1-75†
Quartz	3	—	3
Feldspar	15	—	20
Clay	34	8	40
Volcanic glass	40	20	15
Pyrite	1	—	2
Carb. unspec.	2	70	—
Diatoms	3	2	15
Sponge spicules	2	TR	5
Silicoflagellates	—	—	TR

SITE 434 HOLE B CORE 33 CORED INTERVAL: 590.0-599.5 m

FOSSIL CHARACTER: FORAMS B, B; RADS RP; DIATOMS B | SECTION: 1, 2, CC | METERS: 0.5, 1.0

GRAPHIC LITHOLOGY



LITHOLOGIC SAMPLE: WC, GZ CC — 5GY 3/2, 5GY 5/2, 5GY 2/1, 5GY 3/2, 5GY 3/2, 5BG 5/2 & 5BG 3/2

LITHOLOGIC DESCRIPTION

TUFFITE: 0-80 cm. Greyish olive green (5GY 3/2) and dusky yellow green (5GY 5/2) in color. Brecciated, but contains several coherent layers.
VITRIC SILTY CLAY–VITRIC CLAYSTONE: 80-150 cm. Greenish black (5GY 2/1). Completely disturbed by drilling.
TUFFITE: 150-190 cm. Greyish olive green in color, with patches of greyish blue green (5BG 5/2) and dusky blue green (5BG 3/2) vitric claystone. Highly disturbed by drilling.

CARBON-CAROBNATE (%)

	1-93
Carbonate:	1.0
Organic carbon:	0.5

CARBONATE BOMB: 0%, CC-7

GRAIN SIZE (%)

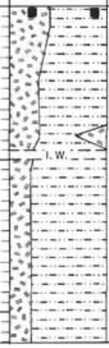
	Sand	Silt	Clay
1-90	1	47	53

SMEAR SLIDES (%)

	1-20	1-60	1-100	1-140	2-10	CC-14†
Quartz	3	3	5	—	3	—
Feldspar	20	20	20	10	20	—
Clay	27	13	32	71	27	83
Volcanic glass	45	55	30	15	40	15
Glauconite	—	TR	—	—	TR	—
Pyrite	2	1	1	4	2	—
Carb. unspec.	—	—	—	—	5	—
Diatoms	10	5	9	—	3	2
Sponge spicules	3	3	3	—	TR	TR

SITE 434 HOLE B CORE 34 CORED INTERVAL: 599.5-609.0 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE
		B				1	0.5, 1.0				WC GZ CC
		B				2					GZ CC
		B		RM	B	CC					



LITHOLOGIC DESCRIPTION

5GY 4/1
5BG 4/2

TUFFITE–VITRIC SILTY CLAY: dark greenish grey (5GY 4/1) and greyish blue green (5BG 4/2) in color. Highly disturbed but with coherent large pieces from 74-86 cm. Patches of greyish blue green (5BG 4/2) vitric silty clay are between 127 and 131 cm. Some tuffite, dusky yellow green (5GY 6/2) is present from 133 to 134 cm, and 165 to 169 cm. An ash patch is at 130 to 134 cm.

CARBON-CARBONATE (%)

	1-92	2-92
Carobnate:	2.0	1.0
Organic carbon:	0.5	0.3

CARBONATE BOMB: 0%, CC-1

5GY 4/1

GRAIN SIZE (%)

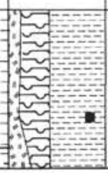
	Sand	Silt	Clay
1-90	0	32	68
2-90	2	43	55

SMEAR SLIDES (%)

	1-20	1-70	1-130	1-134†	2-19	2-110
Quartz	5	3	1	1	—	10
Feldspar	15	10	10	—	—	15
Clay	25	45	58	29	85	46
Volcanic glass	40	30	30	70	15	20
Pyrite	2	1	TR	—	TR	3
Diatoms	10	9	1	—	TR	3
Sponge spicules	3	2	TR	—	—	3

SITE 434 HOLE B CORE 35 CORED INTERVAL: 609.0-618.5 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE
LOWER PLIOCENE	D(*Denticula kamtschatica* Zone ?) R(*Sphaeropyle langii* Zone ?)	B				1	0.5, 1.0				GZ CC
		B		RP	RP	CC					



LITHOLOGIC DESCRIPTION

5GY 4/1

VITRIC DIATOMACEOUS CLAYSTONE: dark greenish grey (5GY 4/1) in color. Strongly brecciated and disturbed. A pebble of dusky yellow (5Y 6/4) marlstone is at 107-108 cm.

CARBON-CARBONATE (%)

	1-52
Carbonate:	8.0
Organic carbon:	0.6

CARBONATE BOMB: 1%, CC-1

GRAIN SIZE (%)

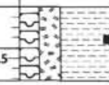
	Sand	Silt	Clay
1-50	1	46	53

SMEAR SLIDES (%)

	1-55†	1-70	CC-14
Quartz	TR	2	3
Feldspar	—	8	10
Mica	—	TR	TR
Heavy mins.	—	1	TR
Clay	5	39	50
Volcanic glass	5	10	20
Pyrite	2	TR	TR
Carb. unspec.	78	10	TR
Diatoms	10	25	10
Radiolarians	—	TR	2
Sponge spicules	—	5	5

SITE 434 HOLE B CORE 37 CORED INTERVAL: 628.0-637.5 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE
LOWER PLIOCENE	R(*Sphaeropyle langii* Zone ?)					1					
		B		RM	RP	CC	0.5				



LITHOLOGIC DESCRIPTION

5GY 3/2

DIATOMACEOUS VITRIC CLAYSTONE: greyish olive green (5GY 3/2) in color. Completely graded by drilling disturbance from 0-40 cm. A pebble of limestone breccia is at 38 cm.

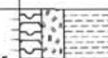
CARBONATE BOMB: 0%, CC-1

SMEAR SLIDES (%)

	1-13	CC-6
Quartz	TR	TR
Feldspar	5	3
Heavy mins.	1	—
Clay	52	52
Volcanic glass	25	25
Diatoms	15	15
Radiolarians	TR	—
Sponge spicules	2	5

SITE 434 HOLE B CORE 36 CORED INTERVAL: 618.5-628.0 m

TIME-ROCK UNIT	BIOSTRAT ZONE	FORAMS	NANNOS	RADS	DIATOMS	SECTION	METERS	GRAPHIC LITHOLOGY	DRILLING DISTURBANCE	SEDIMENTARY STRUCTURES	LITHOLOGIC SAMPLE
LOWER PLIOCENE	D(*Denticula kamtschatica* Zone ?) R(*Sphaeropyle langii* Zone ?)	B		RP	RP	1	0.5, 1.0				WC GZ CC
						2					



LITHOLOGIC DESCRIPTION

5GY 4/1

DIATOMACEOUS VITRIC CLAYSTONE: dark greenish grey in color (5GY 4/1). Intensely brecciated, but clasts are large, commonly larger than 5 cm.

CARBON-CARBONATE (%)

	1-32
Carbonate:	1.0
Organic carbon:	0.6

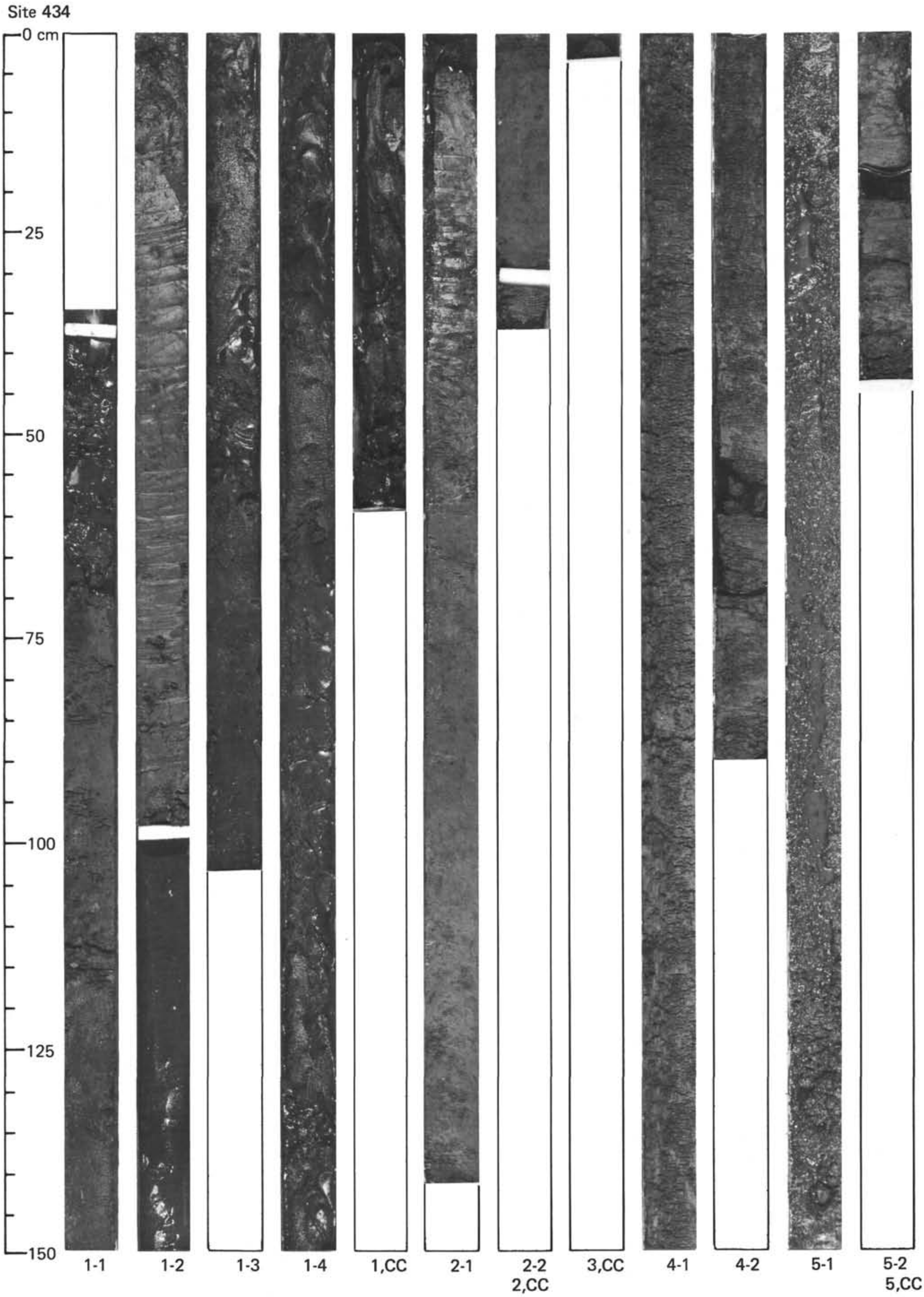
CARBONATE BOMB: 0%, 1-49

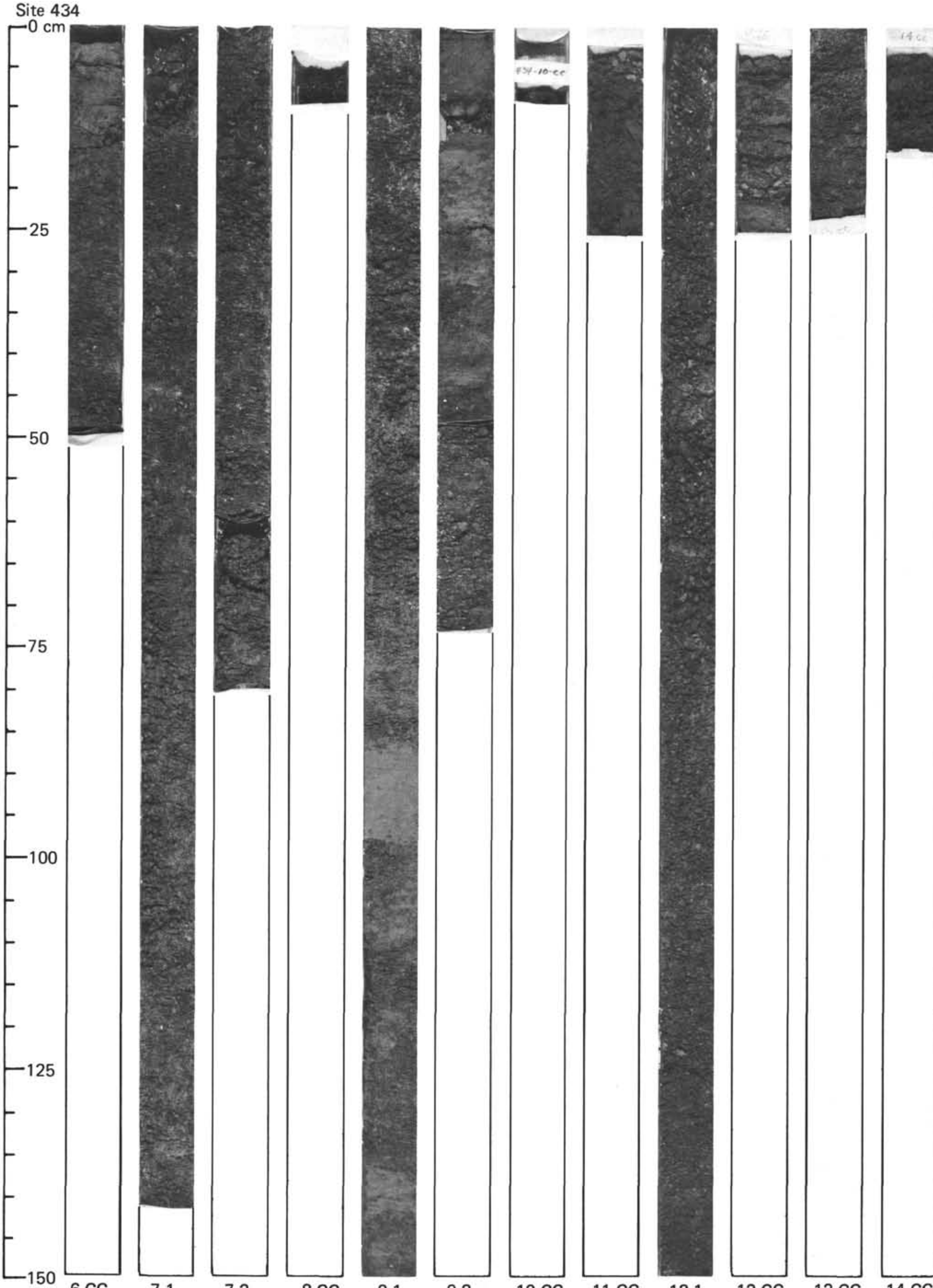
GRAIN SIZE (%)

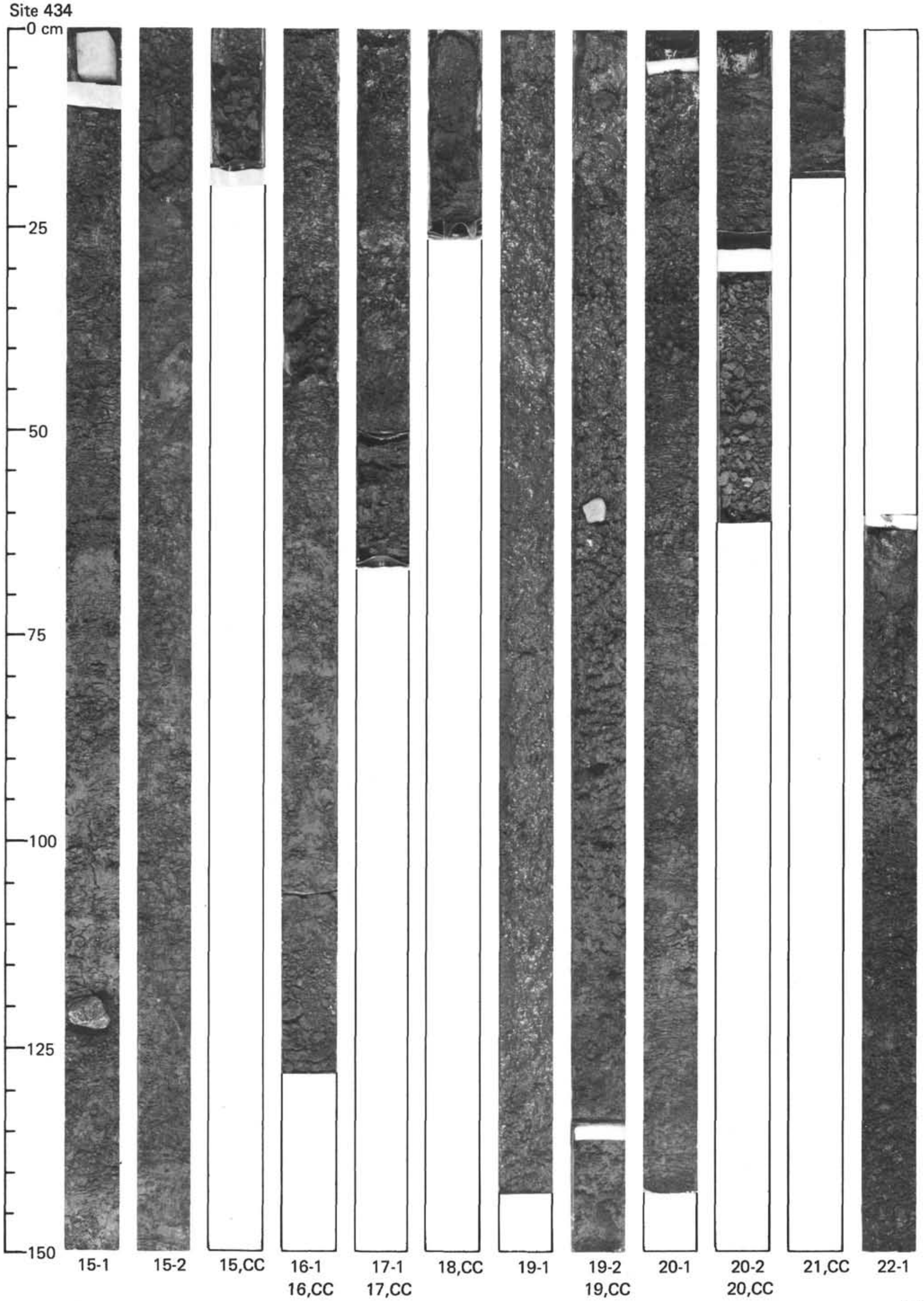
	Sand	Silt	Clay
1-30	0	40	60

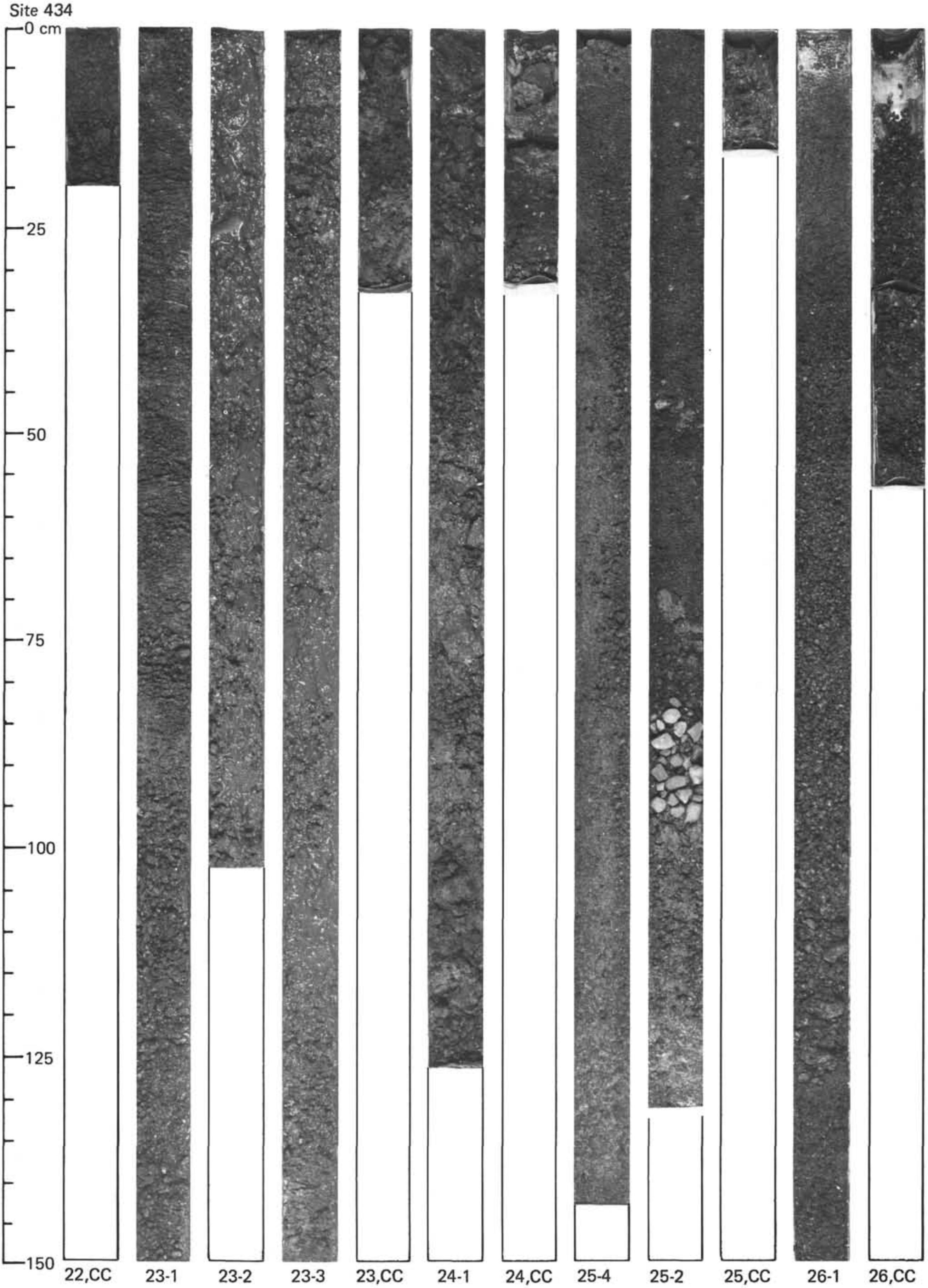
SMEAR SLIDE (%)

	1-10
Quartz	2
Feldspar	5
Heavy mins.	2
Clay	52
Volcanic glass	25
Carb. unspec.	2
Diatoms	15
Sponge spicules	2


Site 434
0 cm
25
50
75
100
125
150
1-1
1-2
1-3
1-4
1,CC
2-1
2-2
2,CC
3,CC
4-1
4-2
5-1
5-2
5,CC


Site 434
0 cm
25
50
75
100
125
150
6,CC
7-1
7-2
7,CC
8,CC
9-1
9-2
9,CC
10,CC
11,CC
12-1
12,CC
13,CC
14,CC


Site 434
0 cm
25
50
75
100
125
150
15-1
15-2
15,CC
16-1
16,CC
17-1
17,CC
18,CC
19-1
19-2
19,CC
20-1
20-2
20,CC
21,CC
22-1


Site 434
0 cm
25
50
75
100
125
150
22,CC
23-1
23-2
23-3
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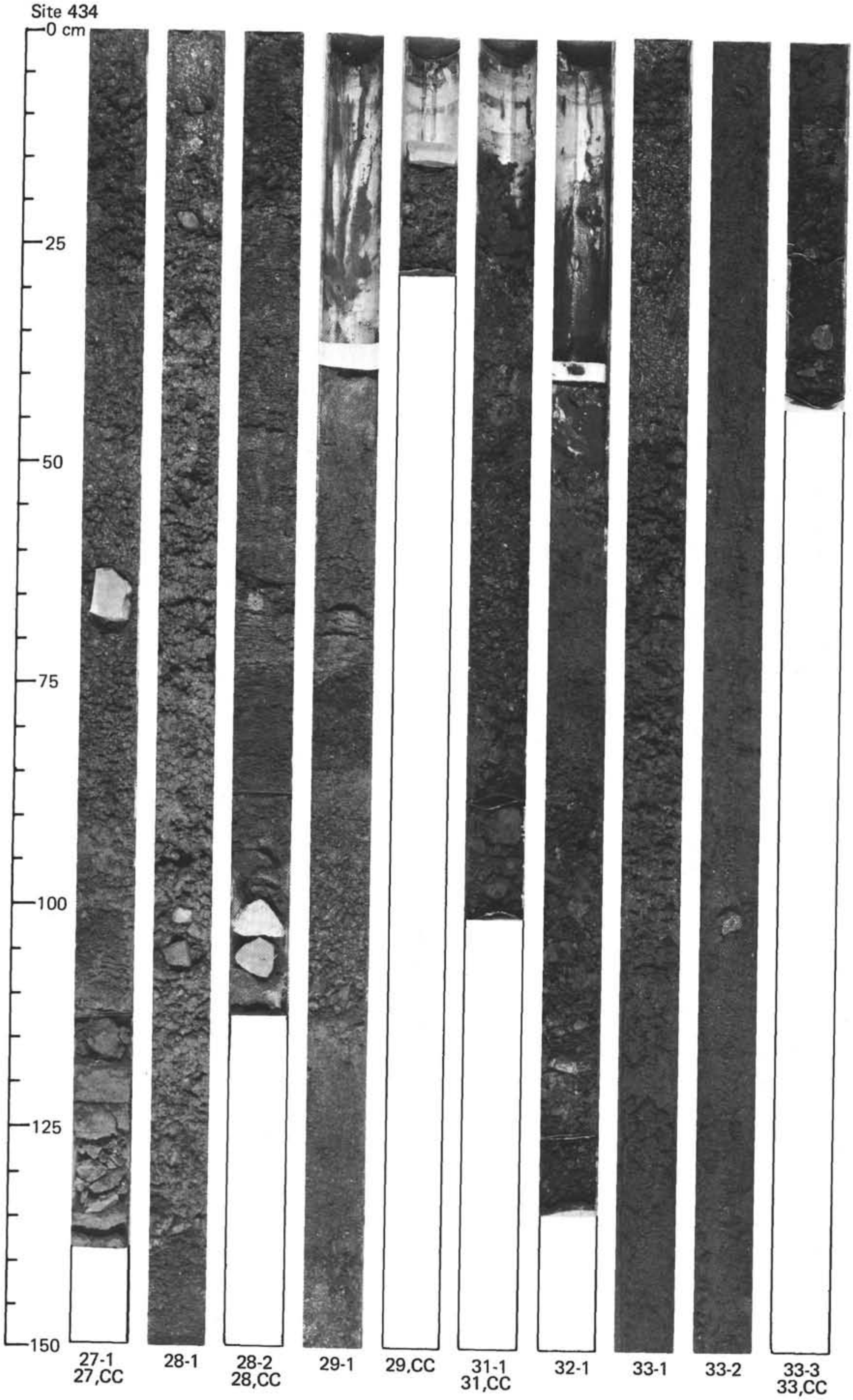
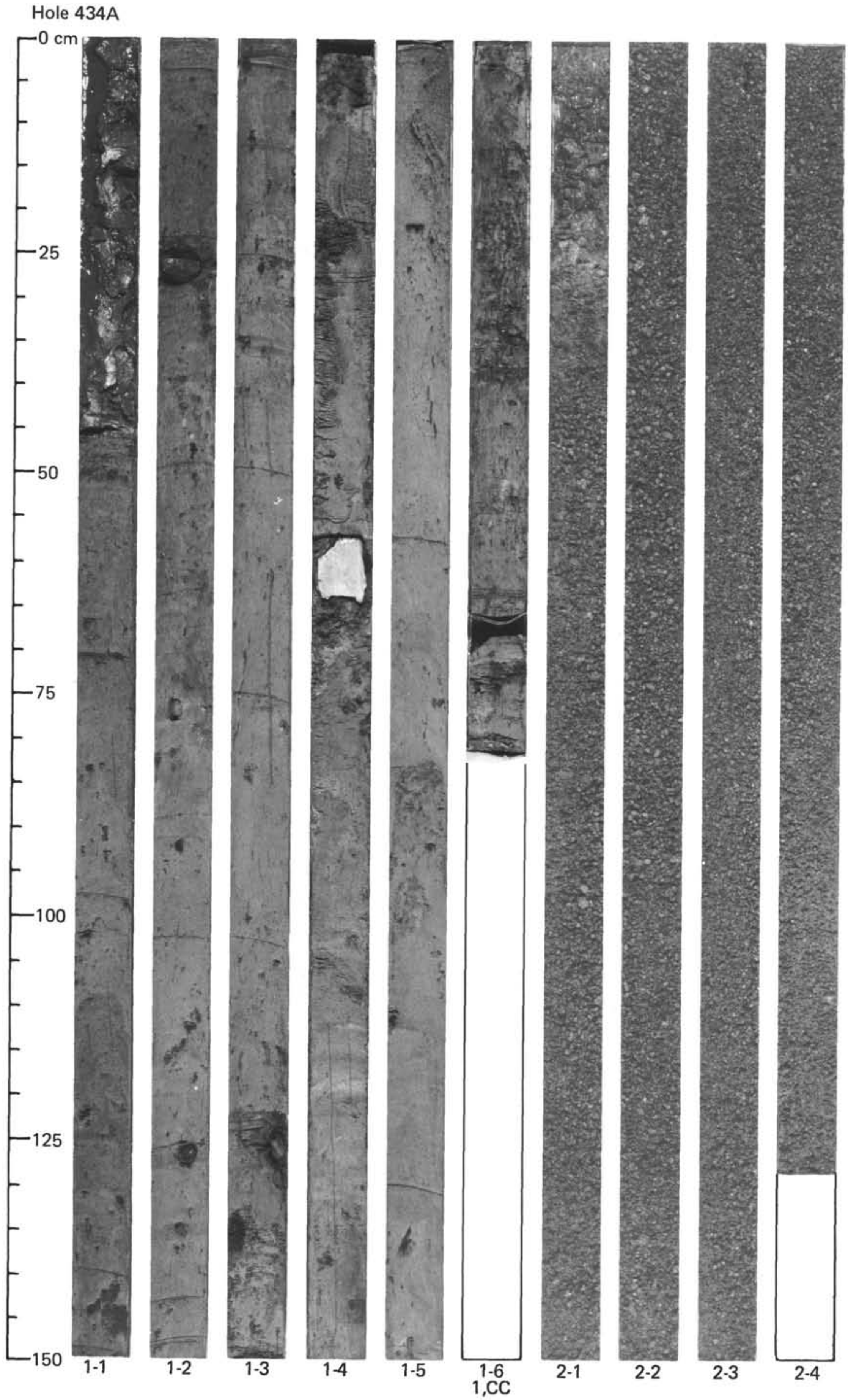
24-1
24,CC
25-4
25-2
25,CC
26-1
26,CC


Site 434
0 cm
25
50
75
100
125
150
27-1
27,CC
28-1
28-2
28,CC
29-1
29,CC
31-1
31,CC
32-1
33-1
33-2
33-3
33,CC


Hole 434A
0 cm
25
50
75
100
125
150
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1-2
1-3
1-4
1-5
1-6
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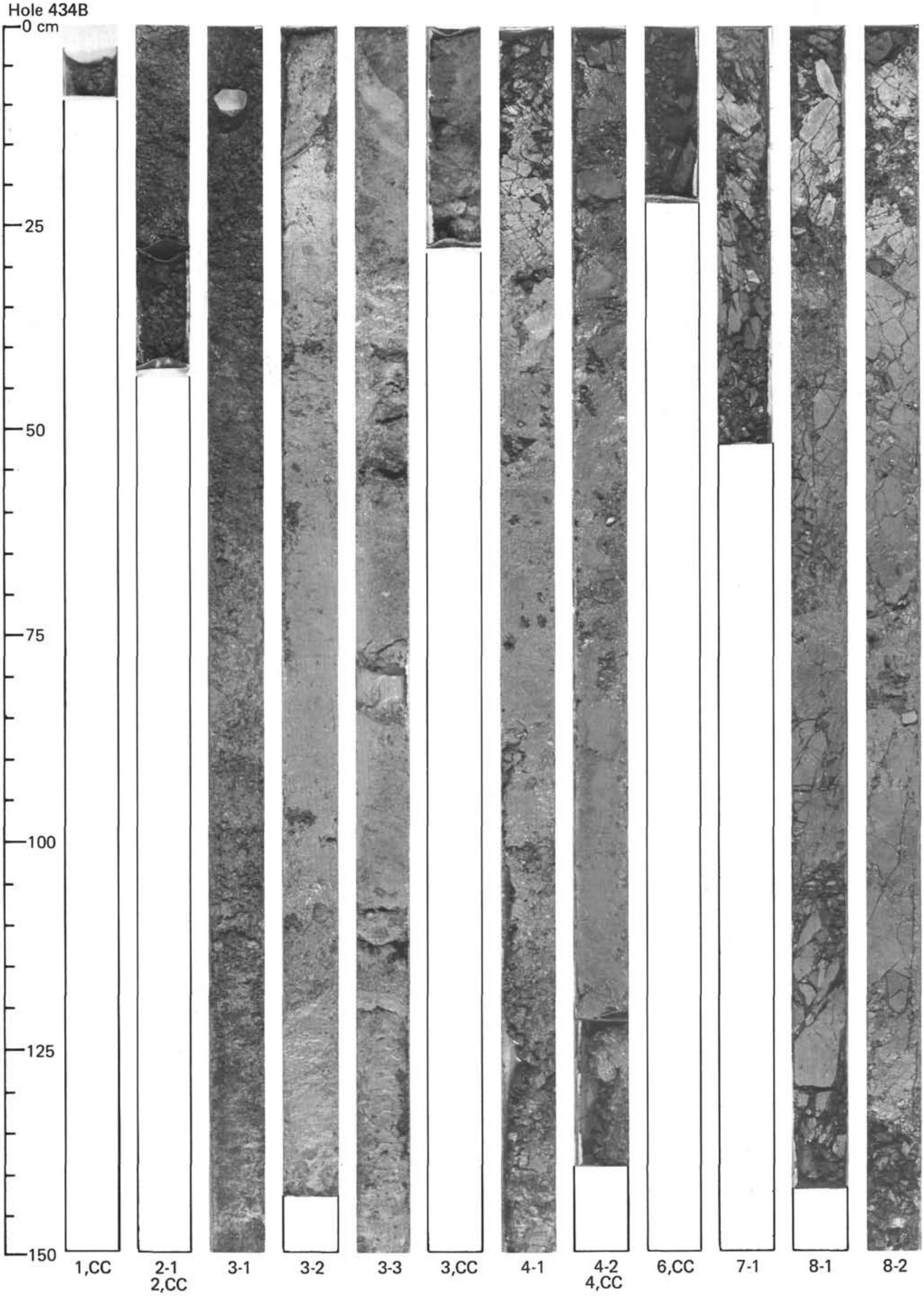
2-2
2-3
2-4


Hole 434B
0 cm
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50
75
100
125
150
1,CC
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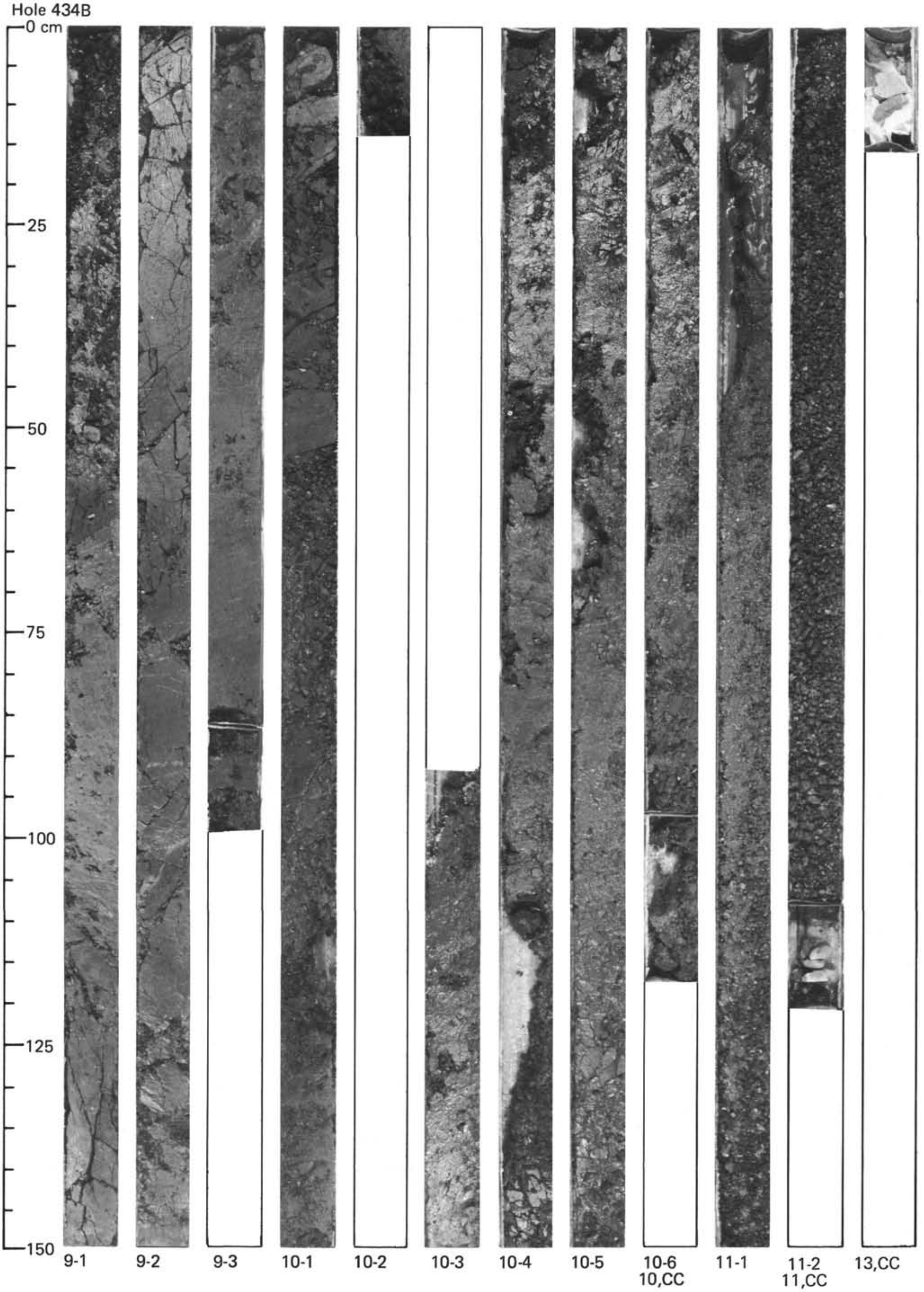
2,CC
3-1
3-2
3-3
3,CC
4-1
4-2
4,CC
6,CC
7-1
8-1
8-2


Hole 434B
0 cm
25
50
75
100
125
150
9-1
9-2
9-3
10-1
10-2
10-3
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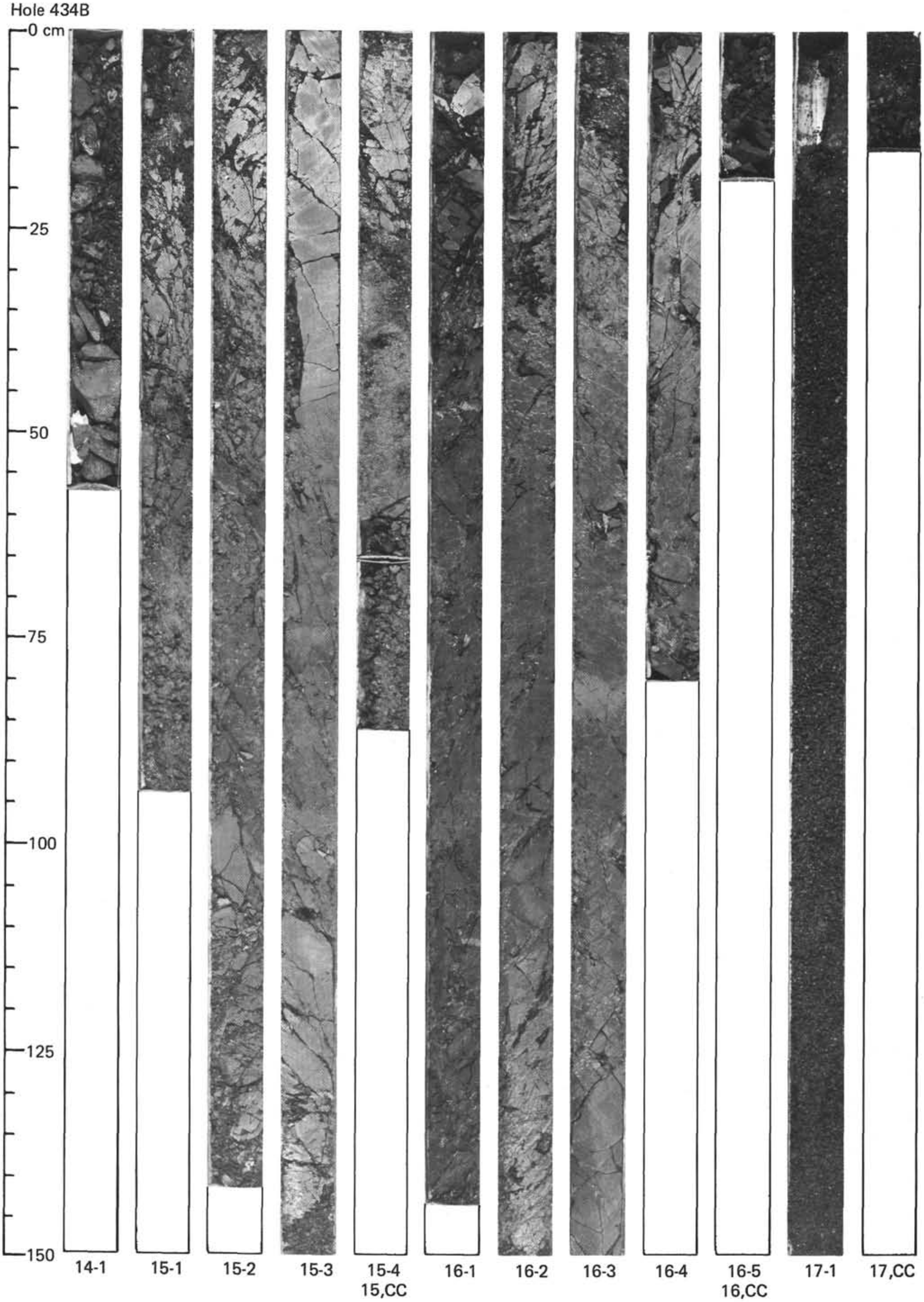
11-2
11,CC
13,CC


Hole 434B
0 cm
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50
75
100
125
150
14-1
15-1
15-2
15-3
15-4
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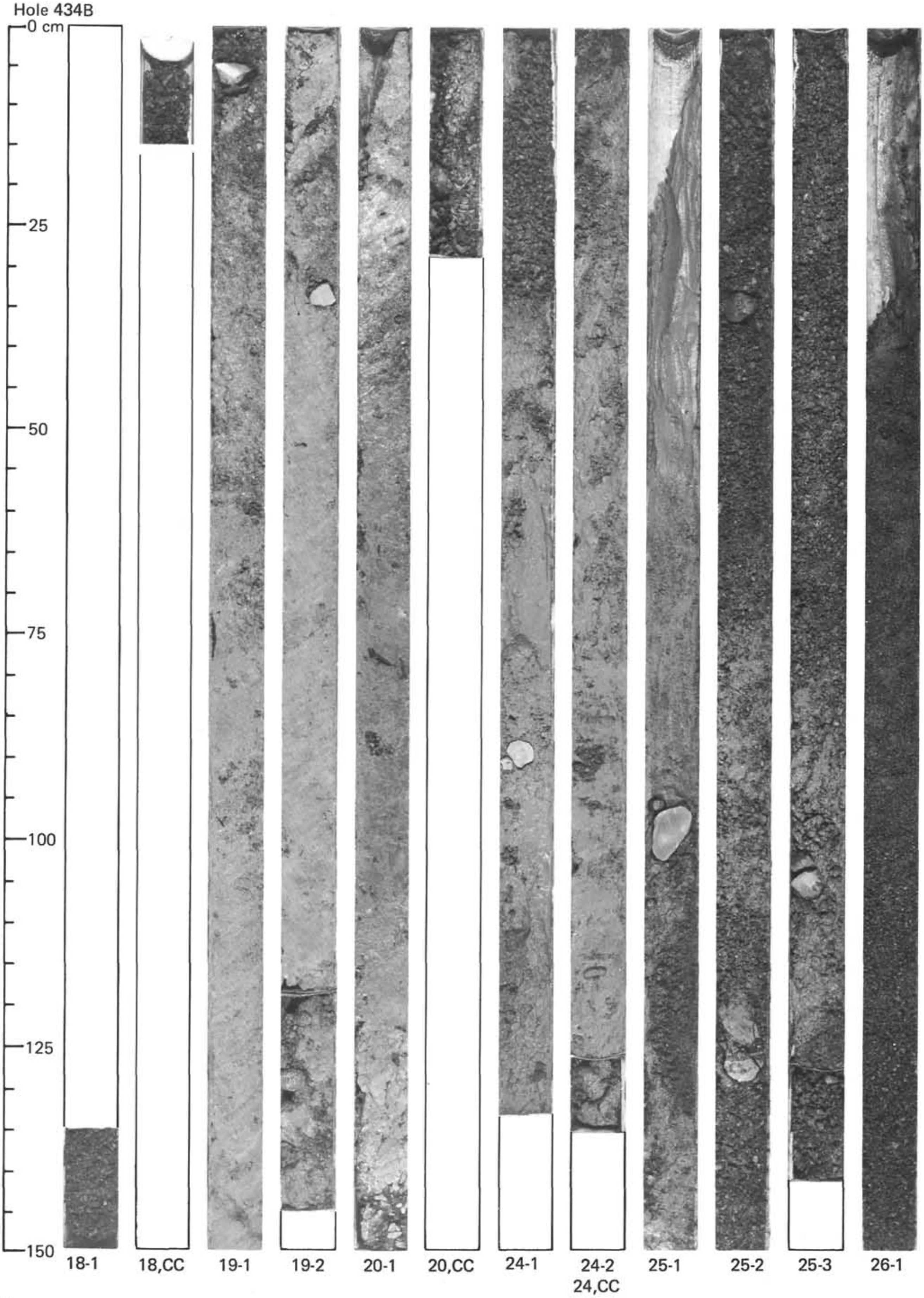
16,CC
17-1
17,CC


Hole 434B
0 cm
25
50
75
100
125
150
18-1
18,CC
19-1
19-2
20-1
20,CC
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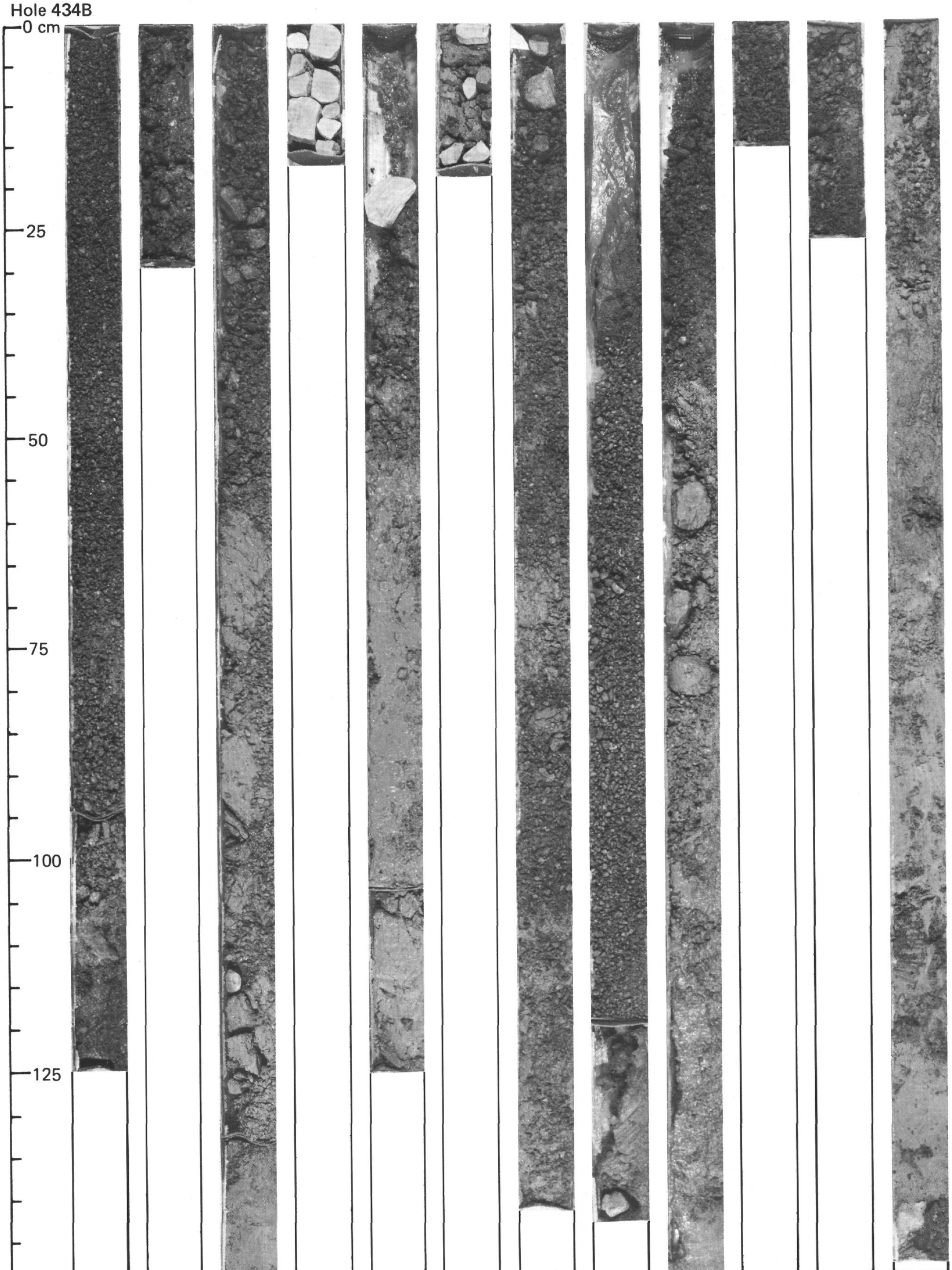
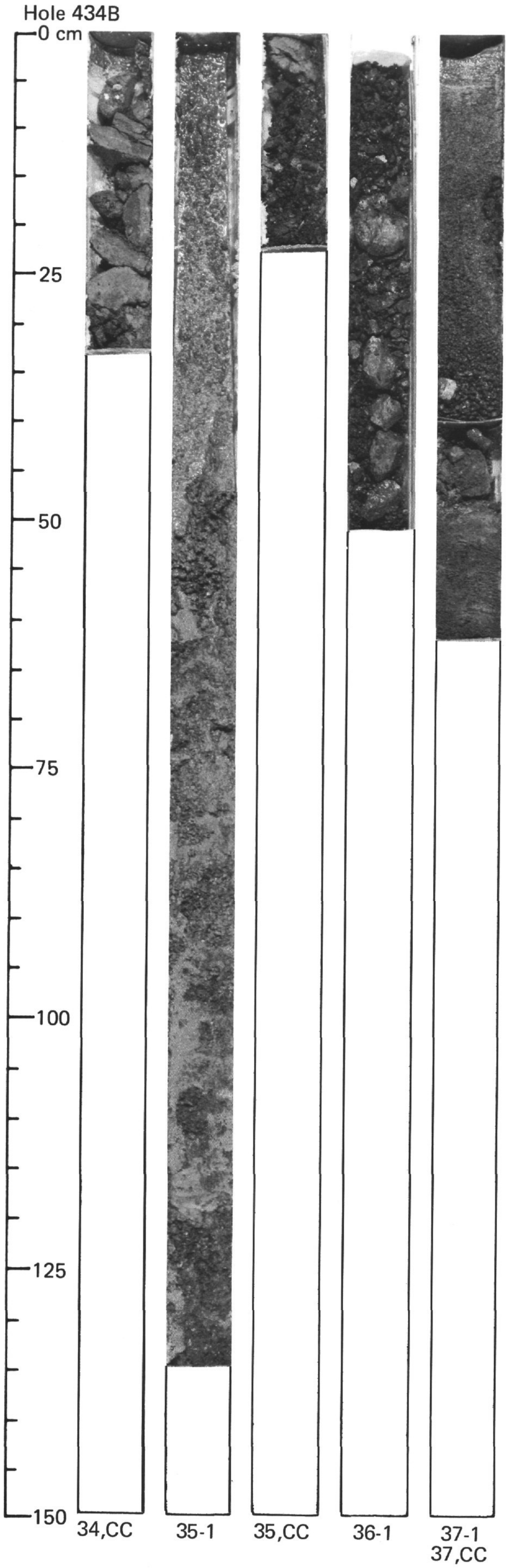
25-2
25-3
26-1


Hole 434B
0 cm
25
50
75
100
125
150
26-2
27,CC
28-1
28,CC
29,CC
30-1
30,CC
32,CC
32-1
33-1
33-2
33,CC
34-1
34-2


Hole 434B
0 cm
25
50
75
100
125
150
34,CC
35-1
35,CC
36-1
37-1
37,CC