6. SITE 89

The Shipboard Scientific Party[1]

SITE DATA

Occupied: March 5-7, 1970.

Position: 20°53.41'N; 95°06.73'W.

Water Depth: 3067 meters.

Total Depth: 440 meters.

Holes Drilled: One.

Cores Taken: Six.

BACKGROUND AND OBJECTIVES

The Bay of Campeche is bounded on the north by the Sigsbee Abyssal Plain. This abyssal plain has been formed by abyssal sediments liberally supplemented by turbidites. A large fraction of the turbidites comes from the north and east, while there is a modest contribution apparently from the south and west. For further detail on the Sigsbee Abyssal Plain, see the "Background and Objectives" sections in chapters 3, 4, 5, 7, and 8.

The Bay of Campeche is bounded on the south by the continental slope and shelf, and the Isthmian embayment, which is described in detail by Murray. (1961). The Isthmian embayment is, in turn, bounded on the east by the Yucatan platform, on the south and southwest by the Sierra Chiapas and on the west by the Sierra Madre Oriental. The embayment is made up of two basins. The Vera Cruz Basin to the west, is separated by the Tuxtla uplift from the Tabasco-Campeche Basin to the east. During Jurassic times, evaporites were deposited in many parts of the Tabasco-Campeche Basin.

On the east, the Bay of Campeche is bounded by the Campeche Scarp and the Campeche Bank. The bank is made up of Cretaceous and Tertiary calcareous sediments laid down in essentially horizontal sheets. The bank and scarp are discussed more fully under the "Background and Objectives" section of Chapters 2 and 3 and in the "Discussion and Interpretation" section of Chapter 3.

In the Bay of Campeche, just west of the Campeche Scarp, lies the north and slightly westward trending Campeche Canyon, apparently an avenue allowing detrital carbonates to be deposited within the predominantly clastic province of the Sigsbee Abyssal Plain. To the west of the Campeche Canyon lies the uplifted area of knolls (Worzel, et al., 1968; Ballard and Feden, 1970), which is about 60 miles wide and might well be called the "Campeche-Sigsbee Salt Dome Province." West of this province is a narrow zone about 20 miles wide with a northward dipping continental rise, which is named the Vera Cruz gap. Just west of this zone lies the eastward dipping continental rise of the eastern coast of Mexico. In this zone lies the folded areas which may be related to salt tectonics as described by Bryant et al., 1968. There is a narrow shelf along the eastern coast of Mexico on the western side of the Bay of Campeche. The north-south trending ridges act as barriers against the movement of sediment westward into the basin. Thus, it is suggested that the Site 89 area receives very little sediment contribution from the west.

Hole 89 was drilled near Site 8 on the lower part of the eastern Mexico continental rise almost where it joins the Vera Cruz gap, approximately midway between the two zones in which salt tectonics is believed to be active. The purpose was to ascertain the sedimentary regime within this zone of the Bay of Campeche, where salt tectonics apparently were not active, so that it could be compared to the sedimentary regime of Hole 88.

The *Glomar Challenger* cored at Site 89 on March 5 and 6. Six cores were recovered from the interval between the sea floor and 440 meters. Coring results are given in the core inventory (Table 1).

NATURE OF THE SEDIMENTS

General Description

Site 89, situated on the Gulf of Campeche continental rise, represents an opportunity to compare rise sediment types with a somewhat more isolated bathymetric high such as at Site 88, located on the crest of a salt diapir. At Site 89, the sequence penetrated consists largely of pelagic carbonate oozes down to approximately 350 meters, whereupon a Late Miocene quartzose and volcanogenic hemilaminite-dominated interval was penetrated. These latter sediments represent a change in depositional setting, in that pelagic processes of sedimentation were equalled by low energy turbidity current deposition. In view of the position of Site 89 on the continental rise, it is suggested that the Miocene hemilaminite facies represents a peripheral deposit to the main axis of deposition of northern abyssal plain and southern continental rise sedimentation.

Cores 1 through 5 generally can be described as greenish gray (5G6/1 to 7/1), moderately to strongly burrowed, clayey, ashy, foraminiferal, nannofossil ooze with variable amounts of volcanic ash occuring as laminae or in burrow-mixed ash-rich zones. As an exception there is an uppermost thin interval of tan (10YR5/4) foraminiferal ooze,

[1]J. Lamar Worzel, Marine Biomedical Institute, University of Texas, Galveston; William Bryant, Texas A&M University (co-chief scientists); Arthur O. Beall, Jr., Continental Oil Company (lead sedimentologist); Kendell Dickinson, United States Geological Survey; Robert Laury, Southern Methodist University; Lee Anderson Smith, ESSO Production Research (lead paleontologist); Blake McNeely, Shell Oil Company; Helen P. Foreman, Oberlin College; Roy Capo, Lamont-Doherty Geological Observatory.

TABLE 1
Core Inventory – Site 89

Core	No. Sections	Date	Time	Cored[a] Interval (m)	Cored (m)	Recovered (m)	Subbottom Penetration (m) Top	Bottom	Lithology	Age
1	3	3/5	2130	3067-3070.5	3.5	3.5	0	3.5	Foram nanno ooze	Late Pleistocene
2	1	3/5	0000	3117-3126	9.0	0.5	50.0	59.0	Foram nanno ooze	Middle Pleistocene
3	4	3/6	0230	3186-3195	9.0	6.0	119.0	128.0	Foram nanno ooze	Early Pleistocene
4	6	3/6	0600	3287-3291	4.0	9.0	220.0	224.0	Foram nanno ooze	Early Pliocene
5	1	3/6	0930	3366-3372	6.0	0.5	299.0	305.0	Nanno ooze	Late Miocene
6	5	3/6	1930	3443-3447	4.0	6.5	376.0	380.0	Nanno ooze	Late Miocene
Total	20				35.5	26.0		440.0		
% Cored					8.0%					
% Recovered						73.2%				

[a]Drill pipe measurement from derrick floor.

and a slightly thicker interval of yellow brown (10YR6/4), vaguely laminated, slightly to moderately burrowed, clayey, foraminiferal nannofossil ooze. Minor fecal/FeS stains occur throughout the cores.

Volcanic ash is considerably more abundant at Site 89 than at Site 88. Glass occurs not only as burrow fill but also in quantities sufficient to produce bands. Shards are poorly sorted, very angular, and generally have a median diameter in the fine sand size. Clear, brown, vesicular (pumice), striated, and exceedingly iron-rich varieties of glass were observed. Accompanying the glass are equally poorly sorted but smaller quantities of apparently volcanogenic components such as sanidine, zoned plagioclase, hornblende, and biotite.

Core 6 consists of green olive gray (5GY5/1-5G6/1), well laminated, sparse to moderately burrowed, nannofossil-rich clay and clayey nannofossil ooze, with occasional thin laminae of quartzose and ashy silt and/or very fine sand (texturally graded with sharp base). Larger burrows are often filled with terrigenous silt. Detrital carbonate makes up a small percentage of clasts in the silts. Miocene sediments at Site 89 differ appreciably from Miocene sediments of Sites 3 and 87, in that the former are less carbonaceous and finer grained. In view of the limited sample available, however, this comparison must be tentative.

Sedimentological Interpretation

Sedimentation on the continental rise in the vicinity of Site 89 has been dominated by pelagic processes since at least late Late Miocene time. The abundance of volcanic ash debris suggests proximity to a source which is quite different from the situation at Site 88 (intermediate) and Sites 2 (Leg 1) and 86 (far). It is also interesting to note that the Plio-Pleistocene section at Site 89 is somewhat thicker than the stratigraphic equivalent at Site 88, suggesting closer proximity to a source of terrigeneous clay debris.

A change in sediment type, as typified by Core 6, suggests that during middle Late Miocene (and older) sedimentation, the continental rise at this locale was dominated by low energy turbidity currents (see Beall and Fischer, 1969). These sediments, described as laminites and hemilaminites/hemipelagites, represent a period of increased sediment influx into the basin as well as into this locale. The turbidite-dominated Miocene sections at Sites 3, 87, 90 and 91 reflect a contemporaneous high rate of sedimentation on the abyssal plain to the north of Site 89.

The portion of the continental slope and rise referred to as the Veracruz Gap in this report is here considered as a probable primary axis of sediment transport during at least Miocene time. Site 89, somewhat peripheral to the Gap and on the easterly dipping segment of the continental rise, would thus occupy a rather peripheral position with respect to the introduction of turbidites into the abyssal plain. Within this context, the laminite facies described at the base of Site 89 would either reflect deposition of diffuse low energy turbidites in a setting removed from the main axis of sediment introduction and deposition, or might possibly reflect a more local introduction of fine clastics from the nearby, easterly dipping continental slope. The presence of the ridge/swale topography in this latter area, if present during Miocene time, would seem a less favorable path of sediment introduction via turbidity currents. In either case, Miocene sediments present at Site 89 appear to represent a generally southeastern source of clastics. The abundance of volcanic debris throughout the sequence is also strongly in favor of proximity to a volcanogenic source terrain, e.g., mainland Mexico.

Physical Measurements

Penetrometer, GRAPE, and natural gamma measurements were determined on at least portions of all cores. As at Site 88, only a few sonic velocity measurements were made, primarily due to the presence of trace amounts of natural gas in the intermediate cores.

Natural gamma measurements range around 3,000 counts, very similar to Site 88. Some of the ash-rich zones have counts in excess of 3,500. Core 6 has a somewhat higher average count, suggesting that the more abundant terrigenous clay, as well as a lower carbonate content, is responsible. Sediment at this level is somewhat more consolidated, which should also be reflected in the natural gamma count, composition being held constant.

Bulk density determinations show an increase with depth, suggesting normal consolidation. As at earlier sites, the bulk density values appear low by at least a factor of about 0.2 g/cc. Penetrometer readings also reflect consolidation with depth, showing a more or less steady increase to a value of approximately 10 in Core 6 (which marks the arbitrary semiconsolidated to consolidated stone boundary). Refer to Beall and Fischer (1969), for further discussion on a proposed scale of consolidation using penetrometer data.

The presence of methane at this site suggests that the mechanism of natural gas generation proposed for Site 88 is plausible. The hypothesis that most of the methane is biogenic and generated at intermediate depths appears to be valid.

BIOSTRATIGRAPHY

The biostratigraphy of Site 89 (adjacent to Site 8) is summarized in Figure 1. The interpretation is based on examination of the foraminifers and calcareous nannofossils. The samples also were examined for radiolarians, but no significant occurrences were noted.

Sample 1 (10-89-1, CC):
Globorotalia truncatulinoides, G. flexuosa, G. menardii, Globigerina inflata, Globigerinoides ruber (pink), *Sphaeroidinella dehiscens* (rare), *Nonion pompilioides, Gephyrocapsa oceanica, Reticulofenestra* sp., *Scapholithus fossilis, Cyclococcolithus leptoporus leptoporus, Coccolithus* sp. cf. *C. pataecus, Cyclococcolithus annulus,* and *Discosphaera tubifer.*
Age: Late Pleistocene (Wisconsinan)
Globorotalia truncatulinoides Zone; *Pulleniatina finalis* Subzone.
Environment: Bathyal.
Remarks: Glass shards (volcanic) were noted in the fine fraction of the washed residue.

Sample 2 (10-89-2, CC):
Globorotalia truncatulinoides, G. scitula, Globigerina inflata, G. eggeri, Globigerinoides ruber (rare), *Sphaeroidinella dehiscens* (abundant), *Helicopontosphaera sellii, Cyclococcolithus leptoporus leptoporus, C. annulus, Coccolithus pataecus, Scyphosphaera pulcherrima, Pseudoemiliania lacunosa, Gephyrocapsa oceanica* (rare), and *G.* sp. cf. *G. caribbeanica.*
Age: Middle Pleistocene (Yarmouthian) *Globorotalia truncatulinoides* Zone; *Globoquadrina dutertrei* Subzone.
Environment: Bathyal.
Remarks: Glass shards (volcanic) and rare reworked Cretaceous, Paleocene, and Mio-Pliocene calcareous nannofossils were noted.

Sample 3 (10-89-3, CC):
Globorotalia truncatulinoides (rare), *G. miocenica* (abundant), *G. pertenuis, G. crassaformis* (rare), *Globigerinoides obliqua, Globigerina inflata, Discoaster brouweri, D. pentaradiatus, Pseudoemiliania lacunosa, Coccolithus pataecus, Cyclococcolithus leptoporus macintyrei, Discolithina millipuncta, and Scyphosphaera pulcherrima.*
Age: Early Pleistocene, probable late Nebraskan: *Globorotalia truncatulinoides* Zone, *Globorotalia tosaensis* Subzone.
Environment: Bathyal.

Sample 4 (10-89-4, CC):
Globigerina nepenthes, Globoquadrina altispira, Globorotalia acostaensis, Globigerinoides obliqua extremus, Discoaster brouweri, D. pentaradiatus, D. surculus, D. asymmetricus, Sphenolithus abies, Ceratolithus tricornulatus, Reticulofenestra pseudoumbilica, and *Pseudoemiliania lacunosa.*
Age: Early Pliocene: *Globorotalia margaritae* Zone.
Environment: Bathyal.
Remarks: A marked increase in benthonic foraminifers was noted.

Sample 5 (10-89-5, CC)
Globorotalia sp. aff. *G. mayeri, G. miocenica, Globoquadrina altispira, G. venezuelana, Globigerina nepenthes, Globigerinoides obliqua extremus, Discoaster bollii, D. exilis, D. hamatus, D. quinqueramus, D. brouweri, Reticulofenestra pseudoumbilica, Sphenolithus abies, Helicopontosphaera sellii, Scyphosphaera pulcherrima,* and *Craspedolithus nitescens.*
Age: Late Miocene: *Globorotalia acostaensis* Zone.
Environment: Bathyal.
Remarks: Reworked foraminifers noted include *Globorotalia fohsi fohsi* (Middle Miocene) and *Globorotalia spinuloinflata* (Middle Eocene). Among the calcareous nannofossils, a reworked Eocene assemblage was noted, including *Chiasmolithus grandis, Coccolithus eopelagicus, Discoaster barbadiensis,* and *Marthasterites tribrachiatus.*

Sample 6 (10-89-6, CC):
Globorotalia mayeri, C. sp. cf. *G. acostaensis, Globigerina nepenthes, Globoquadrina triloba, Orbulina universa, O. suturalis, O. bilobata, Discoaster brouweri, D. bollii, D. quinqueramus, D. exilis, Sphenolithus abies, Reticulofenestra pseudoumbilica, Cyclococcolithus leptoporus macintyrei, C.* sp. cf. *neogammation,* and *Craspedolithus nitescens.*
Age: Late Miocene: *Globorotalia acostaensis* Zone.
Environment: Bathyal.
Remarks: Common reworked Cretaceous and a few reworked Paleocene calcareous nannofossils were noted.

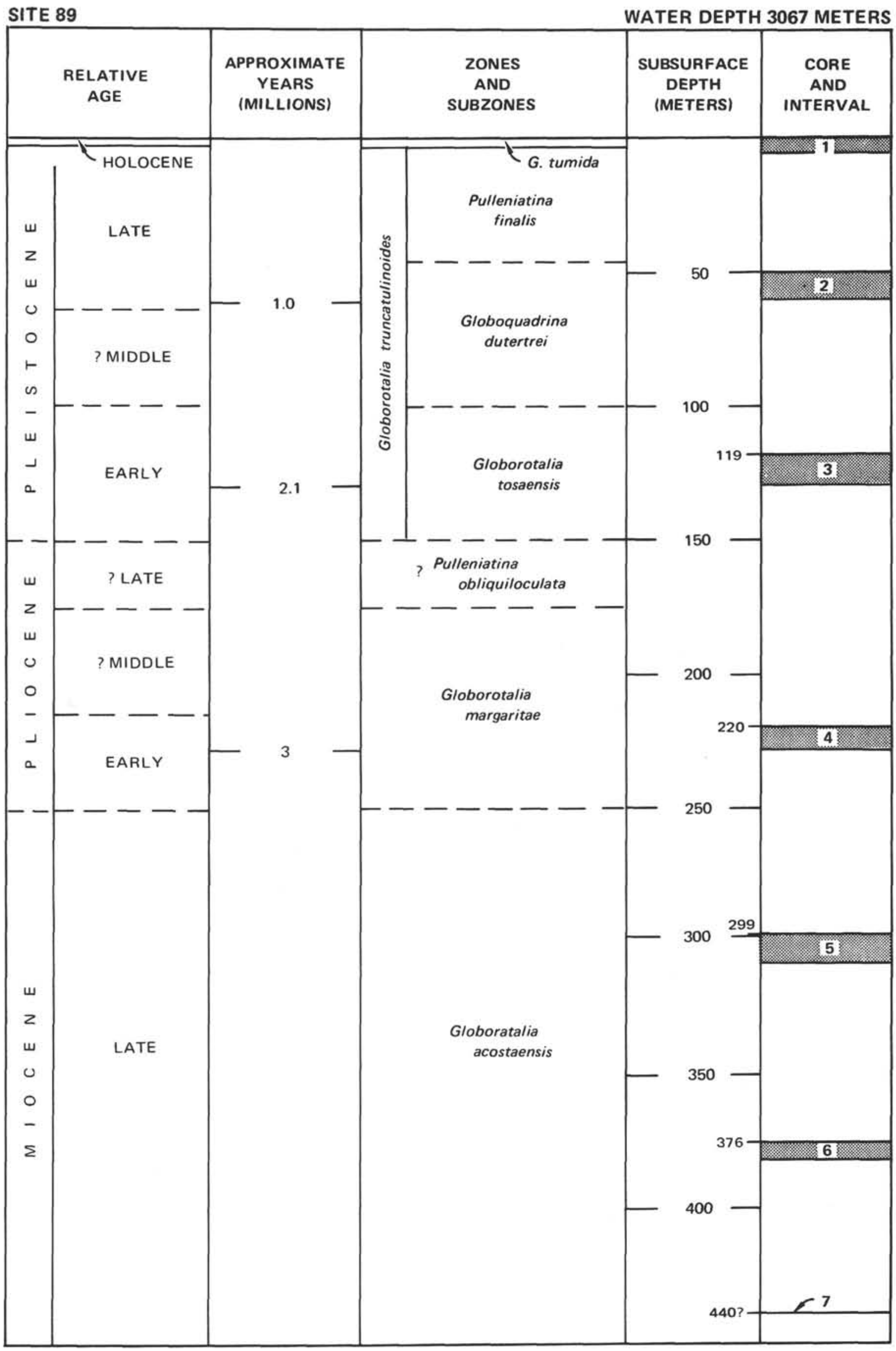


Figure 1. *Biostratigraphic summary of Site 89.*

Sample 7 (10-89–from water ports on drill bit, 440 meters)
Discoaster brouweri, D. quinqueramus, D. exilis, D. sp. cf. *D. hamatus, Cyclococcolithus neogammation, C. leptoporus macintyrei, Reticulofenestra pseudoumbilica, Sphenolithus abies, Helicopontosphaera kamptneri, H. sellii, Coccolithus pelagicus,* s.l., *C. minutulus, C. pataecus,* and *Craspedolithus nitescens.*

Age: No older than Late Miocene; probable *Globorotalia acostaensis* Zone.

All material examined was from bit and drill collars brought up from 440 meters below the sea floor. It is not known that any of the material was from the very bottom of the hole. Material scraped from outside the drill collar was definitely Pleistocene and no material was recovered from the center bit.

Remarks: Cretaceous and Eocene reworked calcareous nannofossils were identified from the assemblage.

DISCUSSION AND INTERPRETATION

Site 89 was drilled on the outermost part of the easterly dipping continental rise off the eastern coast of Mexico, near its junction with the Vera Cruz Gap (the 20-mile-wide northerly dipping continental shelf and rise which falls between the easterly dipping continental slope and rise off the eastern Mexican coast, and the westerly dipping margin "Campeche-Sigsbee Salt Dome Province"). The on-station profile record is shown in Figure 2. Six cores were taken, over a depth range of 380 meters, consisting of pelagic carbonate organogenic oozes with intermixed volcanics for the Pliocene and Pleistocene section, changing to a quartzose, volcanic-rich, terrigenous clay turbidite section, intermixed with calcareous pelagic oozes in the Late Miocene. The uppermost section is slightly to moderately burrowed, with occasional volcanic ash layers. The volcanic ash here is more abundant than at Site 88, suggesting that this site is closer to the source area of the volcanic ash.

The thin turbidite layers intermixed with the pelagic sedimentation in the Miocene suggest that this site was largely protected from sedimentation from the west by the folded zone of the Mexican continental slope. It received small turbidite contributions as peripheral deposits from turbidites which may have flowed through the Vera Cruz Gap. After the Miocene, turbidite deposition largely ceased and pelagic sedimentation ensued, suggesting that either the turbidite flows were more modest or ceased altogether.

Thus, this area appears to have been in a bathyal environment, receiving dominantly calcareous sediments with contributions of terrigenous clays and sands from the south during Miocene times. Volcanic contributions, probably from the west, were more common in Miocene times than later.

Average sedimentary rates were 2.8 cm/10^3y in the Late Miocene, 3.7 cm/10^3y for the Pliocene, and 6.8 cm/10^3y for the Pleistocene with an average rate of 3.8 cm/10^3y from the Late Miocene to the present. The rather low Pleistocene rates of deposition are the result of the protected setting of Site 89. The average rate is about half the rate of deposition at Sites 3 and 88, which is reasonable

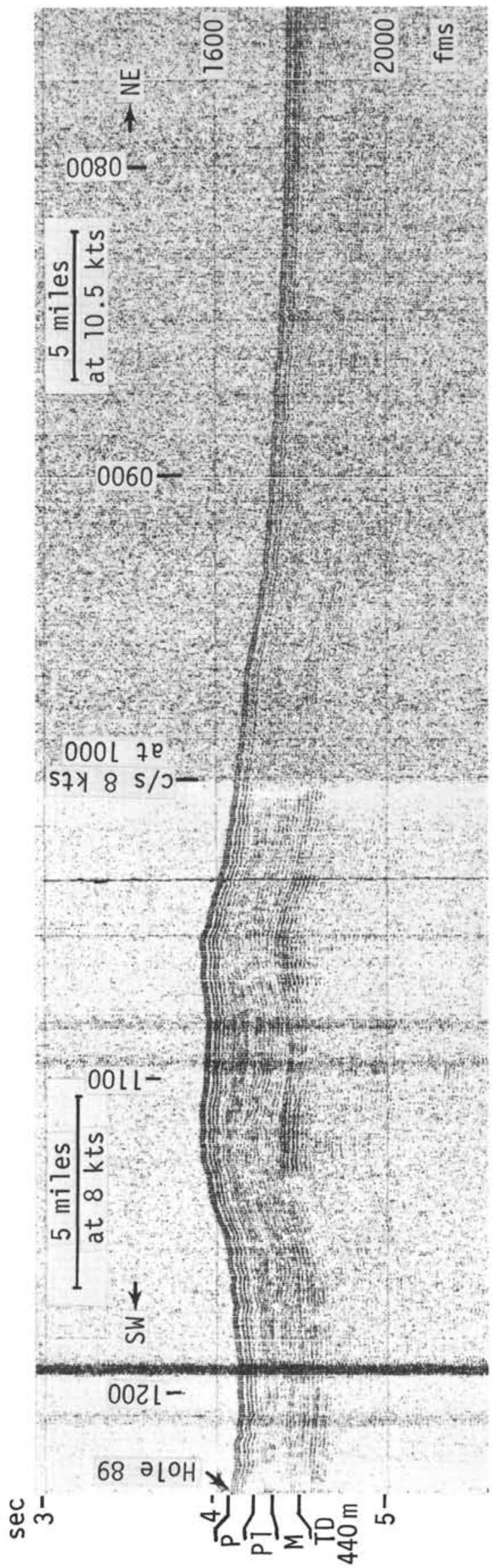


Figure 2. *Profile record, Site 89.*

in view of these latter receiving additional sediments, probably from the north and east.

Core 4, at 220 meters, outgassed moderately. The gas was predominantly methane. For values of methane present, see the "Discussion and Interpretation" section of Chapter 5. Little or no gas was evident in the deeper cores, so it seems evident the gas is of biogenic origin.

It was decided not to continue the hole when the center bit became stuck at a depth of 440 meters.

REFERENCES

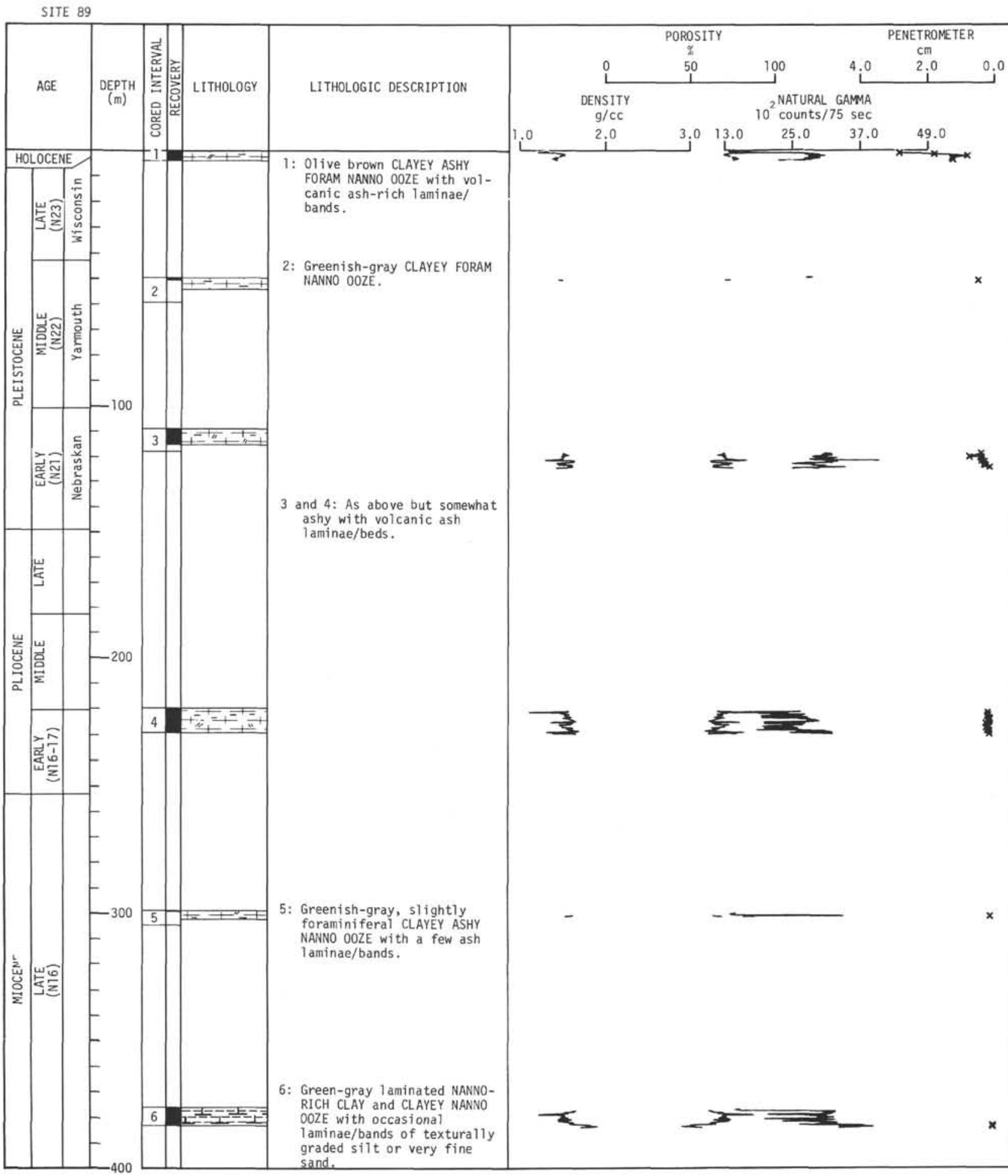
Ballard, J.A. and Feden, R.H., 1970. Diapiric structures on the Campeche Shelf and Slope, Western Gulf of Mexico. Bull. Geol. Soc. Am. **81**, 505.

Beall, A.O. and Fischer, A.G., 1969. Sedimentology. *In* Ewing, W.M., Worzel, J.L. et al., 1969. The Initial Reports of the Deep Sea Drilling Project, Volume I. Washington (U.S. Government Printing Office). 521.

Bryant, W.R., Antoine, J., Ewing, M., and Jones, B., 1968. Structure of Mexican Continental Shelf and Slope, Gulf of Mexico. Bull. Am. Assoc. Petrol. Geologists. **52**, 1204.

Murray, G.E., 1961. Geology of the Atlantic and Gulf Coastal Province of North America. New York (Harper and Bros.). 692.

Worzel, J.L., Leyden, R. and Ewing, M., 1968. Newly Discovered Diapirs in Gulf of Mexico. Bull. Am. Assoc. Petrol. Geologists. **52**, 1194.


SITE 89
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 10^2 counts/75 sec
13.0 25.0 37.0 49.0
HOLOCENE
PLEISTOCENE
LATE (N23)
Wisconsin
MIDDLE (N22)
Yarmouth
EARLY (N21)
Nebraskan
PLIOCENE
LATE
MIDDLE
EARLY (N16-17)
MIOCENE
LATE (N16)
100
200
300
400
1
2
3
4
5
6
1: Olive brown CLAYEY ASHY FORAM NANNO OOZE with volcanic ash-rich laminae/bands.
2: Greenish-gray CLAYEY FORAM NANNO OOZE.
3 and 4: As above but somewhat ashy with volcanic ash laminae/beds.
5: Greenish-gray, slightly foraminiferal CLAYEY ASHY NANNO OOZE with a few ash laminae/bands.
6: Green-gray laminated NANNO-RICH CLAY and CLAYEY NANNO OOZE with occasional laminae/bands of texturally graded silt or very fine sand.

Site 89 Hole Core 1 Cored Interval: 0-3.5 m

AGE	ZONE	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	GRAIN SIZE WEIGHT % SAND	SILT	CLAY
(Holocene)	*Globorotalia truncatulinoides (Pulleniatina finalis* Subzone)	1	0.5, 1.0	VOID						
LATE PLEISTOCENE (Wisconsin)							CLAYEY FORAM NANNO OOZE Yellow-brown (10YR6/4), vaguely laminated (with 10YR4/2); slightly to moderately burrowed.	3.2	14.4	82.4
		2					CLAYEY ASHY FORAM NANNO OOZE Olive-brown (5YR6/1 with mottles of 5GY6/1 (ash)); moderately burrowed with subsidiary laminae/bands and burrow-fill/burrow-mixed volcanic ash-rich zones.	2.2	10.5	87.3
		3					—VOID			
		Core Catcher								

Site 89 Hole Core 2 Cored Interval: 50-59 m

AGE	ZONE	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	GRAIN SIZE WEIGHT % SAND	SILT	CLAY
MIDDLE PLEISTOCENE (Yarmouth)	*Globorotalia truncatulinoides (Globoquadrina dutertrei* Subzone)	1	0.5, 1.0	VOID						
							CLAYEY FORAM NANNO OOZE Greenish-gray (5G6/1 with subsidiary 5GY6/1, minor 5B5/1, and N3); moderately burrowed; minor FeS/fecal (N3) stain throughout.	6.4	15.4	78.2
		Core Catcher								

Site 89 Hole Core 3 Cored Interval: 119-128 m

AGE	ZONE	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	GRAIN SIZE WEIGHT % SAND	SILT	CLAY
EARLY PLEISTOCENE (Nebraskan)	*Globorotalia truncatulinoides (Globorotalia tosaensis* Subzone)	1	0.5, 1.0				Expanded slightly by gas drive? Odorless. —VOID			
		2					FORAM NANNO OOZE Greenish-gray (5G6/1, mottled with 5B5/1 and 5GY6/1); moderate to strongly clayey; somewhat ashy with laminae to beds of volcanic ash and zones of burrow-mixed ash and ooze. Sparse N3 fecal stain. Most burrows filled with volcanic ash.	1.5	21.0	77.5
		3						3.9	28.4	67.7
		4						3.2	18.3	78.5
		Core Catcher								

Site 89 Hole Core 4 Cored Interval: 220-224 m

AGE	ZONE	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	GRAIN SIZE WEIGHT % SAND	SILT	CLAY
EARLY PLIOCENE	*Globorotalia margaritae*	1	0.5, 1.0	VOID			Expanded by gas drive - odorless.			
							VOID			
							VOID			
							VOID			
		2		VOID			CLAYEY FORAM NANNO OOZE Greenish-gray (5G7/1; subsidiary 5GY7/1, N3 and 5B6/1); somewhat ashy; strongly burrowed. Minor fecal/FeS spot stains.	1.1	19.1	79.8
		3		VOID			As above. Severely burrowed with a zone of faint, vague laminations (5G5/1) - Higher clay content?			
		4					VOID			
							VOID			
							VOID			
							Richer in ash as burrow-fill with one lamination very ash-rich.	2.4	22.8	74.8
							VOID			
							As above. Rare vague laminae.			
		5		VOID				0.9	19.8	79.3
				VOID			As above. Severely burrowed with occasional ash-filled burrow. Rare vague laminae.			
		6		VOID				3.9	25.5	70.6
							Increasing in ash content downwards. Note ash beds in lower part - partially altered to brownish-gray clay.			
		Core Catcher								

Site 89 Hole Core 5 Cored Interval: 299-305 m

AGE	ZONE	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	GRAIN SIZE WEIGHT % SAND	SILT	CLAY
LATE MIOCENE	*Globorotalia acostaensis*	1	0.5, 1.0	VOID			CLAYEY ASHY NANNO OOZE Greenish-gray (5G6/1 with subsidiary 5G7/1, 5G5/1); slightly foraminiferal; moderately burrowed; vaguely laminated with a few ash laminae/bands. Burrow-fill also ash. Minor N3 stain.	0.3	32.1	67.6
				VOID						
		Core Catcher								

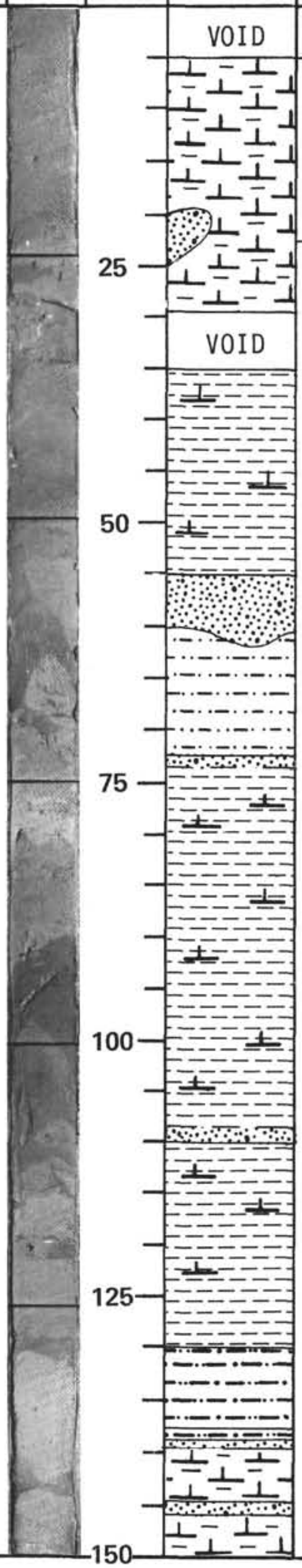
Site 89 Hole Core 6 Cored Interval: 376-380 m

AGE	ZONE	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	SAND	SILT	CLAY
LATE MIOCENE	*Globorotalia acostaensis*	1	0.5, 1.0	VOID			Sections 1-4 brecciated, severely disturbed. Sections 2 and 3 unopened. Similar to above and below.			
		2		UNOPENED			(5GY5/1-5G5/1 with subsidiary 5G6/1 and N3); brecciated severely disturbed.			
		3								
		4						1.3	35.7	63.0
							VOID			
		5*					VOID	0.9	37.5	61.6
		Core Catcher					Laminated NANNO-RICH CLAY and CLAYEY NANNO OOZE Green-olive gray (intercalated 5GY5/1 and 5G6/1); well laminated; sparsely to moderately burrowed with occasional thin laminae/bands of quartzose (ashy) silt/V.F. sand, texturally graded with a sharp base. Larger burrows filled with silt. *See Section Summary for more detail.			

GRAIN SIZE WEIGHT % (SAND, SILT, CLAY)

SITE 89 **CORE** 6 **SECTION** 5

AGE	SECTION PHOTO	cm	LITHO	SMEAR SLIDE	DESCRIPTION
LATE MIOCENE					

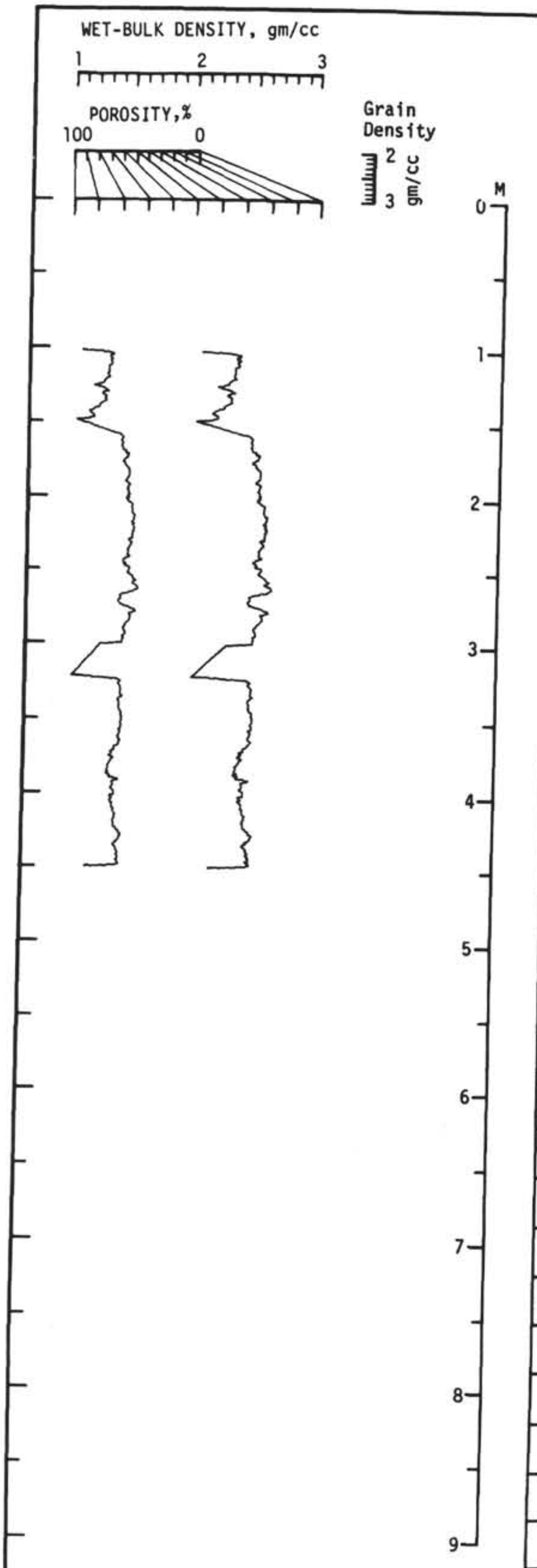


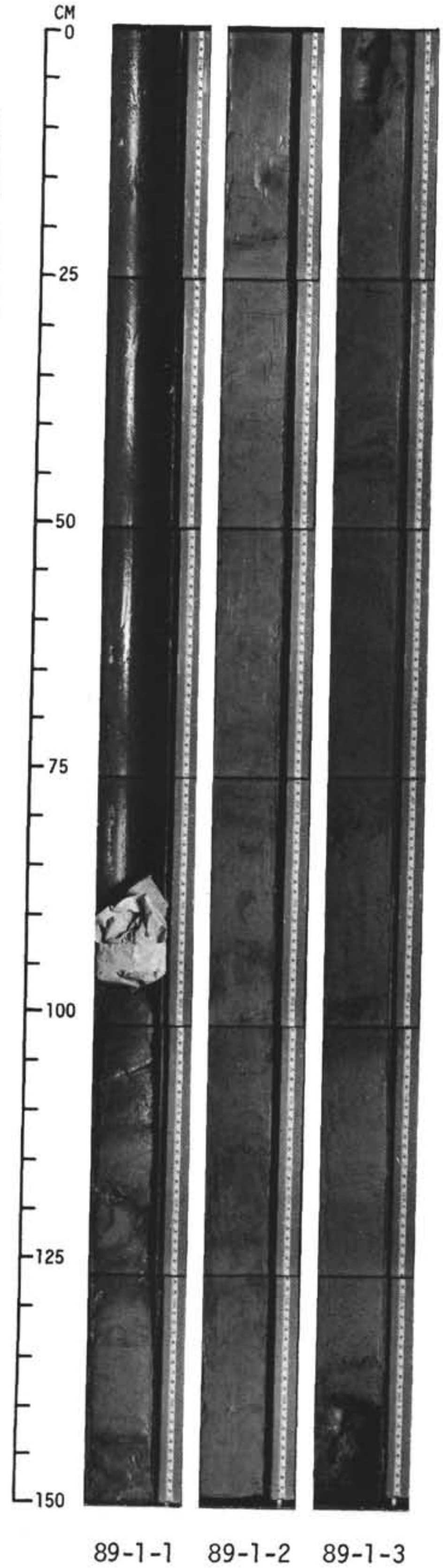
(.9,37.5,61.6; Silty clay)

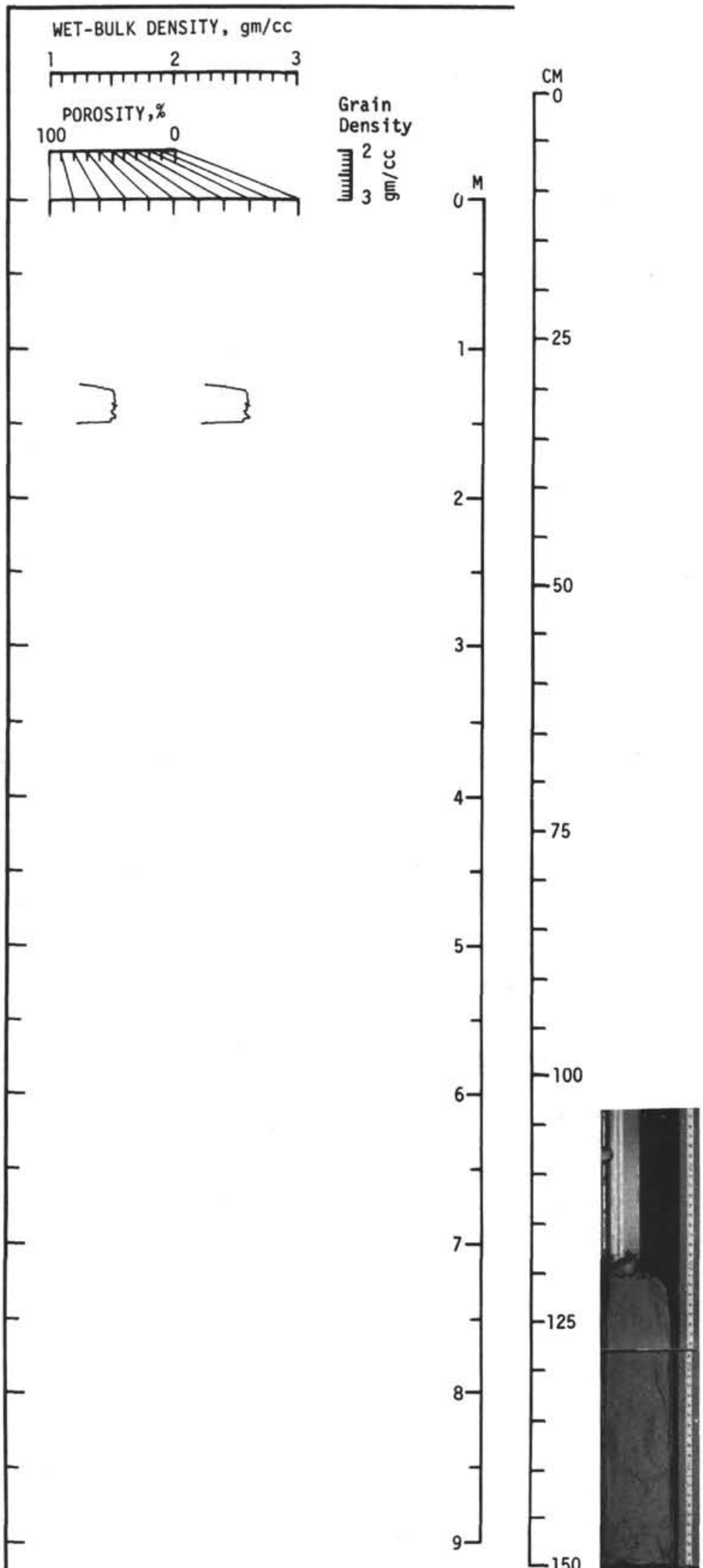
Laminated NANNO RICH CLAY and
CLAYEY NANNO OOZE
Green-olive gray (intercalated 5GY5/1 and 5G6/1); well laminated; sparsely to moderately burrowed with occasional thin laminae/bands of quartzose (ashy) silt/V.F. sand, texturally graded with a sharp base. Larger burrows filled with silt.

Intercalated
5GY5/1 and 5G6/1

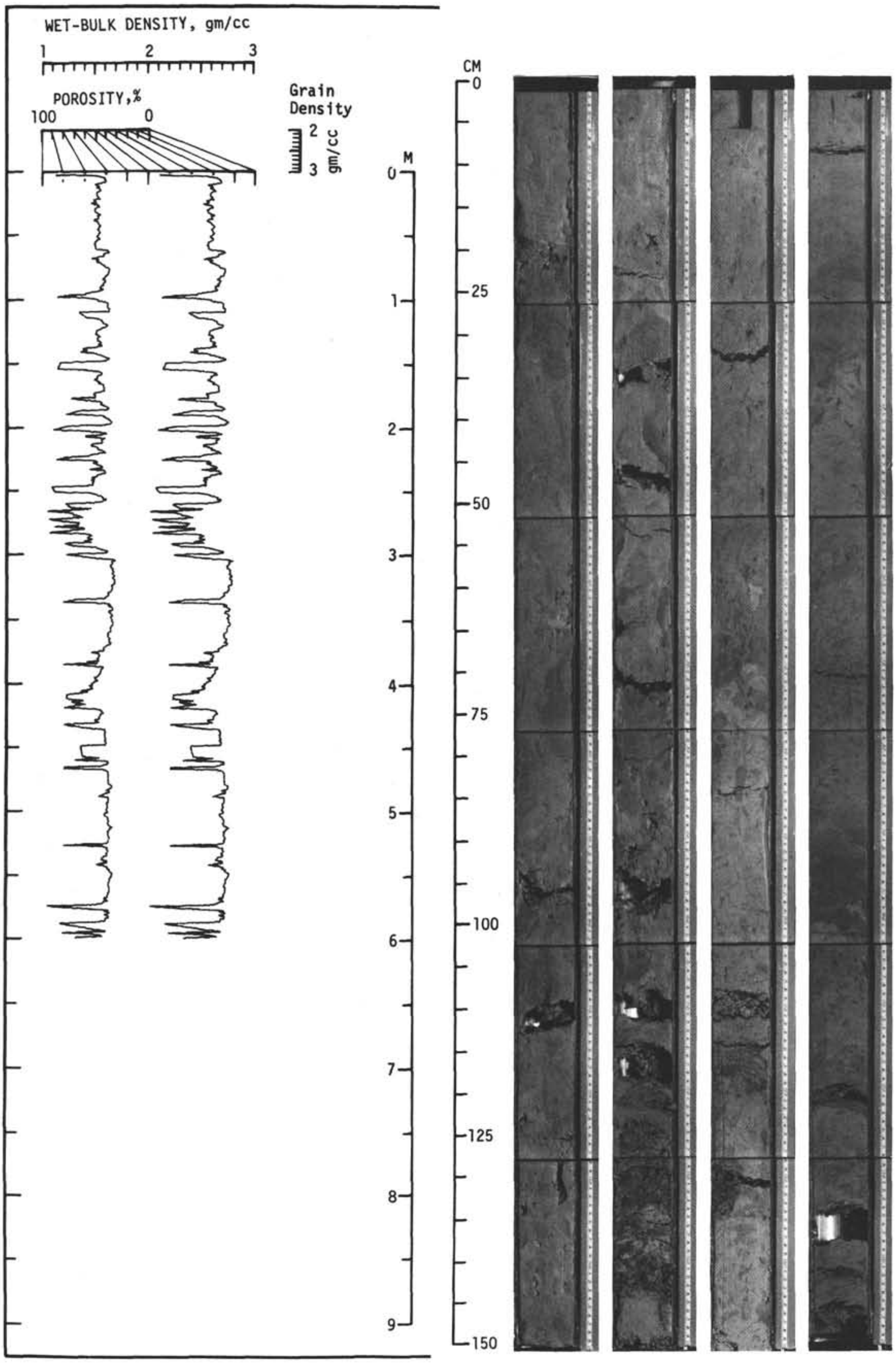
5GY5/1 with N5 (sand); horizontal laminations below, cross-laminations above.


WET-BULK DENSITY, gm/cc
1
2
3
POROSITY,%
100
0
Grain
Density
2
3
gm/cc
M
0
1
2
3
4
5
6
7
8
9

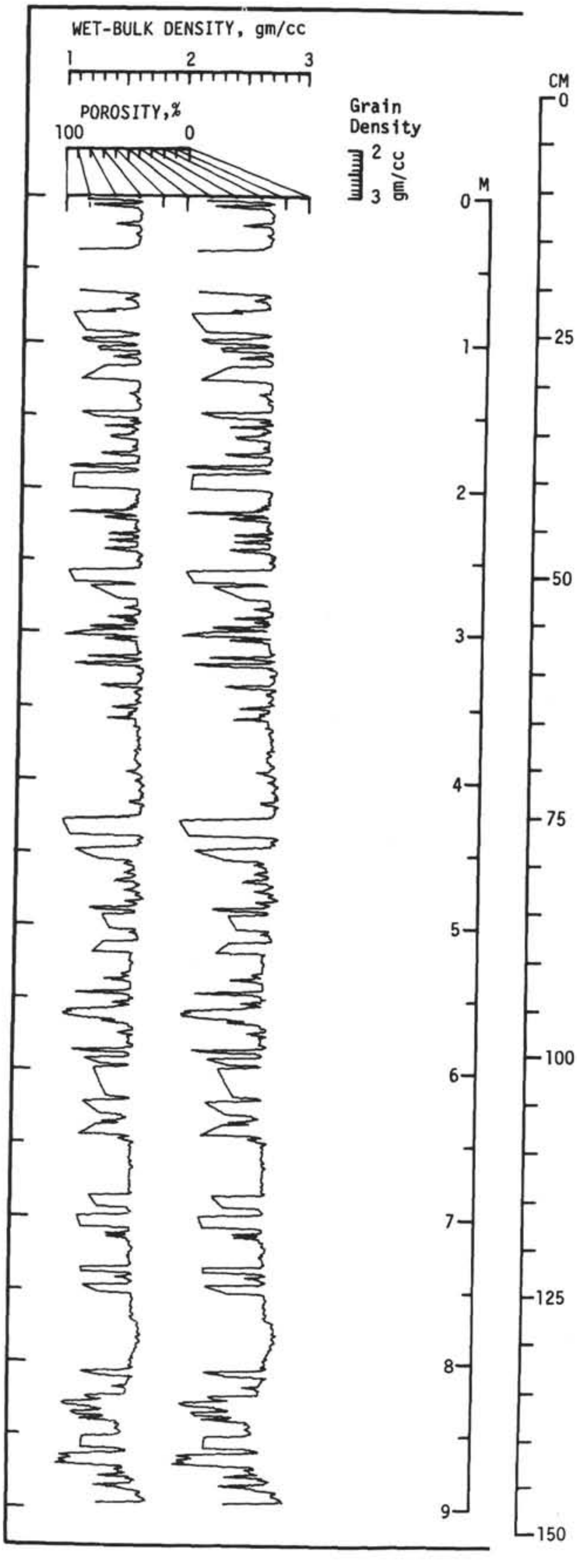

CM
0
25
50
75
100
125
150
89-1-1
89-1-2
89-1-3


WET-BULK DENSITY, gm/cc
1 2 3
POROSITY,%
100 0
Grain Density
2
3
gm/cc
M
0 1 2 3 4 5 6 7 8 9
CM
0 25 50 75 100 125 150

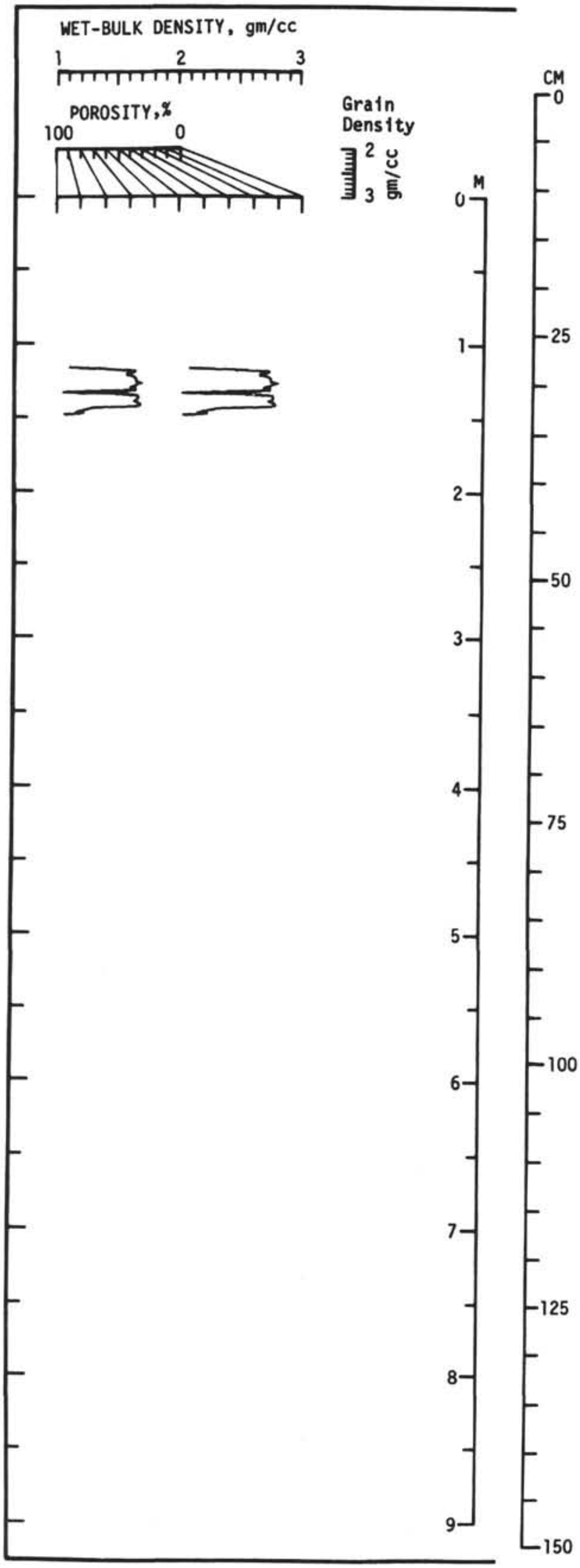
89-2-1



89-3-1 89-3-2 89-3-3 89-3-4

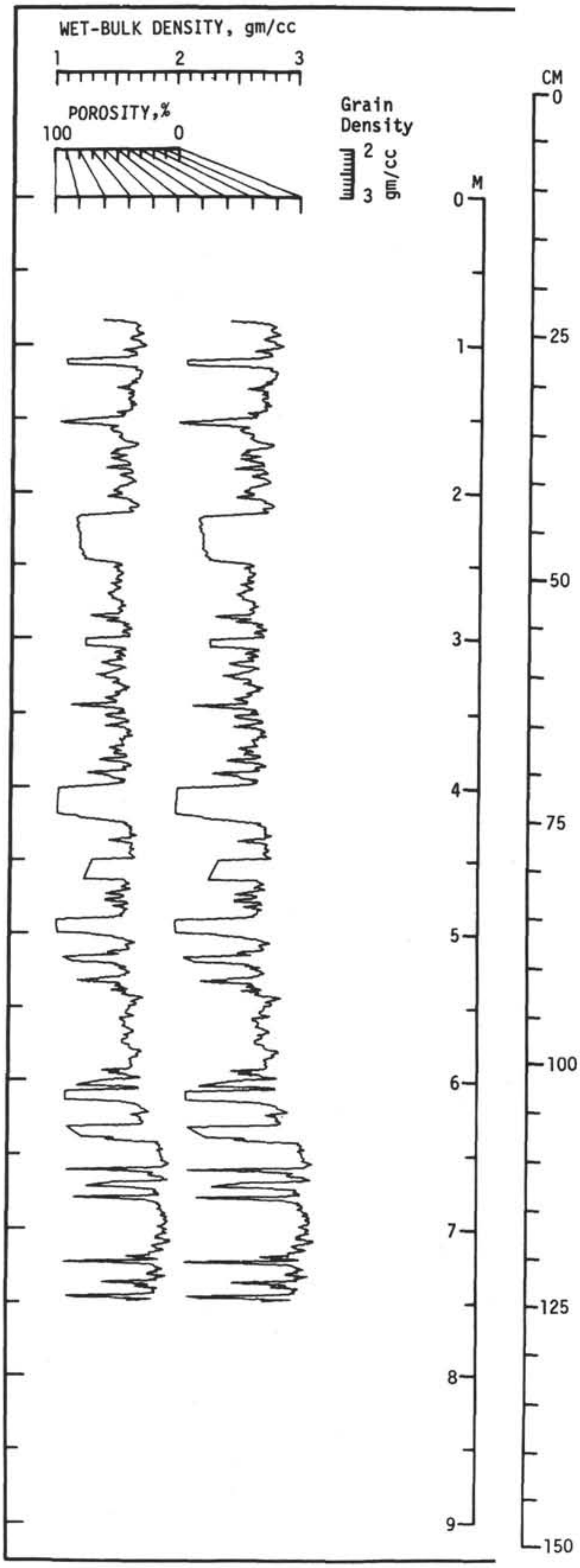

WET-BULK DENSITY, gm/cc
1
2
3
POROSITY,%
100
0
Grain Density
2
3
gm/cc
M
0
1
2
3
4
5
6
7
8
9
CM
0
25
50
75
100
125
150

89-4-1



NO PHOTOGRAPH AVAILABLE

89-5


WET-BULK DENSITY, gm/cc
1
2
3
POROSITY,%
100
0
Grain Density
2
3
gm/cc
M
0
1
2
3
4
5
6
7
8
9
CM
0
25
50
75
100
125
150

89-6-5