2. SITE 135

The Shipboard Scientific Party[1]

ABSTRACT

Site 135 lies about 35 km southeast of the southern edge of the Horseshoe Abyssal Plain on a topographic high 750 meters above the abyssal plain. The top unit, 325 meters thick, is comprised of nannoplankton chalk ooze of Pleistocene, Pliocene, and Miocene ages. Below this, there are 364 meters of mostly terrigenous sediments with some silicified intervals and marl or limestone at the base which range in age from Early Eocene to Early Aptian. It is not possible to reasonably estimate the thickness of individual lithologic units within this lower interval.

A prominent reflecting horizon at ~0.4 second can be traced from beneath the abyssal plain on to the topographic high. In the drilled section this corresponds to a major unconformity which marks the abrupt change from terrigenous to pelagic sedimentation that occurred following post-early Eocene and pre-late Oligocene uplift and faulting.

An estimated 350+ meters of sediment are present between the lowest sample obtained and oceanic basement.

SITE DATA

Time: 0053 October 10, 1970
0146 October 14, 1970

Position: 35° 20.80′N
10° 25.46′W

Water Depth: 13,621 feet
2,270 nominal fathoms
4,152 meters

Total Penetration: 689 meters

Cores Taken: Nine cores and two sidewall samples in Hole 135; one core (no recovery) in Hole 135A.

BACKGROUND AND OPERATIONS

Because there was no detailed survey data available, the *Glomar Challenger* approached the site from the north-northwest along the existing *Jean Charcot* track (see Figure 1). Seismic reflection profiles from the *Jean Charcot* (Figure 2) provided the primary control for site selection.

The initial objectives at Site 135 were threefold: (1) to sample the Tertiary biostratigraphic sequence for comparison with European type-sections; (2) to date the major intermediate reflecting horizon at about 400 meters subbottom; and (3) to sample the basement (at a subbottom depth of ~1000 m) and the sediments immediately overlying it in order to date the oceanic crust near the eastern North Atlantic margin.

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The site lies about 35 km southeast of the Horseshoe Abyssal Plain on a topographic high about 750 meters (400 fm) above the abyssal plain, and south of the eastward extension of the seismically active Azores–Gibraltar Fracture Zone (see Figure 1 and map at the back of this volume).

Acoustic basement reaches a minimum depth of burial of about 1000 m near this location (see Figures 2 and 3). A widespread reflecting horizon, generally conformable with the sea floor, is offset by high angle faults and interrupted by piercement structures. The piercement structures have been interpreted as salt diapirs (Pautot *et al.*, 1970).

Site 120 of Leg 13 (DSDP) was located about 170 km northwest of Site 135, on the north slope of Gorringe Bank and north of the Azores–Gibraltar fracture zone (see Figure 1). Two major unconformities, one between Pleistocene and Miocene and the other between Miocene and Cretaceous, have been inferred at Site 120 by the scientific staff Leg 13 (Ryan and Hsu *et al.*, 1972).

Seismic Reflection Data:	*Jean Charcot*	*Glomar Challenger*
First Reflector	0.40 sec	0.38 sec
Second Reflector	0.75 sec	0.71 sec
Basement Reflector	1.03 sec	0.85 sec (not clearly recorded)

A summary of the drilling and coring record at Hole 135 is given in Table 1 and Figure 4. Changes in drilling rates agree well with the lithostratigraphy as deduced from cored intervals (Figure 4).

Drilling was terminated at a total depth of 689 meters subbottom before acoustic basement was reached. The exact depth to basement, while unknown, is estimated to be over 1000 meters judging from the *Jean Charcot* records and sonic velocity measurements on core samples.

Two sidewall samples were taken to supplement the previously cored intervals. Although partial samples were

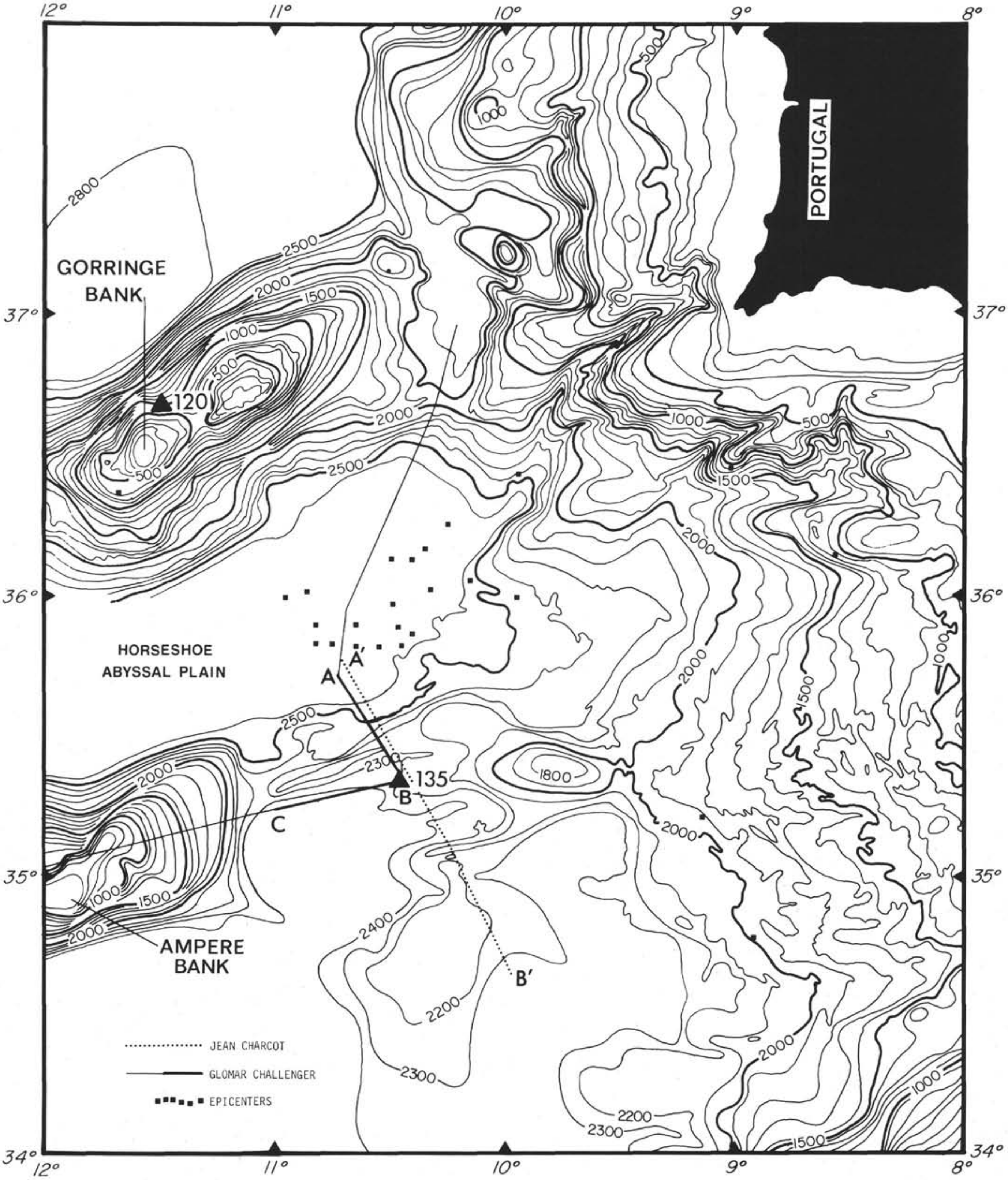

Figure 1. *Location map for Site 135. Contours are in nominal fathoms from unpublished maps of A. S. Laughton (pers. comm.). Letters key profiles in Figure 2. Site 120 was drilled on Leg 13, Deep Sea Drilling Project.*

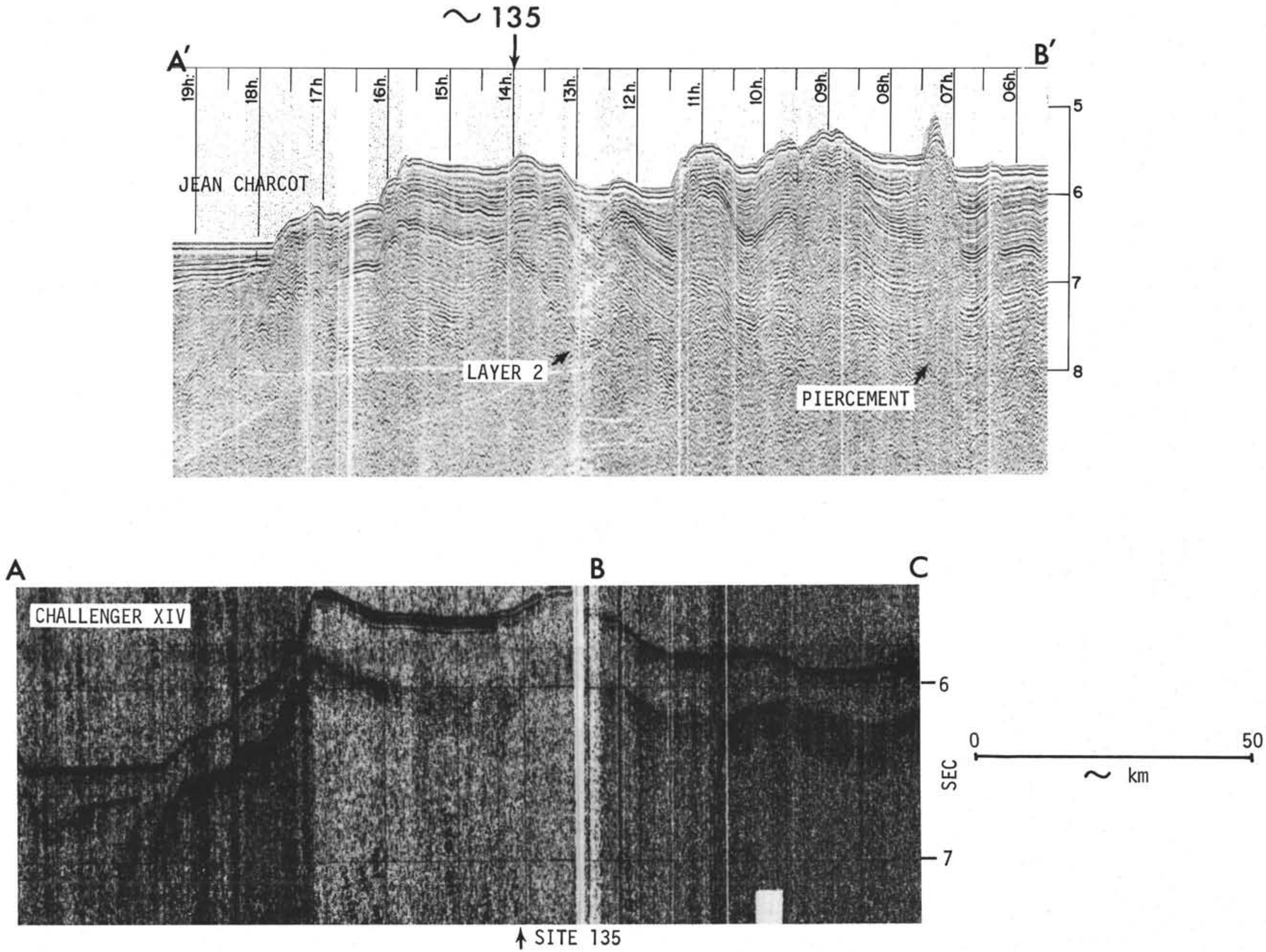

Figure 2. *Seismic profiles in vicinity of Site 135. Location of profiles is shown on Figure 1.* Jean Charcot *seismic record (vertical exaggeration is 20:1) is from X. LePichon* et al., *1970.*

TABLE 1
Drilling and Coring Record for Site 135

Description	Interval Below Sea Floor (m)	Core Recovery (m)	Drilling Rate (m/min)
Core 1	0-4	4.0	
Drill	4-8		0.7
	8-27		2.0
	27-46		1.6
	46-65		0.9
	65-80		2.5
Core 2	80-89	8.5	
Drill	89-104		1.9
	104-123		2.0
	123-132		2.25
	132-151		1.5
	151-161		1.7
	161-173		1.2
Core 3	173-182	2.5	
Drill	182-199		1.4
	199-209		1.7
	209-228		1.9
	228-237		2.25
	237-259		3.7
Core 4	259-268	2.1	
Drill	268-285		0.5
	285-294		0.45
	294-313		0.5
	313-323		0.7
	323-335		0.5
Core 5	335-341	0.7	
Core 6	341-350	0.1	
Drill	350-352		0.5
	352-361		1.5
	361-370		1.5
	370-379		1.1
	379-389		0.8
	389-399		1.7
	399-418		1.2
	418-431		1.1
Core 7	431-435	3.8	
Drill	435-437		0.3
	437-457		0.5
	457-476		0.5
	476-485		0.45
	485-495		0.5
	495-514		0.6
	514-524		0.5
	524-543		0.6
	543-552		0.7
	552-564		1.0
Core 8	564-569	1.0	
Drill	569-571		0.2
	571-580		0.4
	580-589		0.45
	589-599		0.6
	599-617		0.4
	617-627		0.6
	627-646		0.3
	646-656		0.2
	656-676		0.2
	676-685		0.3
Core 9	685-689	1.8	
	Water Depth 4,152 meters		

obtained, minor difficulties were encountered in recovering the corer. These problems were attributed to the failure of the sampler to open fully after passing through the drill bit.

BIOSTRATIGRAPHY

General

Four widely spaced cores (1-4) indicate that the Quaternary to Late Oligocene section, in the upper 325 meters of this hole, consists of deep-water pelagic sediments with strong evidence of calcium-carbonate solution, particularly in the Miocene section. Within Core 2 there is a minor faunal break which may correspond to the Miocene/Pliocene boundary. Below a possible hiatus at about 330 meters and down to total depth of 689 meters, the rocks are mostly clayey sand, with generally poorly preserved micro-fossils. These fossils indicate an Eocene to Cretaceous age but give little precise data on the sedimentary history during this time. It is possible that the relatively rich Upper Cretaceous fossil assemblages of Core 7 and those obtained from a center bit sample near Core 9 were redeposited in Eocene time. The deepest samples at this Site (Core 9) contain a nannoflora of Early Aptian age. A poor sporomorph flora and microplankton of Late Cretaceous age (Senonian or younger) occurs in Core 7. Sporomorphs and microplankton from Core 9 are of Valanginian to Aptian age.

The age-diagnostic fossils from each core are shown in Table 2.

Foraminifera

Cores 1 to 4 contain normal pelagic deep-sea faunas consisting predominantly of planktonic foraminifera. Solution effects are visible throughout but are strongest in Cores 3 and 4. Below Core 4, there is little conclusive information that can be drawn from the foraminifera except that some (if not all) of the Eocene and Late Cretaceous faunas are probably transported and re-deposited. Core 5 contains a single specimen of a (Eocene?) nummulite. Another specimen of *Nummulites*? was found associated with the relatively rich *Globotruncana* assemblage of Core 7. Similarly, the large center bit sample recovered near Core 9 contained, apart from Late Cretaceous Orbitoids, a few specimens *(Nummulites?, Operculina, Amphistegina)* which are probably of Eocene age. These larger foraminifera were derived from a shallow-water environment since they are not normally found in pelagic sediments.

Nannoplankton

Rich and diversified assemblages of calcareous nannoplankton of Pleistocene to Late Miocene age were found in the uppermost 3 cores. Core 4 contains a fairly strongly etched Middle Miocene nannoflora. The two sidewall cores yielded fairly poorly preserved Upper Oligocene to Lower Miocene nannoplankton. Only the most solution resistant ortholiths were preserved in the Early Eocene of Core 5. The Campanian to Maestrichtian nannoplankton in Core 7 lack distinctive markers. Core 8 is barren of nannofossils. Core 9 contains a rich and well-preserved nannoflora of Early Aptian age.

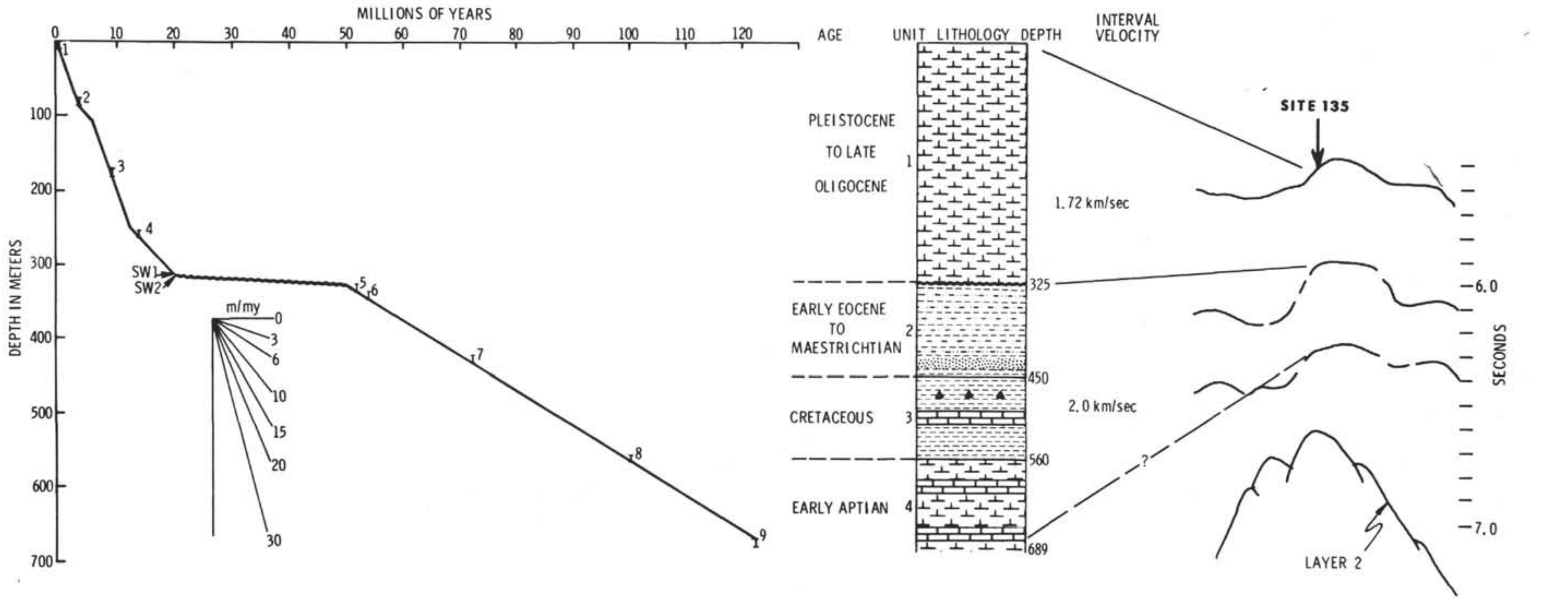

Figure 3. *Geological synthesis at Site 135.*

TABLE 2

CORE	DIAGNOSTIC FOSSILS HOLE 135		
	FORAMINIFERA	NANNOPLANKTON	AGE
1	Rich, predominantly planktonic faunas of Quaternary age (*Globorotalia truncatulinoides* Zone). The predominant species are: *Globorotalia truncatulinoides*, *Gr. inflata*, *Gr. pseudopima* and *Globigerinoides ruber*.	Rich assemblage with *Gephyrocapsa oceanica*, *Coccolithus pelagicus* Preservation: G to E1-01 Zone: *Gephyrocapsa oceanica* Age: Late Pleistocene	Pleisto-cene
2	Rich, predominantly planktonic faunas. Sections 1 to 5 belong to the *Globorotalia margaritae* Zone (Early Pliocene) and contain *Globorotalia margaritae* (small), *Gr. crassaformis* s.l., *Gr. acostaensis* (dextrally coiled), *Sphaeroidinellopsis seminulina* and *Globigerinoides obliquus*. The bottom part of the Core (without *Globorotalia margaritae*) contains *Globorotalia miocea* and may already be Late Miocene in age.	Sections 1-5: Diversified nannoflora with *Ceratolithus rugosus*, *Ceratolithus tricorniculatus*, *Reticulofenestra pseudoumbilica*, *Discoaster brouweri*, *D. surculus*, *D. pentaradiatus* Preservation: E1-01 Zone: *Ceratolithus rugosus* Age: Early Pliocene	Early Pliocene
3	Planktonic and benthonic foraminifera are fairly common. They indicate a Late Miocene age (probably *Globorotalia acostaensis* Zone). Typical species are *Globorotalia acostaensis*, *Gr. cultrata*, *Globoquadrina dehiscens*, *Globigerina nepenthes*, and *Globigerinoides obliquus*. Rather strong solution effects.	Rich and well-preserved nannoplankton with *Discoaster neohamatus*, *D. calcaris*, *D. variabilis*, *Reticulofenestra pseudoumbilica* Preservation: E1-01 Zone: *Discoaster neohamatus* Age: Late Miocene	Late Miocene
4	Fairly rich faunas, but distinctly affected by calcium carbonate solution. An early Middle Miocene age (*Globorotalia fohsi peripheroronda* Zone) is indicated by the presence of *Gr. f. peripheroronda* (with subacute periphery), together with *Gr. archaeomenardii*, *Sphaeroidinellopsis seminulina* and *Globoquadrina dehiscens*.	Abundant but poorly preserved nannofossils. *Discoaster exilis*, *D. deflandrei*, *D. divaricatus*, *Sphenolithus heteromorphus* Preservation: E1-02 Zone: *Sphenolithus heteromorphus* Age: Middle Miocene	Middle Miocene
SW1	A poor fauna with *Globigerina venezuelana* and *Catapsydrax?* sp. Strong downhole contamination from the Pliocene and Quaternary.	Strongly etched nannoflora with *Triquetrorhabdulus carinatus* and *Reticulofenestra abisecta* Preservation: E3-01 Zone: *Triquetrorhabdulus carinatus* Age: Early Miocene	Early Miocene
SW2	A poor, badly contaminated sample. An Early Miocene or possibly Oligocene age is indicated by *Catapsydrax dissimilis* together with *Globigerina cf. ciperoensis angustiumbilicata*, *G. venezuelana*, and *Globorotalia opima nana*.	Same assemblage as in SW 1 plus *Reticulofenestra bisecta*, rare *Sphenolithus belemnos* (small specimen) Zone: *Triquetrorhabdulus carinatus* Age: Late Oligocene	Late Oligocene
5	No foraminifera except a badly preserved small *Nummulites* (?) sp.	Core catcher: Assemblage consisting of solution resistant species only. *Marthasterites tribrachiatus*, *M. contortus*, *D. lodoensis* Zone: *Marthasterites tribrachiatus* Age: Early Eocene	Early Eocene
6	None	None	

TABLE 2 – *Continued*

CORE	DIAGNOSTIC FOSSILS HOLE 135		
	FORAMINIFERA	NANNOPLANKTON	AGE
7	The richest faunas seem to occur in the sandy layers. Typical species are *Globotruncana stuartiformis, Gt. stuarti, Gt. contusa Ft. caliciformis, Heterohelix ultimatumida, Pseudoguembelina excolata, and Gyroidina florealis.* They are of Late Cretaceous (Maestrichtian) age. A single specimen of *Nummulites?* sp. was found in Sec. 2, indicating that the Cretaceous faunas were possibly re-deposited in Eocene? time. (Similar, slightly heterogeneous faunas, but with Cretaceous orbitoids, were found in a center bit sample in this hole).	Poor assemblages with *Watznaueria barnesae, Arkhangelskiella cymbiformis, Micula staurophora, Tetralithus obscurus, Eiffellithus turriseiffeli, Microrhabdulus decoratus, Broinsonia bevieri.* Age: Campanian to Maestrichtian	Maestrich-tian
8	None	None	
9	None	Rich and well-preserved nannoflora including *Nannoconus colomi, Corollithion ellipticum, Eiffellithus trabeculatus, Corollithion achylosum, Cruciellipsis cuvillieri, Micrantholithus obtusus, Cretarhabdus coronadventis, Nannoconus bucheri, Micrantholithus hoschulzi, Diazomatholithus lehmani, Nannoconus steinmanni, Cyclagelosphaera margareli.* Age: Early Aptian	Early Aptian

Organic Microfossils

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Core 7, Section 2, 138-140 cm:

A poor sporomorph flora containing many Angiospermous pollen types such as: *Subtriporopollenites anulatus, Multiporopollenites aff. maculosus,* and several small tricolporate and triporate forms, together with *Classopollis classoides, C. echinatus, Ephedripites sp., Trilobosporites cf. obsitus, Cicatricosisporites sp.,* and *Lygodioisporites perverrucatus.*
Age: Late Cretaceous.

Microplankton scarce and mainly indeterminate; the presence of *Aeroligera* sp. indicates "Senonian or younger."

Core 8, Section 1, 106-110 cm:

No sporomorphs were recovered and only a few indeterminate microplankton fragments.

Core 9, Section 1, 147-149 cm:

A sporomorph flora containing: *Appendicisporites* sp., *Classopollis echinatus, cf. Patellasporites distaverrucosus, Tsugaepollenites mesozoicus, Ephedripites spp., Zonalapollenites dampieri, Parvisaccites radiatus, Araucariacites australis, Eucommiidites troedsonii, Spheripollenites scabratus, Cicatricosisporites dorogensis, Leptolepidites cf. psarosus,* and *Cicatricosisporites cf. cooksonae.*
Age: Hauterivian–Aptian.

Microplankton scarce, with *Canningia hirtella, Hystrichosphaeridium asterigerum,* and *Microdinium sp.*
Age: Early Cretaceous, probably Valanginium–Barremian to possibly Aptian.

Core 9, Section 2, 26-28 cm, and 89-91 cm:

A rich sporomorph flora with abundant *Classopollis classoides, Ephedripites sp.,* common *Cicatricosisporites sp., Circulina sp., Ephedripites spiralis, Eucommiidites troedsonii* and rare *Zonalapollenites dampieri, Clavatipollenites hughesii, Sofrepites cf. legouxae, Araucariacites australis, Caytonipollenites pallidus, Trilites sp.,* (Jardiné & Magloire 1963, type S.CI.128), *Verrutriletes sp., Appendicisporites tricornitatus, Klukisporites cf. variegatus, Spheripollenites scabratus, Syncolporites sp.* and *cf. Monocolpopollenites spheroidites.*
Age: Barremian-Aptian.

Some microplankton with *Hystrichosphaeridium asterigerum, Pseudoceratium pelliferum, Canningia hirtella, Pareodinia ceratophora, Microdinium deflandrei* and *Dingodinium cerviculum.*
Age: Early Cretaceous, probably Valanginium–Barremian to possibly Aptian.

Core 9, Section 2, 146-148 cm:

A poor sporomorph flora containing *Classopollis echinatus, Cicatricosisporites cf. cooksonae, C. dorogensis, C. cf. mohrioides, Eucommiidites troedsonii, Araucariacites*

[2]Koninklijke/Shell Exploratie en Produktie Laboratorium, The Hague

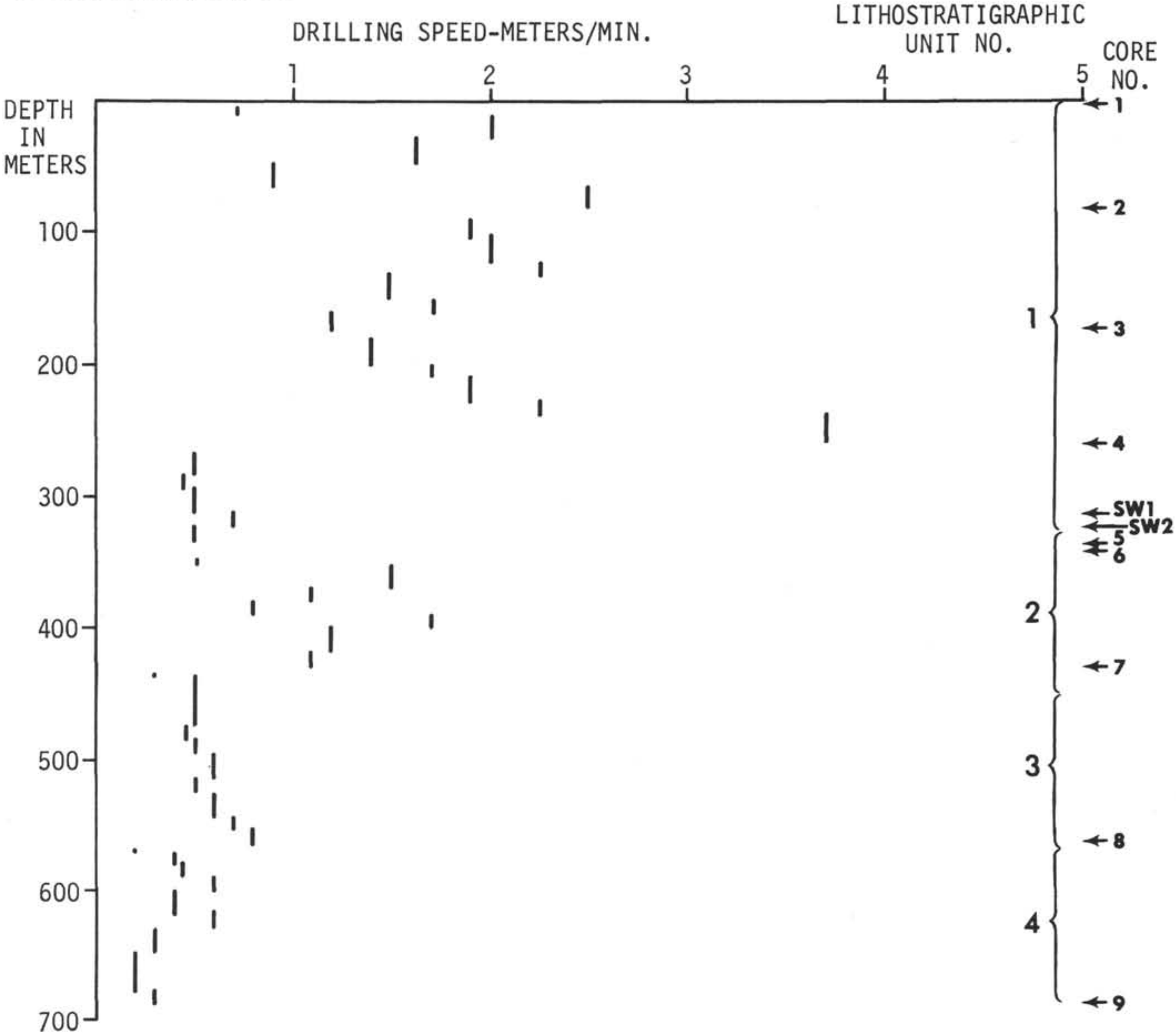

Figure 4. *Drilling and coring summary at Site 135.*

australis, Spheripollenites scabratus, Ephedripites spp., cf. Patellasporites distaverrucosus, Appendicisporites tricornitatus and *Tsugaepollenites mesozoicus.*
Age: Hauterivian–Aptian.

Microplankton scarce, with *Microdinium deflandrei,* and *Hystrichosphaeridium asterigerum.*
Age: Early Cretaceous, probably Valanginium-Barremian to possibly Aptian.

LITHOSTRATIGRAPHY

At Site 135 one hole was drilled to a maximum depth of 689 meters below the sea floor; a second hole (135A) was drilled to about 59 meters, but no core was recovered.

Coring at intervals of approximately 80 meters enabled the following four lithostratigraphic units to be distinguished:

Unit	Cores	Lithology	Depth Below Sea Floor (m)	Age
1	1,2,3,4 SW 1&2	Light–gray nannofossil chalk ooze	0-325	Pleistocene to Late Oligocene
		HIATUS		
2	5,6,7	Olive gray to brown silty mud(stone), sand layers, brown clay	335-450	Early Eocene to Maestrichtian
3	8	Black and green shales with limestone and chert layers	450-560[a]	? Cretaceous
4	9	Nannofossil marl and limestone	560-689[a]	Early Aptian

[a]Unit thicknesses not well determined.

UNIT 1 – Light Gray Nannoplankton Chalk Ooze (Cores 1, 2, 3, 4), SW 1 and 2

This unit is about 325 meters thick and consists mainly of pelagic carbonates deposited since the Late Oligocene. The chalk ooze is largely calcareous nannoplankton, usually with less than 5 per cent planktonic foraminifera. The foraminifera show excellent preservation near the top of the unit but increasing signs of dissolution downward. In the marl near the base, preservation is very poor. Silt-size quartz occurs in traces; the amount is somewhat greater near both the top and base of the unit than elsewhere. Drilling rates usually varied between 1 and 2.5 m/min. Fast drilling near 250 meters suggests that sandy layers may be present. Below 270 meters, rates were reduced to about 0.5 m/min suggesting the presence of firm marls.

UNIT 2 – Olive Gray to Brown Mud (stone), Sand Layers and Brown Clay, Generally Quartz-rich (Cores 5, 6, 7)

This unit is between 115-235 meters thick (change in drilling rate suggests 120 m) and spans the time interval from Maestrichtian to Early Eocene.

Core recovery was poor except in Core 7. Terrigenous sediments low in carbonate (<25%), but carbonate-cemented in places, exhibit various size-grades, colors, and degrees of induration. Silty and clayey mud (stones), usually quartzose and with detrital calcareous grains, are the chief components of the unit. Sand layers (3-25 cm thick) visibly graded in part, contain quartz grains up to 0.3 mm in diameter. The sand layers commonly are alternating with pelagic brown clay. Arkosic sands with highly altered feldspar grains are present. Iron oxide coated quartz grains are also present.

Coarse sand (common size 1-2 mm) consisting mainly of quartz and cert but having small amounts of mica, pyrite, limestone and other lithic fragments (but little feldspar) was recovered from the center bit following recovery of Core 9. Benthonic foraminifera are of Cretaceous age. This sand apparently belongs to either unit 2 or unit 3 (most probably unit 2) since the greater drilling rate suggests that much sand was penetrated).

The brown clay of this unit consists of 50-75 per cent clay minerals and iron oxides, 10-35 per cent quartz, and 10-20 per cent carbonate (some of it dolomite rhombs; the rest detrital). Alternating fast (1.5 m/min) and slow (0.8 m/min) drilling may indicate sand-rich and clay-rich sections in the unit.

UNIT 3 – Black and Green Shale with Limestone and Chert Layers (Core 8)

The thickness of this unit is not known. Only 1 meter of core was recovered near the position where drilling slowed. The age is probably Late Cretaceous based on dates in Cores 7 and 9. The black shale and green siliceous mudstone contain only traces of carbonate; they are rich in zeolite and contain pyrite and 5-10 per cent terrigenous silt. A thin certy bed of silicified laminated silty mudstone contains silica (75%), quartz (29%), clay minerals, and opaque and organic materials. Recrystallized sponge spicules and radiolarians (?) were noted. A thin bed of non-fossiliferous recrystallized limestone consists of large (1-2 mm diameter) fibrous calcite spherulites separated by clay. Drilling rates vary between 0.4 and 1 m/min.

UNIT 4 – Olive Gray and Black Nannofossil Marl and Limestone (Core 9)

The thickness of this unit is unknown; 1.8 meters were recovered. The age is Early Cretaceous. The main facies is dark (sapropelitic ?) shale, laminated in part and rich in calcareous nannofossils; some pyrite and authigenic carbonate is also present. In places, thin silty layers containing much quartz are intercalated with the shale. A slightly quartzose limestone bed, partly micritic, partly sparry, and with 5 per cent nannofossils, was noted. The core catcher contained sand-size material consisting of much quartz and detrital carbonate.

PHYSICAL AND CHEMICAL PROPERTIES

A few sediments recovered from Site 135 were disturbed during coring so physical property measurements may be unreliable.

Penetrometer measurements (units of mm $\times$ 10^{-1}) on the chalk oozes showed a decrease from a mean value of 60 near the surface to a value of 30 at about 175 meters; below this values were relatively constant. The terrigenous sediments (Early Tertiary and Cretaceous) in the lower part of the hole show a wide range of values (5 to 85) due to variations in lithology, degree of induration, and disturbance.

The bulk density (gm/cc) increases from 1.57 near the surface to 1.87 near the bottom of the ooze at 325 meters. Below this level, the density values have a wide scatter with individual readings correlating reasonably well with the different lithologies. The normal range of bulk densities is 1.5 to 1.8; in the less consolidated sands 1.6 to 1.8, and in the indurated beds of silicified mudstone and sandy limestone 1.8 to 2.1. Porosity and water content showed an inverse correlation with bulk density, decreasing downward through the ooze, with scattered values for the terrigenous sediments.

The porosity values determined from the GRAPE are, in general, higher than those calculated from measurement of the water content; the density values obtained by the two methods are in good agreement (Table 3).

Variations in the natural gamma radiation of the samples correlates closely with changes in lithology. Counts from the ooze are fairly uniform, averaging about 550. However, as is common in deep-sea sediments, counts in the top two meters of this ooze are relatively high (up to 1550 counts). Below the ooze, the terrigenous deposits have higher counts. The clays and silts range from about 1000 to 2500; the average being about 1500 counts. There was no significant difference between the black clays and the other clays. The sands give counts of 500 to 1000 except for the arkosic beds in the lower part of Core 7 which have counts of about 1500. The highest counts (up to 3500) were from the zeolitic clay at the bottom of Core 8.

Sonic velocity measurements were made on four samples of lithified sediment as follows: 135-8-1, 60 cm 3.28 km/sec, 110 cm 2.11 km/sec, 135 cm 3.42 km/sec; and 135-9-1, 105 cm 3.47 km/sec.

TABLE 3
Summary of Density, Porosity and Water Content Data for Site 135

			GRAPE			Sediment Sample			
Hole	Core	Section	Depth Below Sea Floor (m)	Density (gm/cc)	Porosity (%)	Depth Below Sea Floor (m)	Water Content (%)	Density (gm/cc)	Porosity (%)
135	1	1	0.75	1.57	65	0.30	40	1.56	62
135	1	2	2.25	1.61	62	1.51	37	1.65	60
135	1	–	–	–	–	2.60	33	1.70	56
135	1	3	3.75	1.61	62	3.14	34	1.67	57
135	2	1	80.75	1.76	50	80.59	31	1.51	47
135	2	2	82.25	1.79	48	81.65	32	1.75	55
135	2	3	83.75	1.74	51	83.14	30	1.75	53
135	2	4	85.25	1.80	47	84.64	32	1.70	55
135	2	5	86.75	1.73	52	86.15	31	1.76	55
135	2	6	88.25	1.80	47	87.64	32	1.70	55
135	3	1	173.75	1.85	36	173.54	26	1.72	45
135	3	1	–	–	–	173.59	20	1.71	33
135	3	2	175.25	1.87	34	174.64	29	1.76	51
135	4	1	259.75	1.79	37	–	–	–	–
135	4	2	–	–	–	260.64	26	1.68	44
135	5	1	335.75	1.46[a]	50	335.73	54	1.28	69
135	7	1	–	–	–	432.43	23	1.66	38
135	7	2	433.25	1.89	29	432.64	21	1.84	39
135	7	3	434.75	1.88	30	434.31	21	1.79	38
135	7	4	436.25	1.86	31	435.60	22	1.78	39
135	8	1	564.75	Variable lithology[b]				–	–
135	9	1	685.75	1.88	30	–	–	–	–
135	9	2	687.25	1.65	49	–	–	–	–

[a]Questionable value as Core disturbed.
[b]Density varied from <1.5 to >2.0 gm/cc

Properties of the interstitial water are within the normal range for seawater with salinities ranging from 32.4 to 34.1 ppt. and pH values ranging from 7.24 to 7.80 (Table 4).

DISCUSSION AND CONCLUSIONS

Site 135 lies on a topographic high (SE of the Horseshoe Abyssal Plain) covered by about 325 meters of calcareous ooze. A thick section of predominantly quartz-rich terrigenous and pelagic sediments low in carbonates lies below the ooze. Calcareous sediments again characterize the lowermost part of the cored sequence below about 560 meters.

An important result obtained from this site is that the occurrence of the major contrast in lithologic type correlates very well in depth with that anticipated for a major reflecting horizon. The reflecting horizon at Site 135 lies at a depth of 0.38 second, and a compressional wave velocity of about 1.77 km/sec for the pelagic sequence can be inferred from the above correlation. There are no other reflecting horizons observed on the seismic record that can plausibly correlate with the lithologic change. Similarly, there are no other observed major differences in lithologic type within the sampled section that could logically create the reflecting horizon.

TABLE 4
Chemical Property Measurements on Samples from Site 135

			Sample Interval (cm)				
Hole	Core	Section	Top	Bottom	pH	Eh	Salinity (°/oo)
135	1	2	141.0	150.0	7.44	+69	34.1
	2	6	0.0	8.0	7.24	+116	33.6
	3	2	0.0	7.0	7.36	+119	33.0
	4	2	0.0	5.0	7.26	+123	33.6
	7	3	140.0	150.0	7.80	+130	32.4

This prominent reflecting horizon extends over many tens of miles as observed on the *Jean Charcot* and *Challenger* seismic records and can be traced from the site northward under the well-layered upper section of the Horseshoe Abyssal Plain. Southeast of Site 135, the reflector is interrupted by deep-seated piercement structures that may be salt diapirs (Pautot *et al.*, 1970). The reflecting horizon is offset along apparent high-angle faults with displacements on the order of 300-500 meters. Although it was evident prior to drilling that tectonism followed the formation of the reflecting horizon, the age of this activity was unknown. The offset reflecting horizon is semi-conformable with the highs and lows of the basement reflector. The transparent (pelagic) section overlying the reflecting horizon is conformable with it and with the sea floor. The inference is that most, if not all, of the movement along these faults took place before Middle Miocene and prior to the deposition of the recovered pelagic carbonates.

The following sequence of events provides the best explanations of the geophysical data and drilling results at this site.

From Late Cretaceous to Early Eocene time, the area was a deep (though not so deep that all calcareous fossils were dissolved) flat-lying oceanic environment. The area was receiving olive and brown clays containing detrital carbonates and intercalated with coarse terrigenous sediments. The area was, in essence, an abyssal plain. The apparent sedimentation rate for this sequence is about 5 m/my. If some allowance is made for rapidly emplaced sands and silts, the true sedimentation for the clays is probably 2-3 m/my. Sediment reaching the area was varied: coarse sands (mostly quartz and chert and shallow-water foraminifera) were transported along the sea floor; and medium to fine sands were probably deposited by turbidity currents. Primary structures, such as crossbedding, indicate the presence of near bottom currents. The sands contain minerals that were derived from both granitic and metamorphic terrains; highly rounded quartz grains with iron oxide coatings are probably of eolian origin (?Sahara-sand); and detrital carbonate sands (later crystallized to coarse-grained limestones) occasionally reached the area.

During some intervals, this environment received little sand, and shales with a high content of organic material were deposited. Some calcareous pelagic components also reached the sea floor at that time, but their net contribution to the sequence was minor. The fertility of the upper waters possibly increased during the Late Cretaceous thus leading to the deposition of siliceous organisms (probably preserved as chert); calcareous organisms were, however, dissolved. An increasing influx of coarse-grained terrigenous sediments (turbidites) in the latest part of the Cretaceous may reflect uplift and erosion of the adjacent continent.

Following the Early Eocene, epeirogenic uplift accompanied by faulting created the topographic highs south of the Horseshoe Abyssal Plain, and the area of Site 135 was made inaccessible to terrigenous sediments. From at least as early as Late Miocene, the area was a site of rapid pelagic carbonate sedimentation at first close to the carbonate compensation depth (~4500 meters) and subsequently well above it. Evidence for this is seen in the poor preservation of calcareous fossils in the Middle Miocene in contrast to the excellent preservation in the Pleistocene.

The unconformity between Early Eocene terrigenous sediments and Late Oligocene pelagic sediments is not yet clearly understood. It is possible that following uplift, the area remained for some time below the carbonate compensation depth so that during this period the site received neither terrigenous nor pelagic sediments. However, a similar stratigraphic hiatus is present at many other sites and an explanation involving more regional processes, such as deep sea erosion and slumping accompanying tectonism or a major change in the pattern of oceanic circulation, is probably more reasonable. Tectonic activity along the east Azores Fraction Zone beginning at least 45 million years ago has been inferred by Krause and Watkins (1970). The regional tectonism and deformation exhibited by the reflecting horizon may relate to these changes in plate tectonic activiity. It should be noted that Site 135 lies only 70 km south of the inferred Azores Fracture Zone, and therefore, could be subject to intense deformation associated along this boundary by interaction between two major crustal plates. The Early Tertiary also marked the initiation of the Alpine orogenic movements in the sub-Betic Chain, 400 km to the northeast of this site.

The unusually high content of nannofossils in the chalk ooze of Unit 1 is unexplained. Differential dissolution cannot be the main cause because the foraminifera in Core 1, although relatively rare, are quite well preserved.

Sediments of Early Aptian age were the oldest materials recovered at Site 135 at a subbottom depth of 689 meters. Although the seismic data from the *Challenger* are not definitive, records from the *Jean Charcot* indicate basement rocks (layer 2) lie an additional 350 meters below the Aptian sediments. These Aptian sediments are well lithified limestones and marl, and penetration by the drill slowed at this point. On both the *Challenger* (at 0.71 sec) and *Charcot* (0.75 sec) seismic reflection records, a second intermediate reflector could be correlated with this change in lithology.

Sedimentation rates below the unconformity are about 5-8 m/my. Extrapolating these rates from the depth of the Early Aptian sediments (~100 m.y.) to the inferred basement, the deduced age of the sediments directly above basement would be about 155-180 million years or Late to Early Jurassic. Site 135 lies about 200 km landward from the eastern Atlantic magnetic quiet zone boundary which has been interpreted as an isochron (Heirtzler and Hayes, 1967). At Site 105 of Leg 11 which lies close to the western Atlantic magnetic quiet zone boundary, sediments of Oxfordian–Callovian (early Late Jurrassic; ~155 my) were recovered overlying an extrusive basalt (Hollister and Ewing *et al.*, 1972).

There is no evidence of salt or associated evaporite sediments in any of the 689 meters of section drilled and sampled. This is not inconsistent with the interpretation of the presence of salt diapirs nearby (Pautot, 1970) since seismic data indicates the source of the presumed salt to be much more deeply seated than the depth of the recovered cores (see Figure 2).

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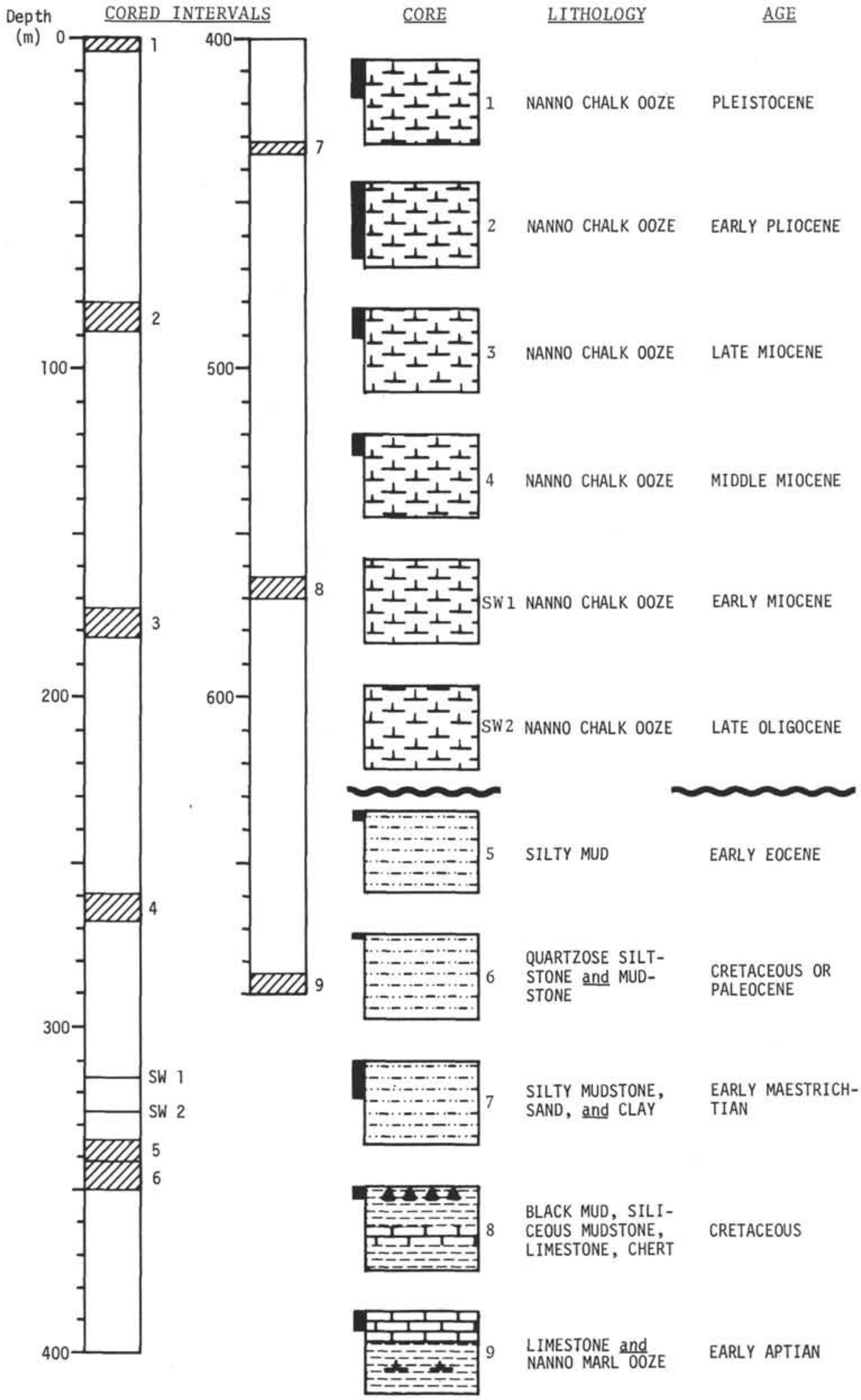
Ryan, W. B. F., Hsu, K. J., *et al.*, 1972. *Initial Reports of the Deep Sea Drilling Project, Volume XIII,* Washington (U. S. Government Printing Office), (in press).

SITE 135-SUMMARY

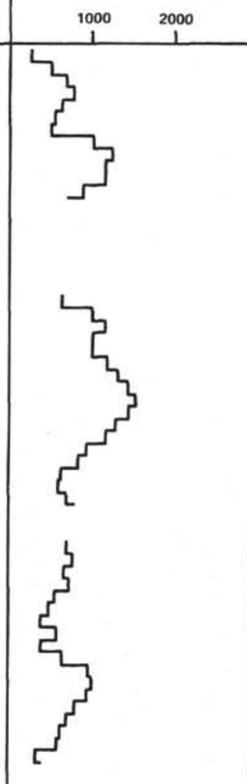


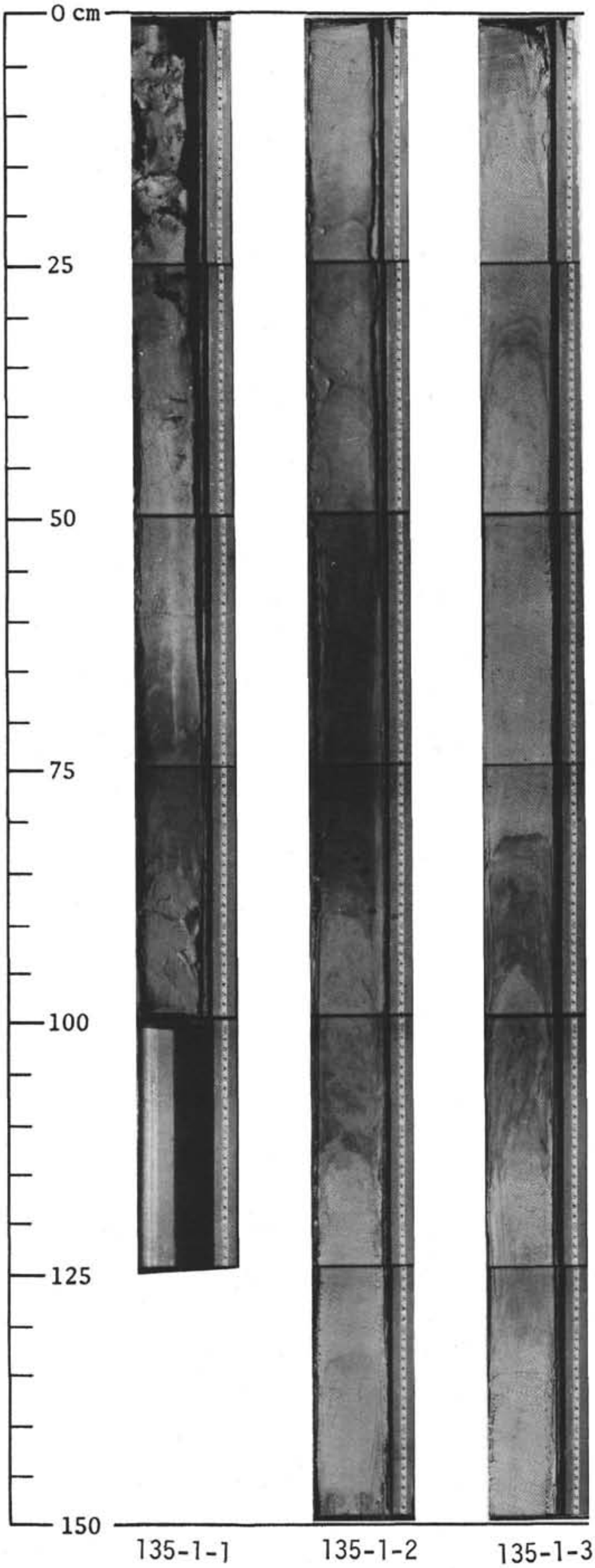
SITE 135 CORE 1 DEPTH (m) 0-4

AGE	ZONE: FORAM	ZONE: NANNO	ZONE: RAD	SECTION	METERS	LITHOLOGIC SYMBOLS	SMEAR SLIDE	LITHOLOGIC DESCRIPTION
LATE PLEISTOCENE	*Globorotalia truncatulinoides*	*Gephyrocapsa oceanica*		1	1		26	GZ 4-21-75 $CaCO_3$ 38 NANNO CHALK OOZE Light gray (10YR 7/2) and grayish brown (10YR 5/2) Forams, mainly fragments 5-10% Quartz silt, at top ~10% at base down to 1% Clay 5-10% $CaCO_3$ 50
				2	2		96 135	GZ 7-20-73 Some fine (~1 mm) lamination, especially in Section 2 Coarse Fraction: $CaCO_3$ 62 Pelagic forams, moderately to well preserved sec.2, 125 cm GZ 5-13-82 $CaCO_3$ 72
				3	3 4		65 88	GZ 2-13-85 GZ 1-18-81
				CC				

NATURAL GAMMA RADIATION

COUNTS/7.6 cm/1.5 min




0 cm
25
50
75
100
125
150
135-1-1
135-1-2
135-1-3

SITE 135 CORE 2 DEPTH (m) 80-89

AGE	ZONE: FORAM	ZONE: NANNO	ZONE: RAD	SECTION	METERS	LITHOLOGIC SYMBOLS	SMEAR SLIDE
EARLY PLIOCENE	*Globorotalia margaritae*	*Ceratolithus rugosus*		1, 2, 3, 4	1, 2, 3, 4, 5, 6		100, 90, 80, 100
LATE MIOCENE	?	*Ceratolithus tricorniculatus*		5, 6, CC	7, 8		75, 100

LITHOLOGIC DESCRIPTION

NANNO CHALK OOZE — $CaCO_3$ 78

$CaCO_3$ 75

White (10YR 8/1) to light gray (5Y 7/1 to 5Y 6/1); dark specks and streaks locally

60 cm GZ 3-22-75

Smear Slide Average:

Nannos	85%
Forams (mostly fragments)	2-10%
Clay	Tr.2%
Quartz	Tr.

30 cm GZ 2-22-76

Coarse Fraction:
Pelagic forams, moderately well preserved

GZ 1-20-79 $CaCO_3$ 70

GZ 5-24-71 $CaCO_3$ 85

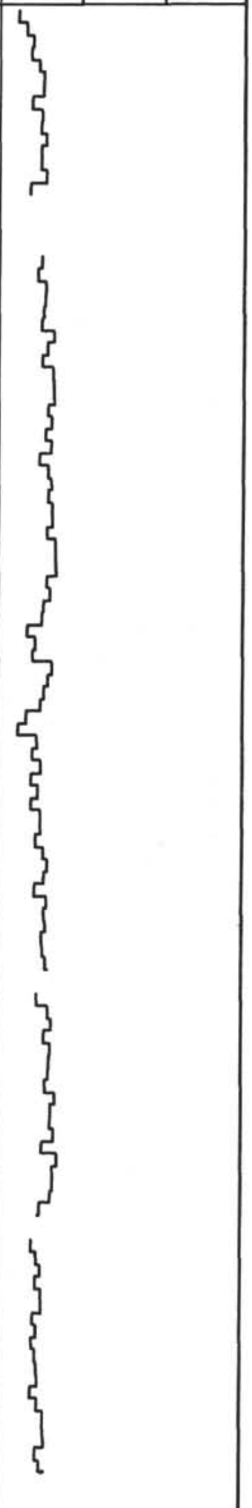
GZ 1-21-78 $CaCO_3$ 71

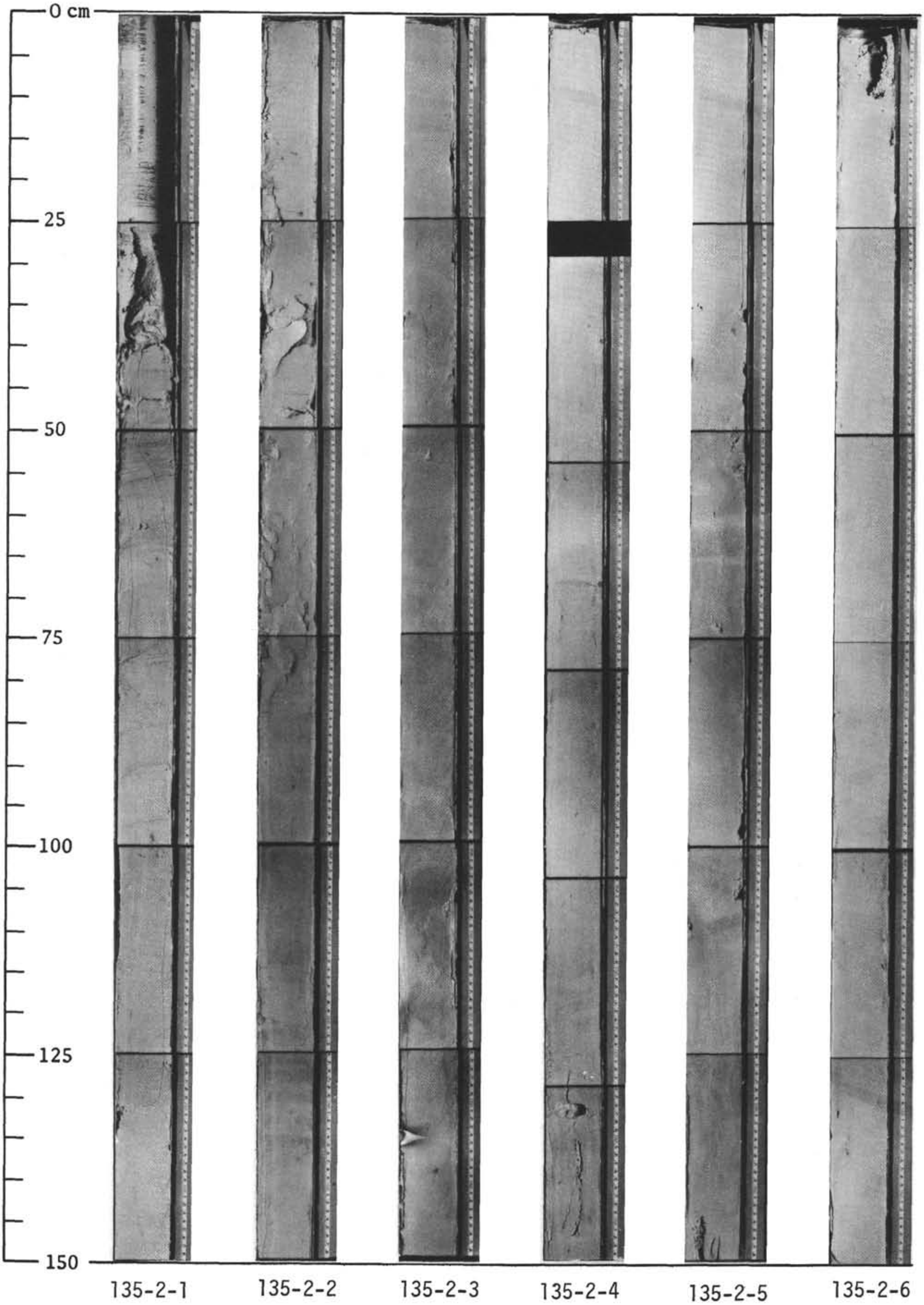
GZ 4-22-74 $CaCO_3$ 80

NATURAL GAMMA RADIATION

COUNTS/7.6 cm/1.5 min

1000 2000




0 cm
25
50
75
100
125
150
135-2-1
135-2-2
135-2-3
135-2-4
135-2-5
135-2-6

SITE 135 CORE 3 DEPTH (m) 173-182

AGE	ZONE: FORAM	ZONE: NANNO	ZONE: RAD	SECTION	METERS	LITHOLOGIC SYMBOLS	SMEAR SLIDE
LATE MIOCENE	*Globorotalia acostaensis ?*	*D. neohamatus*		1	1	VOID	68, 85, 145
				2	2, 3	VOID	75
				CC			

LITHOLOGIC DESCRIPTION

NANNO CHALK OOZE

Light gray (5Y 6/1 to 5Y 6/2, 5Y 7/1 to 5Y 7/2, 10YR 8/1) — $CaCO_3$ 71, $CaCO_3$ 71

Smear Slide Average:

Nannos	95%
Forams (mostly fragments)	1-2%
Clay, quartz, pyrite, chlorite, Fe oxide	Tr.

Alternating bands (15-30 cm) of lighter and darker bands, composition the same. — $CaCO_3$ 85

Coarse Fraction:
Pelagic forams, poorly preserved; also, benthonic forams, calcareous and arenaceous, fish debris, ostracods, spicules

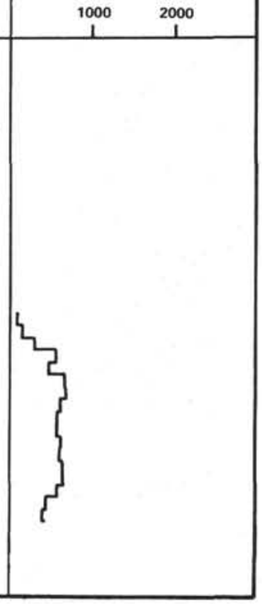
sec.1, 60 cm GZ 0-33-67

sec.1, 65 cm GZ 0-28-72

sec.2, 30 cm GZ 1-28-71

NATURAL GAMMA RADIATION

COUNTS/7.6 cm/1.5 min



SITE 135 CORE 4 DEPTH (m) 259-268

AGE	ZONE: FORAM	ZONE: NANNO	ZONE: RAD	SECTION	METERS	LITHOLOGIC SYMBOLS	SMEAR SLIDE
MIDDLE MIOCENE	*Globorotalia fohsi peripheroronda*	*Sphenolithus heteromorphus*		1	1	VOID	110, 121, 139
				2	2, 3		30, 60, 100
				CC			

LITHOLOGIC DESCRIPTION

NANNO CHALK OOZE

Light gray (10YR 8/1) to light brownish gray (10YR 6/2), colors alternate, mottling intense

Smear Slide Average:

Nannos	90%
Carbonate flour	7%
Clay	3%

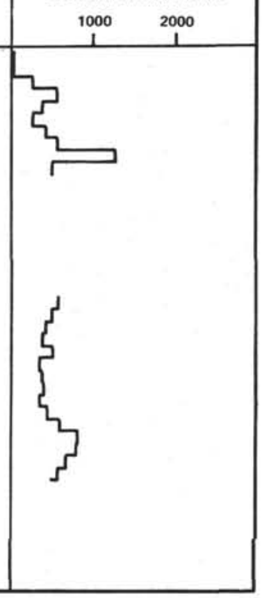
$CaCO_3$ 93

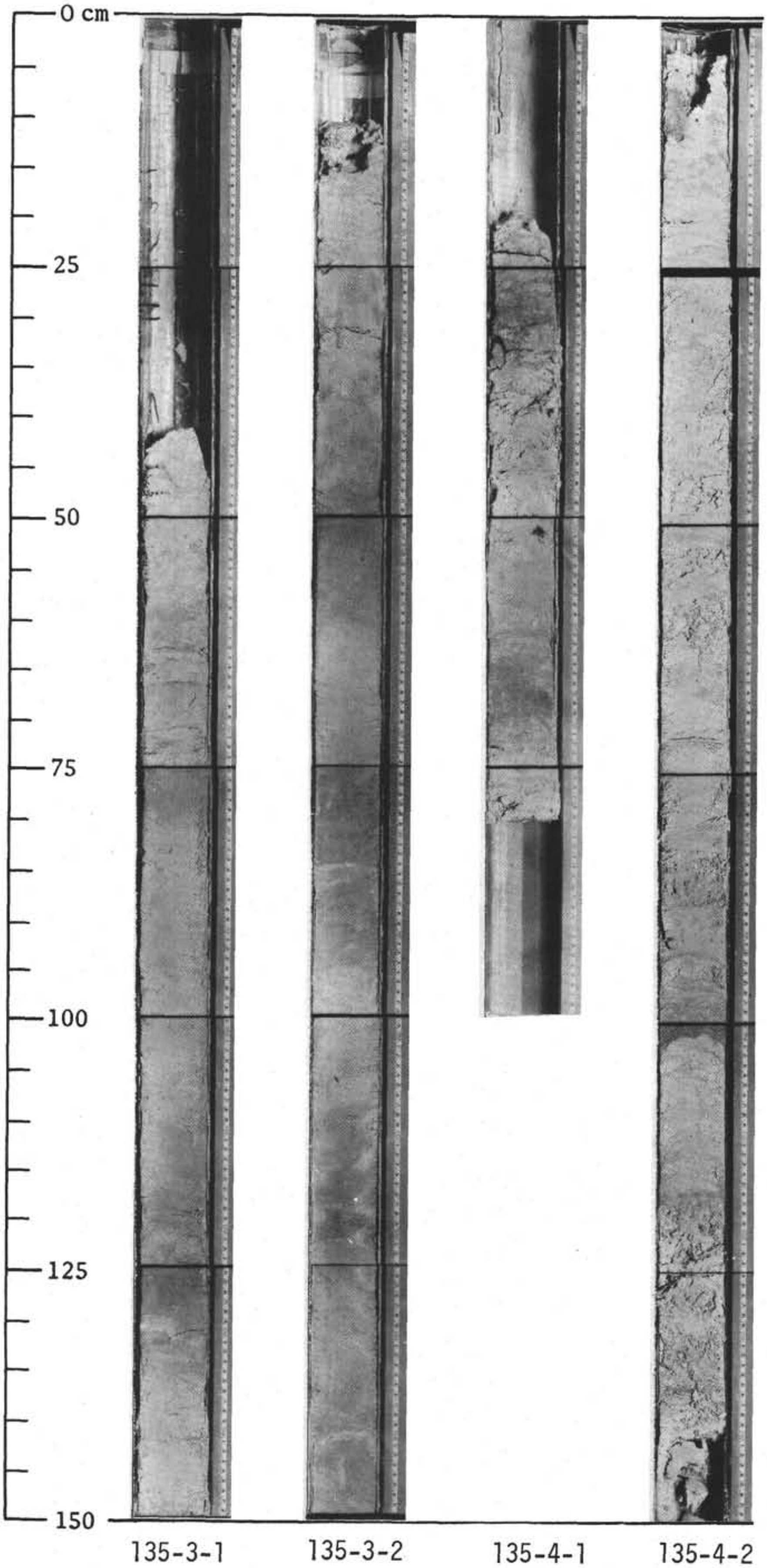
GZ 1-30-69

Coarse Fraction:
Pelagic forams, very poorly preserved, benthonic forams, spicules, fish debris, quartz

NATURAL GAMMA RADIATION

COUNTS/7.6 cm/1.5 min




0 cm
25
50
75
100
125
150
135-3-1
135-3-2
135-4-1
135-4-2

SITE 135 CORE 5 DEPTH (m) 335-341

AGE	ZONE: FORAM	ZONE: NANNO	ZONE: RAD	SECTION	METERS	LITHOLOGIC SYMBOLS	SMEAR SLIDE
EARLY EOCENE		*Marthasterites tribrachiatus*		1	1	VOID	73, 94, 102, 142
				CC			

LITHOLOGIC DESCRIPTION

GZ 2-57-41

SILTY MUD

Banded colors as follows: $CaCO_3$ 9
- 69-78 cm, grayish yellow green (5GY 7/2);
- 78-91 cm, olive gray (5Y 5/2);
- 91-95 cm, reddish brown (5YR 5/3);
- 95-101 cm, olive gray (5Y 5/2);
- 101-108 cm, reddish brown (5YR 5/2);
- then grayish yellow green (5GY 7/2) grading downward to dark gray (5Y 4/1) at base

Smear Slide Average:

Clay	75%
Quartz	10-15%
Carbonate rhombs	7-15%
Biotite, muscovite and chlorite	3--8%
Fe oxides and pyrite	3--5%

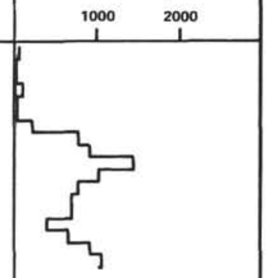
Smear Slide, 102 cm:
(Quartzose layer)

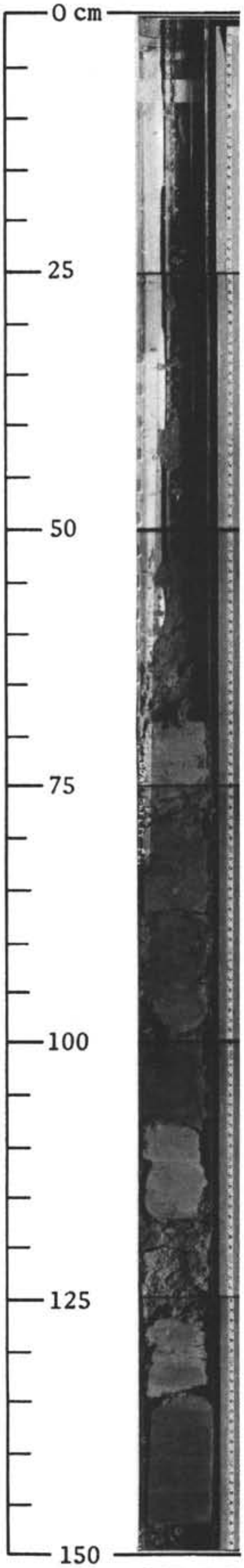
Quartz	25%
Clay	20%
Fe oxide and pyrite	15%
Biotite	15%
Muscovite	5%
Chlorite	3%
Carbonate rhombs	7%
Carbonate flour	5%
Feldspar	1%
Heavies (Titanite, clinozoisite, amphibole, tourmaline)	3%

Coarse Fraction:
Flakes of indurated clay, occasional chert fragment

NATURAL GAMMA RADIATION

COUNTS/7.6 cm/1.5 min

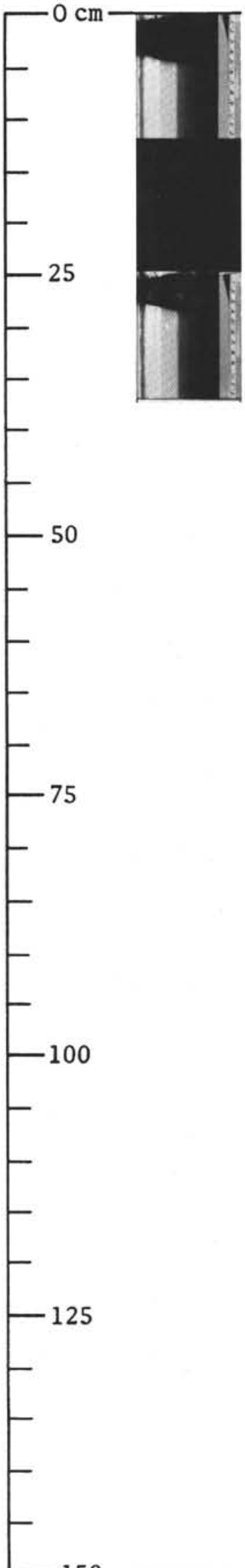




135-5-1

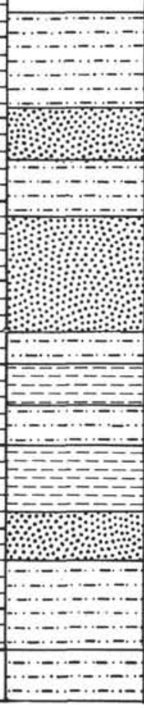
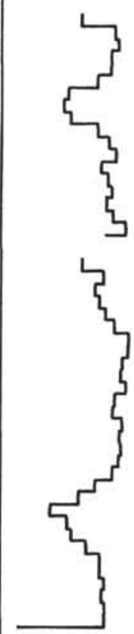
SITE 135 CORE 6 DEPTH (m) 341-350

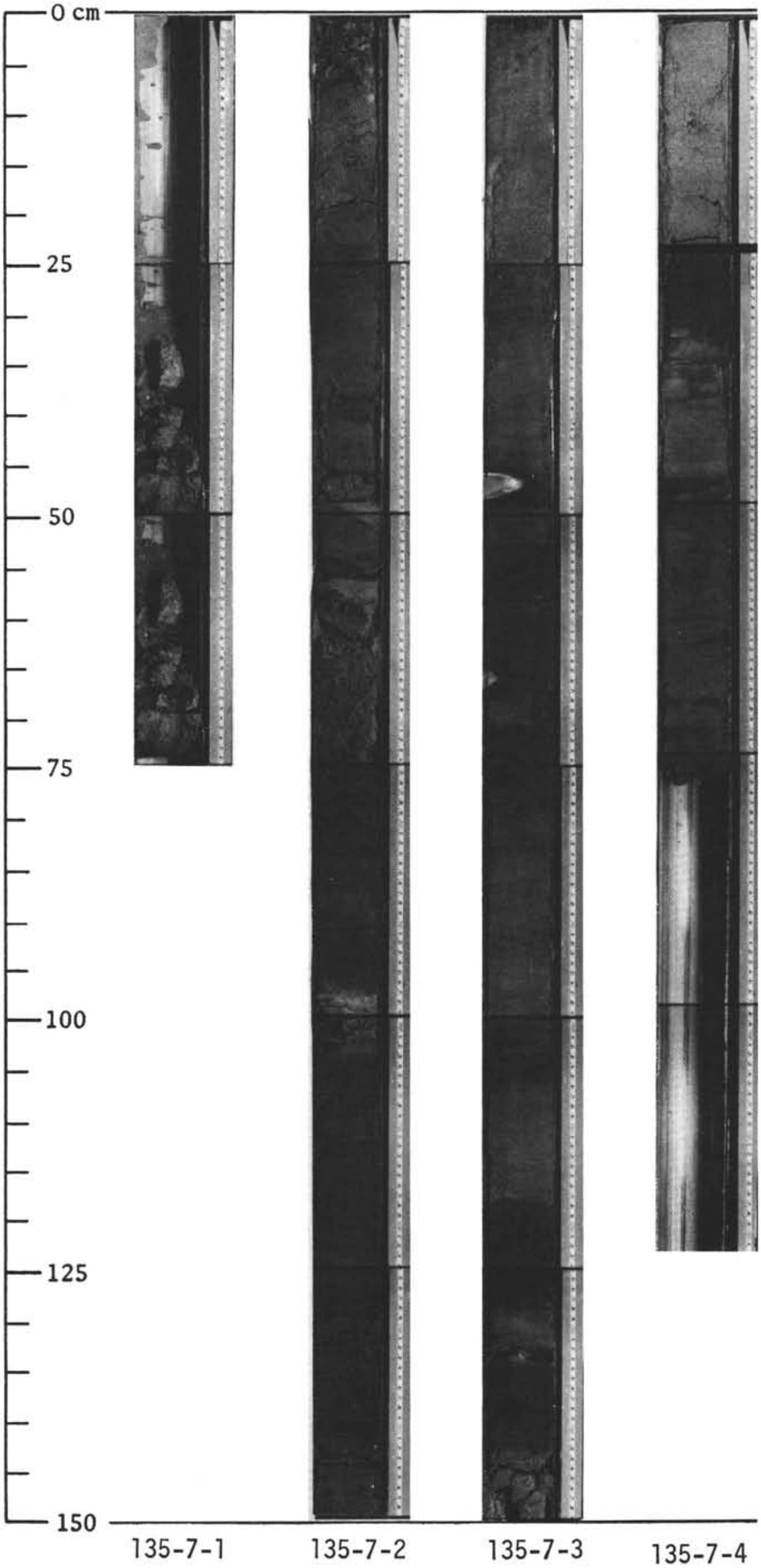
AGE	ZONE: FORAM	ZONE: NANNO	ZONE: RAD	SECTION	METERS	LITHOLOGIC SYMBOLS	SMEAR SLIDE	LITHOLOGIC DESCRIPTION	NATURAL GAMMA RADIATION COUNTS/7.6 cm/1.5 min 1000 2000
CRETACEOUS OR PALEOCENE				1 CC			*	QUARTZOSE SILTSTONE AND MUDSTONE Black (5Y 2/2), semi-consolidated Smear Slide Average: Quartz 45% Clay 20% Biotite and chlorite 5% Fe oxide and pyrite 5% Feldspar 2% Carbonate rhombs 15% Carbonate flour 5% Heavies 1% (Hypersthene, clinozoisite) Coarse Fraction: Flakes of indurated clay, polished quartz, (?) regrown quartz, mica, lithic fragments (schist, sandstone), glauconite * Not to scale, only 4 cm.recovered	



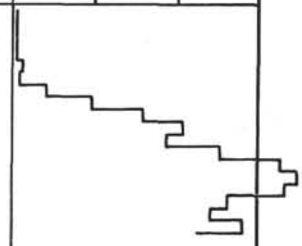
135-6-1

SITE 135 CORE 7 DEPTH (m) 431-435

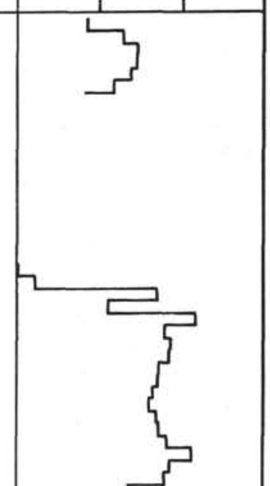
AGE	ZONE: FORAM	ZONE: NANNO	ZONE: RAD	SECTION	METERS	LITHOLOGIC SYMBOLS	SMEAR SLIDE	LITHOLOGIC DESCRIPTION	NATURAL GAMMA RADIATION COUNTS/7.6 cm/1.5 min (1000, 2000)
LATE CAMPANIAN—EARLY MAESTRICHTIAN				1	1	VOID		GZ 4-74-22 SILTY MUDSTONE, SAND AND CLAY Dark gray (10YR 4/1, 5Y 4/1), dark grayish brown (10YR 4/2), greenish gray (5GY 6/1), dark brown (10YR 3/3) Smear Slides show sands and silty muds are mostly quartz, abundant feldspar, chlorite, biotite, and authigenic carbonate. Some sand layers appear graded. Induration and cementation variable throughout core. $CaCO_3$ 28 $CaCO_3$ 24	
				2*	2			Coarse Fraction: Rounded to subangular quartz, lithic fragments(gneiss, schist, limestone, sandstone), mica. Few pelagic forams, spicules, ostracods, benthonic forams, glauconite	
				3*	3 4			* See Section Summary GZ 76-15-9 $CaCO_3$ 16	
					5			GZ 78-13-9 $CaCO_3$ 23 $CaCO_3$ 37 GZ 1-82-17 $CaCO_3$ 21	
				CC					

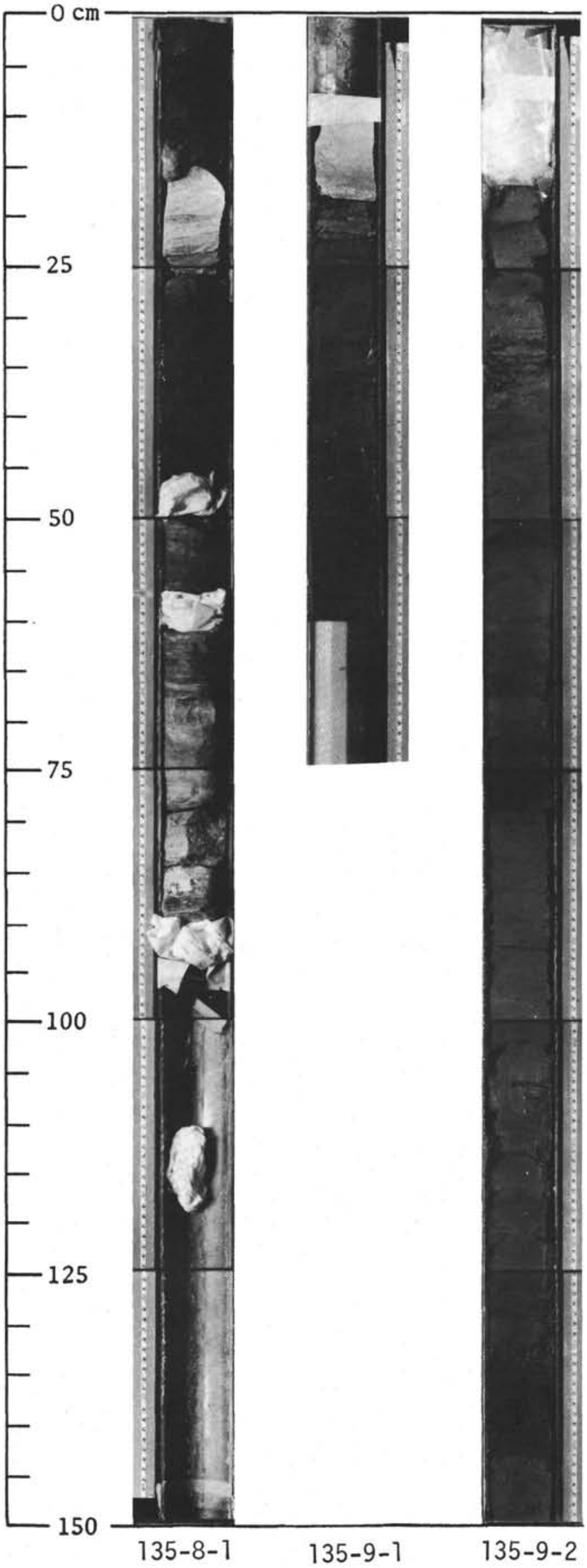

0 cm
25
50
75
100
125
150
135-7-1
135-7-2
135-7-3
135-7-4

SITE 135 **CORE** 8 **DEPTH (m)** 564-569

AGE	ZONE: FORAM	ZONE: NANNO	ZONE: RAD	SECTION	METERS	LITHOLOGIC SYMBOLS	SMEAR SLIDE	LITHOLOGIC DESCRIPTION	NATURAL GAMMA RADIATION COUNTS/7.6 cm/1.5 min (1000, 2000)
CRETACEOUS				1* CC	1	VOID		BLACK MUD AND GREENISH SILICEOUS MUDSTONE, WITH LIMESTONE AND CHERT Coarse Fraction: Chips of light colored siltstone, pebbles of dark laminated mudstone, traces of pyrite and fish debris, fragments of coarsely crystalline limestone * See Section Summary	

SITE 135 **CORE** 9 **DEPTH (m)** 685-687

AGE	ZONE: FORAM	ZONE: NANNO	ZONE: RAD	SECTION	METERS	LITHOLOGIC SYMBOLS	SMEAR SLIDE	LITHOLOGIC DESCRIPTION	NATURAL GAMMA RADIATION COUNTS/7.6 cm/1.5 min (1000, 2000)
EARLY APTIAN	*Chiastozygus litterarius*			1* 2* CC	1 2 3	VOID VOID		LIMESTONE Greenish gray (5G 6/1) GZ 1-34-65 QUARTZOSE NANNOFOSSIL MARL OOZE Olive gray (5Y 4/1) to black (5Y 2/2) Quartz and other terrigenous components Coarse Fraction: Pyritized fecal pellets and burrow fillings, mica, claystone fragments, quartzose siltstone * See Section Summary	


0 cm
25
50
75
100
125
150
135-8-1
135-9-1
135-9-2

SITE 135 CORE SW 1 DEPTH (m) SW 1-315

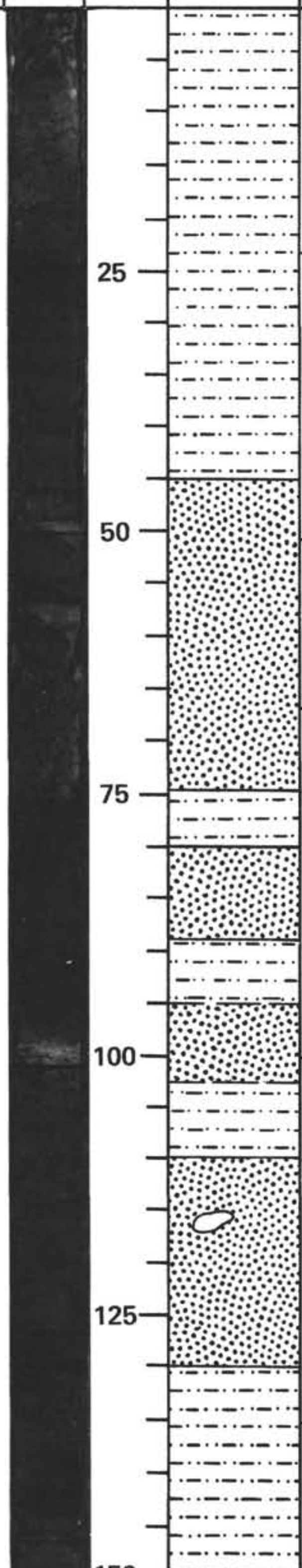
AGE	ZONE: FORAM	ZONE: NANNO	ZONE: RAD	SECTION	METERS	LITHOLOGIC SYMBOLS	SMEAR SLIDE	LITHOLOGIC DESCRIPTION	NATURAL GAMMA RADIATION COUNTS/7.6 cm/1.5 min (1000, 2000)
EARLY MIOCENE		*Triquetrorhabdulus carinatus*		1	1	NOT TO SCALE		SW 1 NANNO CHALK OOZE Coarse Fraction: Mixture of Mn/Fe crust, poorly preserved benthonic forams, planktonic forams, fish debris, angular quartz grains and rounded quartz pebbles, pyritized burrow fillings	

SITE 135 CORE SW 2 DEPTH (m) SW 2-325

AGE	ZONE: FORAM	ZONE: NANNO	ZONE: RAD	SECTION	METERS	LITHOLOGIC SYMBOLS	SMEAR SLIDE	LITHOLOGIC DESCRIPTION	NATURAL GAMMA RADIATION COUNTS/7.6 cm/1.5 min (1000, 2000)
LATE OLIGOCENE	*Globigerina ciperoensis* (?)	*Triquetrorhabdulus carinatus*		1	1	NOT TO SCALE		SW 2 NANNO CHALK OOZE Coarse Fraction: Coarse, rounded quartz sand; also lithic fragments (sandstone, limestone, pyrite, chert, igneous)	

SITE 135 CORE 7 SECTION 2

AGE	SECTION PHOTO	cm	LITHO	SMEAR SLIDE	DESCRIPTION
EARLY CAMPANIAN - EARLY MAESTRICHTIAN					



Smear slide: 23, 51, 67, 100, 135

Feldspathic, quartzose terrigenous SANDY SILT.
Dark gray (10YR 4/1) to dark grayish brown (10YR 4/2). Soft at top to well indurated at 45 cm.

Smear Slide (23 cm):

Quartz	60%
Feldspar	15%
Chlorite and biotite	10%
Carbonate rhombs	10%
Clay	5%
Heavies	Tr.

Sand and sandstone
Greenish gray (5GY 6/1). Cement is carbonate.
Well lithified 45-60 cm

Smear Slide Average:

Quartz	60-70%
Clay	20%
Feldspar	5-10%
Carbonate cement	5-20%
Mica, heavies	Tr.

Colors dark grayish brown (10YR 4/2) and dark gray (5Y 4/1)

X-RAY (75.5 cm; mud layer under sand):

Quartz	A
Feldspar, Kaolin, Calcite, Dolomite(?)	C
Montmorillonite, Chlorite	Tr.

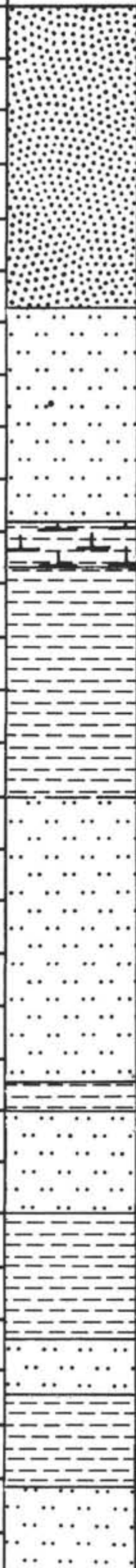
Carbonate cemented sandstone, up to 70% cement.

Graded (?) sand layer.
Clay ball (1 cm. dia.) at 115 cm.

X-RAY (110-111 cm; top of sand layer):

Quartz	A
Feldspar, Mica, Montmorillonite, Mixed Layer (Palygorskite), Chlorite, Kaolin, Calcite, Dolomite.	C

SITE 135 **CORE** 7 **SECTION** 3

AGE	SECTION PHOTO	cm	LITHO	SMEAR SLIDE	DESCRIPTION
EARLY CAMPANIAN - EARLY MAESTRICHTIAN				10	Sand, greenish gray (5GY 6/1). Graded from med. sand at base to fine silty sand at top. Mostly quartz, some feldspar. Calcite 20-25%. Traces of hornblende, biotite, dolomite.
		25			
				40	Silt, light olive gray (5Y 6/1) with thin beds of medium bluish gray (5B 5/1). Composition as above.
		50		50	Calcite cemented quartz mudstone
				73	Silty "red clay", dark brown (10YR 3/3) with small patches of greenish gray (5GY 6/1). Smear shows ~25% quartz, 5% chlorite, 20% carbonate (5% dolomite rhombs)
		75			Graded from silty clay at top to fine silty sand at bottom. Greenish gray (5GY 6/1). Top contact gradational, bottom sharp.
		100			"Red clay" Sandy silt X-RAY (27-28 cm; base of sand layer): Quartz — A Feldspar, Mica, Chlorite, Calcite, Dolomite. — C X-RAY (28-29 cm; mud under sand): Quartz — A Feldspar, Cristobalite(?), Mica, Montmorillonite, Chlorite, Calcite, Dolomite. — C Pyrite — R
		125		130	Arkosic sandy silt, ~40%, feldspar, largely altering to clay
		150			Sandy silt, top of graded sand unit at top of Section 4.

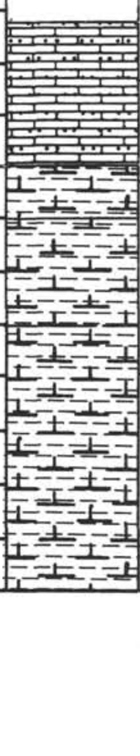
SITE 135 CORE 7 SECTION 4

AGE	SECTION PHOTO	cm	LITHO	SMEAR SLIDE	DESCRIPTION
EARLY CAMPANIAN - EARLY MAESTRICHTIAN		25 50 75 100 125 150	 VOID	9 27 65	Medium to fine grained arkosic sand. Graded bed. "Red clay". Dark brown (10YR 3/3), heavily iron impregnated. Slightly silty dolomitic clay. Clayey silt. Greenish gray (5GY 6/1) with "red" stains (brown 7.5 YR 4/2) on bedding planes. Smear at 65 cm: Quartz 50% Feldspar 5% Chlorite 10% Biotite plus muscovite 10% Detrital carbonate 10% Clay 15% Trace Heavies

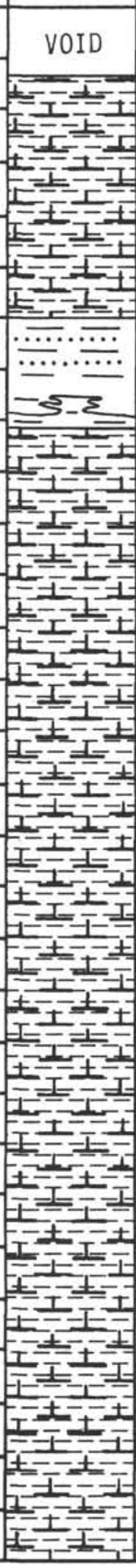
SITE 135 **CORE** 8 **SECTION** 1

AGE	SECTION PHOTO	cm	LITHO	SMEAR SLIDE	DESCRIPTION
CRETACEOUS		25	VOID		X-RAY (102-104 cm): Quartz, Montmorillonite C Palygorskite(?), Heulandite. Tridymite, Mica, Pyrite, Tr. Siderite(?).
		50			Chert and silicified claystone, dark gray (2.5YR N4/0), laminated. Thin section shows it to be a spiculite, silicified silty mudstone (chert) containing abundant recrystallized sponge spicules and (?) Radiolaria.
			▲ ▲ ▲ ▲ ▲ ▲	T.S	Gradational color contact, but sharp change of hardness.
		75		80	Siliceous, (?) zeolitic mudstone, greenish gray (5G 6/1), contains 5-10% terrigenous (quartz, chlorite, amphibole), 5% dark grains, laminated
		100			Well-defined contact. Either mud pebble conglomerate or drilling disturbance.
				113	Shale, olive black (5Y 2/1), finely laminated, contains organic matter and pyrite, smear shows 70% clays, 20% platy mineral (?Zeolite), 10% Quartz, abundant organic matter
		125		126	As at 65-100 cm.
				130 TS	Clayey limestone, greenish-white (5G 9/1), ~80% Carbonate, 10% Clay, 5% Quartz, 5% Pyrite. Carbonate as fibrous spherulites 1-2 mm. diameter.
				144	Black shale, soft, as at 100-124 cm. Core Catcher contains dark brown silicified laminated mudstone (chert). Thin section shows 15% Quartz and other silica, 5% Mica, 80% Clay plus organic matter.
		150	CC	TS	

SITE 135 **CORE** 9 **SECTION** 1

AGE	SECTION PHOTO	cm	LITHO	SMEAR SLIDE	DESCRIPTION
EARLY APTIAN		25, 50, 75, 100, 125, 150	VOID 	TS, 111, 130	X-RAY (99-109 cm): Quartz, Calcite A Feldspar, Mica, Montmorillonite, C Palygorskite(?), Chlorite, Dolomite. Porous, slightly clayey quartzose limestone, greenish gray (5G 6/1). Thin section shows ∿20% quartz silt, 10% clays, 5% micas and opaques (pyrite, Fe oxides). Calcite is partly micrite and partly sparite. Some dolomite rhombs present. Dark gray (5Y 4/1) nanno marl ooze. ∿65% Nannos, 25% Clay, 5% Quartz, 3% Pyrite, 2% Dolomite; black (5Y 2/2), "lensy", parallel and "cross" lamination. Quartzose nanno marl ooze, ∿50% Nannos, 30% Clay, 10% Quartz, 5% Pyrite, 5% Dolomite

SITE 135 **CORE** 9 **SECTION** 2

AGE	SECTION PHOTO	cm	LITHO	SMEAR SLIDE	DESCRIPTION
EARLY APTIAN		25 50 75 100 125 150		30 34 38 60 104 140	NANNO MARL OOZE Olive gray (5Y 4/1). Smear shows 60% carbonate (∿55% nannos, 5% rhombs), ∿20% Clay, 10% quartz, 5% opaques, 1% mica, 1% heavies Alternations of indurated shale (or argillite) with 5-6 very thin sandy silt layers. Convoluted silt layer Laminae, ∿0.5 mm thick Interval between ∿30-45 cm has less carbonate, ∿30-40% Percent of carbonate variable down core. Smear estimates are 65% at 60 cm, 55% at 104 cm, 30% at 140 cm. Rest is mostly clay, with quartz ∿10%, micas 5-10%, pyrite and other opaques to 10%. Olive gray (5Y 4/1) Large pyrite concretions (>5 mm dia.) at 112 cm Dark olive gray (5Y 3/1)