

12. SITE 193

The Shipboard Scientific Party¹

SITE DATA

Date Occupied: 6-7 Sep 71.

Position:

45°48.20'N
155°52.27'E.

Water Depth: 4811 meters.

Penetration: 71 meters.

Number of Holes: One.

Number of Cores: 4.

Total Core Recovered: 12 meters.

Acoustic Basement:

Depth: 0.55 sec (approx. 470 m)

Nature: Unknown

Velocity: Unknown.

Age of Oldest Sediment: Pleistocene.

Basement: Not reached.

SUMMARY

Site 193 is located just west of the Hokkaido Rise (at a water depth of 4811 m). The sediment sequence penetrated consists of 71 meters of upper to lower Pleistocene ash-bearing diatomaceous silty clay to clayey diatom ooze. Ice-rafted(?) erratics of sedimentary rock, dark vitric ashes, and clay balls are present throughout the section.

BACKGROUND AND OBJECTIVES

Description

Site 193 is located near the Hokkaido Rise at about latitude 46°N, a few hundred kilometers east of the Kuril Islands (Figure 1). The sea floor throughout this area is irregular but a fairly uniform and remarkably thick, 350- to 450-meter blanket of pelagic sediment covers an acoustic basement. The upper 160 meters is characterized by numerous internal reflectors, but below here to a subbottom depth of about 400 meters the sedimentary section has few reflecting horizons. Basement is near 430

meters below bottom, at a reflecting time of 0.54 sec. The stratigraphic section revealed acoustically at Site 193 is typical of the entire region.

Objectives

Several major objectives were to be achieved at Site 193: (1) determination of the age of the crust in this critical area between the Kuril Trench and the Shatsky Rise; (2) collection of paleoecologic data to assess the amount of northwest motion of the underlying plate; (3) determination of the lithologic record in this area, especially noting if the thick middle Miocene pelagic clay found at Site 192 occurs here also; and (4) establishment of a biostratigraphic zonation for diatom and silicoflagellates in the Neogene and, hopefully, nannofossils below in Eocene and older units.

OPERATIONS

Pre- and Post-drilling Survey

Site 193 is located just west of the Hokkaido Rise at a water depth of 4811 meters where subbottom profiles

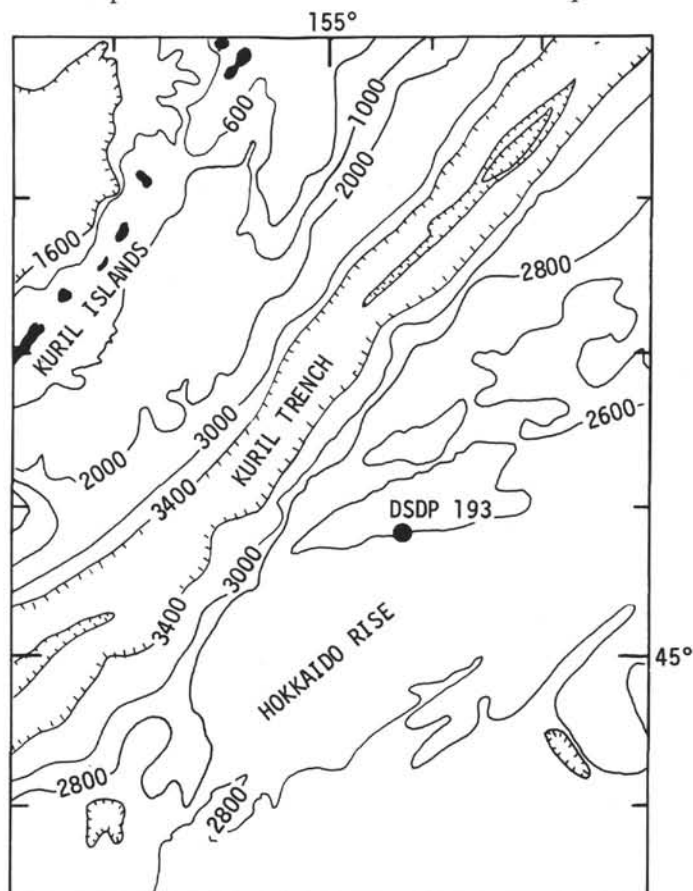


Figure 1. Base map showing the location of Site 193.

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suggest a 300- to 400-meter sediment cover over basement(?). The site was chosen along the planned ship's track from Site 192 to Yokohama. It is not on, but is surrounded by, reference tracks obtained by Scripps Institution of Oceanography and Lamont-Doherty Geological Observatory. The site was approached with a ship's heading of 215°T. The beacon was dropped with the ship almost stopped at 2200 hrs on 6 Sep 71. The air-gun profile collected during the approach (Figure 2) shows a subbottom structure similar to the surrounding reference tracks. The finally accepted position is: 45°48.20'N; 155°52.27'E. No post-drilling was deemed necessary. A map showing the approach and departure survey tracks is shown as Figure 3.

Drilling Program

Site 193 was occupied from 2200 hrs 6 Sep 71 (beacon away) until 2330 hrs 7 Sep 71 with alternating coring and washing from the sea floor to a subbottom depth of 71 meters. During the afternoon of 7 Sep 71 one of the technicians was injured seriously. The ship's surgeon requested immediate evacuation by fastest means possible. The hole was abandoned at that time.

Using recently acquired hydrographic data, the sonic depth of 2545 fms was corrected to 4765 meters giving a water depth of 4771 meters and a drill-floor depth of 4781 meters. This compares with 4821 meters below drill floor based upon the "feel" of the drill string by the driller and some sediment recovery in the first core. The 4821 meters below drill floor, or 4811 meters below sea level, is the accepted depth for this site.

No particular drilling difficulties are to be noted. The last core was not recovered by sand line but was left in the drill string while it was being recovered under emergency conditions. Only a core catcher sample was recovered on Core 4. Presumably most of the core was washed out during pulling of the drill string. A coring summary is given in Table 1.

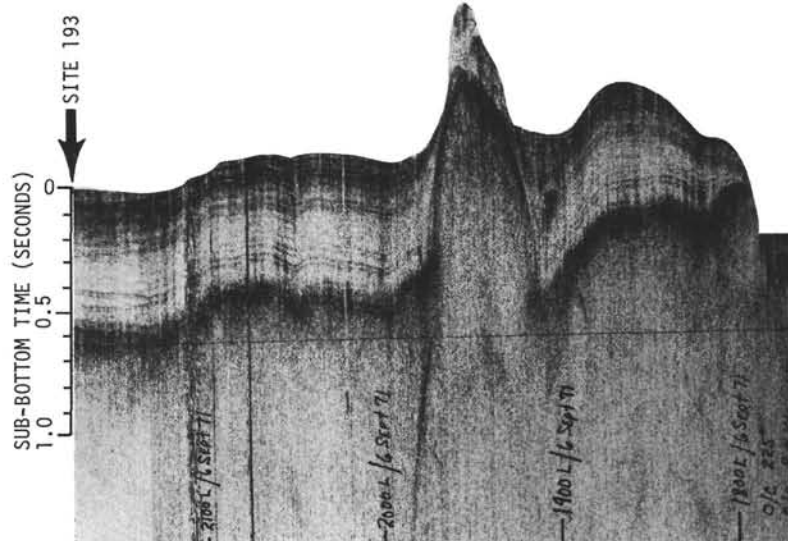
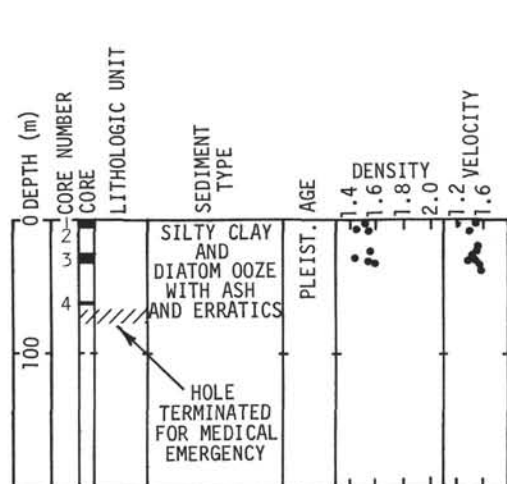


Figure 2. Glomar Challenger air-gun profile obtained on approach to Site 193.

LITHOSTRATIGRAPHY

Summary

The Pleistocene sediment cored at Site 193 is a vitric ash-bearing diatomaceous silty clay to clayey diatom ooze, gray to olive gray in color. The upper part of the 71-meter section appears to be richer in diatoms as well as in ash layers, presumably derived from Kuril volcanism.

Description

Cores 1 and 2 (0 to 11 m below bottom) consist of glass-bearing (vitric ash) diatomaceous silty clays and clayey diatom oozes, dark gray in color. Compositional ranges are: diatoms, 30-60%; silt (mostly feldspar), 10-25%; clay, 15-50%; and glass, 2-10%. Pebbles of sedimentary rock (glacial erratics) and clay balls are common. Layers of dark vitric ash are present, as is a single layer of crystal ash.

Cores 3 and 4 (25 to 71 m below bottom) are diatom and glass-rich silty clays, olive gray in color. Core 3 contains only small scattered pods of vitric ash and a single erratic. The core catcher of Core 4 (the only recovery) contains several erratics and many clay balls.

Comments

1. The entire section is high in volcanic glass and terrigenous silt content, probably pyroclastic and terrigenous debris supplied by the Japanese and Kuril islands.

2. Although we have only spotty recovery, discrete ash units may be more numerous in the upper part of the section.

3. Hays and Ninkovich (1970) state that Northwest Pacific ashes, from Kamchatka and the Kuril Islands, are light in color and composed of colorless shards, while the Aleutians supply both dark and light-colored ashes to the Northeast Pacific. The ashes at Site 193 are dark in color as they appear in the core, but the shards themselves are colorless. The color of the ash as seen in the core is due to contained opaques plus the fact that the shards are being altered to clay.

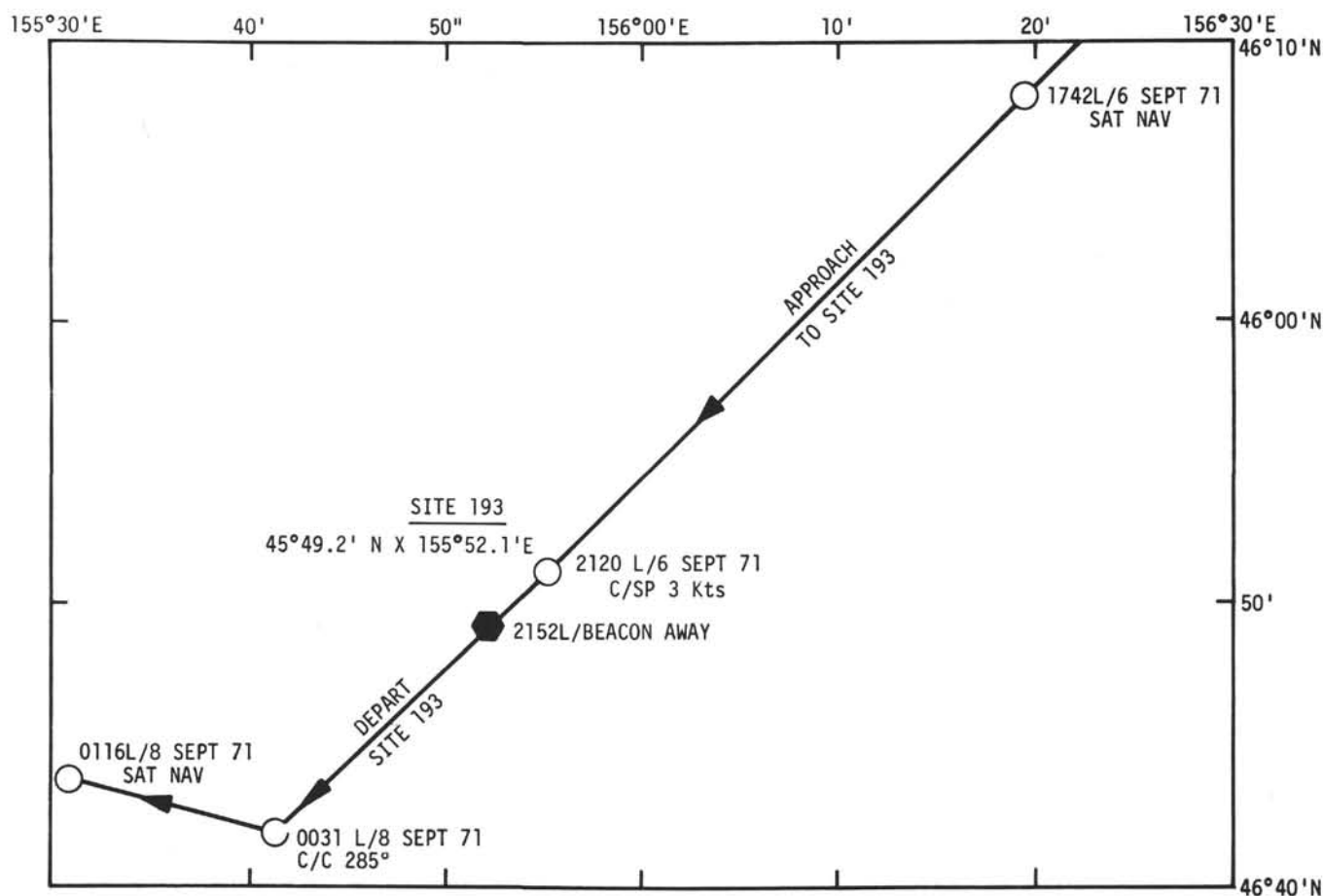


Figure 3. Track chart of Glomar Challenger in the vicinity of Site 193.

TABLE 1
Coring Summary – Site 193

Core	Cored Interval Below Bottom (m)	Cored (m)	Recovered	
			(m)	(%)
1	0-2	2	2.0	100.0
2	2-11	9	3.0	33.3
Wash 3	25-34	9	7.3	81.1
Wash 4	62-71	9	CC	0.0
		29	12.3	42.4

4. Cores 1 and 2 are richer in diatoms than are Cores 3 and 4. The overall low rate of Pleistocene sedimentation at Site 193 indicates this may be due more to a fluctuation in diatom productivity than to a change in rate of supply of terrigenous components.

PHYSICAL PROPERTIES

Bulk density (by the shore laboratory and GRAPE methods), water content, natural gamma radiation, acoustic velocity, vane shear strength, and residual negative pore water pressure were measured on samples obtained at Site 193. GRAPE densities are given on the core summary

sheets. Mean GRAPE densities (averaged over each section), shore laboratory densities, and measured acoustic velocities are given on the site summary sheet.

The samples from Site 193 were quite disturbed. It was apparent that the sediment was mixed during sampling.

Bulk Density

The mean GRAPE densities increase from about 1.42 to 1.48 g/cm³ over the depth range investigated. This is moderately high in comparison with other sites of this leg and somewhat unusual in that the rate of increase over the first 10 meters is not especially high.

Acoustic Velocity

The measured acoustic velocity ranged between 1.47 and 1.56 km/sec with a slight tendency toward increasing velocity with depth. The changes in velocity appear to reflect approximately the changes in measured density.

Summary

The physical property measurements at Site 193 indicate clayey sediment with strength and density which are moderately high for shallow Leg 19 sediment depths. There are no significant breaks in the physical property data trends over the depth range investigated.

PALEONTOLOGY

Site 193 is located west of the Hokkaido Rise. Although no previous subbottom record was available, the site was selected to collect a biostratigraphic section. Site location was based on a shipboard reflection profile. From micropaleontologists' point of view, it was hoped that the sediments would yield a representative assemblage from the southernmost latitude of the present leg so that stratigraphic records of microfauna and flora in Japan and California could be related directly with those of the high-latitude region so far observed. Unfortunately, a medical emergency prevented collecting samples below Core 4, thus only a Pleistocene section was recovered.

Diatoms still constitute the chief biogenic elements, and radiolarians are more abundant in Cores 1 and 2 than in samples of previous sites, but decrease sharply in Cores 3 and 4. Rare fragments of arenaceous foraminifera are found. Silicoflagellates were recovered from Core 1 only, while calcareous nannofossils were completely absent.

Occurrences of temperate-water species of diatoms and Radiolaria are noted from samples at this site.

Radiolaria and Silicoflagellates

Examination of silty clay sediments from Site 193 reveals that both species and specimens of Radiolaria were more abundant in Cores 1 and 2 than any previous sites of the leg. *Stylochlamygdium venustum*, a most common form in Bering Sea sediments, is absent in core catcher samples (Table 12, Chapter 28). Specimens of *Saturnalis circularis* were observed in Cores 3 and 4. Based on observations made on sediments from the eastern and central North Pacific, the northern limit of its biogeographic occurrence (in surface sediments) generally corresponds to the

subarctic boundary of the surface water mass. Of the biostratigraphically significant Pleistocene species (Hays, 1970), *Eucyrtidium tumidulum* was recovered, but *Stylocyrtidium acqilonium* and *Axoprunum angelinum* were not found.

Only Core 1 contains silicoflagellates from this site (Table 12, Chapter 27). Occurrence of "*Mesocena diodon*" and *Dictyocha mutabilis*, typical Miocene forms, indicates that they were reworked from a possible nearby source. At present late Miocene silicoflagellates from Hokkaido are being investigated by Japanese scientists (Ling, personal communication, 1971).

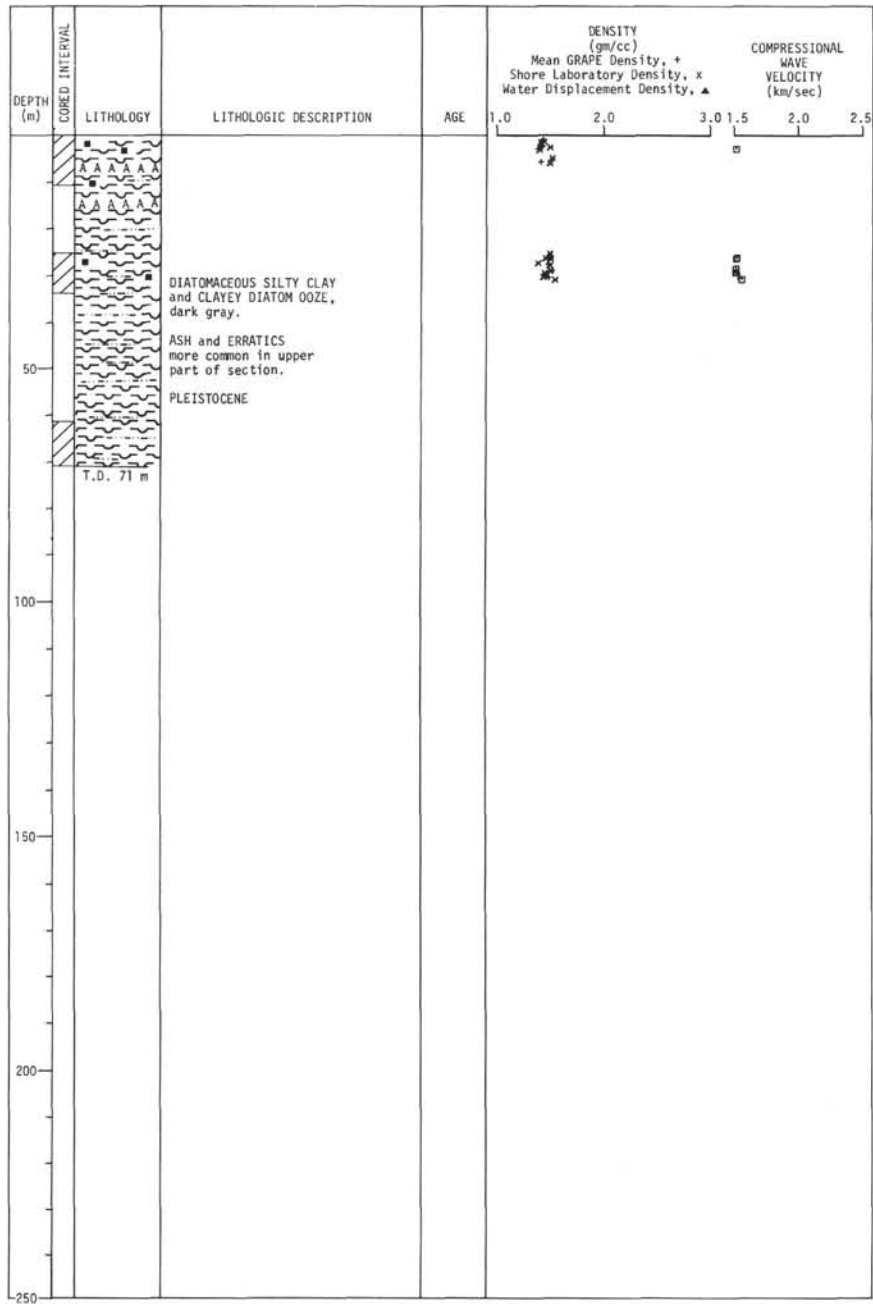
Diatoms

Diatoms were studied from four samples at this site; they are Pleistocene in age. Species composition of the marine planktonic assemblage is similar to that of other sites in this leg and belongs to the subarctic assemblage; however, the occurrence of the following temperate species was noted in Core 1: *Hemidiscus cuneiformis* and *Nitzschia reinholdis*.

REFERENCES

- Hays, J. D., 1970. The stratigraphy and evolutionary trends of Radiolaria in North Pacific deep-sea sediment. In Hays, J. D. (Ed.), Geological Investigations of the North Pacific, Geol. Soc. Am. Mem. 126, 185.
- Hays, J. D. and Ninkovich, D., 1970. North Pacific deep-sea ash chronology and age of present Aleutian underthrusting. In Hays, J. D. (Ed.) Geological Investigations of the North Pacific. Geol. Soc. Am. Mem. 126, 263.

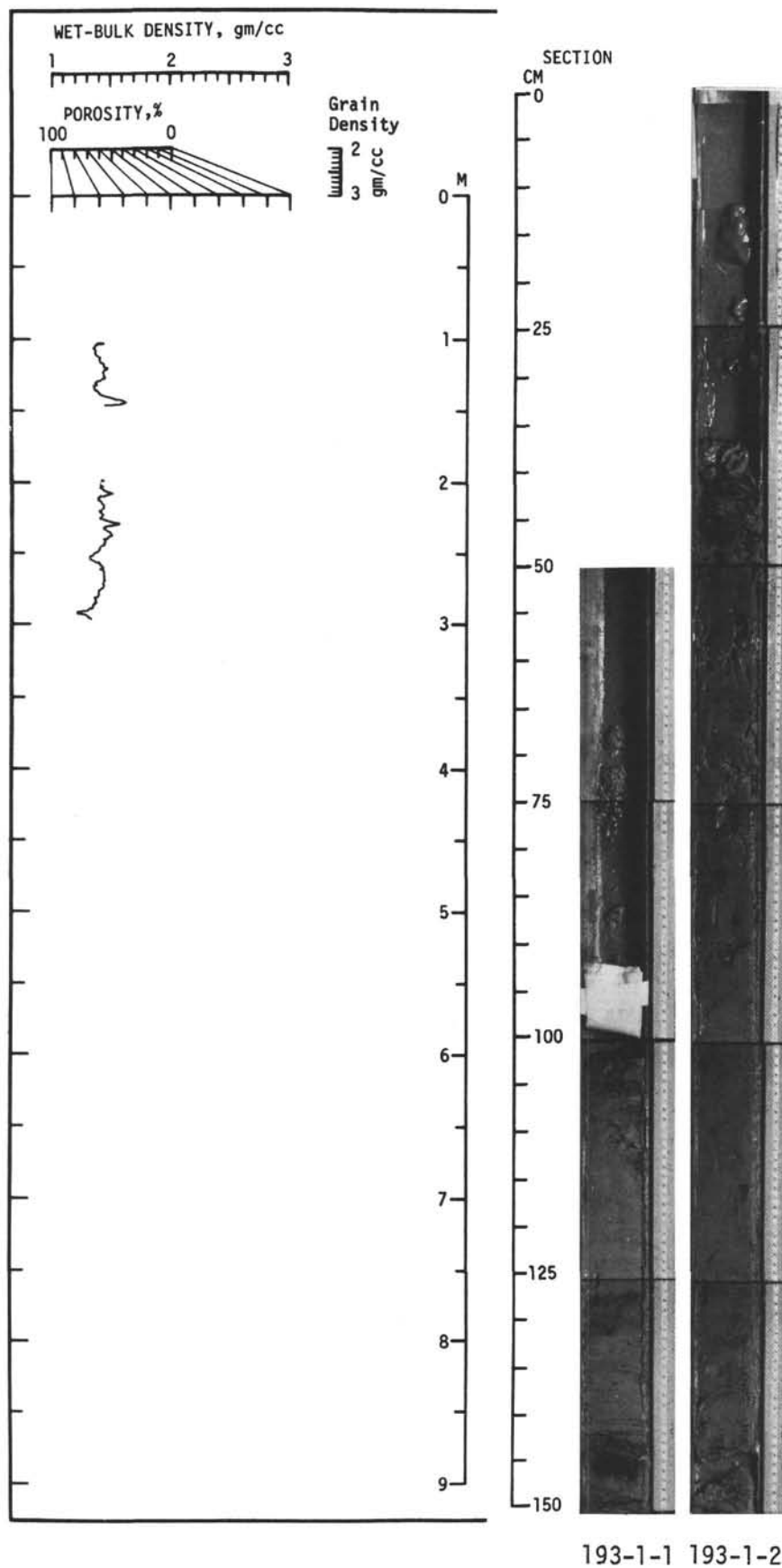
SITE 193



Site 193 Hole Core 1 Cored Interval: 0-2

AGE	ZONE	FOSSIL CHARACTER			SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
		FOSSIL	ABUND.	PRES.						
UPPER PLEISTOCENE	(D) <i>Denticula seminae</i> (S) <i>Distephanus octangulatus</i>	D R S	C F R	G M M	1	0.5 1.0	VOID	 		

Explanatory notes in Chapter 1



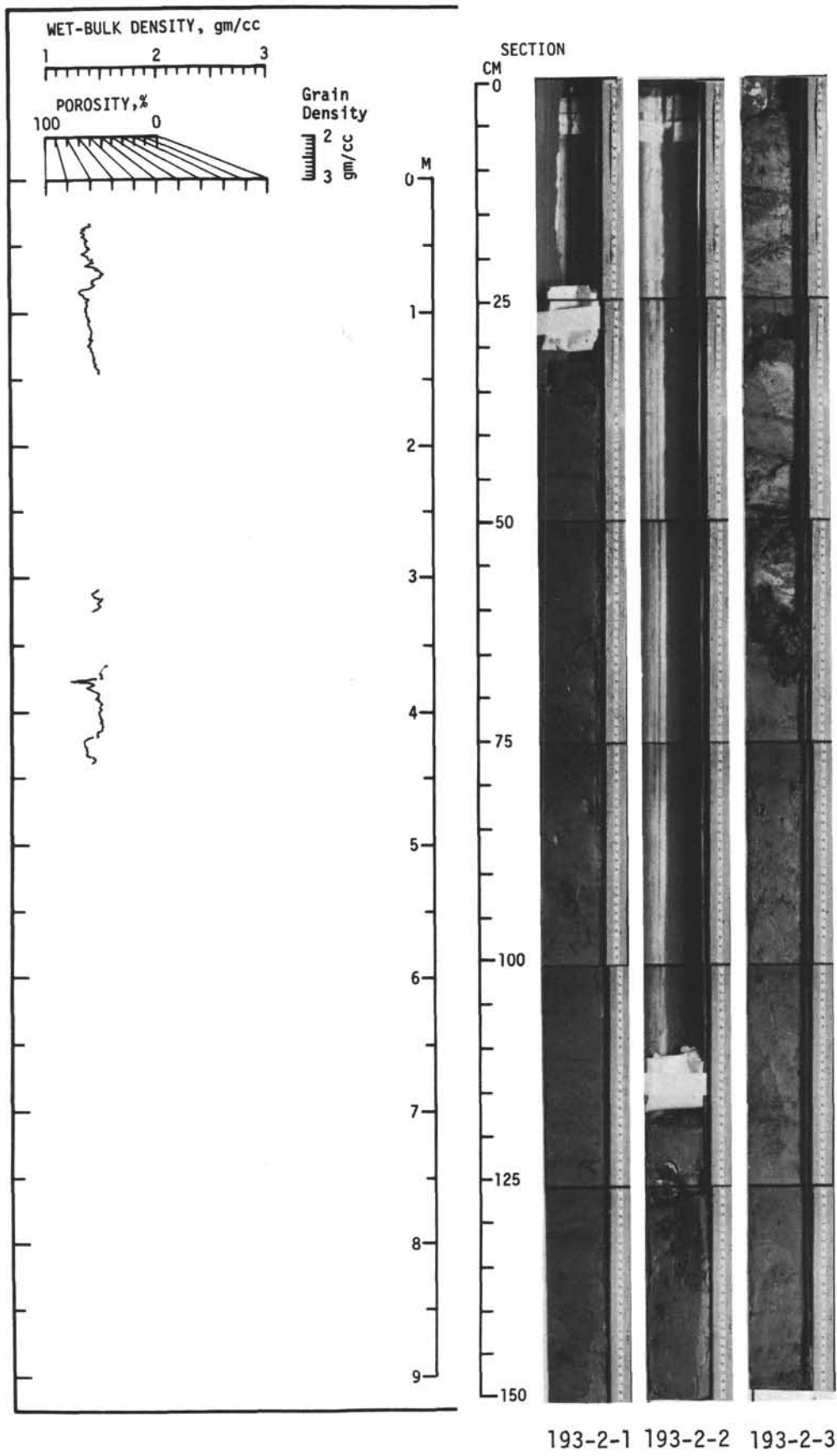
Site 193 Hole Core 2 Cored Interval: 2-11

AGE	ZONE	FOSSIL CHARACTER			SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
		FOSSIL	ABUND.	PRES.						
MIDDLE PLEISTOCENE	(D) <i>Rhizosolenia curvirostris</i> (S) <i>Distephanus octonarius</i>	D R S	C R R	G M M	1	0.5 1.0	VOID		38	VITRIC ASH olive gray (5Y 5/2)
									86 110	GLASS BEARING SILT and CLAY RICH DIATOM OOZE dark gray (5Y 4/1) Slides 1-86 and 1-110 60% diatoms 15% feldspar, qtz 15% clay 10% glass
		R S	F R	M M	2		VOID			
					3				130 131 145	GLASS BEARING DIATOM RICH SILTY CLAY dark gray (5Y 4/1) 10% diatoms, 5-10% glass, 30% silt, 50% clay sec. 2, 129-138 cm, disturbed pod of VITRIC ASH, olive gray (5Y 3/2)
					Core Catcher				67 130	SILT BEARING CLAYEY DIATOM OOZE dark gray (5Y 4/1) Slide 3-130 60% diatoms 10% feldspar, quartz 30% clay 1% pyrite

Core Catcher:

D	F	G
F	-	-
N	-	-
R	R	M
S	-	-

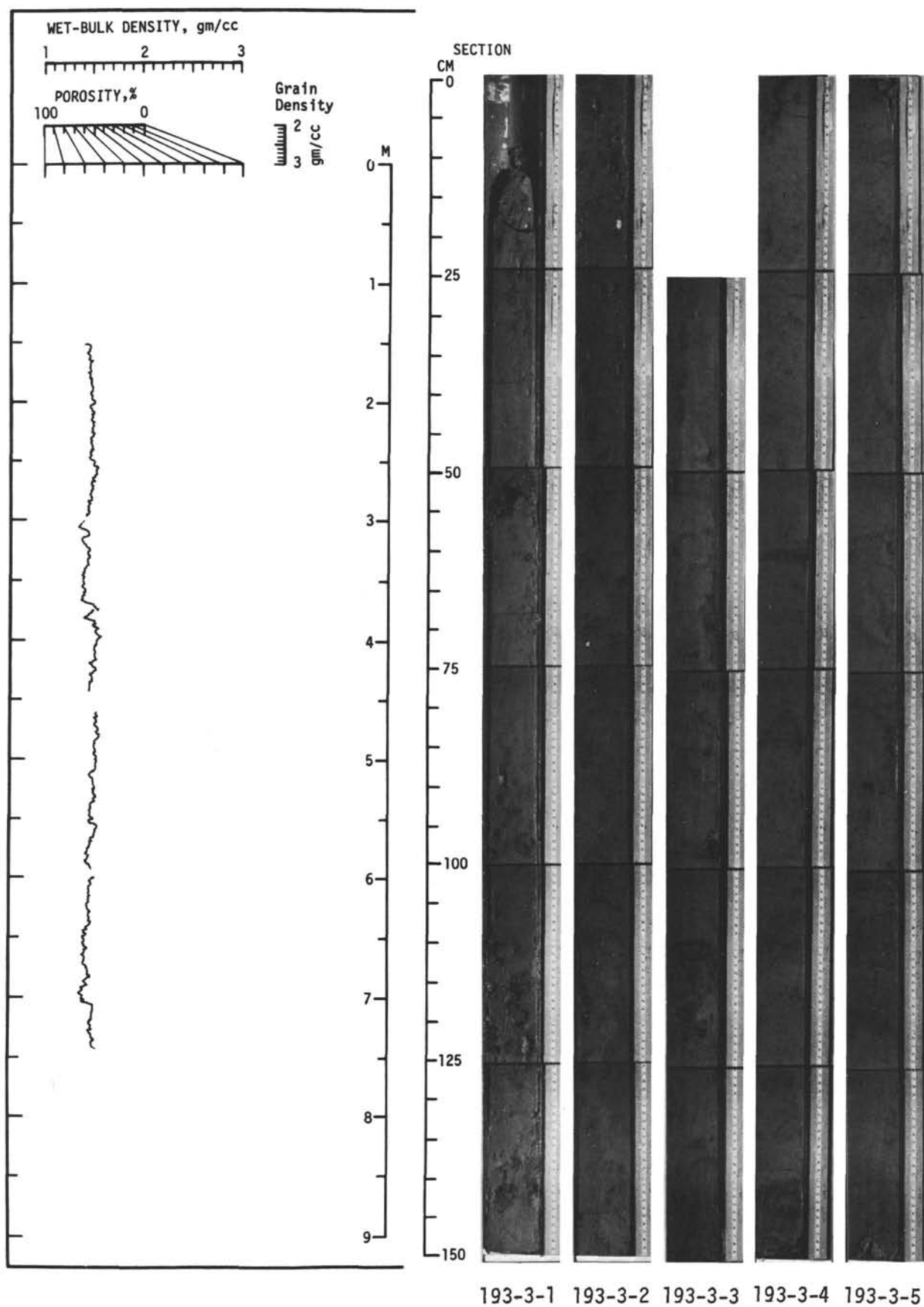
Explanatory notes in Chapter 1



Site 193 Hole Core 3 Cored Interval: 25-34

AGE	ZONE	FOSSIL CHARACTER			SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
		FOSSIL	ABUND.	PRES.						
MIDDLE PLEISTOCENE	(D) <i>Rhizosolenia curvirostris</i>	D R S	C R -	G M -	1	0.5 1.0			56 80	<p>Basic lithology Intermixed zones of: SILT RICH CLAY SILTY CLAY, CLAYEY SILT and DIATOMACEOUS SILTY CLAY olive gray (5Y 4/1 - 5/1) - lighter colored areas are more diatomaceous</p> <p>scattered pods of VITRIC ASH light brownish gray (5YR 6/1)</p> <p>scattered compact clay balls dark greenish gray (5GY 3/1)</p> <p>erratic pebble</p> <p>Slides 1-56 (clay ball) 1-80 20% silt 30% silt 80% clay 70% clay</p> <p>3-40 5-110 30% diatoms 25% silt 30% silt 75% clay 40% clay</p> <p>Core Catcher: D F G F - - N - - R R M S - -</p>
					2					
		D R S	C R -	M M -	3				40 50	
					4					
					5					
					Core Catcher				-110	

Explanatory notes in Chapter 1



SITE 193

Site 193 Hole Core 4 Cored Interval: 67-71

AGE	ZONE	FOSSIL CHARACTER			SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
		FOSSIL	ABUND.	PRES.						
*	*				Core Catcher					DIATOM, SILT and GLASS RICH CLAY olive gray (5Y 5/2) <div> 10% diatoms 15% silt (~5% feldspar) 15% glass 60% clay </div> numerous sedimentary rock erratics and compact clay balls

Core Catcher:

D	F	G
F	-	-
N	-	-
R	R	M
S	-	-

Explanatory notes in Chapter 1

* LOWER PLEISTOCENE

*(D) Actinocyclus oculatus