14. SITE 97

The Shipboard Scientific Party[1]

SITE DATA

Occupied: April 1-3, 1970.

Position: 23°53.05'N; 84°26.74'W.

Water Depth: 2930 meters.

Total Depth: 337 meters.

Holes Drilled: One.

Cores Taken: Twelve.

BACKGROUND AND OBJECTIVES

Site 97 is located one-third of the way between the South Florida platform and the Campeche Bank. The Yucatan Peninsula and Campeche Bank represent a large carbonate platform as does the Florida platform, some 170 km distant from the edge of the Campeche Bank. The results of seismic refraction profiles on the submerged portions of both platforms are very similar suggesting that the Campeche and Florida carbonate banks once formed a continuous carbonate platform which has subsequently been separated by erosion and/or faulting in the Yucatan and Florida Strait areas (Ewing et al. 1970).

Bryant et al. (1969) suggested that the present Florida Strait was part of a shallow-water carbonate bank until Albian or early Cenomanian time and that the area deepened steadily from Cenomanian through Santonian times. From Santonian time until the present, bathyal conditions generally prevailed in the area. It was also their contention that the position of the Florida Strait has shifted through time, but stayed within the same general area since Tithonian (latest Jurassic) time.

It was the objective of Site 97 to drill through the relatively thin overlying sediments into the Cretaceous. Such a location is near the 1600 fm curve in Figure 1. It was hoped that the material recovered would enable us to date and determine conditions of the subsidence of the area between the Florida and Yucatan platforms and to determine whether the area can be related to the Florida Province, the Yucatan Province, or to the Cuban Province. It was hoped that the deeper reflector, about 0.5 sec beneath the 1600 fm curve (Figure 1) and possibly much older than Cretaceous, might be reached if maximum penetration could be achieved. A coring summary is given in Table 1.

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NATURE OF SEDIMENTS

General Description

Site 97 represents a potentially critical key to the problem of configuration of the eastern Gulf of Mexico during Cretaceous, especially mid-Cretaceous, time. Situated on the western approach to the Florida Strait, Site 97 lies several hundred meters above the nearby abyssal plain to the west, where Site 96 was drilled. In contrast to Site 96, Site 97 contains a considerably thinner Pleistocene section and a thicker Miocene-Pliocene(?) section. Thickness of Cenozoic sediments at the two sites is apparently comparable.

Cenozoic sediments at Site 97 are dominantly pelagites, ranging from Pleistocene clayey nannofossil pteropod foraminiferal ooze to somewhat clayey foraminiferal nannofossil ooze in Miocene sediments. Cores 4 and 5, Oligocene and Eocene, respectively, are foraminiferal, nannofossil (soft) chalk and hard chalk. The top of the soft chalk is interpreted to occur at about the level of Core 4, or approximately 200 meters (see Discussion and Interpretation). The section from 200 meters to approximately 290 meters probably corresponds to a section of heavy reflectors on the profiler record. This lower Tertiary section is lithologically similar (pelagic chalk) to the stratigraphically equivalent section in Site 96 and the holes on the Yucatan slope.

Miocene sediments were not sampled at Site 96, but a comparison of Site 97 Miocene sediments with equivalent sediments at Site 94 suggests that the Miocene sediments of Site 97 are enriched in terrigenous clay (although still categorized as pelagites). The increase in abundance of terrigenous clay is attributed to a probable high influx of clay onto the nearby abyssal plain during Miocene time, as indicated by the various holes of Leg 10 which penetrated Miocene sediments. As will be recalled, coarse-grained turbidites and associated fine-grained sediments apparently were widespread during Miocene time. It might also be suggested that this increase in clay content, not seen to such a marked degree in the Yucatan slope site, reflects an increased influx of terrigenous material into the eastern Gulf Abyssal Plain in the area now occupied by the Mississippi Fan. Such an interpretation is quite speculative at this point but nevertheless remains an interesting possibility.

Based on probable thickness of Pliocene sediment at Site 97, it might also be suggested that a similar mechanism operated during Pliocene sedimentation. Since the section was not sampled at this locality, an answer must await further drilling.

The pelagic Cenozoic section at Site 97 apparently sharply overlies an appreciable thickness of lower Cenomanian pebbly mudstone and minor intercalated

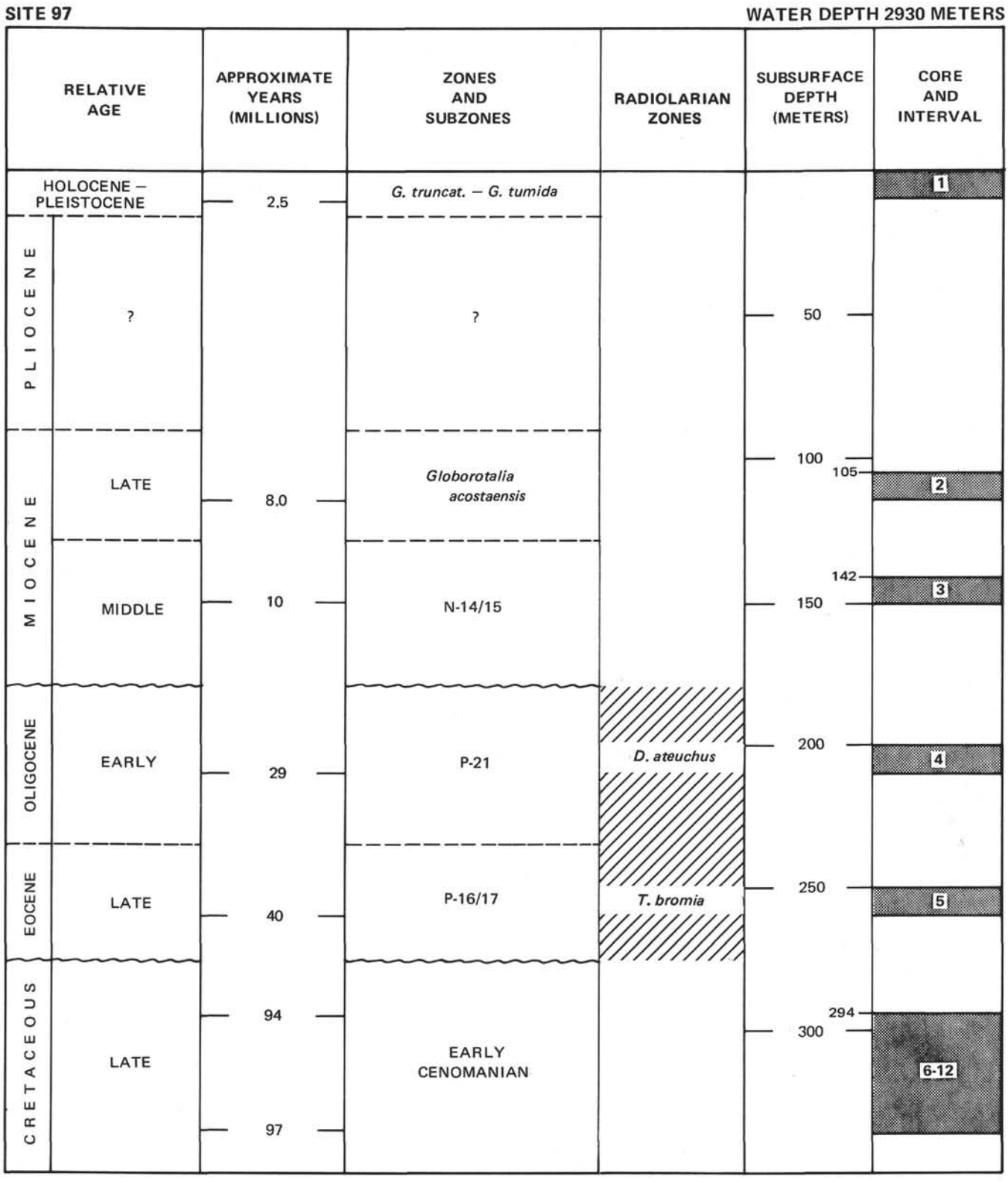

Figure 1. *Biostratigraphic summary of Site 97.*

TABLE 1
Core Inventory – Site 97

Core	No. Sections	Date	Time	Cored[a] Interval (m)	Cored (m)	Recovered (m)	Subbottom Penetration (m) Top	Subbottom Penetration (m) Bottom	Lithology	Age
1	4	4/1	1315	2930-2935	5.0	5.0	0	5.0	Foram nanno ooze	Early Pleistocene-Holocene
2	4	4/1	1950	3035-3040	5.0	5.9	105.0	110.0	Foram nanno ooze	Late Miocene
3	3	4/1	2230	3072-3075	3.0	3.0	142.0	145.0	Foram nanno ooze	Middle Miocene
4	5	4/2	0420	3130-3137	7.0	6.2	200.0	207.0	Foram nanno chalk	Early Oligocene
5	1	4/2	0845	3180-3183	3.0	0.3	250.0	253.0	Foram nanno chalk	Late Eocene
6	1	4/2	1530	3224-3228	4.0	1.1	294.0	298.0	Limestone	Late Cretaceous
7	2	4/2	2230	3235-3238	3.0	2.0	305.0	308.0	Calcilutite	Late Cretaceous
8	4	4/3	0130	3238-3243	5.0	5.5	308.0	313.0	Silty clay	Late Cretaceous
9	1	4/3	0515	3243-3252	9.0	0.8	313.0	322.0	Mudstone	Late Cretaceous
10	3	4/3	0800	3252-3260	8.0	4.2	322.0	330.0	Mudstone	Late Cretaceous
11	1	4/3	1145	3260-3263	3.0	0.7	330.0	333.0	Dol. Limestone	Late Cretaceous
12	1	4/3	1645	3263-3267	4.0	1.2	333.0	337.0	Calcilutite	Late Cretaceous
Total	30				59.0	34.9		337.0		
% Cored					17.5%					
% Recovered						59.2%				

[a]Drill pipe measurement from derrick floor.

nannofossil-rich, clayey, calcilutite. These sediments overlie a sequence of slightly clayey to clayey calcisiltite and dense, hard, slightly dolomitic limestone containing interbedded black chert and minor(?) clayey, nannofossil-rich, calcilutite. All of these sediment types are interpreted sedimentologically as deep water in origin.

The pebbly mudstones consist of abundant clasts of limestone of various colors and hardness, generally comprised of recrystallized (micrite) chalk clasts, along with porous dolomite clasts of possible Lower Cretaceous shelf origin (in Core 9) and mud clasts, often deformed, of slightly clayey to clayey calcilutite (sometimes similar to associated fine-grained interbeds of the sequence described). Paleontological studies suggest that much of the detritus, containing retransported shallow-water forams, is shallow water in origin, and several different ages of sediment are suggested on the basis of disaggregation of individual clasts. Continued work on various clast types should furnish some idea as to the dominant sediments which comprised the clast source. Data in hand would suggest that (pelagic) slope sediments were an important, although not necessarily dominant, source nearby. The considerable amount of miliolid debris reported by McNeely (this report) from these sediments would support a shelf/bank source. A more complete discussion of interpretation regarding the pebbly mudstones will be given in the following section.

The association of the pebbly mudstones with the underlying dense limestone and black chert suggests a not significantly different environment of deposition. The black chert, finely microlaminated, is quite similar to the black chert described from Site 5 of Leg 1 (east of San Salvador in the Atlantic). At that site, black chert is associated with pebbly mudstones essentially identical to that reported from Site 97 and is of the same age. Although dense limestone was not recovered from Site 5, nannofossil-rich calcilutite similar to that described above was. The greenish gray sediment color is also reminiscent of Site 5.

Although additional interpretations regarding seismic reflection data from the region of Site 97 are not available, it would appear that a section of weak reflectors underlies the interval of pebbly mudstone and dense lime discussed above. If this section could be shown, on the basis of interval velocities, to be of the right order for pelagic ooze/chalk, a strong argument could be put forth

that Lower Cretaceous sediments in the vicinity of Site 97 are also of deep-water origin. The presence of known shallow-water carbonates to the north and west (Florida and Yucatan platforms, respectively) with an intervening area of variably shallow- to deep-water carbonates within the strait would support a deep-water interpretation for the abyssal plain region of the Gulf of Mexico. Alternatively, it could be argued that shallow-water limestone underlies, at some depth, the sequence described at Site 97. If this is so, then subsidence must have been quite rapid, with accompanying formation of scarps covered with at least some pelagic ooze (to furnish part of the pebbly mudstone detritus). Although the writer prefers the first interpretation, based on other arguments, the question still remains unresolved.

Sedimentological Interpretation

Perhaps the most interesting sedimentological aspect of Site 97 is the occurrence of pebbly mudstone and associated deep-water sediments, primarily nannofossil-rich calcilutite. The general occurrence of exotic clasts suspended in a matrix of mixed, deep-water ooze/clay and "shallow-water" debris of variable size is common to deep-water sediments of many areas. The rather unique textural mix and fabric of pebbly mudstones has been generally ascribed to a gravity-dominated process known as low velocity mass flow or simply as gravity mud slides of submarine origin. The association of these sediments with clacilutite containing a deep-water fauna is suggestive of nearby areas of high bathymetric relief.

The correspondence in age of pebbly mudstones from Site 97 with those of Site 5 (Leg 1) suggests a common history or sequence of events. The writers would like to suggest that mid-Cretaceous time was marked by a general period of (eustatic?) emergence in the Gulf Coast basin. This is especially marked in the East Texas embayment, where basal Woodbine sands reflect an increase in basinward gradient, a dominantly fluvial aspect, in Cenomanian time. This is not to be directly compared with a conventional progradational phase of clastic sedimentation which accompanied the overall phase of clastic sedimentation throughout the region. In the southeastern Gulf of Mexico area, the advent of pebbly mudstone deposition may reflect a basic period of emergence, whether eustatic or not, during which the incidence of shelf edge-slope gravity slumping would be increased. Although other explanations may be sought, there appears to be little support for massive tectonic adjustments on the local scale. If it can be proven that large-scale fault movements took place during late Albian or early Cenomanian, then that mechanism would become more attractive as an explanation for the pebbly mudstone occurrences.

The hard, dense, horizontally to vaguely laminated to sparsely mottled calcisiltite and calcilutite which occur in Cores 11 and 12 are of somewhat uncertain origin. It appears that dominant carbonate particle types contained within these sediments are fine-grained detrital carbonate and planktonic foraminiferal tests, with rare, unbroken, thin-walled pelecypod shells, ostracod shells, and miliolids. Microscopically, laminae consist of fossil-rich micrite alternating with micrite. The micrite contains abundant particulate organic material as 5 to 10 micron, translucent brown, globules. These sediments resemble similar lithologies from the mid-Paleozoic of the Ouachita fold belt of southeastern Oklahoma and west Texas, which are interpreted variously as moderate to deep water in origin. The association of this rock type with carbonaceous organic-rich, radiolarian(?), microlaminated chert (similar to various deep-water cherts of the open ocean Leg 1 report) and with interbedded, vaguely laminated, clayey, nannofossil-rich calcilutite of probable deep-water origin suggests that the dense limestones are lithified deep-water carbonate analogues of terrigenous clastic hemilaminites/laminites.

Physical Measurements

Natural gamma-ray measurements reflect the conclusions previously mentioned regarding clay content. Relatively high values were obtained for upper Cenozoic sediments and the pebbly mudstones near the base of the hole. The chalks of lower Tertiary age are low in clay content as are the limestones at the base of the hole (which could not be measured). This general trend through the Cenozoic has been shown in most of the sites drilled during Leg 10 and are summarized in the chapter on Sedimentology (this volume).

Density and penetrometer measurements again reflect consolidation with depth. Laboratory determinations of bulk density were approximately 0.2 gm/cc higher than GRAPE values. Penetrometer values on the chalks ranged from approximately 2 or greater (soft) to zero (hard). The effect of increased clay content on penetrometer data is obvious in Core 6, although this sediment may be somewhat mechanically disturbed. Bulk density of the near-surface Pleistocene sediment is considerably higher than normal for most unconsolidated sediments. This is apparently related to a thin section of Lower and Middle Pleistocene overlying Lower Pleistocene, suggesting either rapid consolidation of these sediment types or previously greater depths of burial and subsequent erosion in approximately Middle Pleistocene time.

BIOSTRATIGRAPHY

As interpreted from the fossil plankton (foraminifers, calcareous nannofossils, and radiolarians), the biostratigraphy of Site 97 is summarized in Figure 1.

Sample 1 (10-97-1, CC):

Globorotalia truncatulinoides, G. miocenica, G. pertenuis, G. tosaensis, Discoaster brouweri, D. pentaradiatus, D. surculus, D. asymmetricus, D. perplexus, Ceratolithus rugosus, Pseudoemiliania lacunosa, and *Scyphosphaera intermedia.*

Age: Earliest Pleistocene (Nebraskan); *Globorotalia truncatulinoides* Zone; *Globorotalia tosaensis* sub-Zone.

Environment: Bathyal.

Remarks: Diversity of both the fauna and flora and the absence of *Globigerina inflata* suggest rather warm temperatures. Since, however, *Globoquadrina altispira* was not found among the assemblage members, the sample was not dated as Pliocene. *Globorotalia multicamerata* also, seemingly, had not yet been reached.

Sample 2 (10-97-2, CC):

Globorotalia acostaensis, G. miocenica, Globoquadrina altispira, Globigerina nepenthes, Globigerinoides obliqua, Sphaeroidinella immatura, Discoaster brouweri, D. surculus, D. subsurculus, D. variabilis, D. exilis, D. quinqueramus, Reticulofenestra pseudoumbilica, and fragments of crosphaerid radiolarians.

Age: Latest Miocene: *Globorotalia acostaensis* Zone.

Environment: Bathyal.

Remarks: More than 90 per cent of the washed residue consisted of volcanic glass shards. Sponge spicules also were a common component.

Sample 3 (10-97-3, CC):

Globorotalia mayeri, G. lenguaensis, G. menardii (sinistral), *Globoquadrina* sp., *G. venezuelana, Sphaeroidinella immatura, Discoaster brouweri, D. exilis, D. hamatus, D. bollii, D. challengeri, D. quinqueramus,* and *Catinaster* sp. cf. *C. calyculus.*

Age: Late Middle Miocene (N. 14, possibly N. 15).

Environment: Bathyal.

Remarks: The calcareous nannofossil assemblage, and the frequent occurrence among the foraminifers of *Globorotalia menardii* (sinistral), suggest that the sampled section is possibly *Globorotalia menardii* Zone (N. 15) in age, but *Globorotalia mayeri* supposedly does not occur above its zone. Reworked foraminifers and calcareous nannofossils, on the other hand, were noted from the Late Cretaceous, Middle Oligocene, and Early Miocene.

Sample 4 (10-97-4, CC):

Globorotalia opima opima, G. nana, Globigerina ciperoensis, Globoquadrina venezuelana, Catapsydrax dissimilis, Discoaster deflandrei, D. trinidadensis, D. saundersi, D. adamanteus, Reticulofenestra scissura, Helicopontosphaera parallela, H. truncata, Sphenolithus distentus, S. predistentus, S. pseudoradians, and radiolarians of the *Dorcadospyris ateuchus* Zone.

Age: Early Oligocene (P. 21), the *Globorotalia opima opima* Zone.

Environment: Bathyal.

Sample 5 (10-97-5, CC):

Globorotalia cerroazulensis, G. increbescens, Globigerina rohri, G. yeguaensis, Hantkenina alabamensis, Hastigerina micra, Reticulofenestra umbilica, R. scissura, Cyclococcolithus orbis, Discoaster tani tani, D. saipanensis, D. barbadiensis, Lanternithus minutus, Blackites spinosus, Bramletteius serraculoides, and radiolarians of the *Thyrsocyrtis bromia* Zone.

Age: Late Eocene (P. 16/17), the *Globorotalia cerroazulensis* Zone.

Environment: Bathyal.

Sample 6 (10-97-6, CC):

Sample 7 (10-97-7, CC):

Sample 8 (10-97-8, CC):

Sample 9 (10-97-9, CC):

Sample 10 (10-97-10, CC):

Rotalipora greenhornensis, R. appenninica, Hedbergella washitensis, H. planispira, H. amabilis, H. delrioensis, Praeglobotruncana delrioensis, Planomalina buxtorfi, P. stephani, Globigerinelloides caseyi, G. bentonensis, Watznaueria barnesae, Eiffelithus turriseiffeli, E. augustus, Prediscosphaera cretacea, Zygodiscus phacelosus, Zygodiscus bitraversus, and *Vagalapilla* sp. cf. *V. octoradiata.*

Age: Late Cretaceous (early Cenomanian).

Environment: Bathyal.

Remarks: Much, if not most, of the samples consist of debris from shallow-water carbonate deposits (probable Lower Cretaceous)—the percentage increased downward in the section. The relative abundance of fossil plankton decreased downward in the section, suggesting some sort of transitional zone which must be dated as Late Cretaceous, unless the fossil plankton are shown to be contaminants. *Planomalina buxtorfi* was first noted (highest occurrence noted) in Sample 8 (10-97-8, CC). The species was not found below Sample 10 (10-97-10, CC).

Sample 11 (10-97-11, CC):

All fauna and flora are embedded in very dense and partially recrystallized limestone. No calcareous nannofossils were noted. Thin section work will be required for any foraminiferal determination, but polished surfaces revealed numerous calcisphaerulids. Hydrochloric acid treatment yielded several poorly preserved species of the radiolarian fauna characterized by long, slender stichocyrtids and large spherical forms. The fauna is very similar to one figured by Aliev (1965) from late Albian to early Cenomanian sediments of northeastern Azerbaidzhan (USSR). Since, however, beds underlying Core 11 in Site 97 are well dated as early Cenomanian, a similar age is assigned also to this sample.

Age: Late Cretaceous (early Cenomanian).

Environment: Probable Bathyal.

Sample 12 (10-97-12-1, 46.0-51.0 cm)

Rotalipora appenninica, R. evoluta, Preglobotruncana delrioensis, Hedbergella planispira, H. amabilis, Globigerinelloides caseyi, G. bentonensis, and *Shackoina* sp. cf. *S. multispina.*

Age: Earliest Late Cretaceous (early Cenomanian), *Rotalipora appenninica* Zone.

Remarks: The sample was of a pelagic marl zone between layers of very dense finely bedded limestone with chert layers.

Sample 13 (10-97-12, CC):

Rotalipora evoluta, R. appenninica, Praeglobotruncana delrioensis, Hedbergella planispira, Hedbergella sp., *Globigerinelloides caseyi, Watznaueria barnesae, Cyclolithus? gronosus, C.? actinosus, Zygodiscus deflandrei, Z.* sp. cf. *Z. erectus, Z. bitraversus, Z ? glabrus, Lithraphidites carniolensis, Prediscosphera cretacea, Stephanolithion crenulatum,* and *Radiolithus planus.*

Age: Earliest Late Cretaceous (early Cenomanian), Rotalipora appenninica Zone.

Environment: Bathyal.

Remarks: The sample examined was of the pelagic marl between segments of the very dense finely bedded lime-

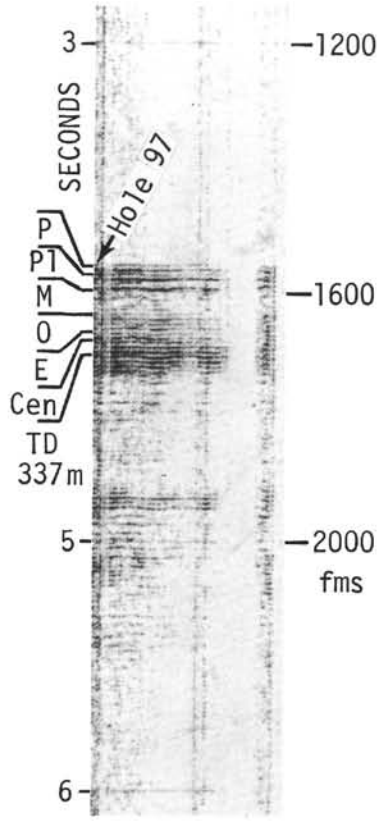

Figure 2. *Profile record, Site 97.*

stone with layers of chert. The lowest material cored is of the dense limestone, but since the marl is interbedded with the dense limestone layers higher in the core, the entire core is dated as earliest Late Cretaceous.

DISCUSSION AND INTERPRETATION

Glomar Challenger occupied Site 97 April 1-3, 1970. Twelve cores, ranging in age from Early Pleistocene (N. 21) to Cenomanian were recovered from Site 97 to a depth of 337 meters (Table 1). Six of the twelve cores recovered were taken by continuous coring below the 305 meter depth (Cretaceous). Only one core was recovered from the Pleistocene (a punch core) at 0 to 5 meters depth. The oldest sediments of Core 1 were of Early Pleistocene (Nebraskan) age and consisted of nannofossil ooze. Foraminifers were common to abundant, detrital carbonate rare to abundant, and traces of pteropod fragments, sponge spicules, plant debris, and radiolaria were noted.

Figure 2 shows a profiler record. This position was a few miles northwest of the planned location because of beacon troubles and the strong currents present. *Glomar Challenger* was steaming at about 5 knots, on about a southwest course in a portion of the Gulf Stream, in order to maintain a position stationary in relation to the ocean floor. Consequently, the recording streamer and air gun were deployed on station while drilling and a record made. Differences in the record are due to changing filter settings and gains to try to determine the settings required to obtain optimum recording results.

The Pleistocene section of Site 97 was much thinner than that of Site 96 (Late Wisconsin-Holocene resting unconformably on thin Early Pleistocene). Considering the elevation of the site above the end of the Mississippi Fan, few, if any, terrigenous sediments were derived from the north as they were at Site 96.

No Pliocene sediments were recovered. Miocene sediments consist of clayey, foraminiferal, nannofossil ooze containing small amounts of quartz, plant fibers, and rare amounts of dark-colored mica, light-colored glass, and sponge spicules. The Miocene section at Site 97 is thicker than that of Site 96. The remaining Tertiary section cored, consists of Oligocene and Eocene foraminiferal nannofossil (soft) chalk and hard chalk. The first occurrence of chalk is interpreted to occur at about 200 meters. The lower Tertiary section of Site 97 is lithologically similar to the stratigraphically equivalent section in Site 96 and the other sites on the Yucatan slope. An unconformity at the end of the Cenozoic section (Late Eocene) is marked by the occurrence of early Cenomanian pebbly mudstone and minor intercalated nanno-rich clayey calcilutite. These sediments overlie a sequence of clayey calcisiltite and dense, hard, dolomitic limestone or dolomite containing interbedded black chert and minor clayey nanno-rich, calcilutite, all deep water in origin. Clasts within this section were suggested to be of several ages and of shallow-water origin. The occurrence of pebbly mudstones from Site 97 has led to the following suggestion as to the sequence of events necessary for their explanation.

The late Early Cretaceous time was marked by a general period of (eustatic) emergence in the Gulf Coast basin. In the southeastern Gulf area, the advent of pebbly mudstone deposition may reflect a basic period of emergence during which time the incidence of shelf edge-slope gravity slumping would be increased. An alternative explanation would be that large-scale fault movements took place in the area during late Albian or early Cenomanian, a not too unlikely event considering that the "Laramide" orogeny began in Cuba during the Campanian-Early Eocene period.

The majority of Cretaceous material recovered and examined by the paleontologists consists of debris from shallow-water carbonate deposits, the percentage increasing downward in the section. The relative abundance of fossil plankton decreases downward in the section, suggesting some sort of transitional zone.

The top of a sequence of reflectors on the profiler record correlates with the top of the Oligocene chalk at 200 meters. A prominent reflector in the series of reflections correlates with the top of the hard chalks which marks the end of the Cretaceous at 294 meters.

The average rate of deposition at Site 97 from Late Eocene to Present was approximately 0.4 cm/10^3y. Because of the widely spaced cores up to the Cretaceous,

rates of deposition could not be calculated, except for the Late Miocene, which was about 1.2 cm/10^3y.

The average rate of deposition is similar to that of Sites 96, 95, and 94. The relationship of the area of Site 97 to that of the Florida and Campeche platforms is still in question, as is the structural relationship between the Florida and Yucatan platforms. The area has a complex geological history and much more thought and study is needed before any definite conclusions can be drawn.

REFERENCES

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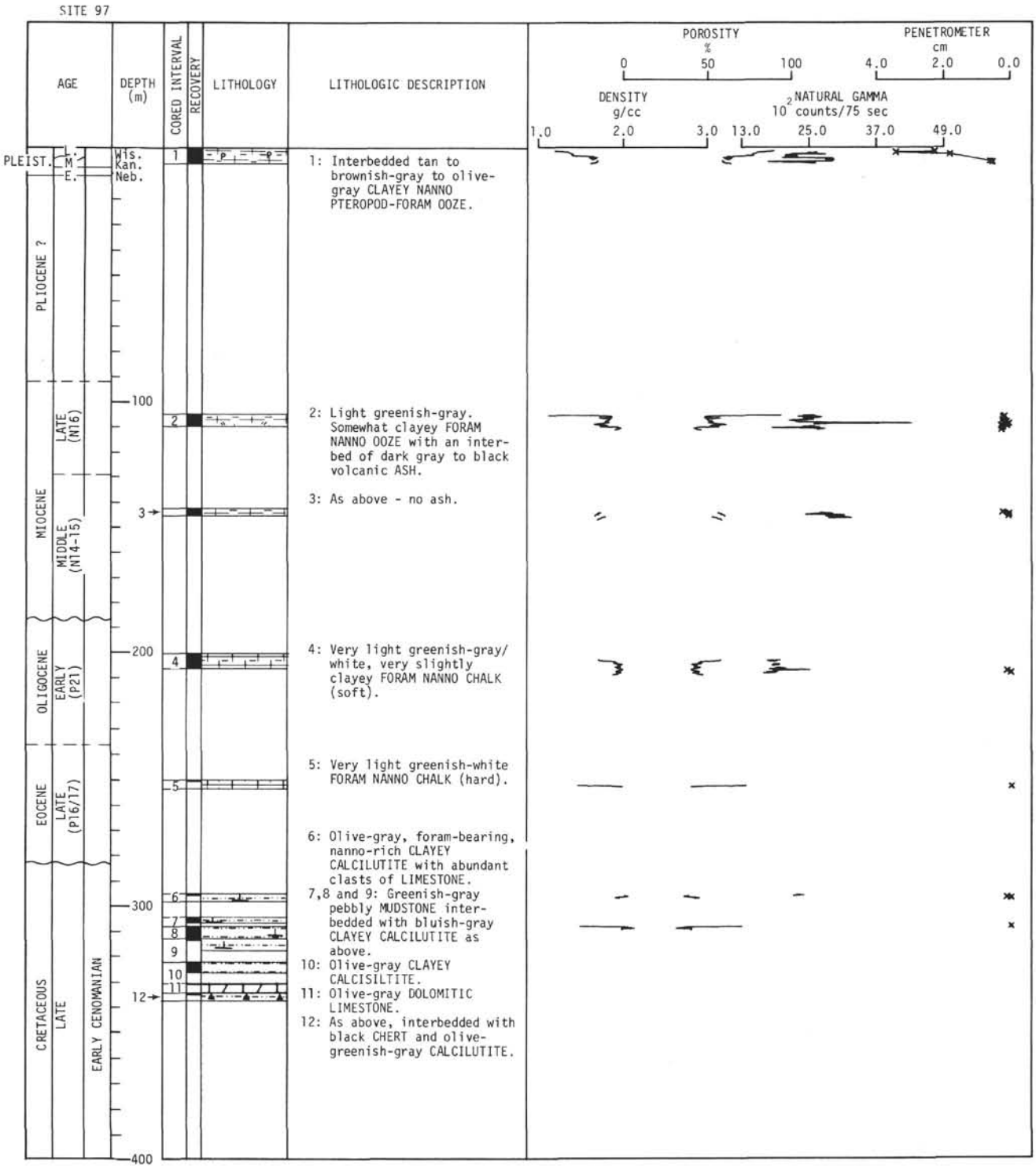
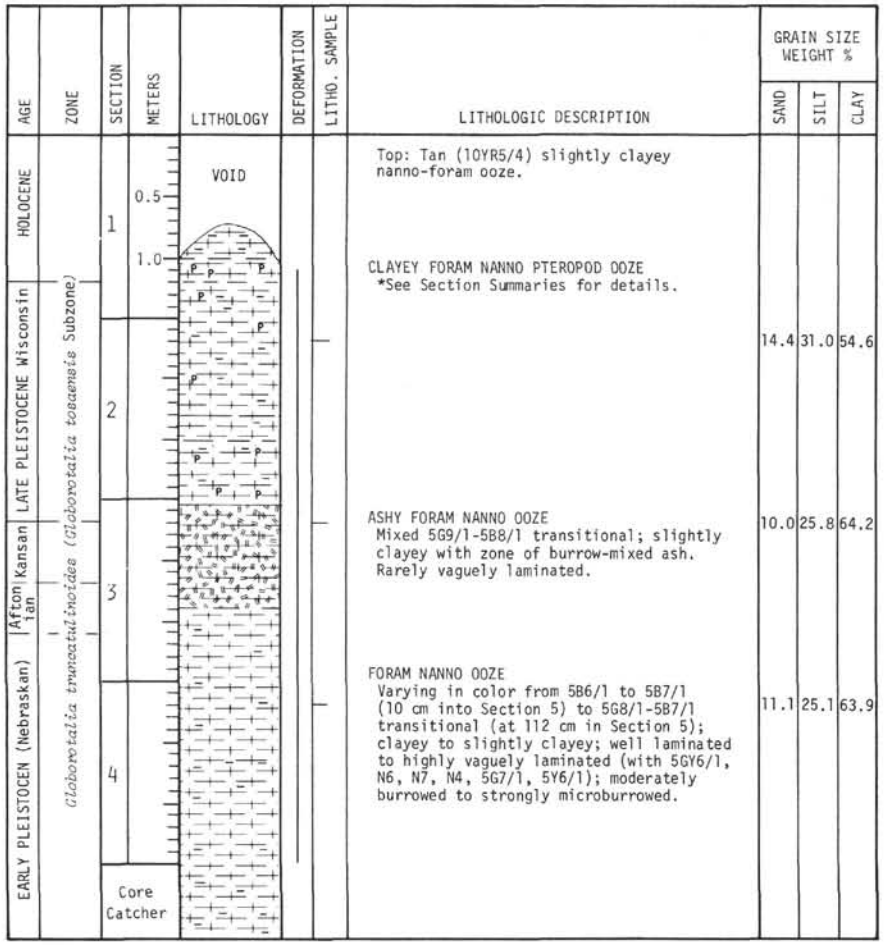
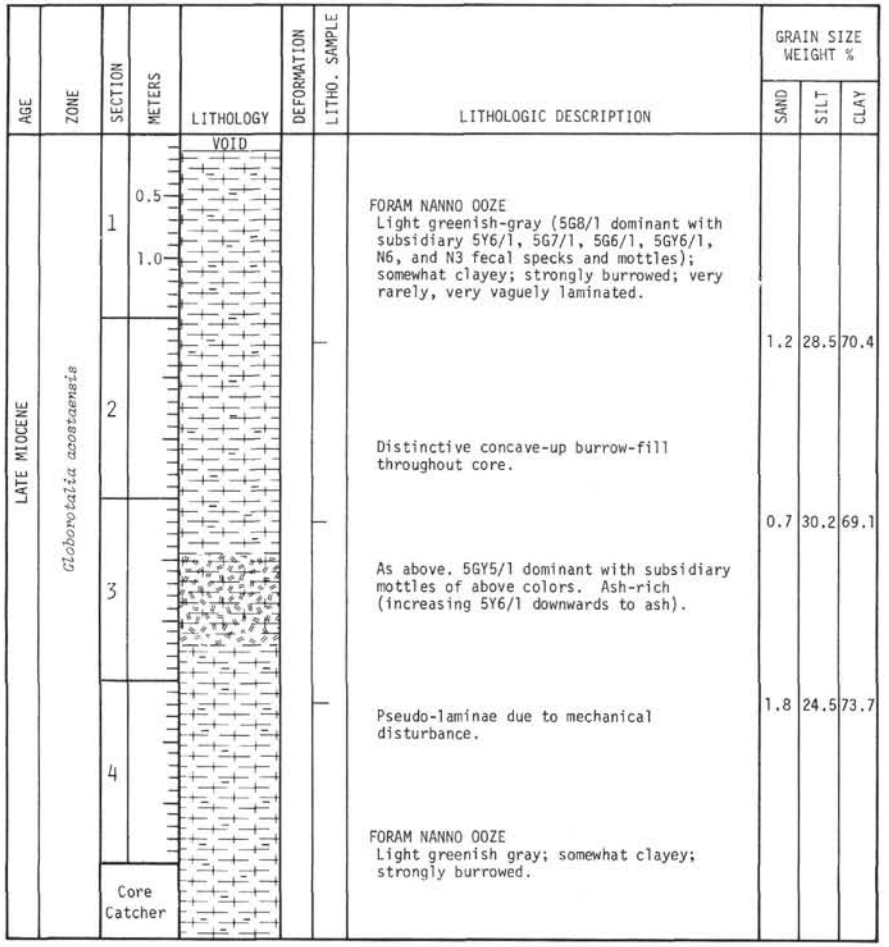

SITE 97
AGE
DEPTH (m)
CORED INTERVAL
RECOVERY
LITHOLOGY
LITHOLOGIC DESCRIPTION
POROSITY %
0 50 100
PENETROMETER cm
4.0 2.0 0.0
DENSITY g/cc
1.0 2.0 3.0
NATURAL GAMMA 10² counts/75 sec
13.0 25.0 37.0 49.0
PLEIST. L. M. E.
Wis. Kan. Neb.
PLIOCENE ?
MIOCENE
LATE (N16)
MIDDLE (N14-15)
OLIGOCENE
EARLY (P21)
EOCENE
LATE (P16/17)
CRETACEOUS
LATE
EARLY CENOMANIAN
100
200
300
400
1: Interbedded tan to brownish-gray to olive-gray CLAYEY NANNO PTEROPOD-FORAM OOZE.
2: Light greenish-gray. Somewhat clayey FORAM NANNO OOZE with an interbed of dark gray to black volcanic ASH.
3: As above - no ash.
4: Very light greenish-gray/white, very slightly clayey FORAM NANNO CHALK (soft).
5: Very light greenish-white FORAM NANNO CHALK (hard).
6: Olive-gray, foram-bearing, nanno-rich CLAYEY CALCILUTITE with abundant clasts of LIMESTONE.
7,8 and 9: Greenish-gray pebbly MUDSTONE interbedded with bluish-gray CLAYEY CALCILUTITE as above.
10: Olive-gray CLAYEY CALCISILTITE.
11: Olive-gray DOLOMITIC LIMESTONE.
12: As above, interbedded with black CHERT and olive-greenish-gray CALCILUTITE.

Site 97 Hole Core 1 Cored Interval: 0-5 m



Site 97 Hole Core 2 Cored Interval: 105-110 m



Site 97 Hole Core 3 Cored Interval: 142-145 m

AGE	ZONE	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	GRAIN SIZE WEIGHT % SAND	SILT	CLAY
MIDDLE MIOCENE	N14/N15	1	0.5–1.0	VOID			Pseudo laminated throughout.			
		2					FORAM NANNO OOZE Light greenish-gray (5G8/1 with subsidiary 5GY6/1, 5Y6/1, 5G9/1?, 5G7/1, N3 and N6-7 faecal stain); somewhat clayey; strongly burrowed; rarely vaguely laminated.			
		3					VOID	2.1	35.6	62.2
		Core Catcher					VOID			

Site 97 Hole Core 4 Cored Interval: 200-207 m

AGE	ZONE	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	GRAIN SIZE WEIGHT % SAND	SILT	CLAY
EARLY OLIGOCENE	P21	1	0.5–1.0	UNOPENED			Section 1 not opened - too disturbed.			
		2					Brecciated-mechanically disturbed. Pseudo laminated - strongly disturbed. FORAM NANNO CHALK (soft?) Very light greenish-gray/white (5G9/1); very slightly clayey; probably strongly(?) burrowed. N7 fecal stain.	3.5	48.2	48.4
		3					As above. Some N9-5G9/1 mottles. N7-N3 fecal stain.	8.4	54.7	36.9
		4								
		5					As above. Ashy? Chalk zone heavily stained with N4-N7.	5.7	52.9	41.5
		Core Catcher								

Site 97 Hole Core 5 Cored Interval: 250-253 m

AGE	ZONE	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	GRAIN SIZE WEIGHT % SAND	SILT	CLAY
LATE EOCENE	P16/P17	1	0.5 1.0	VOID			FORAM NANNO CHALK (hard) Very light greenish-white (5G9/1-N9 transitional mottled with 5G6/1-8/1 locally. Rare N6); strongly burrowed.	0.6	45.0	54.4
		Core Catcher								

Site 97 Hole Core 6 Cored Interval: 294-298 m

AGE	ZONE	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	GRAIN SIZE WEIGHT % SAND	SILT	CLAY
LATE CRETACEOUS (Early Cenomanian)		1	0.5 1.0				Odorless. Clasts of chalk (5Y8/1) and chert (5GY6/1). Clasts of recrystalized chalk (hard calcilutite) containing ammonite. CLAYEY CALCILUTITE 5Y6/1; Nanno-rich; foram-bearing with abundant clasts of: LIMESTONE (recrystallized chalk) several colors (5YR8/1,N7,N8,5YR9/1,5Y8/1, 5B7/1) with: MUD 5B5/1 and 5G4/1. Clasts range from 1 mm to several cm. (pebbly mudstone)			
		Core Catcher								

Site 97 Hole Core 7 Cored Interval: 305-308 m

AGE	ZONE	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	GRAIN SIZE WEIGHT % SAND	SILT	CLAY
LATE CRETACEOUS (Early Cenomanian)		1	0.5 1.0	VOID			Large flat clast of LIMESTONE 5Y6/1 mottled with 5B7/1 or N7; burrow mottled microcrystalline (recrystallized chalk?). 5B5/1 clast. 5B6/1 clast. 5Y9/1 and 8/1 clasts. 5G5/1 and 6/1 laminated clasts. Dominant 5Y8/1 and 9/1 clasts. Pebbly MUDSTONE Greenish-gray; foram and clay-rich nanno-mudstone/ calcilutite with abundant rock clasts of chalk, calcilutite, mudstone and clayey chalk (5B6/1). CLAYEY CALCILUTITE/MUD 5B6/1 laminated with 5/1 and 7/1; nanno-rich; foraminiferal?; well laminated to microlaminated; sparsely(?) burrowed/ microburrowed. Pebbly MUDSTONE As above. CALCILUTITE 5G7/1 dominant; highly burrow mottled (N7,N8); somewhat clayey; foram(?) and nanno-rich. Pebbly MUDSTONE As above. Large clast (~10 cm) of recrystallized chalk in catcher.	2.2	48.1	49.8
		2								
		Core Catcher								

Site 97 Hole Core 8 Cored Interval: 308-313 m

AGE	ZONE	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	GRAIN SIZE WEIGHT % SAND	SILT	CLAY
LATE CRETACEOUS (Early Cenomanian)		1	0.5	VOID			CALCAREOUS SILTY CLAY 5B5/1 with minor 6/1-7/1; nanno-bearing vaguely laminated; moderately microburrowed.	0.9	13.8	35.3
			1.0				5B7/1 strongly burrow mottled clayey calcilutite.	4.3	49.4	46.3
							Pebbly mudstone (as in core 7).			
							Moderately mottled hemi-pebbly			
							Mudstone with soft chalk containing clasts. Mixed 5G7/1,5B5/1-6/1,5Y6/1.			
		2		VOID			Strongly mottled clayey calcilutite. 5G8/1-9/1 mixed with minor 5B5/1-6/1.			
							Moderately burrowed calcareous mud/clayey calcilutite. 5G6/1.			
							CLAY/CALCILUTITE 5B5/1 dominant; predominantly vaguely laminated; sparsely(?) burrowed.			
		3		VOID			Recrystallized chalk clasts in matrix of calcilutite/siltite.	11.9	47.4	40.8
		4		VOID			Pebbly MUDSTONE 5Y6/1-5GY6/1 transitional; chalk-calcilutite and dolomite clasts in a matrix of clayey calcilutite. Considerable soft calcilutite clasts.			
							5Y8/1 soft calcilutite chalk/large clast?			
		Core Catcher								

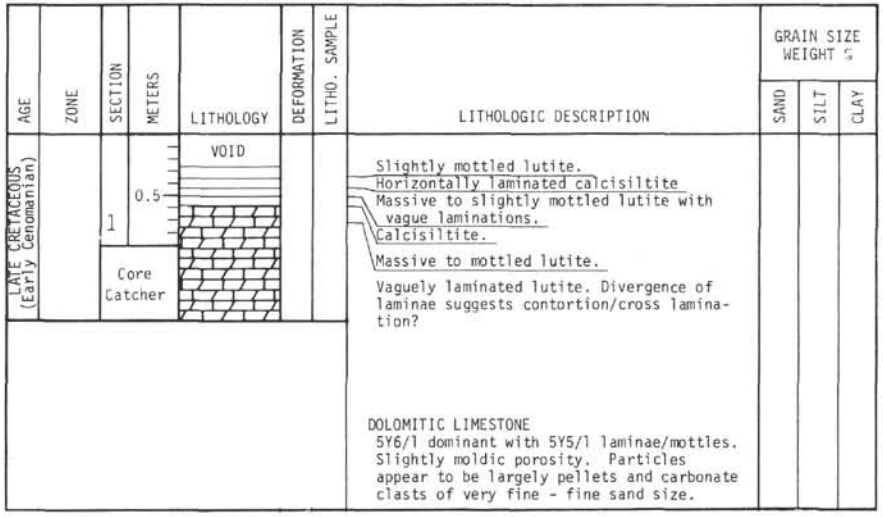
Site 97 Hole Core 9 Cored Interval: 313-322 m

AGE	ZONE	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	GRAIN SIZE WEIGHT % SAND	SILT	CLAY
LATE CRETACEOUS (Early Cenomanian)		1	0.5	VOID			Predominantly disturbed.			
			1.0				Pebbly MUDSTONE 5Y7/1-5GY7/1 transitional is dominant as in core 8.			
		Core Catcher					Note: One large fragment of porous, lower K shallow water, pelletal calcarenite. (limestone-dolomite).			

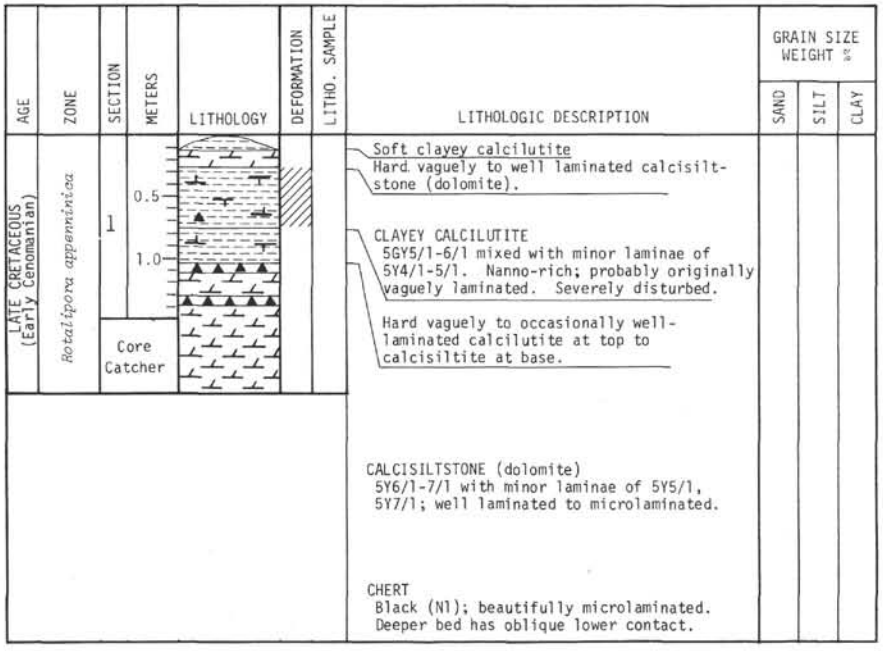
Site 97 Hole Core 10 Cored Interval: 322-330 m

AGE	ZONE	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	GRAIN SIZE WEIGHT % SAND	SILT	CLAY
LATE CRETACEOUS (Early Cenomanian)		1	0.5				Note: Core 10 not described in detail. Odorous - H_2S, strongly disturbed.			
			1.0				Lithologically similar to core 9, but has a smaller number of exotic rock clasts.			
		2					CALCISILTITE 5Y6/1 with distorted laminae of 5Y7/1. Slightly clayey to clayey. Some sand to pea-gravel clasts.			
		3					Probably fine-grained analogue of core 9. Orientation of laminae suggests presence of large contortions/slump bedding.			
							Note: One small fragment of black (N2-3) chert was observed in Section 2.			

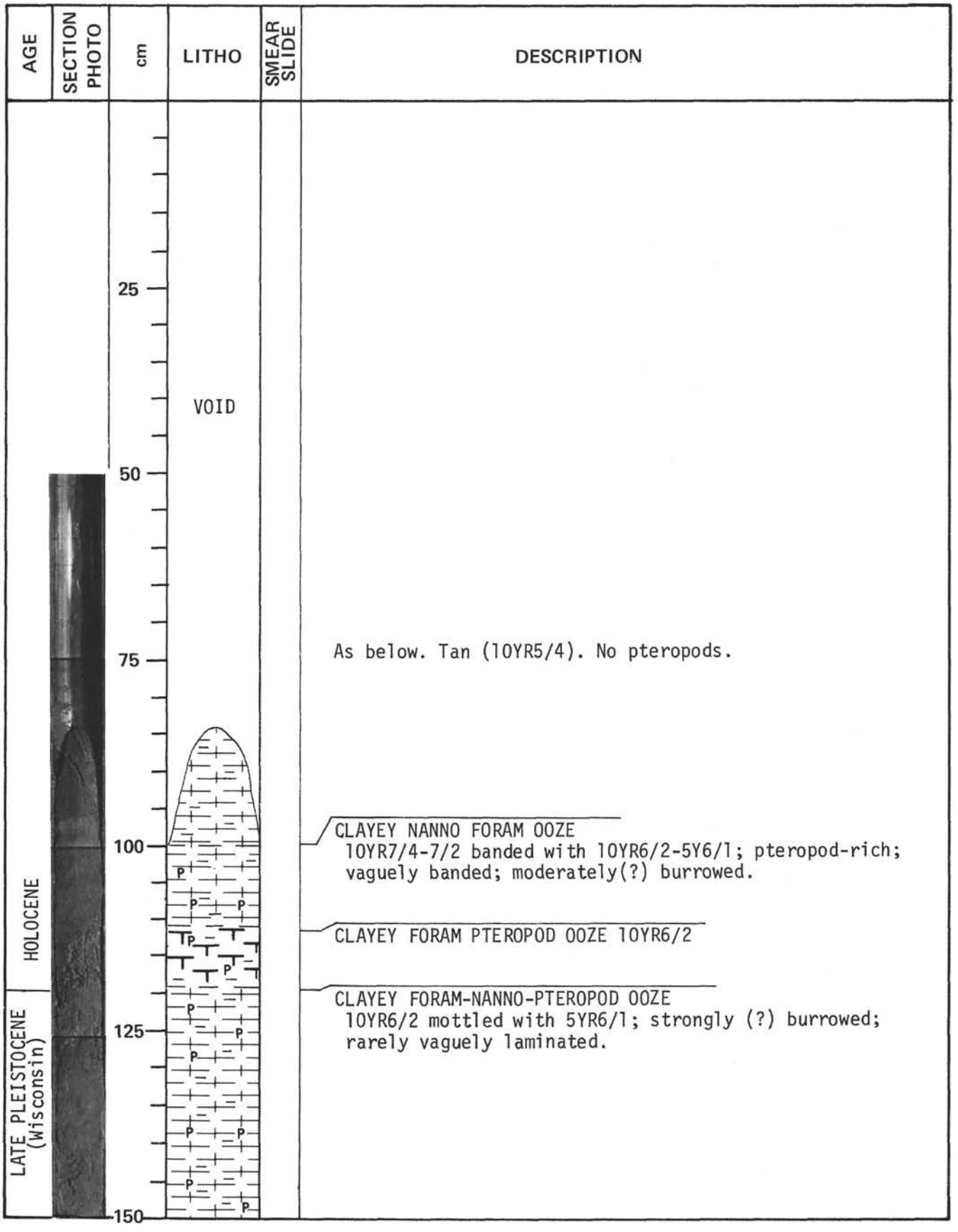
Site 97 Hole Core 11 Cored Interval: 330-333 m



Site 97 Hole Core 12 Cored Interval: 333-337 m



SITE 97 CORE 1 SECTION 1



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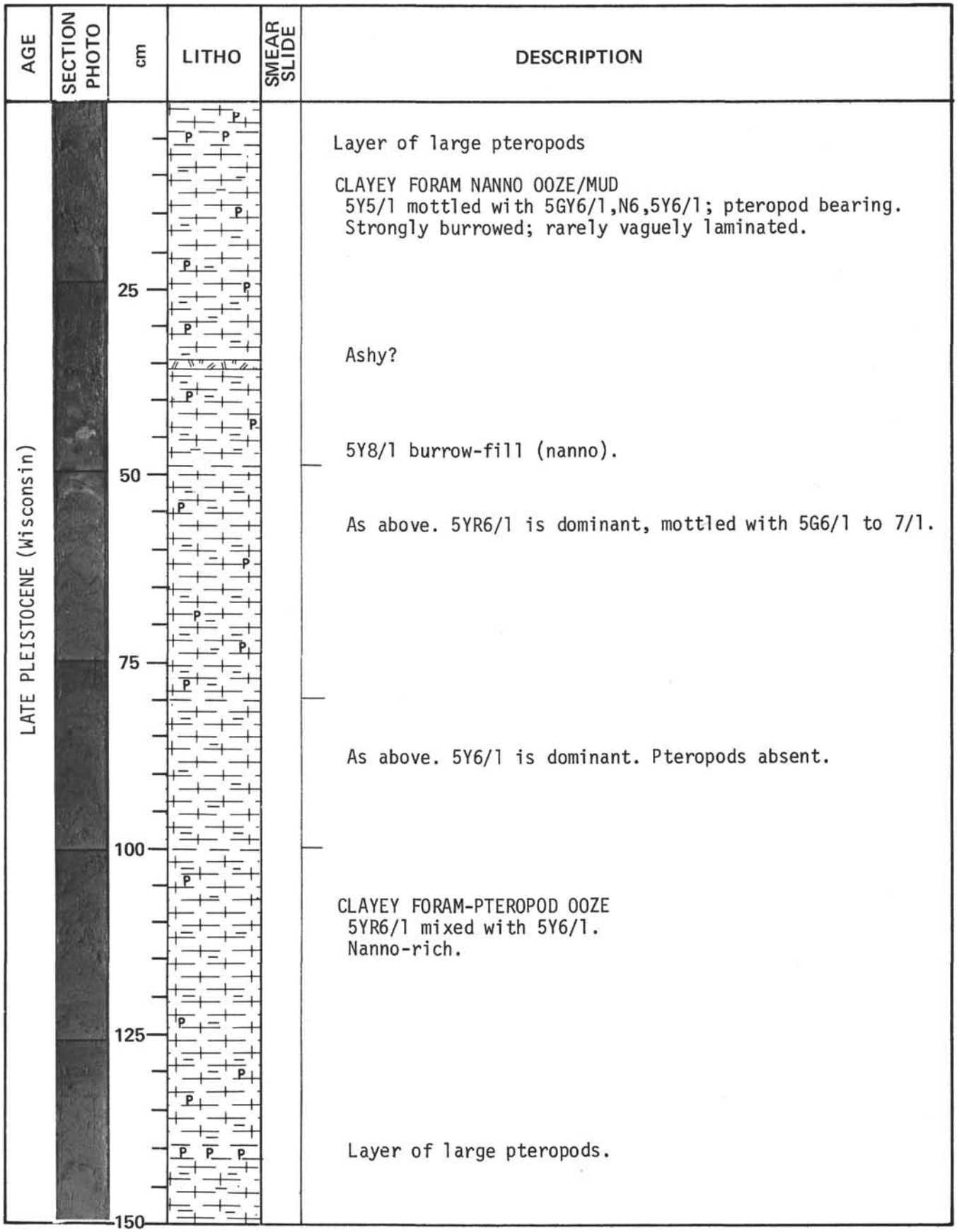

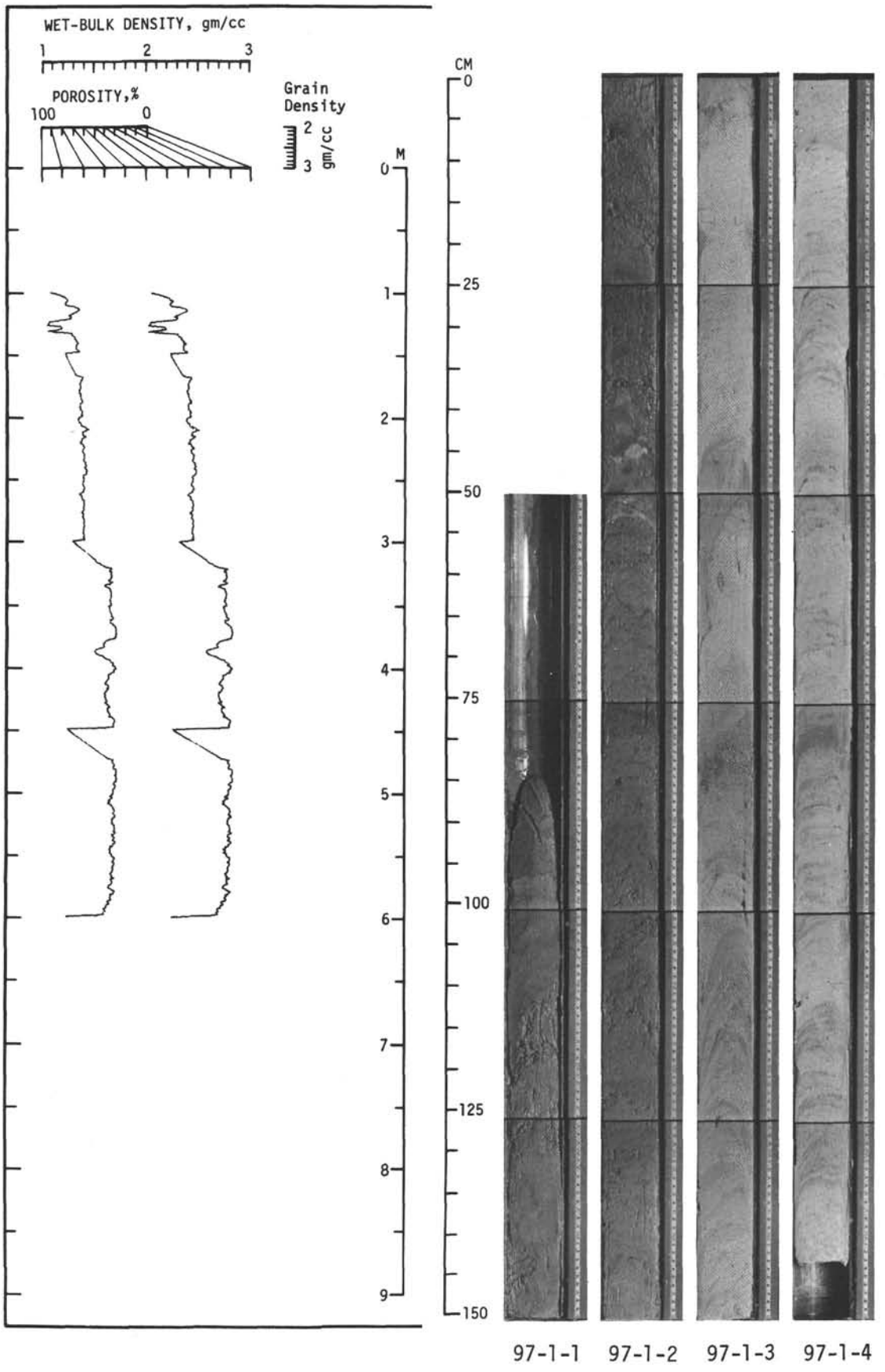
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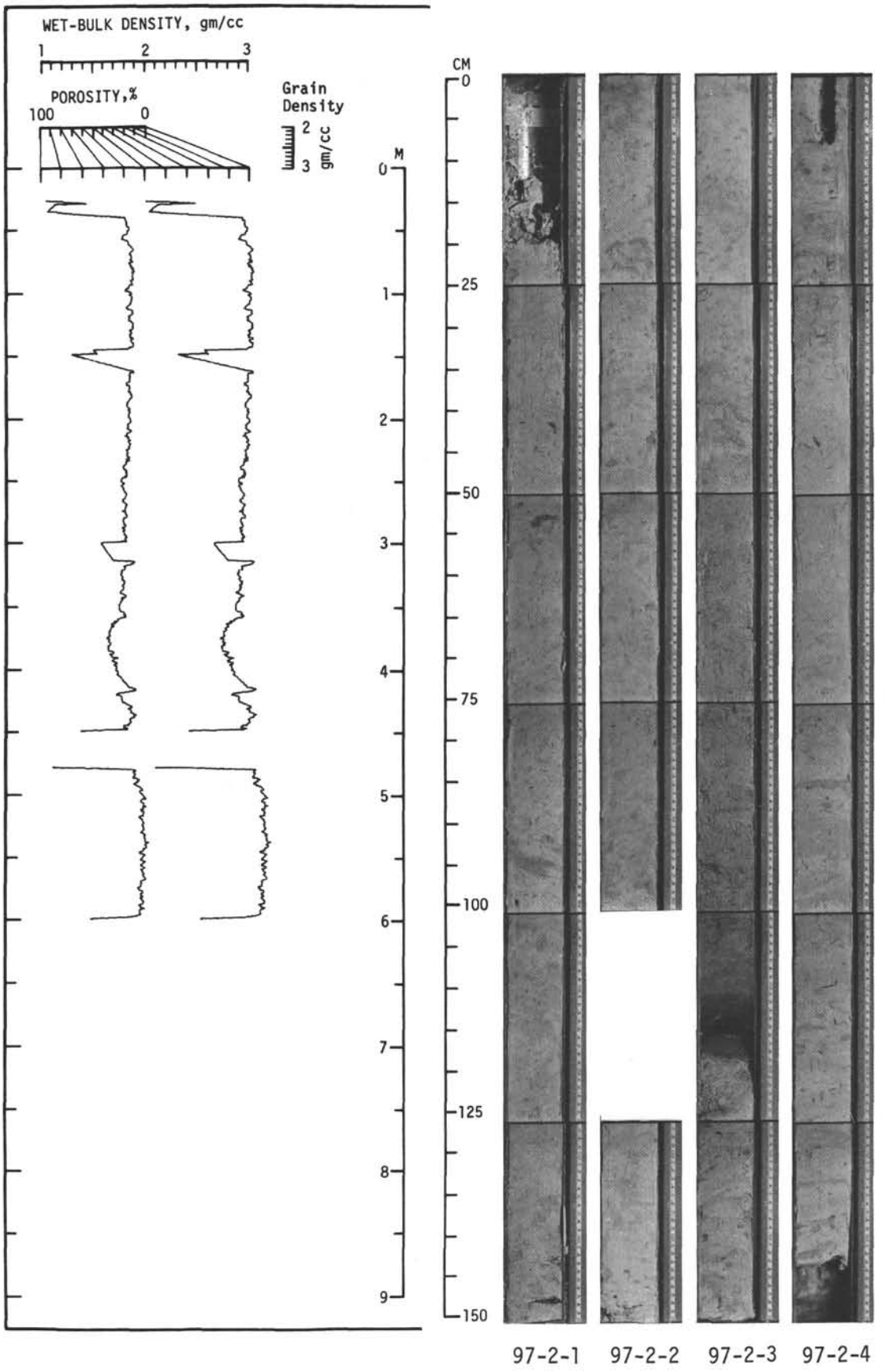
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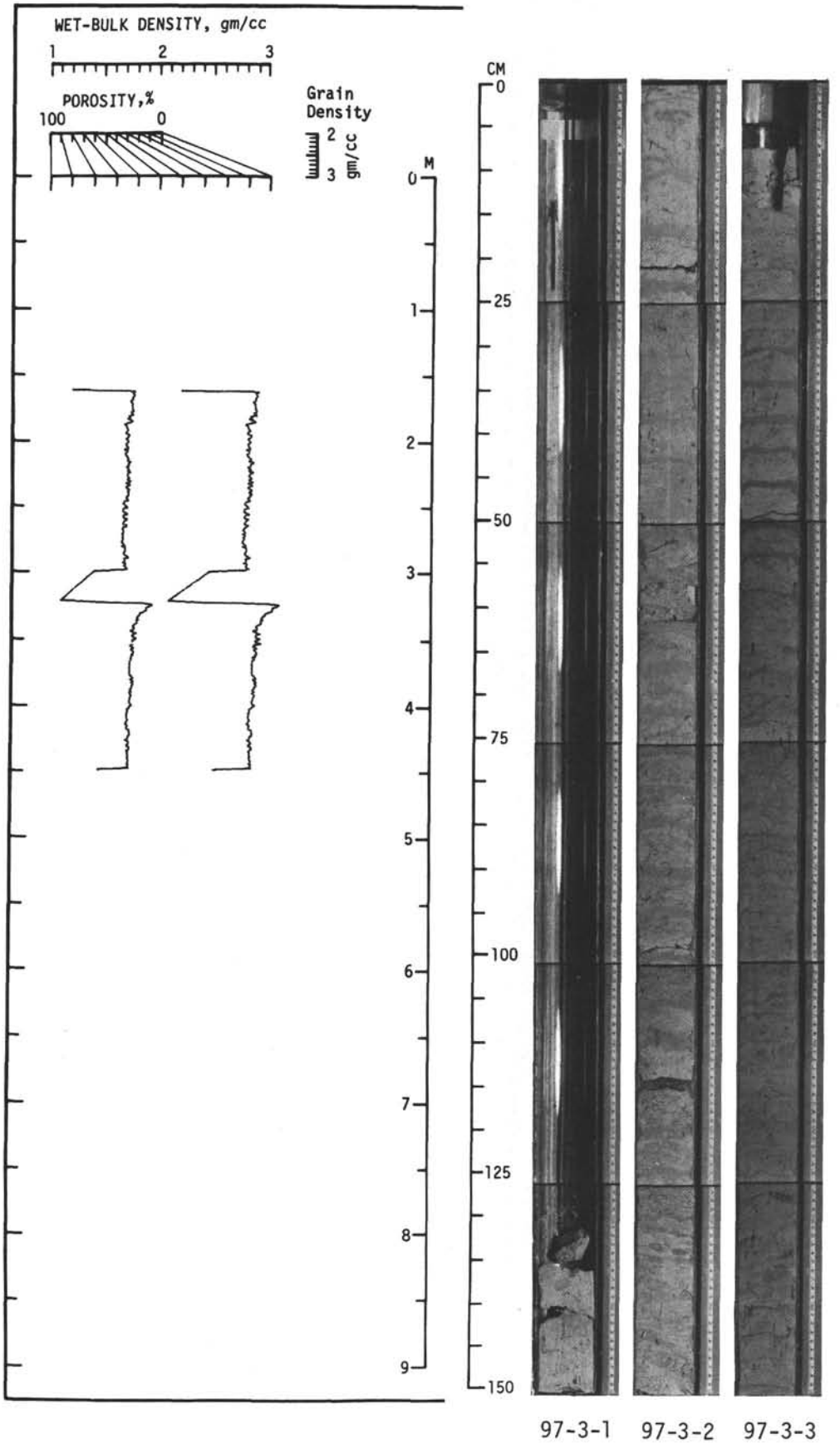
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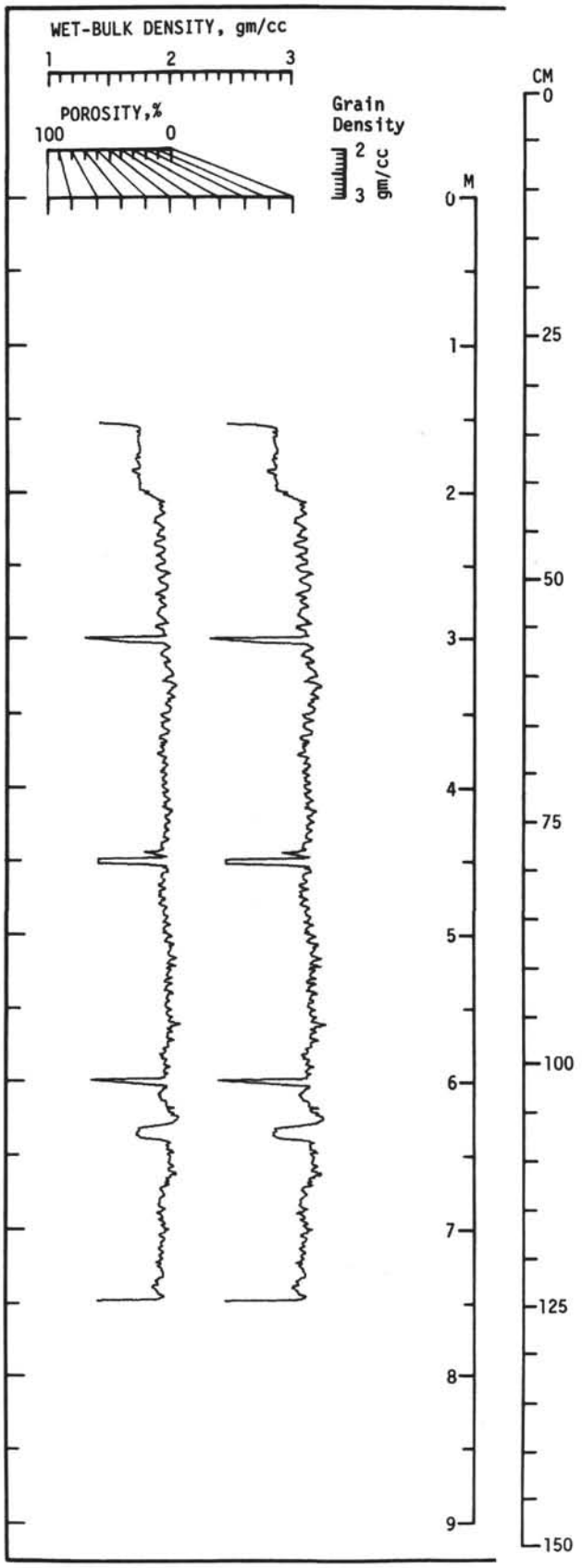

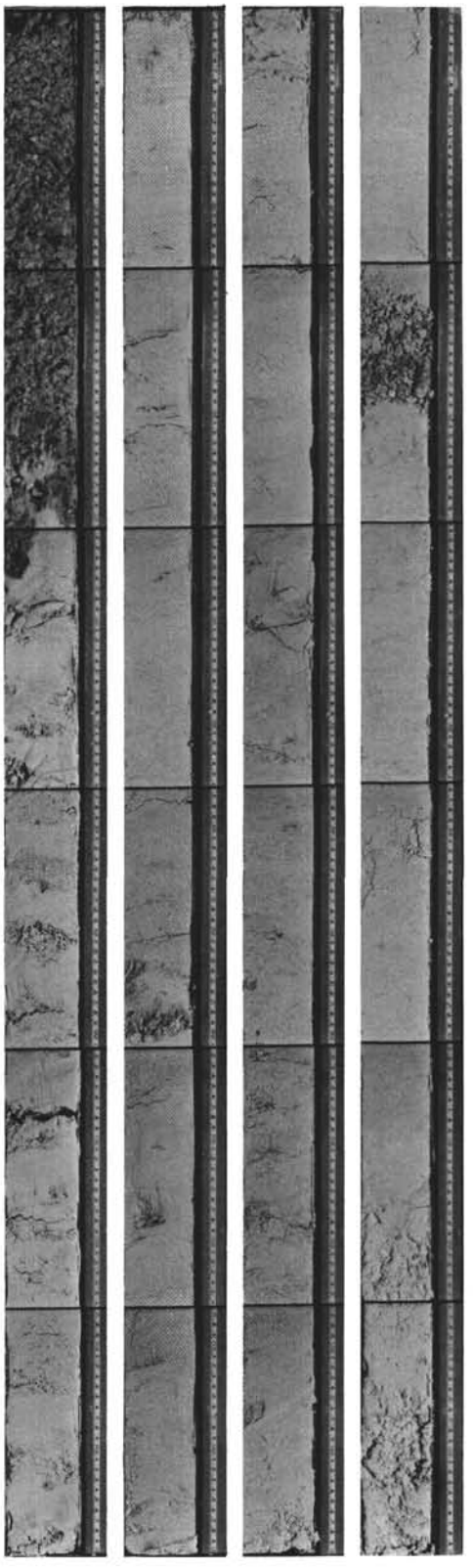

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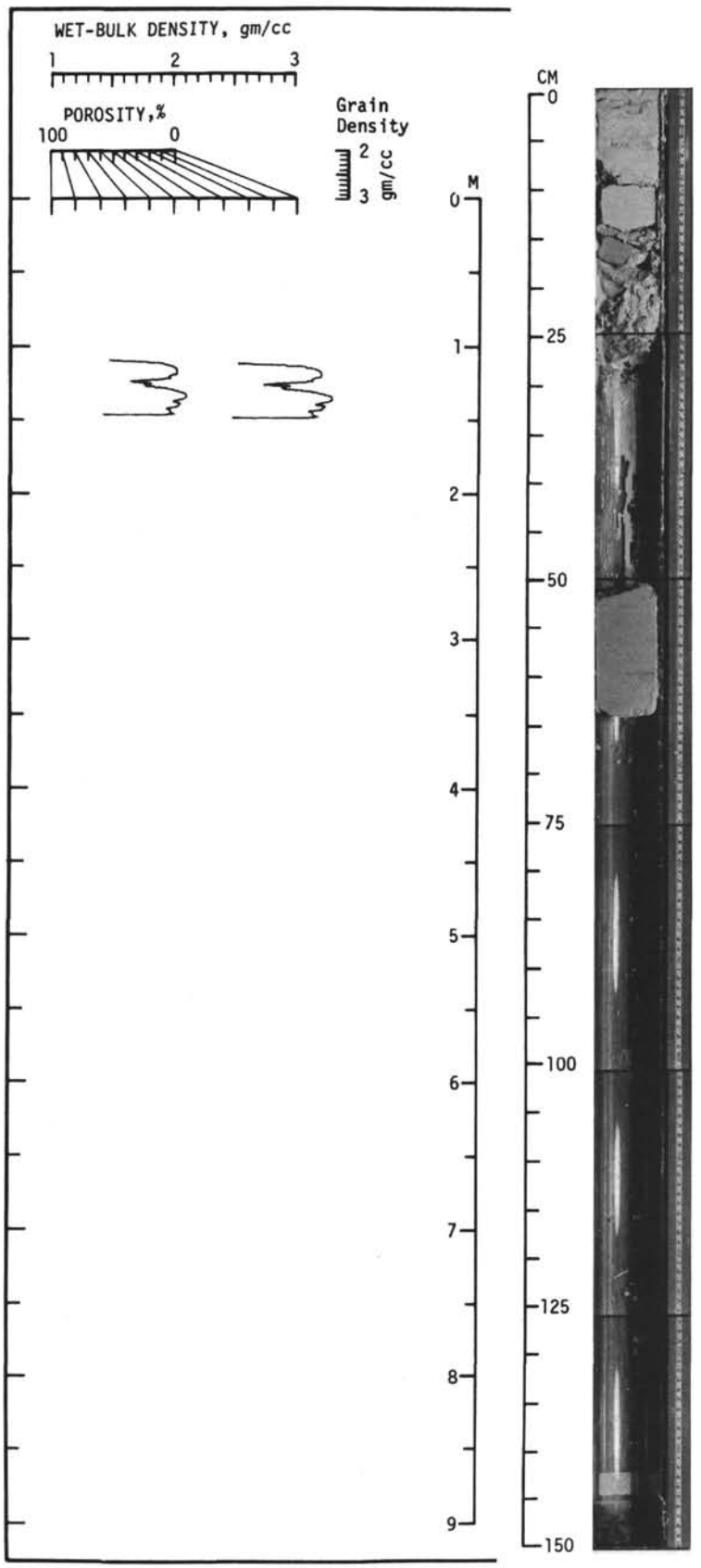
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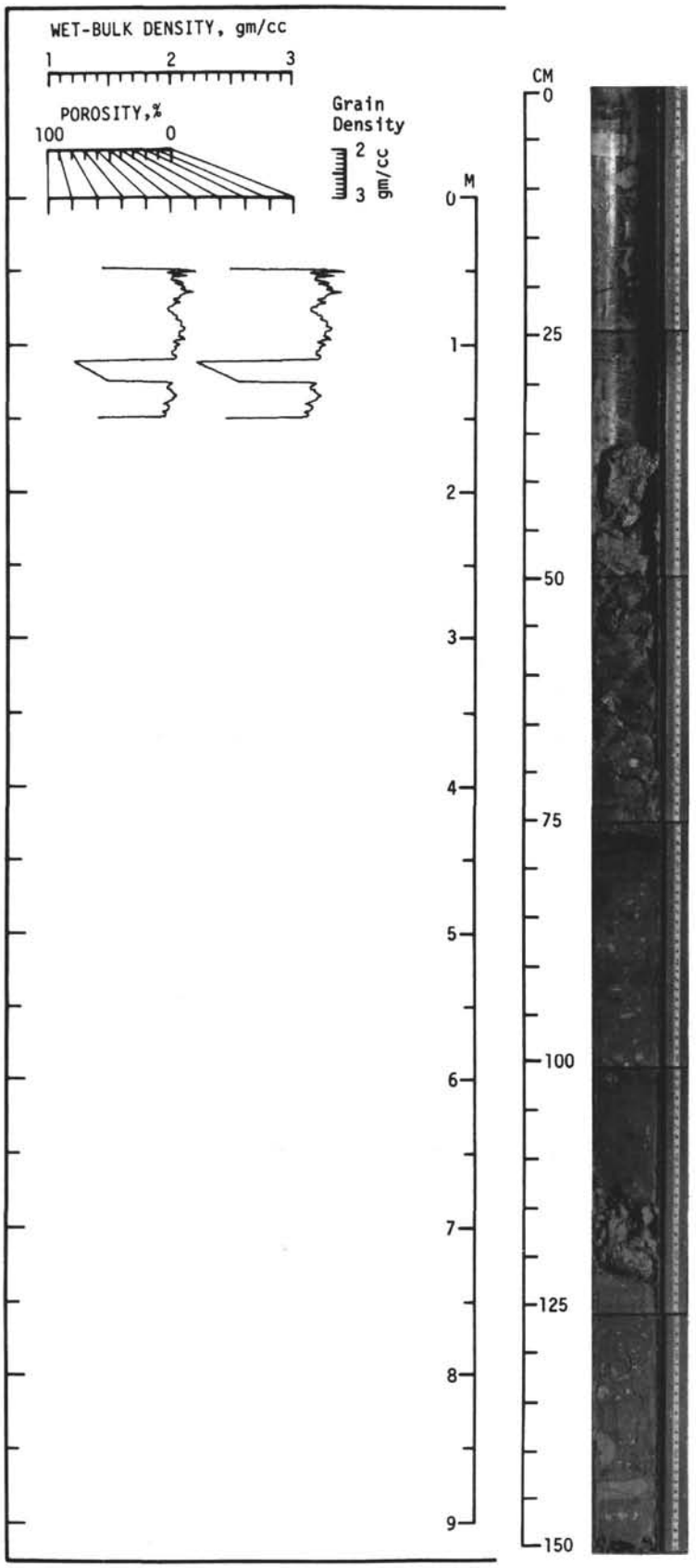
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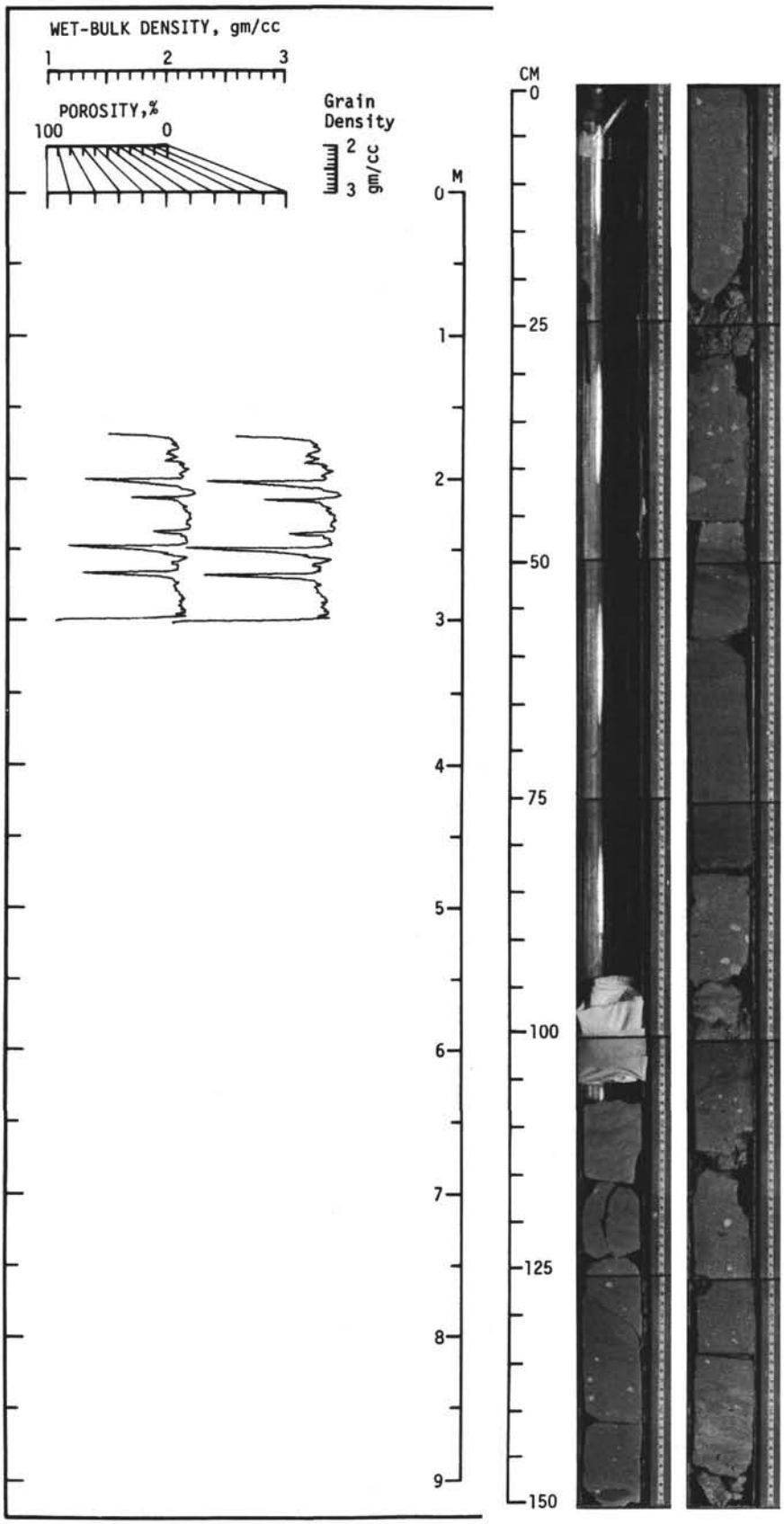
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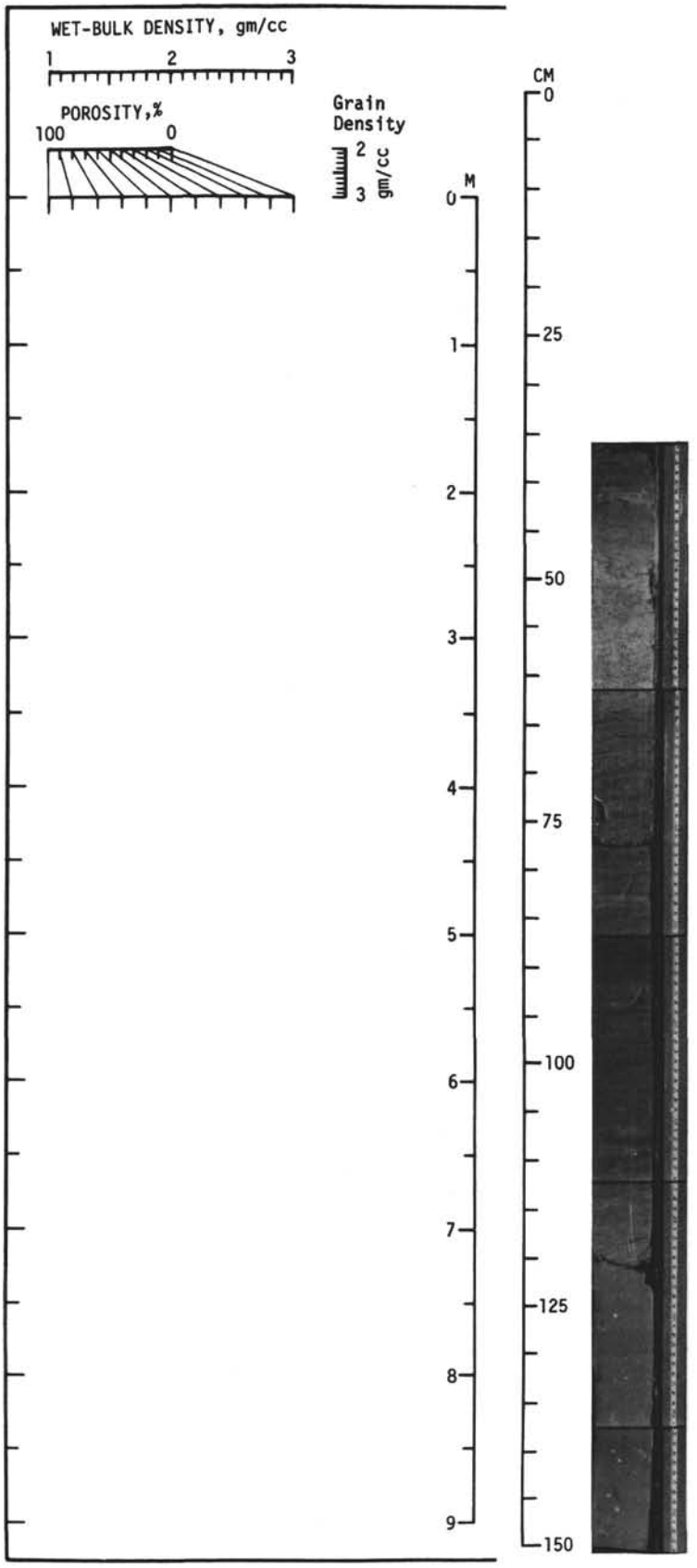
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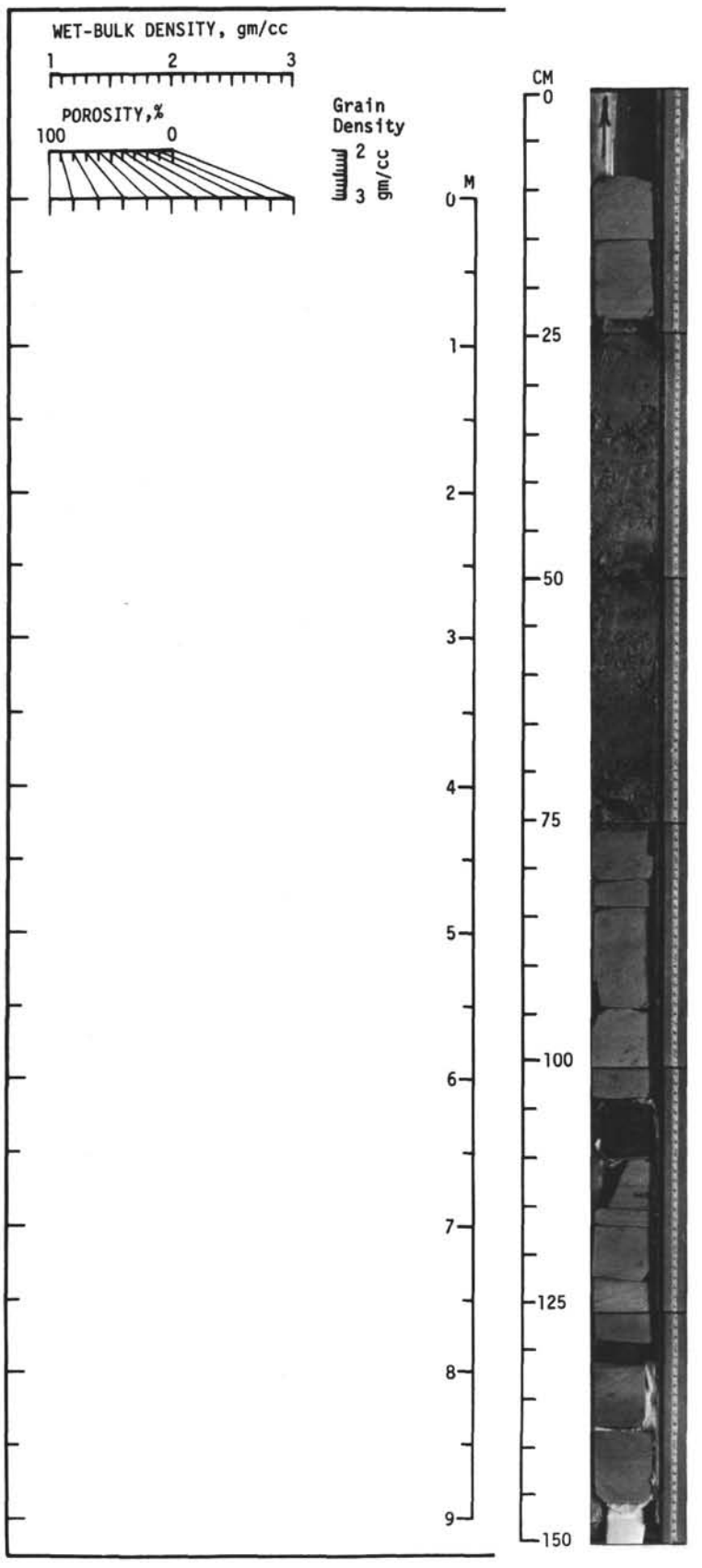
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