9. SITE 282

The Shipboard Scientific Party[1]
With Additional Contribution From
Graeme J. Wilson, New Zealand Geological Survey, Lower Hutt, New Zealand

SITE DATA

Location: Magnetic Quiet Zone west of Tasmania

Position: 42°14.76'S; 143°29.18'E

Water Depth:
PDR, from sea level: 4202 meters
From drill pipe measurement from derrick floor: 4217 meters (adopted)

Dates Occupied: 5-8 April 1973

Depth of Maximum Penetration: 310.5 meters

Number of Holes: 1

Number of Cores: 20

Total Length of Cored Section: 167.5 meters

Total Recovery:
Length: 63.7 meters
Percentage: 38

Age of Oldest Sediment Cored: Late Eocene

Summary: Drilled in magnetic quiet zone, veneer of Pleistocene nannofossil and foraminifera oozes disconformably underlain by 7 meters of late Miocene nannofossil ooze in turn disconformably underlain by 42 meters of early Miocene detrital silty clay nannofossil ooze. This is also disconformably underlain by 59 meters of middle Oligocene detrital clayey silt nannofossil ooze and nannofossil detrital sand-silt-clay, which is conformably underlain by 78 meters of middle-early Oligocene detrital silty clay nannofossil ooze. Conformably underlain by 103 meters of late Eocene organic-rich nannofossil-bearing silty clay to clayey silt, immediately overlying pillow basalt.

Late Eocene sea floor here formed well after initial rifting. Basalt not unusual but mineralized with specks of native copper. Sediments not baked. As at Site 280 Paleogene mostly continuous sedimentation with the Neogene highly condensed with unconformities. Detrital sediments in lower 130 meters similar to Site 280 in character; indicate restricted circulation and terrigenous deposition during late Eocene-early Oligocene. Site 282 nearer to an Australian detrital source. Apparently much reworking from shallow water throughout Cenozoic. Paleogene detrital to Neogene biogenic sedimentation reflects changing character of sedimentation in South Australia resulting from northward drift and assumed changing climatic regimes. Increasing biogenic deposition currents initiated near Paleogene-Neogene boundary related to initiation of circumpolar current.

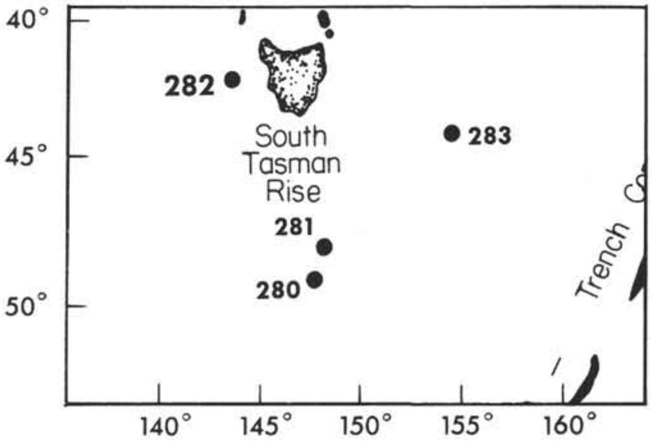

Figure 1. *Location of Site 282, DSDP Leg 29.*

BACKGROUND AND OBJECTIVES

From a geophysical point of view, Site 282 in the magnetic quiet zone (Figure 1) was clearly the most important site to be drilled. The magnetic quiet zone is especially intriguing when it occurs at oceanic depths. Weissel and Hayes (1972) show the quiet zone southwest of Tasmania (Figure 2), but the high topography in this area is probably the same type of continental material that was cored at Site 281.

The site (Figure 3) is apparently on the strike of the high topography of the Tasman Rise, but is located in deep water (4200 meters) within the magnetic quiet zone (Figure 4).

Site 282 was the first site of Leg 29 to be located in the southern subtropical water mass, thus it was almost certain that biostratigraphic sequences would differ markedly from those obtained further south in subantarctic waters. The location of the site to the west of Tasmania was well placed for the study of the marine transgression to the area resulting from rifting and spreading of Australia and Antarctica. It is possible that oceanic sedimentation commenced earlier than in the

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[1] James P. Kennett, Graduate School of Oceanography, University of Rhode Island, Kingston, Rhode Island; Robert E. Houtz, Lamont-Doherty Geological Observatory of Columbia University, Palisades, New York; Peter B. Andrews, New Zealand Geological Survey, Christchurch, New Zealand; Anthony 'R. Edwards, New Zealand Geological Survey, Lower Hutt, New Zealand; Victor A. Gostin, University of Adelaide, Adelaide, Australia; Marta Hajós, Hungarian Geological Survey, Budapest, Hungary; Monty Hampton, University of Rhode Island, Kingston, Rhode Island; D. Graham Jenkins, University of Canterbury, Christchurch, New Zealand; Stanley V. Margolis, University of Hawaii, Honolulu, Hawaii; A. Thomas Ovenshine, U.S. Geological Survey, Menlo Park, California; Katharina Perch-Nielsen, Institut for Historisk Geologi, Copenhagen, Denmark.

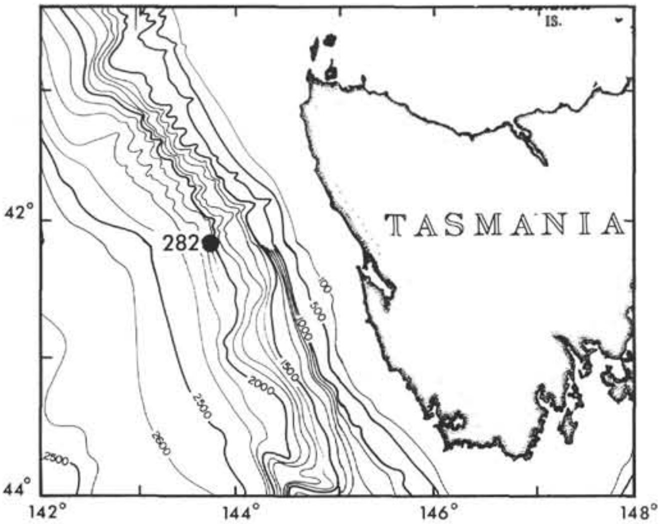


Figure 2. *Bathymetry at Site 282.*

area south of the South Tasman Rise because of earlier rifting. The sedimentary history should supply further important information on the evolution of the circum-polar current.

OPERATIONS

The approach to Site 282 in the north Magnetic Quiet Zone was along an *Eltanin*-53 track (Figure 5). A satisfactory site was selected, and the beacon dropped while underway at over 9 km/hr (5 knots).

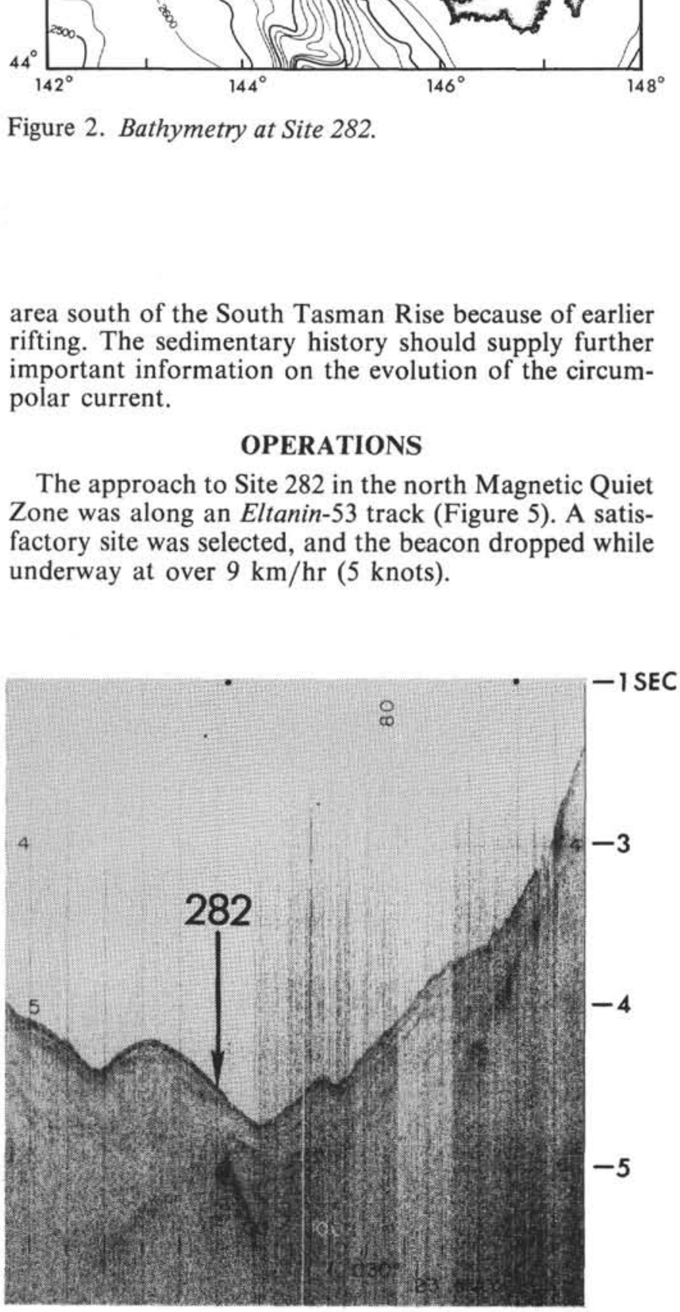


Figure 3. *Profiler section at Site 282.*

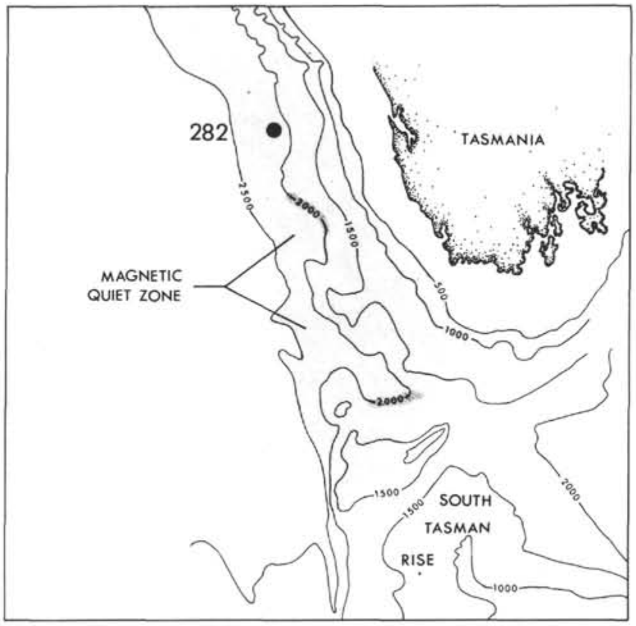


Figure 4. *Magnetic quiet zone at Site 282 (modified from Weissel and Hayes, 1972).*

The bottom hole assembly and drill pipe were run in and the sea floor was tagged at 4217 meters. The hole was spudded and a mudline punch core recovered. Two additional cores were cut in progressively more resistant sediment without any recovery. While retrieving the third core at 4245 meters the computer failed, and the ship experienced an excursion of 450 meters (1500 feet) off the hole.

After determining that it was possible to maintain position satisfactorily, the hole was washed back down to 4245 meters, and a short core cut. Because of the resistance of the sediment, the hole was washed down to 4270.5 meters and continuously cored to 4340 meters. From this depth the hole was drilled and cored to a total depth of 4527.5 meters or 310.5 meters below the sea floor. Basalt was encountered at 4512 meters (295 meter penetration), and 15.5 meters cored with 7.2 meters recovery. The details of the coring are in Table 1.

LITHOLOGY

A sedimentary sequence 295 meters thick was cored; it is underlain by a fine-grained extrusive pillow basalt, of which 15.5 meters was penetrated. A stratigraphic summary is presented in Table 2 and on Figure 6. The sediment composition of the various units, based on smear slide descriptions is found in Table 3.

Unit 1

This unit is about 6 meters thick and consists of four subunits with sharp or soupy contacts. Severe disturbance by drilling probably altered the original sequence. At least the top 8 cm consists of greenish-gray, soupy, micarb nannofossil Bryozoa-rich foraminiferal ooze. The underlying 60 cm consists of a yellowish-gray, soft, Bryozoa/foraminifera-rich nannofossil ooze which

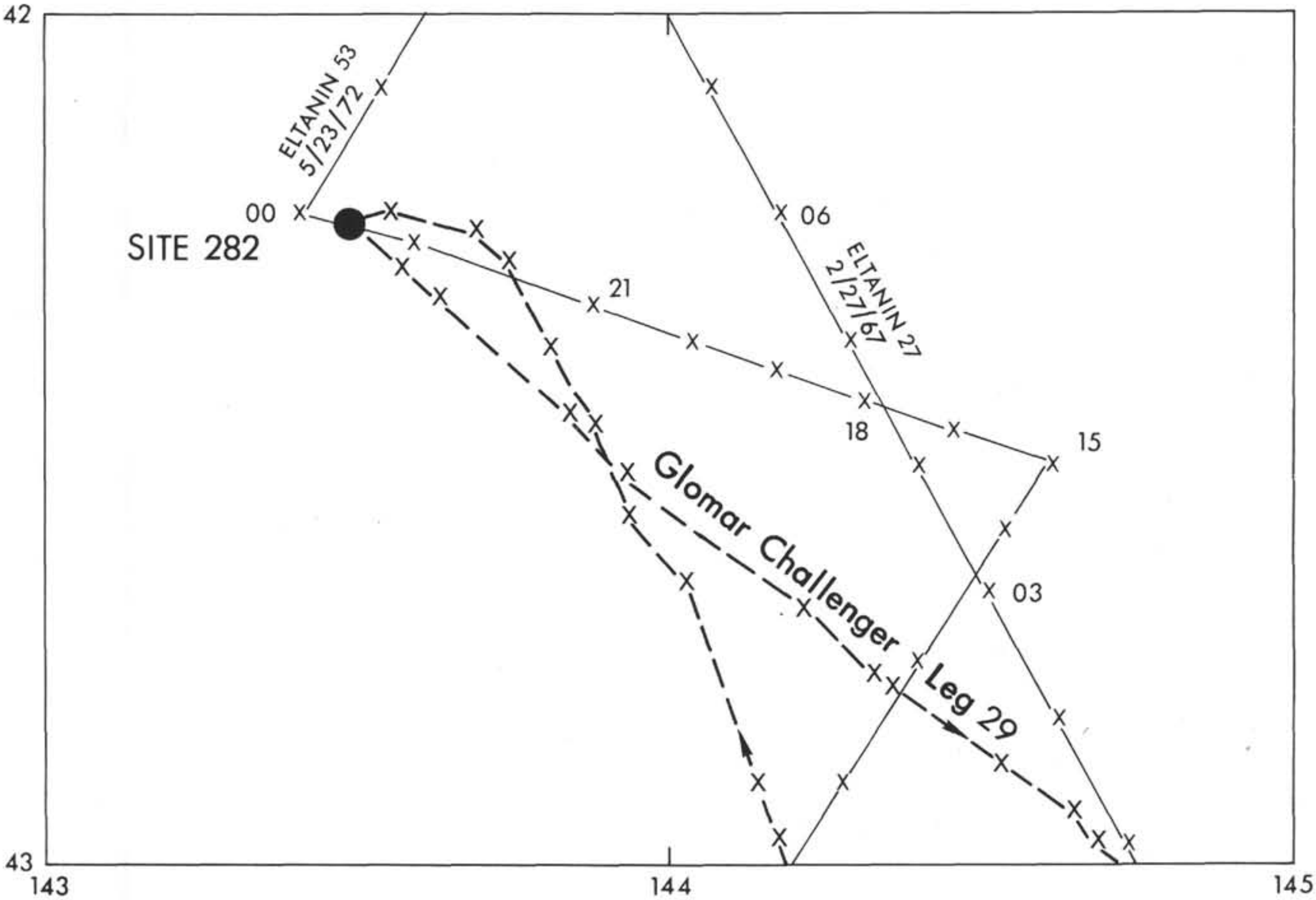


Figure 5. *Track chart.*

TABLE 1
Coring Summary, Site 282

Core	Cored Interval Below Bottom (m)	Cored (m)	Recovery (m)	Recovery (%)
1	0.0-9.0	9.0	8.3	92
2	9.0-18.5	9.5	0.0	0
3	18.5-28.0	9.5	0.0	0
4	28.0-34.0	6.0	5.2	86
5	53.5-56.5	3.0	2.0	67
6	56.5-66.0	9.5	CC	0
7	66.0-75.5	9.5	3.8	40
8	75.5-85.0	9.5	5.1	54
9	85.0-94.5	9.5	4.3	45
10	94.5-104.0	9.5	CC	0
11	104.0-113.5	9.5	5.1	54
12	113.5-123.0	9.5	2.8	30
13	132.5-142.0	9.5	6.8	72
14	161.0-170.5	9.5	3.2	34
15	189.5-199.0	9.5	3.3	35
16	218.0-227.5	9.5	1.5	16
17	256.0-265.5	9.5	4.7	49
18	294.0-298.0	4.0	3.4	85
19	298.0-307.0	9.0	0.7	7
20	307.0-310.5	3.5	3.5	100
Total		167.5	63.7	38

changes indistinctly downward into 2.24 meters of medium-bluish-gray, soft, detrital silty clay micarb ooze. A slight color change downward is recorded as the sediment becomes soupy and changes into about 2.5 meters of light-olive-gray to greenish-gray, soupy to soft, detrital silty sand-rich Bryozoa foraminiferal ooze. The unit is late Pleistocene.

Unit 2

This late Miocene unit is about 7 meters thick. It is an almost pure, soft, white nannofossil ooze. Indistinct layering is present, while some pale-purple streaks are probably caused by manganese stain on the nannofossils. A continuous section was not obtained, and Sample 2, CC (18.5 m) revealed a slightly different early Miocene sediment. An unconformity or, less probably, a reduced middle Miocene sequence is present in this interval. It is significant that the middle Miocene marks the maximum Cenozoic marine transgression over the southern Australian continent.

Unit 3

This early Miocene unit is 42 meters thick but only 8.4 meters were recovered. It varies from greenish-gray and

TABLE 2
Lithologic Summary, Site 282

Unit	Lithology	Subbottom Depth (m)	Unit Thickness (m)
1	Interbedded and mixed greenish-gray to yellowish-gray, soupy to soft; bryozoa/ micarb/detrital silty clay-rich foraminiferal and nannofossil oozes	0-6	6
2	White, soft, nannofossil ooze	6-13	7
3	Greenish-gray, soft to stiff, foram/ glauconite-bearing detrital silty clay nannofossil ooze	13-55	42
4	Light-olive-gray, greenish-gray to dark-greenish-gray, stiff, glauconite/ micronodule-bearing, sponge spicule-rich nannofossil detrital silty clay	55-105	50
5	Dark-olive-gray, stiff, organic carbon bearing nannofossil-rich detrital silty clay	105-114	9
6	Greenish-gray to olive-gray, stiff, sponge spicule-rich nannofossil detrital silty clay	114-192	78
7	Very dark-brown, stiff, sponge spicule, nanno and organic carbon-bearing silty clay to clayey silt	192-295	103
8	Fine-grained, extrusive pillow basalt with calcite veins, glass rinds, and some altered calcareous sediments between the pillows	295-310.5	15.5+

soft to pale-olive and stiff, being mainly a foraminifera/glauconite-bearing detrital silty clay nannofossil ooze. In places where the unit has not been severely disturbed by drilling, various distinct and indistinct color mottles are seen. Some are caused by burrowing organisms, while others appear to be local concentrations of fine-grained glauconite.

Unit 4

This middle Oligocene unit is 50 meters thick. The disconformable relationship between Units 3 and 4 is marked by the sharp color and compositional change in Core 5. The unit is distinguished by a high content of silt and clay plus sponge spicules and various amounts of micronodules. It is dominantly a light-olive-gray, greenish-gray to dark-greenish-gray, stiff, glauconite micronodule-bearing, sponge spicule-rich nannofossil detrital silty clay. The abundance of nannofossils is variable. The lower part of the unit contains a significant proportion of various fine-grained rock fragments as well as dominant quartz. Structures vary from fine laminations to thicker (4-8 cm) color bands. The intensity of burrow mottling varies from rare to abundant in various parts of the unit. Rare dark streaks are caused by an abundance of pyritized sponge spicules.

Unit 5

This middle Oligocene unit is about 9 meters thick. It is distinctly darker in color (dark olive gray), and contains abundant detrital silt and clay, most of which is coated with a brown organic stain. Nannofossils and sponge spicules are not as common as in adjacent units, but thin bivalves, a solitary coral, and other unidentifiable shell fragments are present. These suggest either a different depositional environment or a reworked origin for sediments. The unit is best described as an organic carbon-bearing nannofossil-rich detrital silty clay.

Unit 6

This early to middle Oligocene unit is 78 meters thick. It is similar to Unit 4 and is a stiff, sponge spicule-rich, nannofossil detrital silty clay. The nannofossil content is highly variable; however, the sand content increases towards the base of the unit but is lower than that of Unit 5.

Distinct, color-graded layers (20-90 cm thick) are common. Many grade from a dark base (olive gray) to a paler top (greenish gray), but some are reversed. Thin layers (1-2 cm) of green glauconite-rich sediment occur sporadically throughout. Some layers contain isolated distinct burrow mottles, but other parts are intensely mottled. In one closely spaced examination, the nannofossils were found to be abundant in the light colored part, and rare in the darker parts of the sediment. The composition of the lowest few meters is transitional into the underlying unit.

Unit 7

This late Eocene unit is 103 meters thick. It is generally a very dark brown, stiff, sponge spicule nannofossil organic carbon-bearing silty clay to clayey silt. The amount of nannofossils and quartz sand is highly variable. Feldspar and mica are present in small but

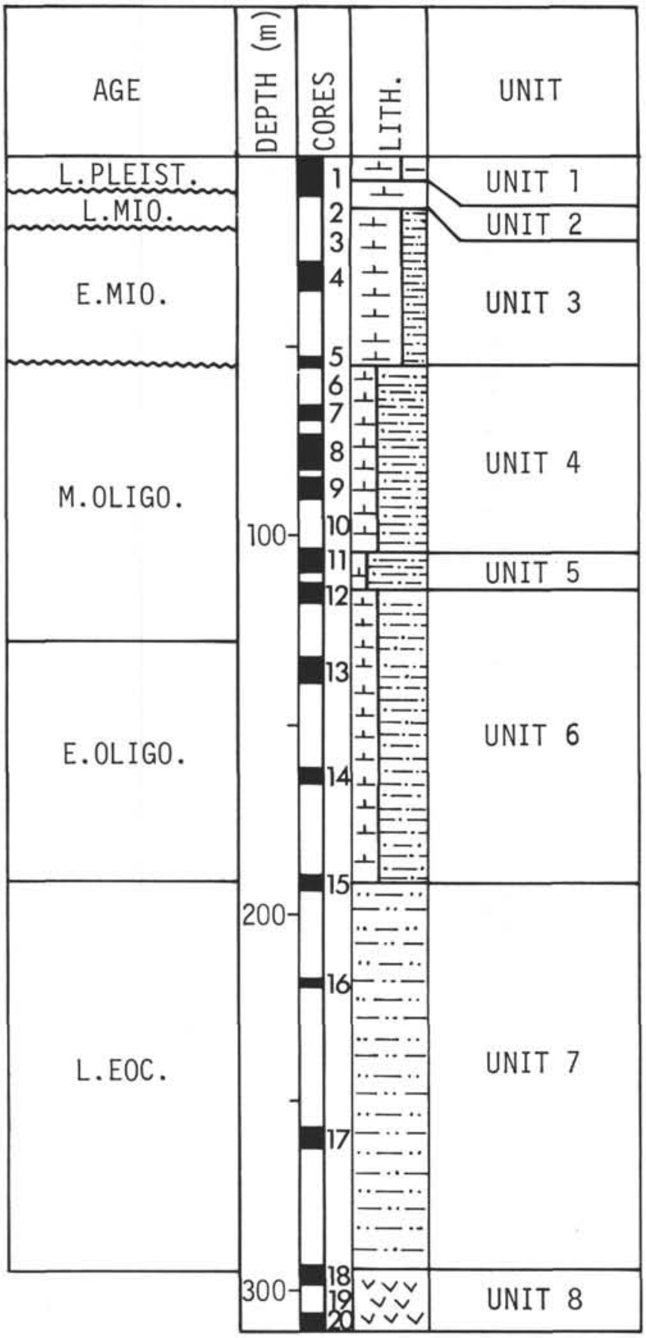


Figure 6. *Stratigraphic sequence cored at Site 282.*

significant amounts. Immediately above the basement contact the sediment becomes semilithified and rich in zeolites, palagonite, and volcanic glass. There is no evidence of baking of the sediment, which seems to have been deposited on cold pillow basalt.

The only structures visible are a few paler colored or sandier layers (1-4 cm thick), and rare glauconitic pods. The pervasive brown stain is organic. (Analyses by J. M. Hunt indicate about 590 ppb by weight of total C_4-C_7 hydrocarbons.)

Unit 8

This is a fine-grained extrusive pillow basalt that was penetrated for a depth of 15.5 meters (7.6 m recovered). It consists dominantly of zoned long plagioclase laths and smaller pyroxene crystals containing numerous tiny iron-oxide crystals. Calcite, chlorite, limonite, and other alteration products occur interstitially. The texture is subophitic with subradiating plagioclase laths. Phenocrysts of pyroxene and some plagioclase are rare and typically small. Numerous fractures in the basalt are filled with calcite, some of these bearing specks of native copper. Greenish-black volcanic glass rinds are common and outline the major pillow structures. Most of the calcite veins thin out, suggesting a contraction origin. Some calcareous sediment occurs in the interpillow areas. This has been recrystallized, but some included biogenic structures have been preserved. The upper 2 meters of the basalt is weathered to greenish gray but lower parts are generally olive black and fresher, except where intensely fractured.

Conclusions

The well-preserved pillow structures of the basalt and the incorporated sediment indicates that fairly pure calcareous material (probably a nannofossil ooze) was being deposited at the time that the basalt was extruded onto the ocean floor. The sedimentary sequence overlying the basalt varies mainly in the proportions of nannofossils and detrital (dominantly terrigenous) sand, silt, and clay (Table 3). The abundant nannofossils and sponge spicules, the general uniformity of the individually thick units, and the lack of medium-scaled current-formed structures are indicative of a deep oceanic environment of deposition.

Units 4-7, late Eocene to middle Oligocene, appear to have been deposited continuously at a fairly rapid rate. Direct sediment contribution by basic volcanic activity appears to be restricted to the very base of the sediment sequence, and even this basal sequence contains a high proportion of sand- and silt-size quartz apparently derived from the adjacent continent.

The ubiquitous organic brown stain in Unit 5 and especially Unit 7 suggests a reducing environment with little circulation. These units have been only slightly reworked by burrowing as compared to Units 4 and 6. The often graded color layering of Unit 6 may be partly the effect of alternating terrigenous and pelagic sedimentation. This unit also shows the clearest burrow mottling present.

At 55 meters subbottom depth, the probably middle Oligocene to early Miocene unconformity marks a reduction of the total detrital content in the overlying Unit 3. This is accompanied by a decrease in sponge spicules and micronodules. Late Miocene Unit 2 is a thin nannofossil ooze layer with no significant terrigenous contribution. The presence of the unconformity, an increase in biogenic material, and reduction of the terrigenous contribution must indicate increasing oceanic circulation following the mid Oligocene. Decreasing terrigenous supply probably also reflects reduced local tectonic activity at the newly formed continental margin and the development of extensive continental shelf sequences. Significantly, the nature of the

TABLE 3
Sediment Composition for Site 282
(Percentage) Based on Smear Slide Description

Sample (Interval in cm)	Sponge spicules	Micarb	Nannofossils	Foraminifera	Bryozoa	Other	Quartz	Feldspar	Mica	Clay Minerals	Heavy Minerals	Rock Fragments	Total Detrital[a]	Glauconite	Micronodules	Volcanic Glass palagonite zeolite	Detrital			Lithologic Unit
																	Sand	Silt	Clay	
1-1, 62	tr	12	13	50	20								5							
1-1, 75	1	8	52	12	11		tr		2	4	2		8	tr						
1-1, 148		50		tr			8			35	7		50					30	70	1
1-1, 135	4	35	2	26	16		7			4	2	2	15	2			80	20		
1-4, 1	3	10	2	50	25								15				70	30		
1-4, 120		5	5	50	25		5				5		10				60	40		
1-5, 30	tr		98	1									1	tr						
1-5, 130			100																	2
1, CC			100	tr			tr													
2, CC	tr	10	78	5									5	2						
3, CC	tr		75	10		tr							5	10						
4-1, 120			53				4			35	tr		40	8						
4-2, 65 (green mottle)		25	65				2		1	6			9	1			10	20	70	3
4, CC			80	5									5	5						
5-1, 119			93				2		1	1	2		6				10	60	30	
5-2, 18	tr		56	2			6		tr	34	tr		40	tr	2		5	10	85	
5, CC top	12		47	7		tr			1	28	3		32		2			35	65	
5, CC (bottom)	tr		40			tr	13	tr	tr	34	tr		50	10				10	90	
6, CC	18	4	60	10		tr	4		2	1	1		8	tr	tr		15	60	25	
7-1, 70	3		40				20		tr	30	tr		50		7		tr	40	60	
7, CC	12		64				9	2	1	4	3		19	5	tr		50	30	20	
8-2, 46	5		60				12			18			30	tr	5		5	50	45	
8-2, 97	7	tr	67			tr	15	3		2	3		23	2			25	55	20	4
8, CC	2		73				6			14	tr		20	5	tr		10	20	70	
9-1, 133 (black streak)	15		30	tr			25		5	10		15	55	tr						
9, CC	15		45				15			5		10	30	10	5			80	20	
10, CC	10		45				15			12		8	35	5	5		10	55	35	
11-1, 127 (dark mottle)			1			tr	55	13	4	15	4		91		7		65	20	15	5
11, CC	5	1	30	2	tr		25	10	2	18	3	tr	58	2	2		40	30	20	
12-3, 69 (dark mottle)	25		30				3				2			(40-dolo-mite)						
12-3, 76	10		60				15		2	6	2		25	5			10	60	30	
12, CC	12		71	tr			5	1	1	4	4		15		1		20	40	40	
13, CC	15	5	55	tr			13		tr		tr		15	3	7		10	90		6
14-2, 99 (sandy layer)	20		36	2		tr	16	4	2	3	8	2	35	4	3		52	33	15	
14, CC	15		57			tr	18	2	4		4		28				30	55	15	
15-2, 124	18		58			1	8	2	3		3		16	5	2		25	55	20	
15, CC	6	2	7	tr			30	5	5	40			80		5		10	40	50	
16, CC	13	1	8	tr		tr	22	5	5	30	8		70	2	5		25	35	40	
17, CC	10	tr	25				40	3	3	9	tr		60		5		5	80	15	7
18-1, 102	5		35				27			21		tr	48		7	5	10	55	35	
18-1, 116	tr		tr				33	5	10		4		52		2	45	15	60	25	

Note: tr = trace.

[a] Total detrital includes clay minerals of any origin.

epicontinental sedimentation in southern Australia changed from dominantly terrigenous in the Paleogene to biogenic in the Miocene.

The uppermost thin unit with its variety of calcareous oozes and bryozoan and terrigenous debris reflects the fluctuating sea level and climatic conditions of the Pleistocene. Much of the sediment has been reworked from the narrow Tasmanian continental shelf.

GEOCHEMICAL MEASUREMENTS

Table 4 and Figure 7 present the variations of the geochemical data in comparison with the lithologic units. *p*H values in the sediment are all lower than that of the reference surface seawater. A wide range in alkalinity exists from 2.74 meq/kg in Core 1, to 8.70 meq/kg in Core 15. The average salinity in the sediments is very close to that of the open surface waters.

BIOSTRATIGRAPHY

This sedimentary sequence is late Pleistocene to early late Eocene, but, due to three unconformities, can be readily subdivided into late Pleistocene, late Miocene, early Miocene, and mid or late Oligocene to early late Eocene intervals. These age assignments are based on the persistent presence of rare to common planktonic foraminifera and abundant calcareous nannofossils. Additionally, the Paleogene part of this sequence contains calcareous benthonic foraminifera, rare to common siliceous sponge spicules, variable but generally low numbers of palynomorphs, and very rare Radiolaria. Contrary to expectations, diatoms are absent.

Foraminifera

Eight planktonic foraminiferal zones plus three unconformities in the cored sequence have been identified at Site 282 (Table 5).

The preservation of the planktonic foraminifera changes from very good in the *G. (G.) truncatulinoides* Zone to very poor in the *G. (S.) linaperta* Zone, a marked deterioration with increasing age. Benthonic foraminifera present in the early Oligocene to late Eocene are shallow-water assemblages, but it is not determined whether the specimens are indigenous or transported.

Globorotalia (G.) truncatulinoides Zone

Core 1 yielded an excellent Pleistocene-Recent fauna either with reworked late Miocene planktonic foraminifera or the Pleistocene fauna was completely mixed with the late Miocene fauna during drilling. The Pleistocene-Recent fauna represents warmer water than at previously cored sites on Leg 29. This is based on the presence of *Globigerinella aequilateralis* and *Globigerinoides ruber.* The unconformity between the *G. (G.) truncatulinoides* and *G. (G.) miotumida miotumida* zones has been placed between Samples 1-1, 61 cm and 1, CC.

Globorotalia (G.) miotumida miotumida Zone

A diagnostic fauna was obtained from Sample 1, CC, including the benthonic species *Bolivinita quadrilatera* which has its initial appearance at the base of the zone in southeast Australia and New Zealand. The presence of large numbers of specimens from the *G. (G.) truncatulinoides* Zone in the sample has probably resulted from massive downhole contamination. The unconformity between the *G. (G.) miotumida miotumida* and the *G. (G.) woodi connecta* zones has been placed between Samples 1, CC and 2, CC.

Globigerina (G.) woodi connecta Zone

Only a small fauna was obtained from Sample 2, CC which is heavily contaminated with species from the *G. (G.) truncatulinoides* Zone. Because *Globigerinoides trilobus trilobus* and *Globorotalia (T.) zealandica* are not present, the assemblage is placed in the *G. (G.) woodi connecta* Zone. The lack of *Globorotalia (T.) praescitula* suggests that the sample is from the lower part of the *G. (G.) woodi connecta* Zone. The fauna is moderately preserved and the diversity fairly low but this may be partly due to the small sample size of Sample 2, CC. The boundary between the *G. (G.) woodi connecta* and the *G. (G.) woodi woodi* zones has been placed between Samples 2, CC, and 3, CC.

TABLE 4
Shipboard Geochemical Data, Site 282

		Sample Interval		*p*H				
Core	Section	Top (m)	Avg (m)	Punch-in	Flow-thru	Alkalinity (meq/kg)	Salinity (°/oo)	Lithologic Unit
Surface Seawater Reference				8.08	7.87	2.54	34.9	
1	6	0.0	8.95	7.47	7.58	2.74	34.9	2
5	1	53.5	54.97	–	7.72	3.81	34.9	3
7	0	66.0	66.45[a]	6.87	7.24	4.50	34.9	4
11	4	104.0	112.03	6.63	7.18	8.60	35.2	5
13	5	132.5	140.53	–	7.37	5.96	33.8	6
15	3	189.5	197.53	–	7.02	8.70	34.4	7
17	4	256.0	264.03	–	6.96	5.38	33.6	
Average				7.05	7.43	5.13	34.5	

[a] A cold squeeze (4°C) of this sample showed the following values: punch-in *p*H=7.23, Flow-thru *p*H=8.36; Alk=1.32, and S=34.4°/oo.

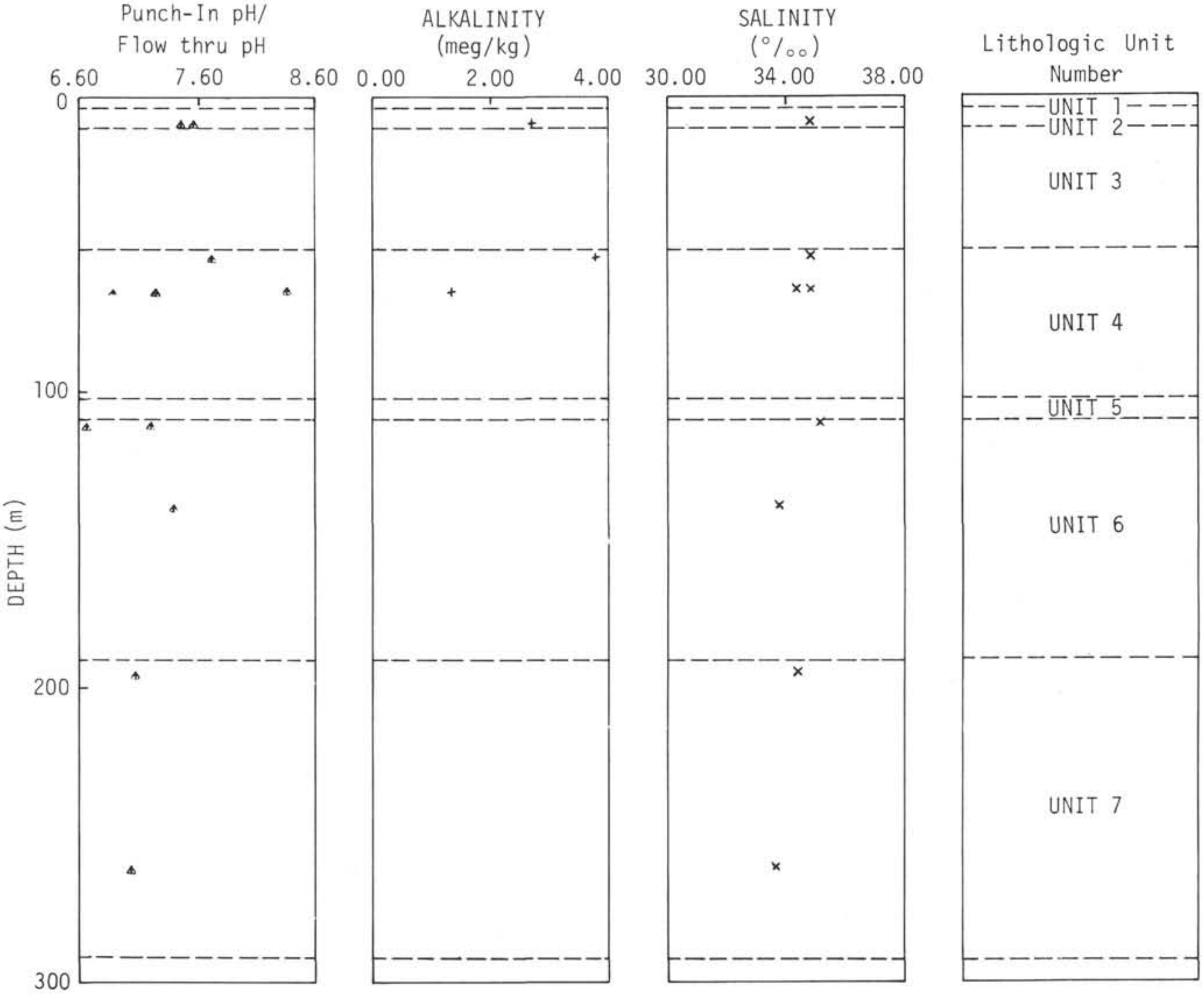


Figure 7. *Shipboard geochemical data versus depth, Site 282.*

Globigerina (G.) woodi woodi Zone

The presence of the relatively early form of the zone fossil places the lowest samples (3, CC; 4, CC; and 5-1, 130 cm) in the lower part of the *G. (G.) woodi woodi* Zone. The faunal diversity is moderate and the preservation poor to moderate. The unconformity between the *G. (G.) woodi woodi* and the *G. (G.) euapertura* zones has been placed between Samples 5-1, 130 cm and 5-2, 22 cm. This unconformity is probably related to the one recorded at Site 281 and also to unconformities at similar stratigraphic levels recorded at sites in the Tasman and Coral Seas (Kennett et al., 1972).

Globigerina (G.) euapertura Zone

The *G. (G.) euapertura* Zone fauna is well developed in Sample 6, CC, but diversity decreases and the preservation deteriorates towards the upper part of the zone. A relatively shallow-water benthonic fauna is present in Sample 6, CC with *Pyrgo, Robulus, Nodosaria, Cassidulina,* and *Bulimina.* The boundary between the *G. (G.) euapertura* and the *G. (S.) angiporoides angiporoides* zones has been placed between Samples 6, CC and 7-1, 130 cm.

Globigerina (S.) angiporoides angiporoides Zone

In Core 7 the preservation is moderate to poor, but in Cores 8-14 there is a marked deterioration, resulting in poorly preserved faunas. The zone fossil appears to have had a solution-resistant test and dominates the low-diversity fauna. A possible shallow-water benthonic fauna is present in Sample 11, CC with *Cibicides, Spirillina,* and polymorphinids. The boundary between the *G. (S.) angiporoides angiporoides* and the *G. (G.) brevis* zones has been placed between Samples 14, CC and 15-1, 126 cm.

TABLE 5
Planktonic Foraminiferal Zones, Site 282

Age	Planktonic Foraminiferal Zones	Taxa Used to Delimit the Zones
Pleistocene	*Globorotalia (G.) truncatulinoides*	
	Unconformity	
Upper Miocene	*Globorotalia (G.) miotumida miotumida*	
	Unconformity	
Lower Miocene	*Globigerina (G.) woodi connecta*	I.A. *G, (G.) woodi connecta*
U	*Globigerina (G.) woodi woodi*	
	Unconformity	
M	*Globigerina (G.) euapertura*	
Oligocene L	*Globigerina (S.) angiporoides angiporoides*	Ext. *Globigerina (S.) angiporoides angiporoides*
	Globigerina (G.) brevis	Ext. *Globorotalia (T.) gemma*
Upper Eocene	*Globigerina (S.) linaperta*	I.A. *G. (T.) gemma*

Note: I.A.=initial appearance; Ext.=extinction.

Globigerina (G.) brevis Zone

The presence of *Globorotalia (T.) gemma* with *Globigerinatheka (G.) index index* places the fauna in the *G. (G.) brevis* Zone. Some samples from the upper part of Core 15 but below the extinction level of *G. (G.) index index* do not contain this taxon. It is difficult to interpret the poorly preserved low-diversity fauna. Either *G. (G.) index index* is not present due to environmental factors or it was reworked into the upper part of the *G. brevis* Zone in the lower Oligocene. The boundary between the *G. (G.) brevis* and the *G. (S.) linaperta* zones has been placed between Samples 15-3, 135 cm and 15, CC.

Globigerina (S.) linaperta Zone

The fauna in the upper part of the zone in Sample 15, CC is poorly preserved, of low diversity, and there is a marked deterioration in preservation in Cores 16 and 17. In Sample 15, CC there is a shallow-water benthonic fauna with *Cibicides, Bulimina, Lagena, Nodosaria, Nonionella, Quinquiloculina,* and *Spirillina.* Sample 16, CC yielded only a few broken benthonic specimens, but in Core 18, 5 cm above the sediment-basalt contact there are a few specimens of the zone fossil together with *Alabamina, Bolivina, Bulimina,* and an agglutinated tube.

Calcareous Nannofossils

Rare to mainly abundant calcareous nannofossils occur in the late Pleistocene, Miocene, Oligocene, and late Eocene at Site 282. The preservation varies from poor to good, being mainly related to the lithology.

Pleistocene

Late Pleistocene-Recent assemblages occur in the upper sections of Core 1. Preservation is poor to moderate, being best in the youngest sample. In all samples, rare to few *Reticulofenestra pseudoumbilica* indicate either reworking from Miocene-early Pliocene, or, more likely, contamination from the underlying Miocene sections. In Sample 1-3, 145 cm, *R. pseudoumbilica* is common, but the Pleistocene forms are still present. In Sample 1-4, 26 cm, only a few *R. pseudoumbilica* and rare discoasters occur besides the abundant Pleistocene assemblage. The boundary between the Pleistocene and Miocene is placed between Samples 1-4, 26 cm, and 1-4, 130 cm. In the latter sample, *R. pseudoumbilica* is dominant, a few discoasters are present, and the small forms of *Cyclococcolithina leptoporus* that are abundant-common in the overlying Pleistocene samples become few. However, *Gephyrocapsa oceanica* and *G. aperta* still occur and are thought to represent contamination by drilling disturbance. The Pleistocene assemblages do not include *Pseudoemiliania lacunosa.* A late Pleistocene age (*Coccolithus pelagicus* Zone) is suggested.

Miocene

Below the unconformity in Section 1-4 occurs a mid Miocene-early Pliocene (*Reticulofenestra pseudoumbilica* Zone) assemblage (dated as late Miocene by the foraminifera) of abundant but very poorly preserved coccoliths. Diversity is very low, due in part to the clearly visible solution, but primarily due to low diversity of the original assemblages. This is suggested by the sparsity of discoasters (only *Discoaster variabilis* is present) which are more solution resistant.

Early Miocene (*Discoaster deflandrei* Zone) assemblages including *D. deflandrei, D. divaricatus, Helicopontosphaera ampliaperta, H. euphratis, H. kamptneri,* and *H. recta* occur in Cores 2-4, and down to Sample 5-1, 136 cm. Calcareous nannofossils are still abundant and, in some samples, show very good preservation and high diversity. The zone fossils used in the zonation of Martini (1971) occur too sporadically to be useful in a zonation at this latitude. Discoasters are well developed and a new, relatively large, delicate form of *Ilselithina* was found together with a species similar to *Ericsonia fenestrata,* which is 3μ-5μ in diameter.

Oligocene

Oligocene assemblages were found from Sample 5-1, 148 cm to Core 15, preservation varying greatly from very poor to good, and frequency from rare to abundant. A low diversity is noted in the mid to late Oligocene, but it is difficult to judge whether it is due to solution or a low, worldwide nannofossil diversity in the Oligocene.

A rather abrupt change in the coccolith assemblage occurs between Samples 5-1, 136 cm and 5-1, 148 cm parallel with a lithology change between these two samples. *Chiasmolithus altus, Reticulofenestra bisecta,* and *Zygrhablithus bijugatus* form part of the *Reticulofenestra bisecta* Zone assemblage below; they are absent above where *Helicopontosphaera ampliaperta* occurs. This sudden change suggests an interruption in sedimentation. Its length, however, cannot be measured in terms of a detailed nannofossil zonation. Another possibility is that the change of facies brought with it a change in the coccolith assemblage.

In most of Core 5, preservation is moderate to good, diversity is quite high, and the assemblage includes in addition to long ranging species, *Helicopontosphaera euphratis, H. obliqua, H. recta, Orthozygus aureus,* and *Orthozygus* sp. From 5, CC (base) to 10, CC, preservation and diversity is poor, but coccoliths are abundant. A lithologic change was noted in 5, CC. Because *Reticulofenestra placomorpha* is missing, the sequence is placed in the mid-late Oligocene (*Reticulofenestra bisecta* Zone). In Core 11, the diversity increases markedly, *Orthozygus* reappears, and in Sections 11-1 and 11-2, *Lanternithus minutus* occurs. From Samples 11-2, 110 cm, to 11, CC, the assemblage again changes, and rare to common *Isthmolithus recurvus* is found together with rare *Reticulofenestra placomorpha.* However, this late Eocene-early Oligocene assemblage is underlain, in Cores 12-15, by sediments bearing mid to early Oligocene assemblages and thus is considered to result from reworking. Downcore from Core 12, *Reticulofenestra placomorpha* and *"Cyclococcolithus" formosus* occur sporadically in Sections 13-4 to 13, CC, and in Core 14. In the moderately well-preserved assemblages of Core 15, *R. placomorpha* is common and *I. recurvus* absent to usually common. In Sample 15-3, 10 cm large coccoliths of the *Ericsonia subdistichus* group are common. Their size diminishes downward, where they become rare and finally absent in Core 18. The highest *Discoaster saipanensis* was found in Sample 15-2, 95 cm, and thus the Eocene-Oligocene boundary placed above this sample.

Eocene

From Sample 15-2, 95 cm downward, rare *Discoaster saipanensis* occur together with *"Reticulofenestra" reticulata,* which was also found as high as Sample 15-3, 20 cm. This points to late Eocene for the remainder of Core 15.

From Core 16 downward, coccoliths are rare to abundant and usually poorly preserved. While *Reticulofenestra placomorpha, "R." reticulata,* and *Discoaster tani nodifer* are present in all samples, typically large *R. bisecta* is very rare (the small forms are common) and *I. recurvus* is missing. An early late Eocene age is adopted for these sediments above the basalt. Further subdivision of the late Eocene was not possible.

Remarks on neritic species

It is of special interest to note at this site the presence of varying amounts of *Transversopontis obliquipons,* few *T. pulcheroides* and *T. pulcher* as well as rare to few *Discolithina multipora* in the Eocene and Oligocene. The holococcoliths *Orthozygus aureus, Orthozygus* sp., *Dactylethra punctulata,* and *Lanternithus minutus* also occur in many late Eocene and early Oligocene samples.

In the Paleogene, *Discolithina* and *Transversopontis* are absent or very rare in open-ocean sediments, and are believed to be restricted to shallow-water areas; from there they might have been transported to the probably much greater depths of deposition of this site. The holococcoliths also seem to have preferred shallow waters or, at least, are usually only preserved in shallow-water deposits. Their presence might indicate a shallow-water environment or, more likely, rapid burial at greater depths following transport from shallow waters.

Remarks on relations between lithology and coccoliths

The late Eocene to early Miocene sediments contain varying amounts of terrigenous material. The relationship between the lithology and the coccoliths was briefly examined to determine whether the species are recording their initial ranges or are reworked from shallower water into the deeper waters of this site. The latter is suggested for some samples by the common presence of holococcoliths, and representatives of the Pontosphaeraceae.

From Section 13-4, samples were taken at four intervals: 23 cm, 31.5 cm, 34 cm, and 44 cm, from the top and bottom of a possible graded bed, from the top of the underlying layer, and from a brownish upper part of a layer. No significant difference was found in the coccolith assemblages from the top and bottom part of the possible graded bed. Coccoliths are abundant and moderately well preserved. However, in the two samples from the pelagic parts of the other beds, coccoliths are very rare and poorly preserved in the layer just underlying the possible graded bed, and only a few, poorly preserved coccoliths occur in the lowermost sample at

44 cm. A sample taken at 110 cm again includes abundant, moderately well-preserved coccoliths. It is possible that in the early Oligocene, conditions for the sedimentation and preservation of coccoliths repeatedly changed from very good to very poor over short time intervals, e.g., by the repeated influx of nearly contemporaneous or older coccolith-rich sediments from nearby shelf or slope areas into deepthhss near the calcite compensation depth.

Diatoms

All the core catchers from Hole 282 were studied and found to be essentially barren of diatoms. Fragments of *Arachnoidiscus* were found in 5, CC; 6, CC; 7, CC; and 15, CC but their poor state of preservation did not allow any identification at the species level.

Porifera

The only siliceous fossils present in the samples of the core catchers studies from Site 282 were sponge spicules which are common and diverse in the Paleogene (Cores 5-17), and they were studied in some detail. The inventory of the forms present is illustrated on Plates 1-3 and Figure 8. Thus far, on Leg 29, abundant and large sponge spicules have been observed in Eocene and Oligocene sediments, whereas they seem to be poor both in diversity and abundance in the Miocene, Pliocene, and Pleistocene.

Palynology

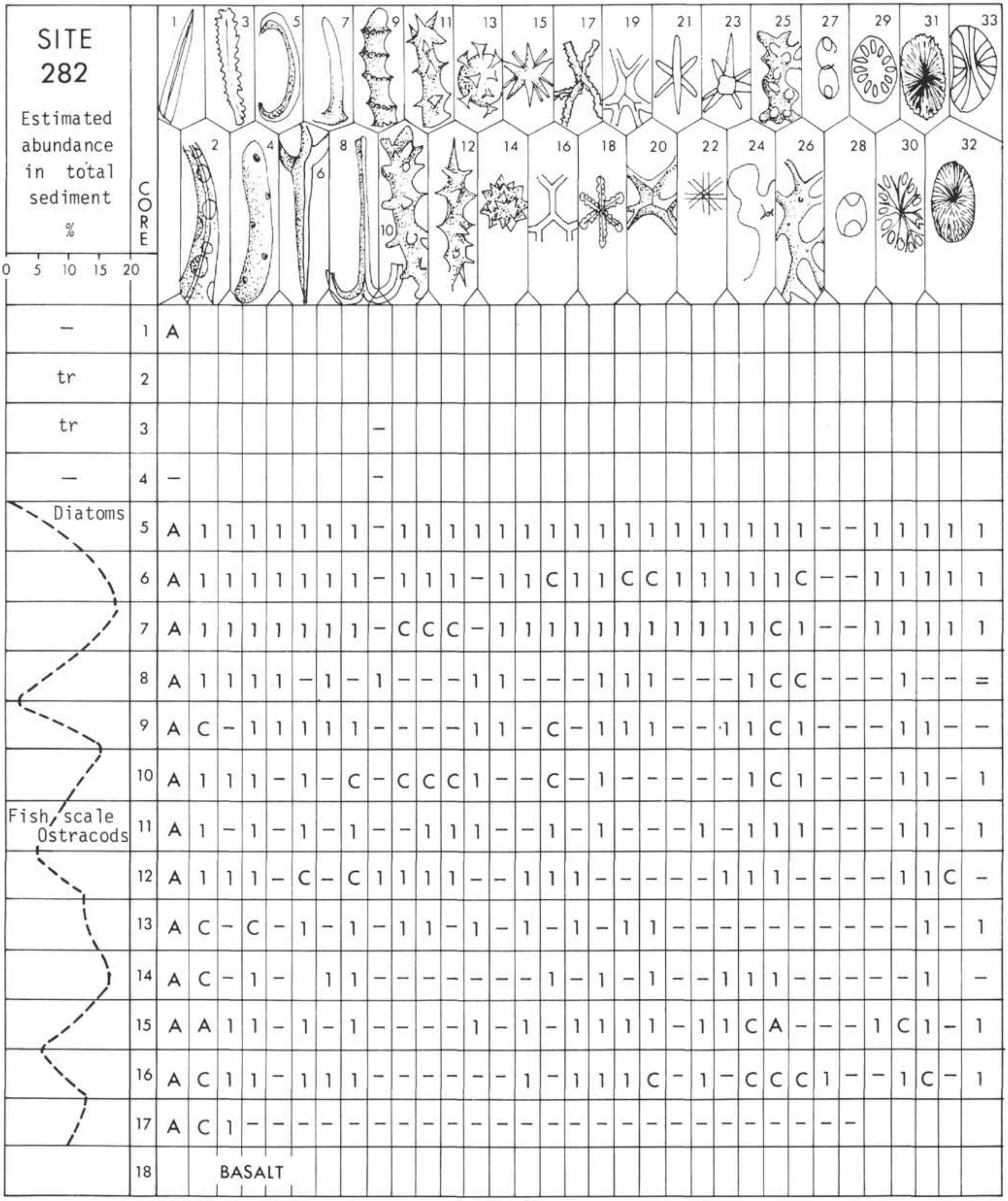
Fourteen core-catcher samples were examined, representing Cores 4-17, and Lithologic Units 3-7. The palynofloras are generally fairly poor. Core 4 is dominated by the dinoflagellate, *Hystrichokolpoma rigaudae* (Deflandre and Cookson). Other dinoflagellates include *Operculodinium* sp. and *Spiniferites cingulatus* (O. We.). Pollen is rare and includes *Nothofagus* aff. *matauraensis* (Couper). All palynomorphs are very pale and show virtually no carbonization. Their age is uncertain, but is probably post-Oligocene on account of the dominance of *H. rigaudae* and the absence of *Deflandrea.* Core 5 contains a sparse palynoflora including *Lingulodinium machaerophorum* (Deflandre and Cookson), *Spiniferites ramosus* (Ehr.), *Cleistosphaeridium* sp., *Deflandrea phosphoritica* Eis., *Hystrichokolpoma rigaudae* Defl. and Cooks., ?*Tectatodinium* sp., *Spiniferites cingulatus* (O. We.), and a probable reworked specimen of *Areosphaeridium dictyoplokus* (Klumpp). Miospores include *Nothofagus* aff. *matauraensis* Couper, *Cyathidites* sp., and *Podocarpidites* sp; their age is probably Oligocene or older, based on the presence of *Deflandrea phosphoritica.* Core 6 contains assemblages similar to Core 5. Core 7 lacks dinoflagellate cysts but contains a few sparsely represented pollen species including *Nothofagus* sp., *Dacrydiumites* sp., *Triorites harrisii* Couper, and Proteaceae. Age is indeterminate. Cores 8-10 are barren. Core 11 contains fairly abundant pollen, including *Nothofagus* cf. *spinosus* Couper, which in New Zealand is restricted to the Oligocene and Miocene (Couper, 1960). Other pollen species include *Dacrydiumites* sp., *Triorites harrisii* Couper, *Proteacidites* sp., Myrtaceae, and *Podocarpidites* spp. Dinoflagellate cysts include *Deflandrea phosphoritica* Eis., *Operculodinium* sp., *Hystrichokolpoma* cf. *rigaudae* Defl. and Cooks. *Cyclonephelium* sp., *Spiniferites ramosus* (Ehr.), and an undescribed species of *Palaeoperidinium.* Age is Oligocene or older. Core 12 contains an assemblage similar to Core 11 with the addition of the Eocene-?Oligocene dinoflagellate *Deflandrea macmurdoensis* Wilson. Core 13 contains several reworked palynomorphs of probable Permian age, including *Parasaccites* sp. and *Densipollenites* sp. Dinoflagellates include *Deflandrea* cf. *heterophlycta* Defl. and Cooks. Age is indeterminate although *Deflandrea heterophlycta* has not been recorded above the late Eocene. Core 14 is barren. Core 15 contains a typical late Eocene dinoflagellate assemblage including *Deflandrea phosphoritica* Eis. (dominant) and *Wetzeliella (Rh.) glabra* Cookson. The same species of *Wetzeliella* has been recorded from the Eocene of Australia (Cookson, 1956), and upper Eocene of New Zealand (Wilson, 1967). Other dinoflagellate species include *Hystrichokolpoma* cf. *rigaudae* Defl. and Cooks, *Spiniferites ramosus* (Ehr.), *Cyclonephelium* sp., and *Areosphaeridium dictyoplokus* (Klumpp). Pollen is dominated by beech pollen representing both the *fusca* and *brassi* types. Core 16 contains a somewhat similar assemblage to Core 15, and also includes *Turbiosphaera* aff. *filosa* (Wilson). Age is Eocene. Core 17 is generally similar to Core 16 and also contains *Deflandrea heterophlycta* Defl. and Cooks., and an ornate species of *Leptodinium.* Age is Eocene.

SEISMIC DATA

The lack of internal reflectors in the profiler record at the site (Figure 3) is consistent with the sonic log, which shows a regular velocity increase with depth without important velocity changes. The velocity gradient that can be estimated is 0.8 sec^{-1}.

SEDIMENTATION RATES

Paleontological control for Site 282 is very good and the sedimentation rate curve (Figure 9) has been established on several accurately determined biostratigraphic horizons. The late Eocene to middle Oligocene sedimentation rates are 2.5-3.0 cm/1000 yr. Detrital sediments in the lower part of this interval become increasingly biogenic towards the upper part. The sequence is similar to the late Eocene at Site 280, although sedimentation rates are slightly higher at Site 280 (~4 cm/1000 yr). In the middle middle Oligocene, the sedimentary record changes from one of uninterrupted deposition to one of erosion. Almost all of the middle middle Oligocene to present day is represented in at least three unconformities. During the early Miocene, bottom currents decreased enough to enable slow deposition (0.7 cm/1000 yr) of nannofossil ooze. This decrease in bottom current activity might have resulted from substantial warming and Antarctic deglaciation during this time. Erosion resumed after the early Miocene, although very thin sequences of late Miocene nannofossil oozes and late Pleistocene foraminifera and nannofossil ooze represent brief depositional intervals.



Estimated abundance in total sediment %	CORE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
—	1	A																																
tr	2																																	
tr	3									–																								
—	4	–								–																								
Diatoms	5	A	1	1	1	1	1	1	1	–	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	–	–	1	1	1	1	1
	6	A	1	1	1	1	1	1	1	–	1	1	1	–	1	1	C	1	1	C	C	1	1	1	1	1	C	–	–	1	1	1	1	1
	7	A	1	1	1	1	1	1	1	–	C	C	C	–	1	1	1	1	1	1	1	1	1	1	1	C	1	–	–	1	1	1	1	1
	8	A	1	1	1	1	–	1	–	1	–	–	–	1	1	–	–	–	1	1	1	–	–	–	1	C	C	–	–	–	1	–	–	=
	9	A	C	–	1	1	1	1	1	–	–	–	–	1	1	–	C	–	1	1	1	–	–	1	1	C	1	–	–	–	1	1	–	–
	10	A	1	1	1	–	1	–	C	–	C	C	C	1	–	–	C	–	1	–	–	–	–	–	1	C	1	–	–	–	1	1	–	1
Fish scale Ostracods	11	A	1	–	1	–	1	–	1	–	–	1	1	1	–	–	1	–	1	–	–	–	1	–	1	1	1	–	–	–	1	1	–	1
	12	A	1	1	1	–	C	–	C	1	1	1	1	–	–	1	1	1	–	–	–	–	–	1	1	1	–	–	–	–	1	1	C	–
	13	A	C	–	C	–	1	–	1	–	1	1	–	1	–	1	–	1	–	1	1	–	–	–	–	–	–	–	–	–	–	1	–	1
	14	A	C	–	1	–		1	1	–	–	–	–	–	–	–	1	–	1	–	1	–	–	1	1	1	–	–	–	–	–	1		–
	15	A	A	1	1	–	1	–	1	–	–	–	–	1	–	1	–	1	1	1	1	–	1	1	C	A	–	–	–	1	C	1	–	1
	16	A	C	1	1	–	1	1	1	–	–	–	–	–	–	1	–	1	1	1	C	–	1	–	C	C	C	1	–	–	1	C	–	1
	17	A	C	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–					
	18			BASALT																														

Figure 8. *Siliceous fossils recorded at Site 282. Forms numbered 1-12 are shown on Plate 1, 13-23 on Plate 2, and 24-33 on Plate 3.*

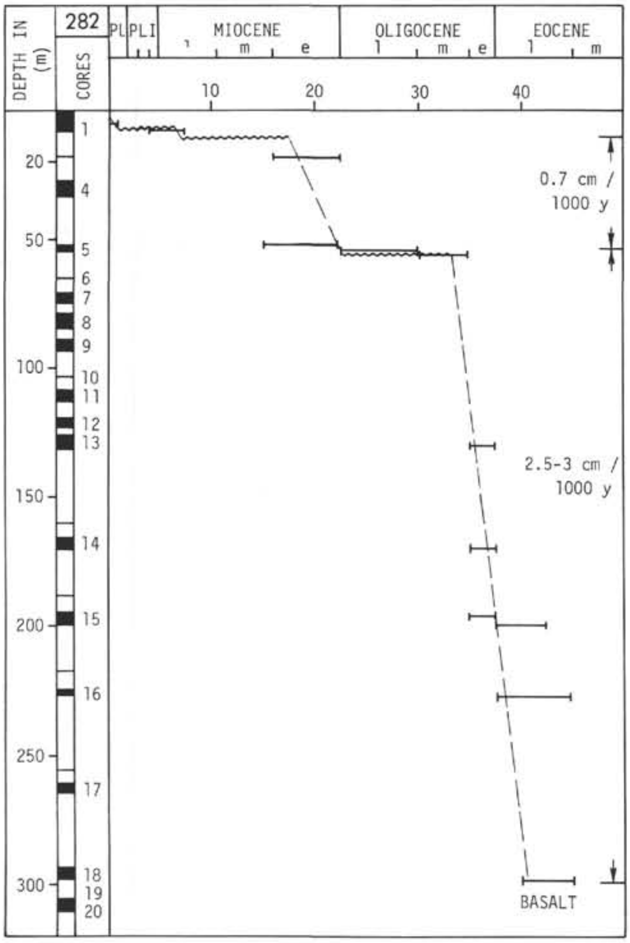


Figure 9. *Sedimentation rate curve for Site 282.*

SUMMARY AND CONCLUSIONS

Site 282 is located within the magnetic quiet zone south of Australia. This site is located in deep water (4212 m) near the base of the continental slope of western Tasmania, about 100 km from the edge of the continental shelf (Figures 1, 2, 4). Twenty cores were recovered with 295 meters of penetration into sediment and 15 meters of penetration into pillow basalt. The sediments are deep oceanic throughout, almost exclusively detrital (terrigenous) near the base, and become detrital-bearing nannofossil oozes in the middle and nannofossil ooze in the upper portion.

Seven sedimentary units are distinguished as follows: A veneer (6 m) of late Pleistocene foraminiferal and nannofossil ooze (Unit 1) is unconformably underlain by about 7 meters of late Miocene white, soft nannofossil ooze (Unit 2). This interval is separated from the underlying interval (Unit 3) by either a highly condensed sequence (9 m maximum thickness) or, more likely, by an unconformity. Unit 3 consists of 42 meters of early Miocene detrital-bearing nannofossil ooze. This unit is in turn separated by a substantial unconformity from 50 meters of nannofossil detrital silty clay (Unit 4) and 9 meters of middle Oligocene nannofossil-rich detrital silty clay (Unit 5). This is conformably underlain by 78 meters of nannofossil detrital silty clay of early Oligocene and earliest middle Oligocene age (Unit 6), and 103 meters of very dark brown, stiff organic stained silty clay to clayey silt (Unit 7). Basement at Site 282 is a fine-grained extrusive pillow basalt, mineralized with specks of native copper. The overlying sediments are not baked.

Rare to common planktonic foraminifera and abundant calcareous nannofossils occur throughout. Additionally the Paleogene part of the sequence contains calcareous benthonic foraminifera, rare to common siliceous sponge spicules, and very rare Radiolaria. Diatoms are virtually absent.

Conclusions

The magnetic quiet zone is a feature of fundamental significance that runs parallel to many stable continental margins. The coring of late Eocene apparently normal pillow basalts at Site 282 eliminates the possibility that the quiet zone is foundered continental material.

The age difference between the oldest magnetic anomalies (55 m.y.) and the basal sediment (late Eocene) here may not be significant. The drill site is on a basement pinnacle (Figure 4) which may not have retained the oldest sediments, and the basal sediments have poor paleontological control.

The age of basement is crucial because the quiet zone cannot be related to the initial rifting process if the basement here is at least 10 m.y. younger than the oldest anomalies. If the basement is as old as the initial rifting, the quiet zone could result from the process proposed by Poehls et al. (1973).

The four major events in the sedimentary history at Site 282 are: moderately rapid and continuous sedimentation in the late Eocene to middle Oligocene with sedimentation rates of 2.5-3.0 cm/1000 yr; a period of erosion recorded by a substantial unconformity spanning the late middle Oligocene, the late Oligocene, and the lowermost Miocene; slow and continuous sedimentation throughout the early Miocene; another period of prolonged erosion spanning almost the entire middle Miocene-middle Pleistocene interrupted only by a short interval of sedimentation during the early late Miocene. This was followed by minor deposition during the late Pleistocene.

Poorly fossiliferous late Eocene detrital sediments are similar in character and age to those at Site 280. Both are dark colored, organically rich, poor in biogenic components, and judging from an absence or marked reduction of calcareous microfossils, were deposited below or close to the calcium carbonate compensation depth. Site 282 does differ in lacking clear burrowing in the presence of some stratification and in the absence of agglutinated foraminifera. The presence of the ubiquitous organic brown staining material is probably related to a reducing environment with restricted circulation as at Site 280. The similarity of the late Eocene sediments of Sites 280 and 282 strongly suggests terrigenous deposition within the same deep basin with restricted circulation. Slightly coarser sediments at Site 282 suggests deposition closer to the source area, presumably in southern Australia. However sedimentation rates are higher during this interval at Site 280. The presence of shallow-water benthonic foraminifera is almost certainly due to reworking from nearby shallow water areas of Tasmania. Direct sediment contribution by basic volcanic activity appears to be restricted to a thin zone immediately above basement.

The increasing biogenic contribution during the Oligocene parallels that at Site 280 except that at Site 280 this is recorded by increasing siliceous biogenic material. At Site 282 it is recorded by increasing calcareous biogenic material. Inasmuch as both sites are at the approximately same depths (presently), and were probably at similar depths during the Oligocene, it is possible that the differences in biogenic components are related to latitudinal differences in the distribution of diatoms and calcareous nannoplankton as in the present day Southern Ocean. Together they represent increasing oceanic circulation during the Oligocene probably resulting from growth of the oceanic region south of Australia.

In the middle middle Oligocene, the sedimentary record changes from one of uninterrupted deposition to one of erosion, recorded by substantial unconformities. Almost all of the middle middle Oligocene to present day is represented in at least three unconformities. The oldest unconformity (middle middle Oligocene to the late Oligocene) is indicative of erosion-nondeposition in the deep-sea area south and immediately west of Tasmania, resulting from the initiation of deep-sea circumpolar circulation south of Australia. Although overlapping slightly with the Leg 21 regional unconformity, the two unconformities are not directly related except that both events appear to be related to the sequential paleocirculation changes resulting from breakup of Australia and Antarctica. The unconformity found during Leg 29 records the development of the circumpolar current south of Australia, while the unconformity found during Leg 21 represents intensification of bottom-water flow through the Tasman Sea-Coral Sea region. This bottom water had its source in the Ross Sea region prior to the breakup of Australia and Antarctica. Circumpolar current development interfered with this north-south flow and basic paleocirculation patterns changed throughout the southwest Pacific.

During the early Miocene, bottom currents decreased enough to enable slow deposition of nannofossil ooze. This decrease in bottom-current activity might have resulted from substantial warming and some Antarctic deglaciation during the early Miocene. However, very thin sequences of late Miocene nannofossil ooze and late Pleistocene foraminiferal and nannofossil ooze also represent brief depositional intervals, the latter at least during glacial conditions.

The general change from Paleogene detrital to Neogene biogenic sedimentation and the related differences in sedimentation rates reflect the changing pattern of sedimentation in southern Australia. This change resulted from a reduction in local tectonism at the newly formed continental margin, the development of extensive continental shelves, and possibly a more arid climate as Australia moved north into lower latitudes.

The variety of biogenic material and terrigenous debris in the late Pleistocene reflects reworking of materials from the shallow water areas of Tasmania during a period of fluctuating sea level.

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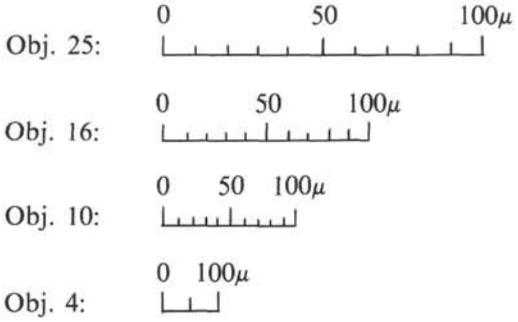
PLATE 1

Oligocene Siliceous Sponge Spicules and Skeletons from Hole 282
Morphological names as given by Laubenfels (1955)

Figure 1	Oxea; Sample 10, CC (obj. 10).
Figure 2	Oxea; Sample 5, CC, upp. (obj. 16).
Figure 3	Style; Sample 5, CC, upp. (obj. 10).
Figure 4	Strongyl; Sample 7, CC (obj. 16).
Figure 5	Sigma; Sample 5, CC, upp. (obj. 10).
Figure 6	Triaene, Sample 5, CC, upp. (obj. 10).
Figure 7	Discontriaene; Sample 5, CC, upp. (obj. 16).
Figure 8	Triaene; Sample 11, CC (obj. 16).
Figure 9	Style (acanthose); Sample 8, CC (obj. 25).
Figure 10	Style (acanthose); Sample 9, CC (obj. 25).
Figure 11	Style (acanthose); Sample 5, CC, upp. (obj. 25).
Figure 12	Streptaster; Sample 11, CC (obj. 16).



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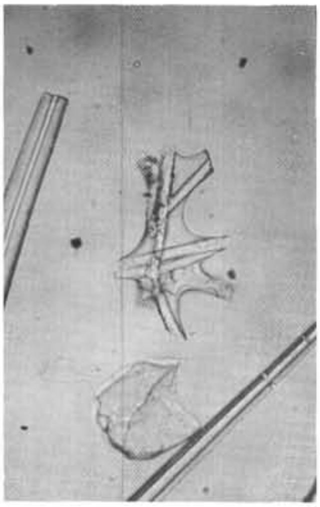
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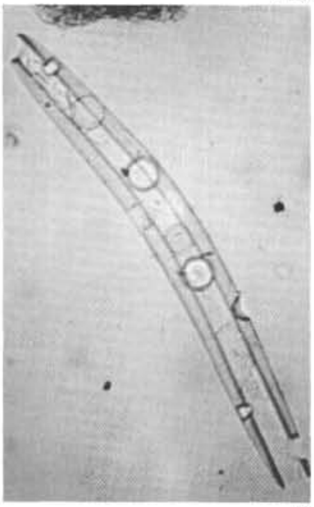
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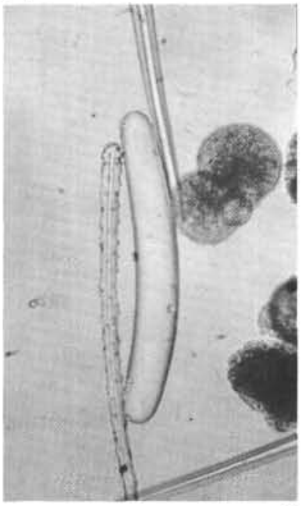
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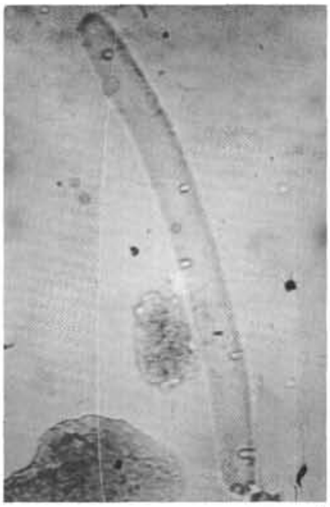
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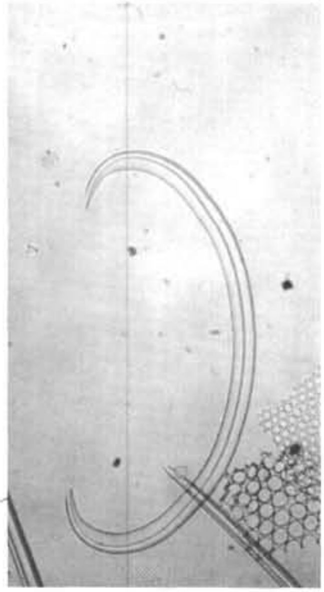
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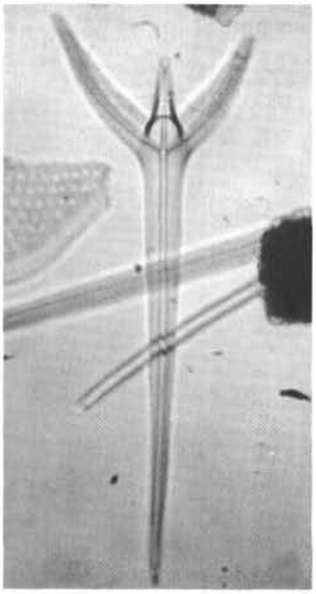
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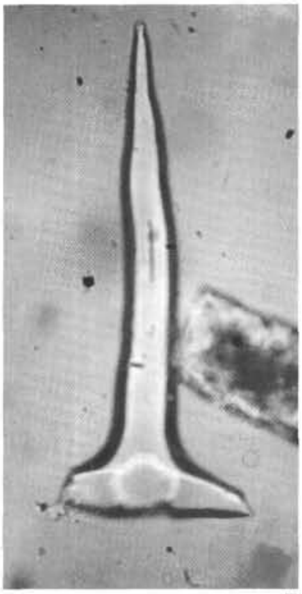
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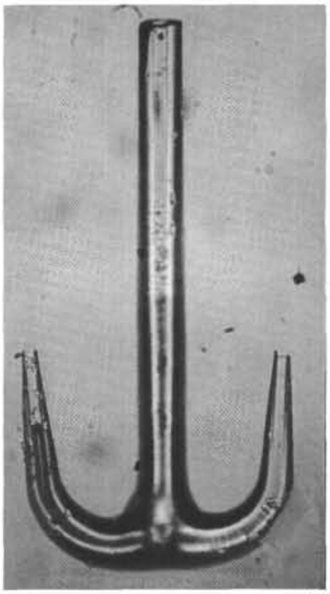
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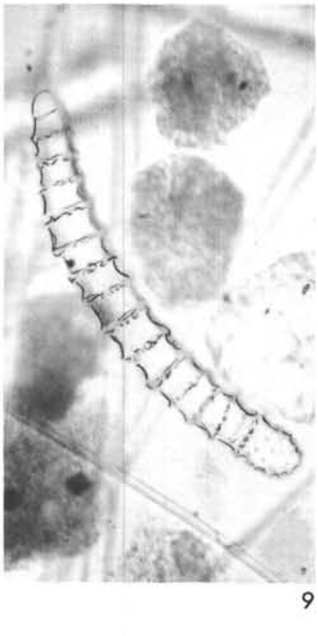
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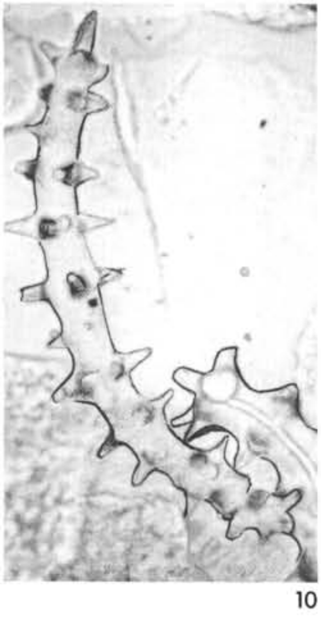
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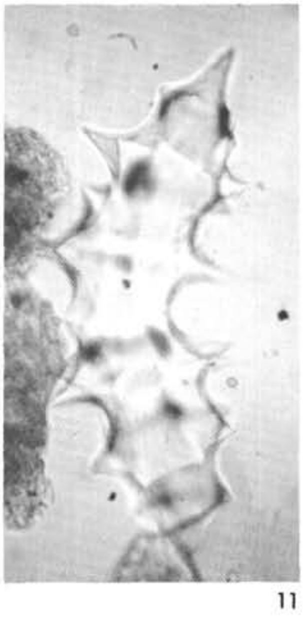
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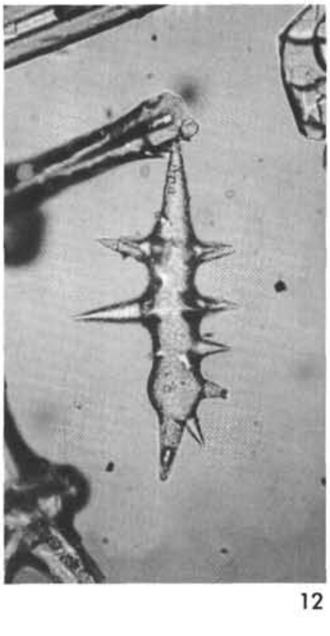
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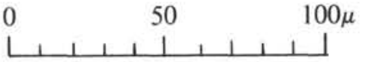
PLATE 2

Oligocene Siliceous Sponge Spicules and Skeletons from Hole 282
Morphological names as given by Laubenfels (1955)

Figure 1	Sphaeraster; Sample 10, CC (obj. 25).
Figure 2	Sphaeraster; Sàmple 11, CC (obj. 25).
Figure 3	Euaster; Sample 5, CC, upp. (obj. 10).
Figure 4	Dichotriaene; Sample 5, CC (obj. 4).
Figure 5	Dichotriaene (acanthose); Sample 5, CC, upp. (obj. 10).
Figure 6	Hexaster; Sample 5, CC (obj. 10).
Figure 7	Dichotriaene; Sample 11, CC (obj. 16).
Figure 8	Dichotrichaene; Sample 5, CC, upp. (obj. 10).
Figure 9	Oxiaster; Sample 10, CC (obj. 25).
Figure 10	Euaster; Sample 11, CC (obj. 25).
Figure 11	Euaster; Sample 10, CC (obj. 25).

Obj 25:



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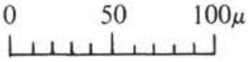
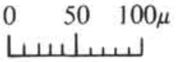


Obj. 10:



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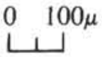

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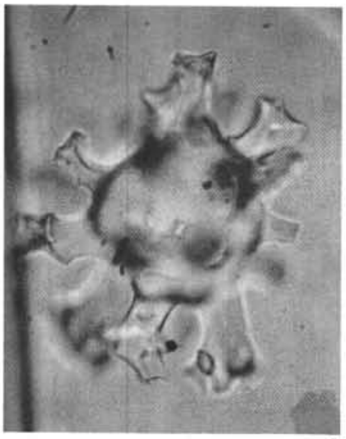
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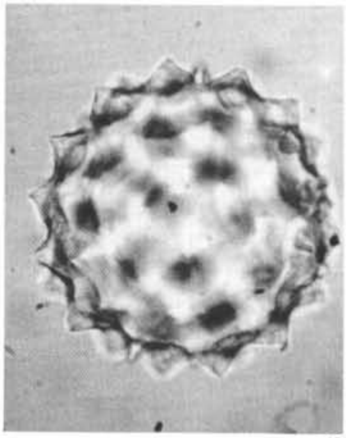
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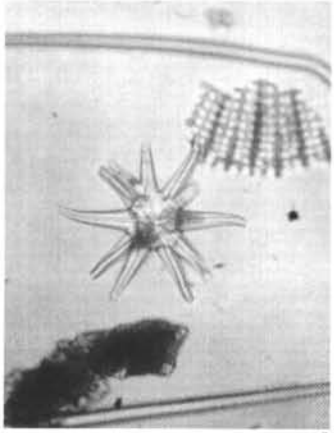
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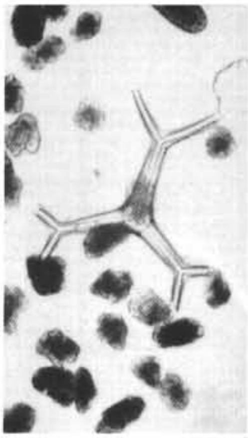
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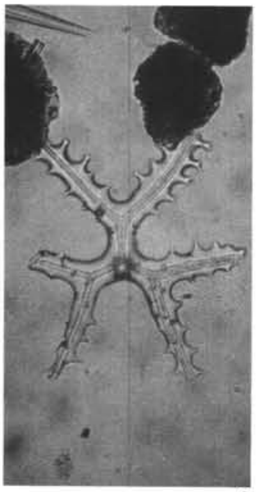
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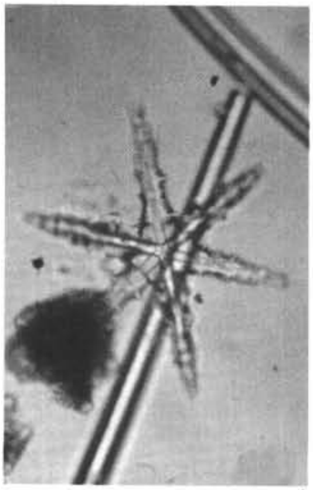
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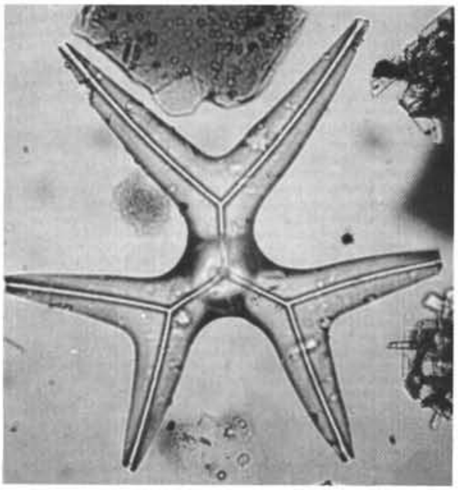
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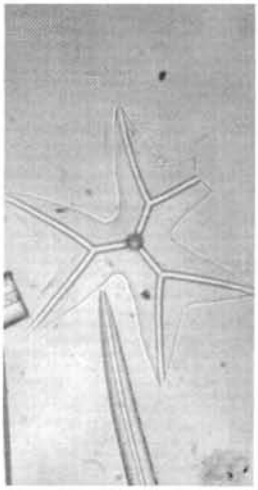
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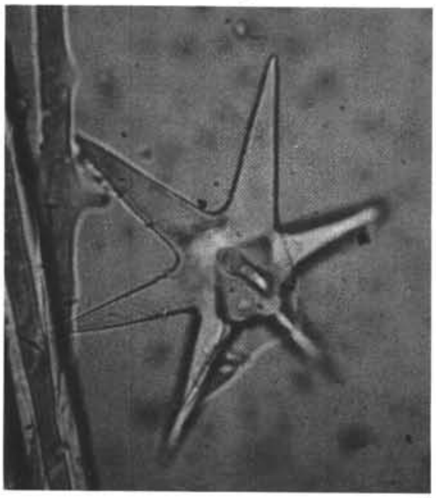
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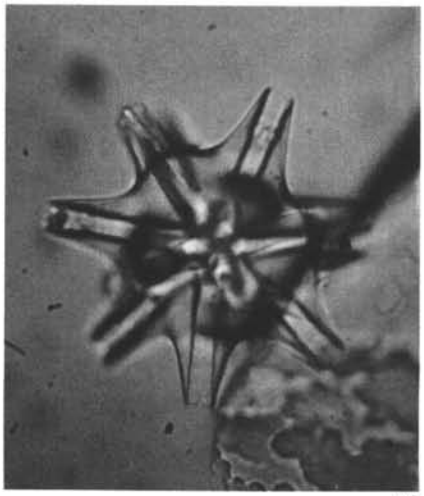
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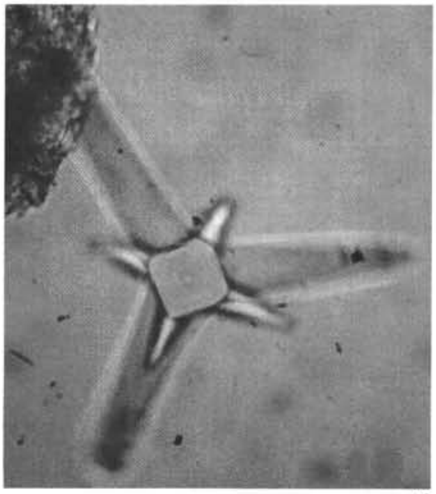
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PLATE 3

Oligocene Siliceous Sponge Spicules and Skeletons from Hole 282
Morphological names as given by Laubenfels (1955)

Figure 1	Phyllotriaene; Sample 5, CC, upp. (obj. 16).
Figure 2	Tetraclone; Sample 7, CC (obj. 25).
Figure 3	Phyllotriaene; Sample 5, CC, upp. (obj. 10).
Figure 4	Forma indet.; Sample 8, CC (obj. 25).
Figure 5	Forma indet.; Sample 7, CC (obj. 25).
Figure 6	Discotriaene; Sample 5, CC, upp. (obj. 16).
Figure 7	Discotriaene; Sample 6, CC, upp. (obj. 16).
Figure 8	Sterraster; Sample 5, CC, upp. (obj. 25).
Figure 9	Sterraster; Sample 5, CC, upp. (obj. 25).
Figure 10	Discotriaene; Sample 11, CC (obj. 25).

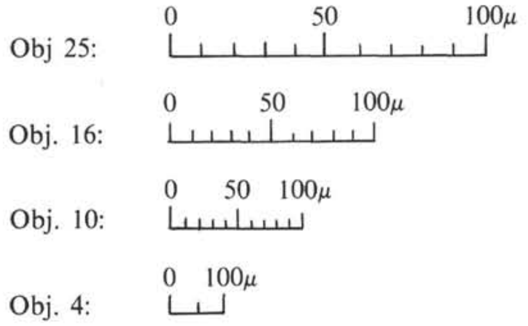
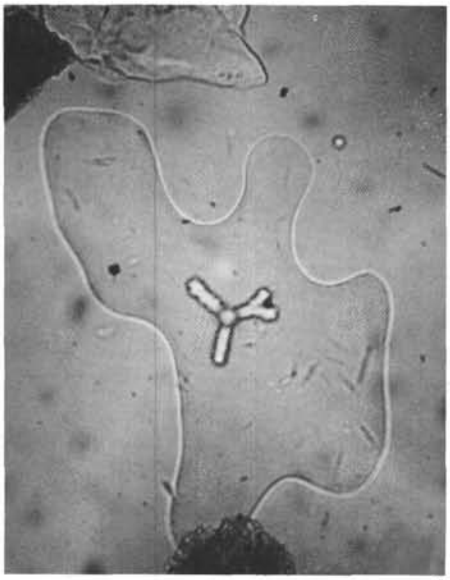


PLATE 3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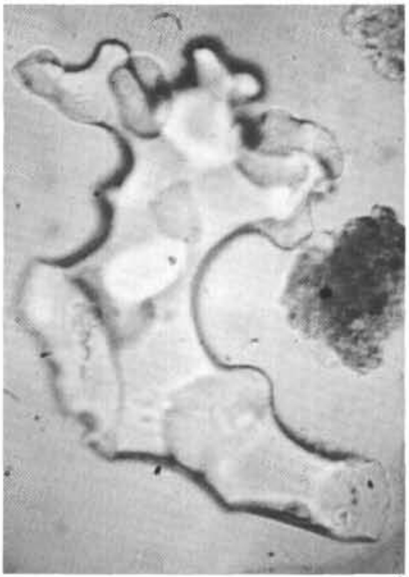
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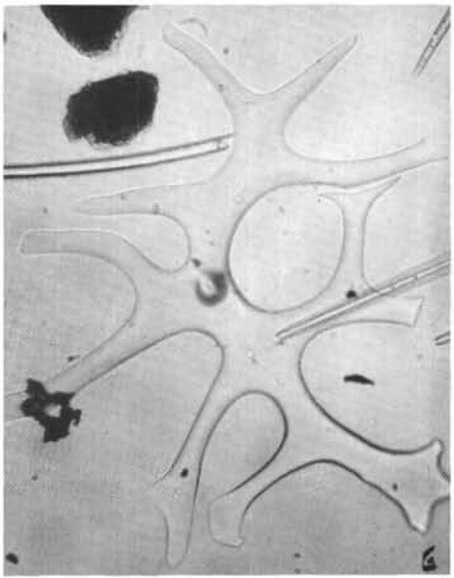
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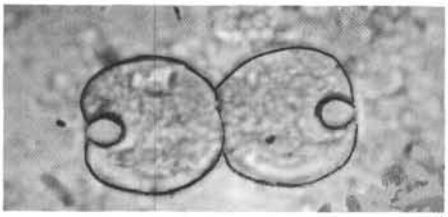
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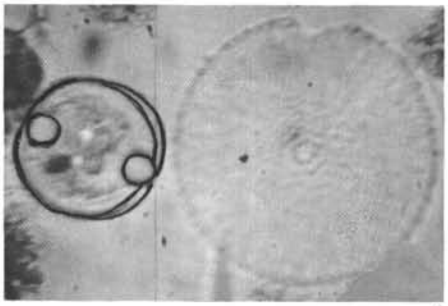
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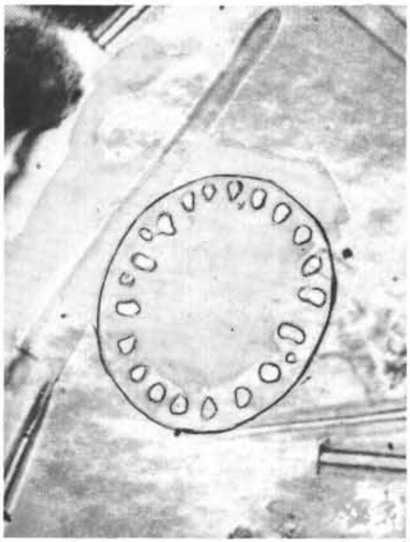
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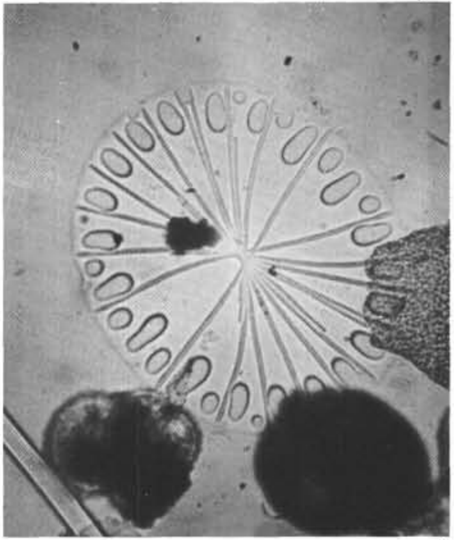
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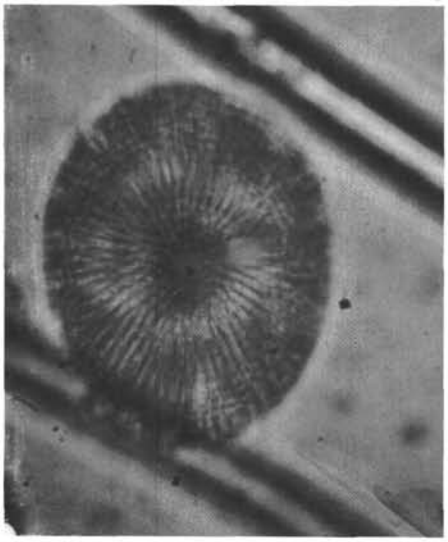
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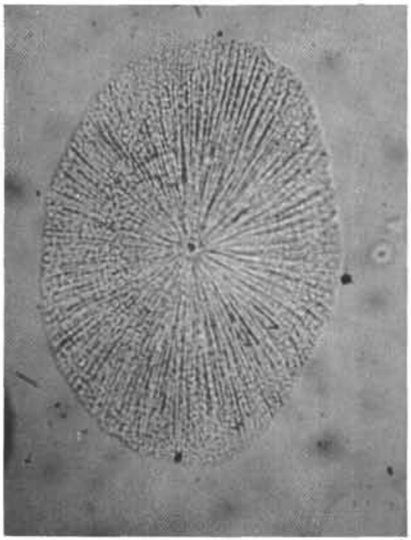
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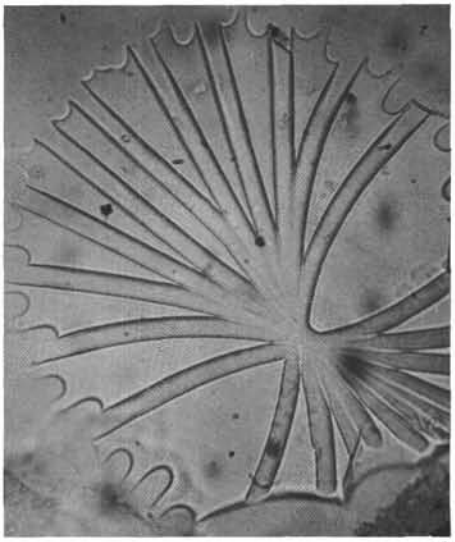
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APPENDIX A

Summary of X-Ray[a], Grain Size, and Carbon-Carbonate Results, Site 282

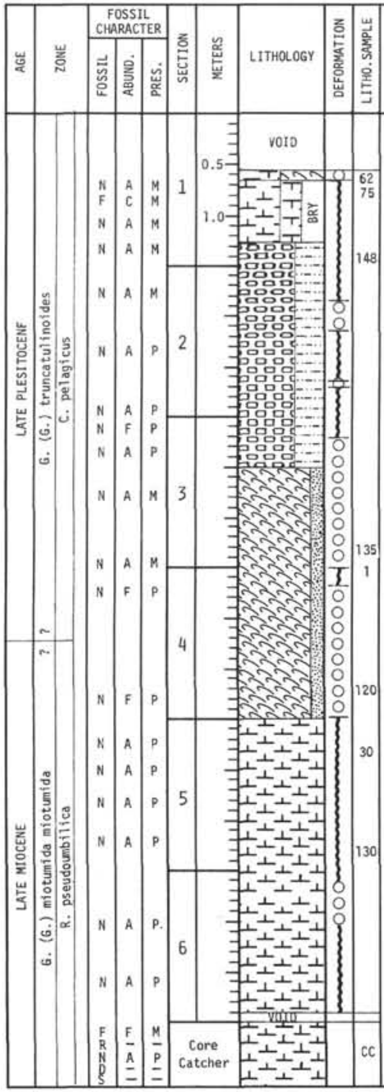
Section	Sample Depth Below Sea Floor (m)	Lithology	Age	X-Ray[b]									Grain Size				Carbon Carbonate			Comments
				Bulk Sample Major Constituent			2-20μ Fraction Major Constituent			<2μ Fraction Major Constituent			Sand (%)	Silt (%)	Clay (%)	Classification	Total (%)	Organic (%)	$CaCO_3$ (%)	
				1	2	3	1	2	3	1	2	3								
282-1-3	3.6-3.7	**Unit 1** Bryozoa, micarb, & detrital silty clay-rich foram & nanno oozes	Late Pleistocene	Calc.	Arag.	Quar.	Quar.	Mica	Plag.	Mont.	Kaol.	Mica	63.2	16.3	20.5	Clayey sand	0.9	0.2	6	
282-4-2	30.2	**Unit 3** Foram/ glauconite-bearing micronodule nanno ooze	Early Miocene	Calc.	Mont.	Quar.	Quar.	Mica	Kaol.	Mont.	Kaol.	Quar.	0.2	32.8	67.0	Silty clay	4.1	0.2	32	
282-5-2	55.4-55.7	**Unit 4** Glauconite & Micronodule bearing, sponge spicule-rich nanno detrital silty clay	Middle Oligocene	Calc.	Quar.	Mont.	Quar.	Mica	Kaol.	Mont.	Kaol.	Quar.	2.7	49.2	48.1	Clayey silt	3.3	0.5	23	Arag. in bulk fraction
282-5, CC	62.5			Calc.	Quar.	Mont.	Quar.	Mica	Kaol.	Mont.	Kaol.	*	1.0	43.0	56.0	Silty clay	4.4	0.4	33	*Quar.-mica equal in abundance
282-5, CC	64.0			Calc.	Quar.	Mont.	Quar.	Mica	Mont.	Mont.	Kaol.	Quar.	1.0	34.1	64.9	Silty clay	3.3	0.1	26	
282-7-2	67.9			Calc.	Quar.	Mont.	Quar.	Mica	Plag.	Mont.	Kaol.	Quar.	3.5	48.4	48.1	Clayey silt	2.8	0.2	21	
282-8-2	77.6-77.8			Quar.	Calc.	Mont.	Quar.	Mica	Mont.	Mont.	Kaol.	Quar.	4.7	45.4	49.9	Silty clay	2.5	0.2	19	
282-9-2	87.1-87.6			Quar.	Calc.	Mont.	Quar.	Mica	Mont.	Mont.	Kaol.	Quar.	6.7	47.4	45.9	Clayey silt	2.6	0.2	20	
282-11-4	109.0	**Unit 5** Nannofossil detrital silty clay	Middle Oligocene	Mont.	Quar.	Kaol.	Quar.	Mica	Mont.	Mont.	Kaol.	Quar.	6.7	23.2	70.0	Silty clay	3.5	2.4	9	Arag. in bulk fraction
282-11, CC	113.0-113.5			Quar.	Mont.	Mica	Quar.	Mica	Plag.	Mont.	Kaol.	Quar.	6.6	32.9	60.5	Silty clay	3.7	2.8	7	
282-12-3	117.1-117.3	**Unit 6** sponge spicule-rich nanno detrital silty clay	Early Oligocene to middle Oligocene	Calc.	Quar.	Mont.	Quar.	Mica	Kaol.	Mont.	Kaol.	Quar.	7.0	43.3	49.7	Silty clay	4.9	0.2	40	
282-13-3	136.5-136.6			Mont.	Quar.	Mica	Quar.	Mica	Plag.	Mont.	Kaol.	Quar.	2.2	38.5	59.4	Silty clay	2.3	0.5	15	Gyps. in bulk fraction
282-14-3	164.8			Mont.	Quar.	Calc.	Quar.	Mica	Plag.	Mont.	Kaol.	Quar.	3.7	49.0	47.3	Clayey silt	2.0	0.2	15	Gyps. in bulk fraction
282-15-2	191.2-191.3			Calc.	Quar.	Mont.	Quar.	Clin.	Mica	Mont.	Kaol.	Mica	16.5	49.6	33.8	Clayey silt				
282-15, CC	198.5-199.0	**Unit 7** Sponge spicule nanno & organic carbon-bearing silty clay to clayey silt	Late Eocene	Quar.	Mica	Clin.	Quar.	Clin.	Mica	Mont.	Kaol.	*	12.1	43.8	44.1	Silty clay	3.5	3.1	3	*Quar.-mica equal in abundance
282-16-1	218.6			Quar.	Clin.	Mica	Clin.	Quar.	Mica	Mont.	Kaol.	Mica	4.9	46.5	48.6	Silty clay	7.0	5.7	11	
282-17-3	259.7-259.8			Quar.	Calc.	Clin.	Quar.	Clin.	Mica	Kaol.	Mont.	Mica	4.3	49.3	46.4	Clayey silt	4.5	3.0	13	
282-18-1	295.1			Quar.	Clin.	Mica	Quar.	Clin.	Mica	Kaol.	Mont.	Mica	–	–	–	–	4.2	2.9	11	

Note: * = see comments column.

[a] Complete results of X-ray, Site 282, will be found in Appendix I.

[b] Legend in Appendix A, Chapter 2, Site 275.

Site 282 Hole Core 1 Cored Interval: 0.0-9.0 m



LITHOLOGIC DESCRIPTION

Unit 1. Sec. 1, greenish gray (5GY 6/1), soupy MICARB, NANNO AND BRYOZOA-RICH FORAM OOZE with a sharp contact at 60 cm to a yellowish gray (5Y 8/1), soft, BRYOZOA AND FORAM RICH NANNO OOZE. An indistinct contact occurs at 125 cm (Sec. 1) to a medium bluish gray (5B 6/1), soft DETRITAL SILTY CLAY MICARB OOZE, which is greenish gray (5GY 6/1) soft grading down to 5G 6/1 soft and yellowish gray (5Y 8/1) soupy. This lithology continues to Sec. 3 (50 cm) where a soupy contact occurs to a light olive gray (5Y 6/1) to greenish gray (5GY 6/1) soupy to soft DETRITAL SILTY SAND-RICH BRYOZOA FORAM OOZE (mainly sand-sized biogenic detritus). At the base of Sec. 4 is a sharp contact to Unit 2: a white (N9) soft, NANNO OOZE with pale purple (5P 6/2) streaks at 10, 30 and 60 cm, and an indistinct layering at 80 and 90 cm.

SS 1-62		SS 1-75		SS 1-148		SS 3-135		SS 4-1	
F	-50%	N	-52%	M	-50%	F	-26%	F	-20%
N	-13%	F	-12%	F	-TR	B	-16%	B	-25%
DE	5%	B	-11%	DE	-50%	SF	-35%	N	- 2%
M	-12%	S	- 1%	Q	- 8%	N	- 2%	SF	-10%
S	-TR	G	-TR	HM	- 7%	S	- 4%	DE	-15%
OF	-20%	Det.		CM	-35%	G	- 2%	S	- 3%
(B&OST)		CO_3	- 8%			DE	-15%		
		DE	- 8%	Sd	- 0%	Q	- 7%	Sd	-70%
		Q	-TR	ST	-30%	HM	- 2%	ST	-30%
		Mi	- 2%	CL	-70%	CM	- 4%	CL	- 0%
		HM	- 2%			RF	- 2%		
		CM	- 4%						
						Sd	-80%		
						ST/CL	-20%		

SS 4-120		SS 5-30[1]		SS 5-130		SS CC	
F	-50%	N	-98%	N	-100%	N	-100%
B	-25%	F	- 1%			F	-TR
N	- 5%	G	-TR			Q	-TR
SF	- 5%	S	-TR				
DR	-TR	DE	- 1%				
G	- 5%						
DE	-10%						
Q	- 5%						
HM	- 5%						
Sd	-60%						
ST	-40%						
CL	- 0%						

[1] (purple streak) cause unknown poss. Mn stain on nannos.

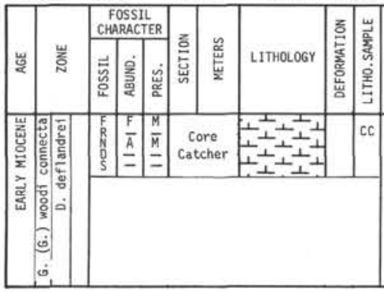
X-ray 3-66 (Bulk)

Calc	- M	Kaol	- TR
Arag	- P	Mica	- TR
Quar	- P	Mont	- TR

Grain Size 3-62 (63.2, 16.3, 20.5)

Carbon Carbonate 3-56 (0.9, 0.2, 6.0)

Site 282 Hole Core 2 Cored Interval: 9.0-18.5 m



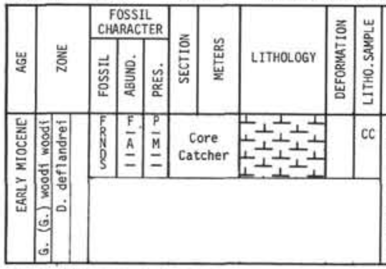
LITHOLOGIC DESCRIPTION

Core catcher only contains Unit 3: a greenish gray (5G 6/1) soft DETRITAL SILT, MICARB, AND FORAM-BEARING NANNO OOZE.

SS CC

N	-78% (Di 15%)
F	- 5% (corroded)
M	-10%
S	-TR
G	- 2%
DE	- 5% (complex)

Site 282 Hole Core 3 Cored Interval: 18.5-28.0 m



LITHOLOGIC DESCRIPTION

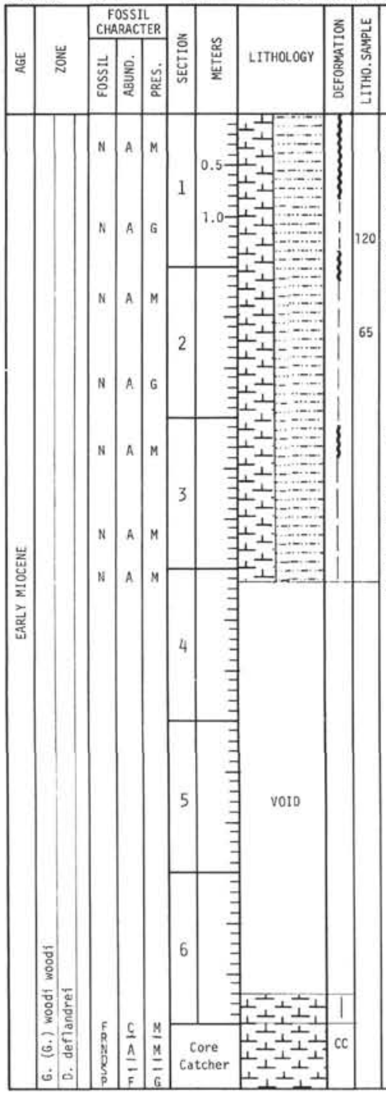
Small amount of core catcher contains a greenish gray (5G 6/1), soft DETRITAL SILT, GLAUCONITE AND FORAM-BEARING NANNO OOZE.

SS CC

N	-75%
F	-10% (fragments)
G	-10%
DE	- 5%
D	-TR
S	-TR

Explanatory notes in Chapter 1

Site 282 Hole Core 4 Cored Interval: 28.0-34.0 m



LITHOLOGIC DESCRIPTION

Dominantly a greenish gray (5GY 6/1) stiff, GLAUCONITE-BEARING NANNO DETRITAL SILTY CLAY with color mottles of 5G 6/1, 5GY 8/1, and rarely 5Y 8/1; intensely to moderately mottled; some with sharp outlines, others with indistinct outlines. Core catcher consists of a greenish gray (5G 6/1) soft DETRITAL SILT, GLAUCONITE AND FORAM BEARING NANNO OOZE. (The carbonate content is probably over estimated).

SS 1-120		SS 2-65[1]		SS CC	
N	-53%	N	-65%	N	-80%
G	- 8%	M	-25%	F	- 5%
CM	-35%	G	- 1%	G	- 5%
DE	- 4%	DE	- 9%	DE	- 5%
HM	-TR	Q	- 2%	Q	
Q	- 4%	Mi	- 1%	Fd	
		CM	- 6%	HM	
		Sd	-10%		
		ST	-20%		
		CL	-70%		

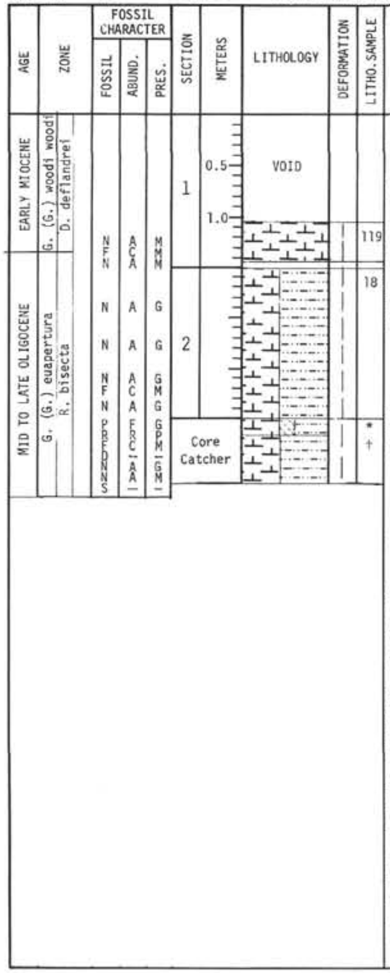
[1] (dark green mottle) green color probably due to clay-sized glauconite.

X-ray 2-74 (Bulk)
Calc - A Mica - P
Quar - P Mont - P
Kaol - P

Grain Size 2-71 (0.2, 32.8, 67.0)

Carbon Carbonate 2-70 (4.1, 0.2, 32)

Site 282 Hole Core 5 Cored Interval: 53.5-56.5 m



LITHOLOGIC DESCRIPTION

Greenish gray (5G 6/1), stiff to pale olive (2.5Y 6/4), stiff DETRITAL CLAY SILT-BEARING NANNO OOZE with interbedded color bands greenish gray (5G 6/1) and medium light gray (N6), stiff. Unit 4: (at Sec. 1, 135 cm) olive gray (5Y 4/1) to greenish gray (5GY 6/1), stiff, NANNO DETRITAL SILTY CLAY with vague color bands. Core catcher lithologies include: 0-5 cm of dark greenish gray (5GY 4/1), stiff SPONGE SPICULE RICH NANNO DETRITAL SILTY CLAY laminated, some burrows and at 5-17 cm a greenish gray (5G 6/1), stiff GLAUCONITE BEARING NANNO DETRITAL SILTY CLAY.

SS 1-119		SS 2-18		SS CC*		SS CC†	
N	-93%	N	-56%	N	-47%	N	-40%
G	- 1%	F	- 2%	F	- 7%	S	-TR
DE	- 6%	S	-TR	S	-12%	Fish Remains	-TR
Q	- 2%	MicroN	- 2%	MicroN	- 2%	G	-10%
Mi	- 1%	G	-TR	DE	-32%	DE	-50%
HM	- 2%	DE	-40%	Mi	- 1%	Q	-13%
CM	- 1%	Q	- 6%	CM	-10%	Fd	
Sd	-10%	HM	-TR	CL/CAL agg.	-18%	Mi_1	- 3%
ST	-60%	Mi	-TR	HM (inc. tour.)	- 3%	HM	
CL	-30%	CM	-34%	Sd	- 1.0%	Sd	- 1.0%
		Sd	- 5%	ST	-34.1%	ST	-43.0%
		ST	-10%	CL	-64.9%	CL	-56.0%
		CL	-85%				

[1] Includes collophane, rutile, hornblende, and authigenic tourmaline.

X-ray 2-70 (Bulk)
Calc - A Plag - TR
Arag - P Mica - P
Quar - P Mont - P
K-Fe - TR Pyri - TR
Kaol - P

X-ray CC* (Bulk)
Calc - A Kaol - P
Quar - P Mica - P
K-Fe - TR Mont - P
Plag - TR Pyri - TR

X-ray CC† (Bulk)
Calc - A Kaol - TR
Quar - P Mica - P
K-Fe - TR Mont - P
Plag - TR

Grain Size 2-40 (2.7, 49.2, 48.1)

Grain Size CC* (1.0, 43.0, 56.0)

Grain Size CC† (1.0, 34.1, 64.9)

Carbon Carbonate 2-30 (3.3, 0.5, 23)

Carbon Carbonate CC* (4.4, 0.4, 33)

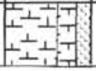
Carbon Carbonate CC† (3.3, 0.1, 26)

* Top of core catcher.

† Base of core catcher.

Explanatory notes in Chapter 1

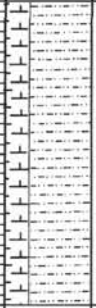
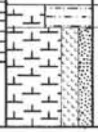
Site 282 Hole Core 6 Cored Interval: 56.5-66.0 m

AGE	ZONE	FOSSIL CHARACTER			SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
		FOSSIL	ABUND.	PRES.						
MID TO LATE OLIGOCENE	G. (G.) euapertura	F R N D S P	F R A – – F	P P G – – G	Core Catcher				CC	Core catcher only: dark greenish gray (5GY 4/1), stiff, FORAM AND SPONGE SPICULE RICH NANNO OOZE. (The carbonate content is probably over estimated).

<u>SS CC</u>

N	-60%	
F	-10%	(filled with Mn)
M	- 4%	(reworked)
D	-TR	
MicroN	-TR	
G	-TR	
S	-18%	
DE	- 8%	
Q	- 4%	
Mi	- 2%	
HM	- 1%	
CM	- 1%	
Sd	-15%	
ST	-60%	
CL	-25%	

Site 282 Hole Core 7 Cored Interval: 66.0-75.5 m

AGE	ZONE	FOSSIL CHARACTER			SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
		FOSSIL	ABUND.	PRES.						
MID OLIGOCENE	G. (S.) angiporoides angiporoides	N F	A F	M P	1	0.5 1.0			70	Greenish gray (5GY 6/1), stiff MICRONODULE-BEARING AND NANNO-RICH DETRITAL SILTY CLAY; same lighter colored (5Y 6/1 to 7/1) indistinct layers in Sec. 1 (53-58, 64-68 and 106-150 cm); numerous micro mottles and rare larger (1 cm) mottles of olive gray color (5Y 4/1). In Sec. 6 at 94-101 and 109-117 cm the unit is yellowish gray (5Y 7/1), soft; and at 101 to 109 cm the unit is greenish gray (5G 5/1) stiff, probably glauconite bearing. At 115 cm, Sec. 6 and into core catcher is a light olive gray (5Y 6/1), stiff to greenish gray (5GY 6/1) SPONGE SPICULE AND SILTY SAND-RICH NANNO OOZE. (The carbonate content is probably over estimated).
		N	A	M	2					
					3		VOID			
					4					
					5					
		N	C	P	6					
		F R N D S P	F R A – – F	P M M – – M	Core Catcher				CC	

<u>SS 1-70</u>		<u>SS CC</u>	
N	-40%	N	-64%
S	- 3%	S	-12%
MicroN	- 7%	MicroN	-TR
DE	-50%	G	- 5%
Q	-20%	DE	-19%
Mi	-TR	Q	- 9%
HM	-TR	Fd	- 2%
CM	-30%	Mi	- 1%
		HM	- 1%
Sd	-TR	OP	- 2%
ST	-40%	CM	- 4%
CL	-60%		
		Sd	-51%
		ST	-30%
		CL	-19%

<u>X-ray 2-42 (Bulk)</u>

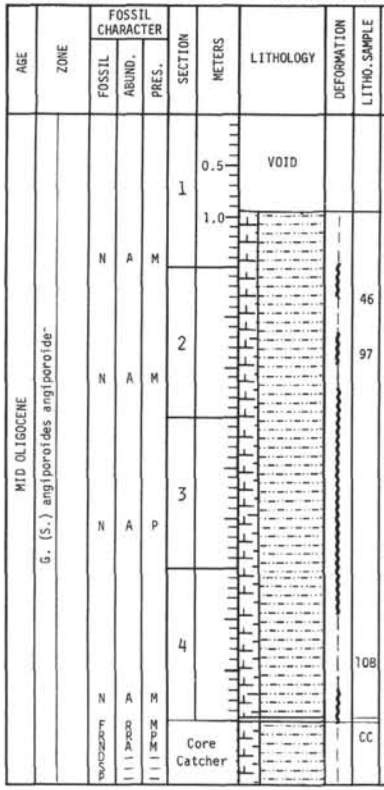
Calc	- A	Kaol	- TR
Quar	- A	Mica	- P
K-Fe	- TR	Mont	- P
Plag	- TR	Clin	- TR

<u>Grain Size 2-39</u> (3.5, 48.4, 48.1)

<u>Carbon Carbonate 2-37</u> (2.8, 0.2, 21)

Explanatory notes in Chapter 1

Site 282 Hole Core 8 Cored Interval: 75.5-85.0 m



LITHOLOGIC DESCRIPTION

Light olive gray (5Y 6/1), to greenish gray (5GY 6/1), intensely mottled - some darker (5Y 4/1) rare light (5Y 8/1); stiff to soft NANNO DETRITAL SILTY CLAY. Burrow mottles at 110, 122, 145 cm of Sec. 3, 1 cm in diameter. Sec. 4 shows: (65-72 cm) olive gray (5Y 5/1) with dark greenish gray at base (5G 5/1); (90-92 cm) a very stiff layer of greenish gray (5G 6/1), yellowish gray (5Y 8/1) and olive gray (5Y 5/1) at 147-150 cm. The core catcher consists of a olive gray (5Y 5/1), stiff GLAUCONITE BEARING, DETRITAL SILTY CLAY-RICH NANNO OOZE. (The carbonate content is probably over estimated).

SS 2-46[1]	SS 2-97[2]	SS 4-108[3]	SS CC
N -60%	N -67%	S -25%	N -73%
S - 5%	M -TR	R -TR	G - 5%
MicroN- 5%	R - 1%	G -20%	S - 2%
(probably	S - 7%	Q -25%	MicroN-TR
pyrite)	G - 2%	Fd - 5%	DE -20%
G -TR	Py -TR	Mi[4] - 5%	Q - 6%
DE -30%	DE -23%	RF	HM -TR
Q -12%	Q -15%		CM -14%
CM -18%	Fd - 3%		
	(plag.)		
Sd - 5%	HM - 3%		
ST -50%	CM - 2%		
CL -45%			
	Sd -25%		
	ST -55%		
	CL -20%		

[1] light mottle

[2] average lithology

[3] acid insol. >63μ

[4] chert, glass with microlites, volcanic mesostasis (matrix)

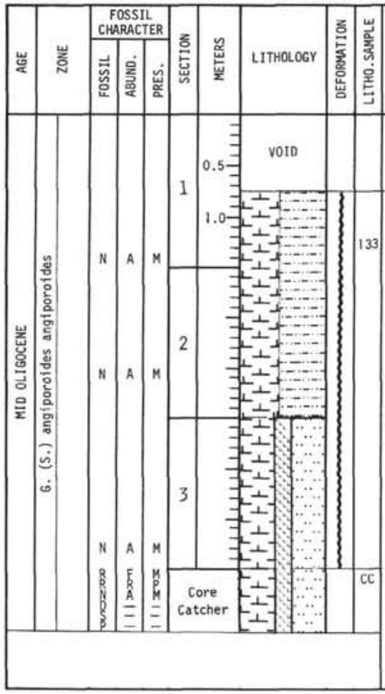
X-ray 2-63 (Bulk)

Calc	- A	Kaol	- TR
Quar	- A	Mica	- P
K-Fe	- TR	Mont	- P
Plag	- P	Clin	- TR

Grain Size 2-60 (4.7, 45.4, 49.9)

Carbon Carbonate 2-77 (2.5, 0.2, 19)

Site 282 Hole Core 9 Cored Interval: 85.0-94.5 m



LITHOLOGIC DESCRIPTION

Sec. 1 (75 cm) to Sec. 2 (150 cm) shows a light olive gray (5Y 7/1), stiff, plus a smeared out olive gray (5Y 5/1) layer brownish black streaks (5YR 2/1), mottled greenish gray (5G 6/1) and light bluish gray (5B 7/1) grading to greenish gray (5GY 6/1) becoming greener (greener than 5G 6/1) below 106 cm in Sec. 2; stiff NANNO DETRITAL CLAYEY SILT to a SILT in Sec. 3. Sec. 3 colors are greenish gray (5G 6/1) to light olive gray (5Y 6/1) below 80 cm. All sections moderately mottled and intensely deformed. The core catcher is greenish gray (5G 6/1) with some olive gray streaks (5Y 5/1), stiff GLAUCONITE AND MICRONODULE BEARING SPONGE SPICULE RICH NANNO DETRITAL SILT.

SS 1-133[1]	SS CC
G -TR	N -45%
F -TR	S -15%
N -30%	MicroN- 5% (probably pyrite)
S -15%	CM - 5%
DE -55%	G -10%
Q -25%	DE -25%
RF -15%	Q -15%
Mi - 5%	RF -10%
CM -10%	
	Sd - 0%
	ST -80%
	CL -20%

[1] (brownish black streak) color caused by pyritized sponge spicules

X-ray 2-67 (Bulk)

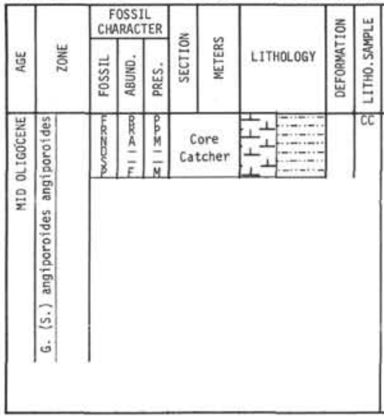
Calc	- A	Kaol	- TR
Quar	- A	Mica	- P
K-Fe	- TR	Mont	- P
Plag	- P	Clin	- TR

Grain Size 2-64 (6.7, 47.4, 45.9)

Carbon Carbonate 2-61 (2.6, 0.2, 20)

Explanatory notes in Chapter 1

Site 282 Hole Core 10 Cored Interval: 94.5-104.0 m



LITHOLOGIC DESCRIPTION

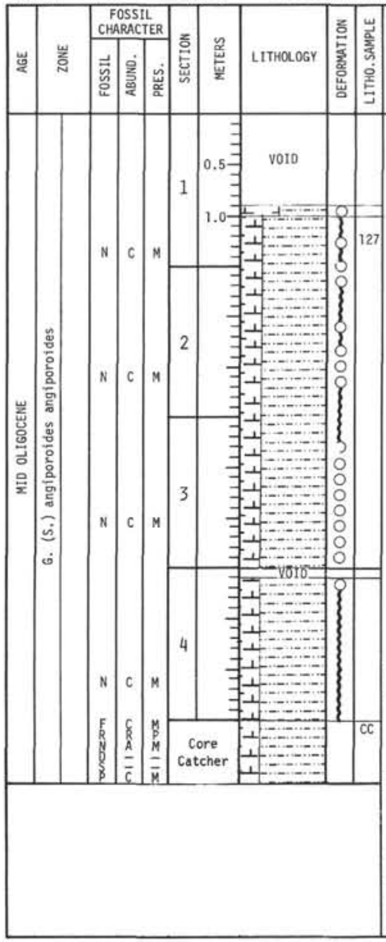
Core catcher only: greenish gray (5GY 5/1) stiff GLAUCONITE, MICRONODULE AND SPONGE SPICULE BEARING NANNO DETRITAL CLAYEY SILT.

SS CC[1]
N -45%
S -10%
MicroN- 5%
G - 5%
DE -35%
  Q -15%
  RF - 8%
  CM -12%

Sd -10%
ST -55%
CL -35%

[1] one pyrite concretion with glauconite (1 cm^3)

Site 282 Hole Core 11 Cored Interval: 104.0-113.5 m



LITHOLOGIC DESCRIPTION

Drilling breccia. Greenish gray (5G 6/1), stiff. NANNO DETRITAL SILTY CLAY: at 100 cm Sec. 1 is contact to Unit 5: dark olive gray (5Y 3/1) to olive gray (5Y 4/1) with rare olive black (5Y 2/1) sandy mottles (oval, 1 cm across) NANNO-RICH DETRITAL SILTY CLAY. A few shell (bivalve?) fragments scattered throughout. Sec. 4 becomes dominantly olive gray (5Y 4/1), stiff and very intensely deformed and mottled. Core catcher: a dark olive gray (5Y 3/1), stiff NANNO RICH DETRITAL SILTY CLAY. [Includes a solitary coral (6 mm long) and bivalve fragments(?)]

```
SS 1-127¹      SS CC²          SS CC³
MicroN- 7%     N      -30%     S      -25%
N      - 1%    F      - 2%     G      -15%
R      - 1%     (Mn filled)    Q      -35%
DE     -91%    B      -TR      Fd     - 5% (incl. microcline)
  Q    -55%    SF     - 1%     Mi     - 5%
  Fd   -13%    S      - 5%     HM     - 5% (pyroxene, biotite)
  Mi           MicroN- 2%      RF     -15%
  HM   - 8%    G      - 2%
  CM   -15%    DE     -58%
-----------      Q    -25%
Sd     -65%      Fd   -10%
ST     -20%      Mi
CL     -15%      HM   - 5% (hornblende)
                 CM   -18%
               -----------
               Sd     -40%
               ST     -30%   very poor sorting
               CL     -30%
```

[1] (dark mottle) Abundant med. brown isotropic mineral and abundant organic stain.

[2] large detrital quartz with brown organic coatings

[3] Insol. residue

X-ray 4-54 (Bulk)

Calc	- P	Kaol	- P
Arag	- TR	Mica	- P
Quar	- A	Mont	- A
K-Fe	- TR	Clin	- TR
Plag	- TR	Pyri	- TR

X-ray CC (Bulk)

Calc	- P	Kaol	- P
Quar	- A	Mica	- P
K-Fe	- TR	Mont	- P
Plag	- TR	Pyri	- TR

Grain Size 4-51 (6.7, 23.2, 70.0)

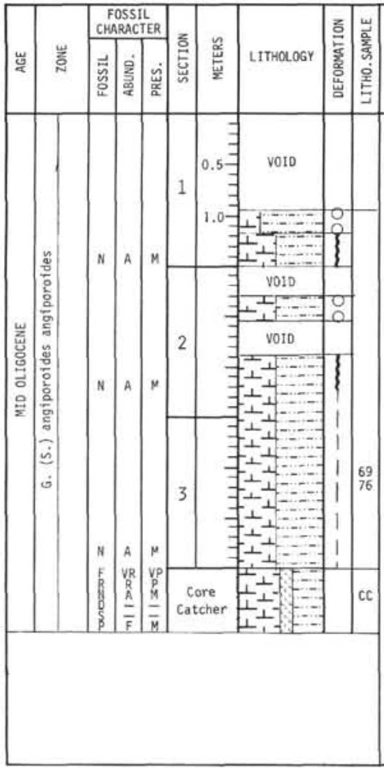
Grain Size CC (6.6, 32.9, 60.5)

Carbon Carbonate 4-45 (3.4, 2.4, 9)

Carbon Carbonate CC (3.7, 2.8, 7)

Explanatory notes in Chapter 1

Site 282 Hole Core 12 Cored Interval: 113.5-123.0 m



LITHOLOGIC DESCRIPTION

Drilling breccia in Sec. 1 (95-120 cm) includes 2 fragments like 11 CC. Unit 6: beginning at 120 cm, Sec. 1 is a greenish gray (5GY 6/1) stiff GLAUCONITE AND SPONGE SPICULE BEARING NANNO DETRITAL SILTY CLAY. Color variations all moderately mottled and show 1-140 to 3-55 color grading from olive gray (5Y 4/1) and dark greenish gray (5GY 4/1) to greenish gray (5G 6/1). At Sec. 3 55-110 light greenish gray (5GY 8/1) grading down to greenish gray (5G 6/1) and at (110-121 cm) a light olive gray (5Y 5/1) and light greenish gray (5G 7/1). In the core catcher is a greenish gray (5GY 6/1), stiff to semilithified, SPONGE SPICULE AND DETRITAL SILTY CLAY-RICH NANNO OOZE. (The carbonate content is probably over estimated).

```
SS 3-69[1]       SS 3-76[2]      SS CC[3]
N      -30%      N      -60%     N      -71%
S      -25%      S      -10%     F      -TR
DR/rose-         G      - 5%     S      -12%
 ttes  -40%      DE     -25%     MicroN- 1%
Q      - 3%        Q    -15%     DE     -15%
HM     - 2%        Mi   - 2%       Q    - 5%
                   HM   - 2%       Fd   - 1%
                   CM   - 6%       Mi   - 1%
                 ___________       HM   - 4%
                 Sd     -10%       CM   - 4%
                 ST     -60%     ___________
                 CL     -30%     Sd     -20%
                                 ST     -40%
                                 CL     -40%
```

[1] dark mottle

[2] typical lithology (see also CC 12)

[3] dark brown opaques and organic matter

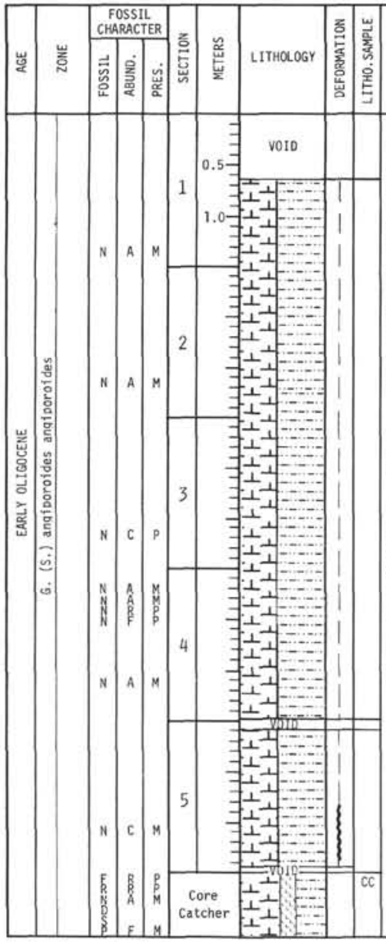
X-ray 3-80 (Bulk)

```
Calc  - A    Kaol  - P
Quar  - A    Mica  - P
K-Fe  - TR   Mont  - P
Plag  - TR
```

Grain Size 3-70 (7.0, 43.3, 49.7)

Carbon Carbonate 3-60 (4.9, 0.2, 40)

Site 282 Hole Core 13 Cored Interval: 132.5-142.0 m



LITHOLOGIC DESCRIPTION

Light greenish gray (5GY 7/1) with some dark mottles of olive gray (5Y 5/1), and areas of greenish gray (5G 6/1) with bands 1 cm thick of dark greenish gray (5G 4/1). The lithology is a NANNO DETRITAL SILTY CLAY but some layers have very few nannos. A possible graded bed is found at the top of Sec. 3; color banding in greenish grays and olive grays and mottling noticeable lower in core, core is stiff. The core catcher is a greenish gray (5GY 5/1), stiff SPONGE SPICULE NANNO RICH DETRITAL SILTY CLAY.

```
SS CC[1]
N      -55%
F      -TR
S      -15%
M      - 5%
MicroN- 7%
G      - 3%
DE     -15%
  Q    -13%
  Mi   -TR
  HM   -TR
___________
Sd     -10%
ST     -90%
CL     - 0%(?)
```

[1] Max. GZ 1.2 mm, ooze stained brown by organic substance

X-ray 3-108 (Bulk)

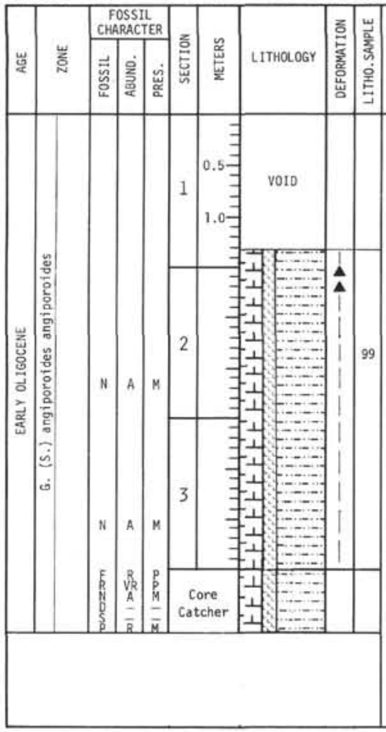
```
Calc  - P    Mica  - P
Quar  - A    Mont  - A
K-Fe  - TR   Clin  - TR
Plag  - P    Gyps  - TR
Kaol  - P
```

Grain Size 3-105 (2.2, 38.5, 59.4)

Carbon Carbonate 3-102 (2.3, 0.5, 15)

Explanatory notes in Chapter 1

Site 282 Hole Core 14 Cored Interval: 161.0-170.5 m



LITHOLOGIC DESCRIPTION

Greenish gray (5GY 6/1) with some olive gray (5Y 4/1) stain: stiff, SPONGE SPICULE NANNO RICH DETRITAL CLAYEY SILT. Color variations occur with olive gray (5Y 5/1), light greenish gray (5GY 8/1) olive gray (5Y 4/1), and greenish gray (5GY 6/1). Some sandy layers at 5-26 cm, and 98-101 cm in Sec. 3. Greenish gray (5GY 6/1), stiff SPONGE SPICULE NANNO-RICH DETRITAL CLAYEY SILT - in core catcher.

SS 2-99[1]		SS CC[2]	
N	-36%	N	-57%
F	- 2%	D	-TR
D	-TR	S	-15%
S	-20%	DE	-28%
MicroN	- 3%	Q	-18%
G	- 4%	Fd	- 2%
DE	-35%	Mi	- 4%
Q+RF	-18%	HM	- 4%
Fd	- 4%		
Mi	- 5%	Sd	-30%
HM	- 8%	ST	-55%
		CL	-15%
Sd	-52%		
ST	-33%		
CL	-15%		

[1] (sandy layer); HM incl. pyrite; rock fragments up to med. sand size large clumps probably glauconitized clay aggregates

[2] HM incl. tourmaline, hornblende

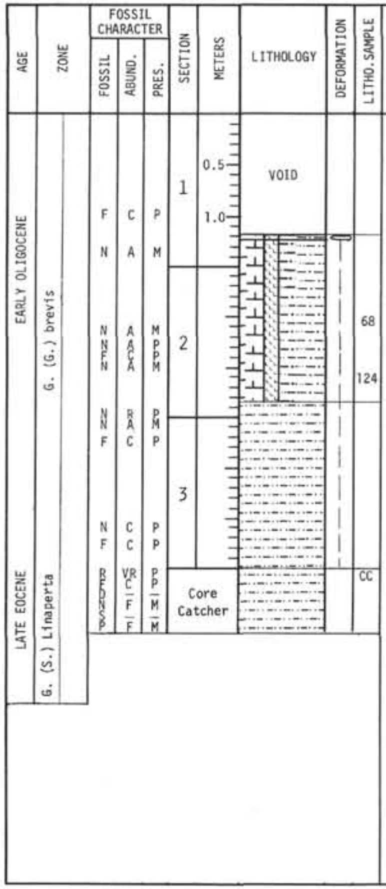
X-ray 3-80 (Bulk)

Calc	- P	Mica	- P
Quar	- P	Mont	- A
K-Fe	- P	Clin	- TR
Plag	- TR	Gyps	- TR
Kaol	- P		

Grain Size 3-77 (3.7, 49.0, 47.3)

Carbon Carbonate 3-75 (2.0, 0.2, 15)

Site 282 Hole Core 15 Cored Interval: 189.5-199.0 m



LITHOLOGIC DESCRIPTION

Core begins with a fragment (probably displaced) olive gray (5Y 4/1) in color on top of a greenish gray (5GY 6/1) and yellowish gray (5Y 8/1) SPONGE SPICULE RICH SAND SILT CLAY NANNO OOZE which is stiff to semilithified: lower portion of Sec. 2 shows interlayered yellowish gray (5Y 8/1) and light olive gray (5Y 6/1) with rare vague mottles. At 135 cm, Sec. 2 is Unit 7: a stiff, SILTY CLAY. In Sec. 2, 135-150 cm it is brownish black (5YR 2/1) with a green glauconitic pod at 142 cm. In Sec. 3, 6-11 cm a greenish gray (5GY 6/1), "sandier" layer occurs with sharp contacts; at 11-101 cm dark yellowish brown (10YR 4/2) scattered white grains and fragments (agglutinated forams?) and at 101-150 cm a very dark brown (10YR 2/2). The core catcher is a very dark brown (10YR 2/2), stiff MICRONODULE, SPICULE AND NANNO-BEARING SILTY CLAY.

SS 2-68[1]	SS 2-124[2]		SS CC[3]	
	N	-58%	N	- 7%
	D	- 1%	F	-TR
	S	-18%	M	- 2%
	MicroN	- 2%	S	- 6%
	G	- 5%	MicroN	- 5%
	DE	-16%	DE	-80%
	Q	- 8%	Q	-30%
	Fd	- 2%	Fd	- 5%
	Mi	- 3%	Mi	- 5%
	HM	- 3%	CM	-40%
	Sd	-25%	Sd	-12.1%
	ST	-55%	ST	-43.8%
	CL	-20%	CL	-44.1%

[1] Mostly very fine coarse sand size pale green glauconitize clay silt aggregates. Some silt-very fine sand size dark green/black botryoidal angular subequent glauconite(?). Also pyrite rosettes.

[2] (typical lithology), rutile, sphene, garnet(?)

[3] GZO+0.15 X=0.05 (poorly sorted, angular submicroscopic brown stain on everything)

X-ray 2-25 (Bulk)				X-ray CC (Bulk)			
Calc	- A	Mica	- P	Calc	- TR	Mica	- P
Arag	- TR	Mont	- P	Quar	- A	Mont	- P
Quar	- A	Clin	- TR	Plag	- TR	Clin	- P
Plag	- TR	Pyri	- TR	Kaol	- P	Pyri	- P
Kaol	- TR						

Grain Size 2-22 (16.5, 49.6, 33.8)

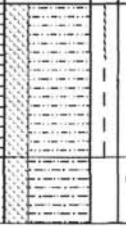
Grain Size CC (12.1, 43.8, 44.1)

Carbon Carbonate CC (3.5, 3.1, 3)

Explanatory notes in Chapter 1

Site 282 Hole Core 16 Cored Interval: 218.0-227.5 m

AGE	ZONE	FOSSIL CHARACTER FOSSIL	FOSSIL CHARACTER ABUND.	FOSSIL CHARACTER PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
LATE EOCENE	R. bisecta	N	F	P	1	0.5 1.0			
		F D N S R P	- - R - VR F	- - M - P M	Core Catcher				CC



LITHOLOGIC DESCRIPTION

Very dark brown (10YR 2/2) stiff with indistinct horizontal bands 1-4 cm thick SPONGE SPICULE RICH DETRITAL SILTY CLAY. The core catcher sample is a very dark brown (10YR 2/2), stiff SPONGE SPICULE RICH DETRITAL SAND-SILT-CLAY.

SS CC[1]
G - 2%
MicroN- 5%
N - 8%
F -TR
D -TR
S -13%
CF - 1%
DE -70%
Q -22%
Fd - 5%
Mi - 5%
HM - 8%
CM -30%

Sd -25%
ST -35%
CL -40%

[1] Rock fragments micaceous, varied heavy minerals. Abundant submicroscopic brown stain.

X-ray 1-55 (Bulk)

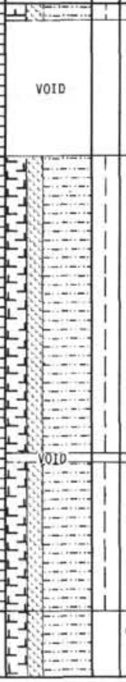
Calc	- P	Mica	- P
Quar	- A	Mont	- TR
K-Fe	- TR	Clin	- P
Plag	- TR	Pyri	- TR
Kaol	- P		

Grain Size 1-58 (4.9, 46.5, 48.6)

Carbon Carbonate 1-56 (7.0, 5.7, 11.0)

Site 282 Hole Core 17 Cored Interval: 256-265.5 m

AGE	ZONE	FOSSIL CHARACTER FOSSIL	FOSSIL CHARACTER ABUND.	FOSSIL CHARACTER PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
LATE EOCENE	R. bisecta				1	0.5 1.0	VOID		
		N	C	P	2				
		N	A	M	3				
					4				
		F D N S R P	VR - C - VR F	VP - P - P M	Core Catcher				CC



LITHOLOGIC DESCRIPTION

Core is a very dark brown (10YR 2/2) stiff, SPONGE SPICULE AND NANNO RICH CLAYEY SILT. Largely structureless, but any structures could be difficult to see due to dark color. In Sec. 3 (125-127) is a "sandy" layer. Sec. 4 has a pebble at 17-19 cm, angular, 4 x 3 cm, subequant. Lithified sediment - similar appearance to matrix. Rare shell fragments scattered throughout. The core catcher lithology is a very dark brown (10YR 2/2) stiff to semilithified ORGANIC AND MICRONODULE BEARING SPONGE SPICULE AND NANNO RICH CLAYEY SILT.

SS CC[1]		SS CC[2]	
Q	-40%	Org. M-	5%
S	-20%	MicroN-	5%
G	-15%	N	-25%
RF	-15%	M	-TR
Fd/HM	-TR	S	-10%
Sphaeras- tra	-10%	DE	-60%
		Q	-40%
		Fd	- 3%
		Mi	- 3%
		HM	-TR
		CM	- 9%
		Sd	- 5%
		ST	-80%
		CL	-15%

[1] (Insoluble Residue >63μ) Sphaerastra (also a sponge)

[2] GZ range 0.5→0.105 X silt 0.02 pervasive submicroscopic brown stain

X-ray 3-97 (Bulk)

Calc	- P	Mica	- P
Quar	- A	Mont	- P
K-Fe	- TR	Clin	- P
Kaol	- P	Pyri	- TR

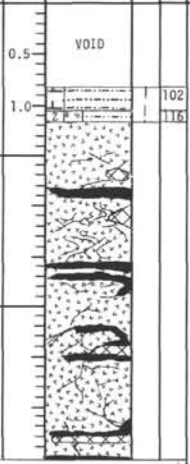
Grain Size 3-75 (4.3, 49.3, 46.4)

Carbon Carbonate 3-74 (4.5, 3.0, 13)

Explanatory notes in Chapter 1

Site 282 Hole Core 18 Cored Interval: 294.0-298.0 m

AGE	ZONE	FOSSIL CHARACTER			SECTION
		FOSSIL	ABUND.	PRES.	
LATE EOCENE	G. (S.) Linaperta R. bisecta	N F N	F VR R	P P P	1 2 3



LITHOLOGIC DESCRIPTION

Core, from 72-105 cm is a very dark brown (10YR 2/2). Dark yellowish brown (10YR 4/2) semilithified NANNO RICH DETRITAL CLAYEY SILTSTONE. At 105 cm a very dark brown (10YR 2/2) becoming paler upwards. ZEOLITE AND VOLCANIC GLASS RICH DETRITAL CLAYEY SILTSTONE. Unit 8: BASALT (basement) intensely weathered but still showing original texture. The basalt also contains: saccharoidal carbonate with lithic fragments; carbonate rock with pyrite with secondary carbonate in geode; black (N2) to greenish black (5G 2/1) glass; 1 mm thick veins of a pale green mineral (steatite?). Glass rinds up to 1 cm in thickness; carbonate (calcite) with sedimentary inclusions and polygonal dolomite(?); a saccharoidal carbonate at 130 cm, Sec. 3 which is probably a baked sediment, white (N9) with small spherical bodies (rads?); and specks of native copper in calcite veins. In the upper 1.5 m, the basalt changes in color from greenish gray (5G 8/2) and (5GY 7/2), and light bluish gray (5B 7/1) on internal surfaces downward to light olive gray (5Y 5/1) and (5GY 5/1). In Sec. 3 it becomes increasingly darker until it is olive black (5Y 2/1): calcite veins filling hairline fractures to cracks 2 mm thick are present throughout. Petrographic description with Core 20.

SS 1-102[1]		SS 1-116	
N	-35%	VG	-20%
S	- 5%	Paly	-10%
MicroN	- 7%	Z	-15%
VG	- 5%	MicroN	- 2%
DE	-48%	S	-TR
Q	-27%	N	-TR
CM	-21%	DE	-52%
		Q	-33%
Sd	-10%	Fd	- 5%
ST	-55%	Mi	-10%
CL	-35%	HM	- 4% (euhedral tourmaline)
		Sd	-15%
		ST	-60%
		CL	-25%

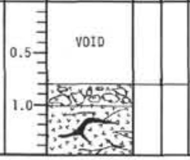
[1] deeply brown stained

X-ray 1-108 (Bulk)			
Calc	- P	Mica	- P
Quar	- A	Mont	- P
K-Fe	- TR	Clin	- P
Plag	- TR	Pyri	- TR
Kaol	- P		

Carbon Carbonate 1-105 (4.2, 2.9, 11)

Site 282 Hole Core 19 Cored Interval: 298.0-307.0 m

AGE	ZONE	FOSSIL CHARACTER			SECTION
		FOSSIL	ABUND.	PRES.	
					1

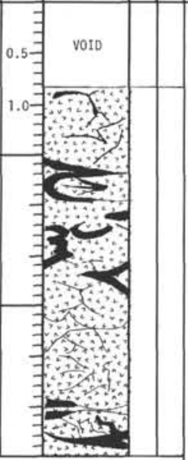


LITHOLOGIC DESCRIPTION

Fragments of basalt with calcite veins (70 to 100 cm): at 100 cm BASALT with calcite veins, pyroxene phenocrysts up to 2 mm diameter. Petrographic description found with Core 20 summary form.

Site 282 Hole Core 20 Cored Interval: 307.0-310.5 m

AGE	ZONE	FOSSIL CHARACTER			SECTION
		FOSSIL	ABUND.	PRES.	
					1 2 3



LITHOLOGIC DESCRIPTION

PILLOW BASALT. The pillow basalt shows the following characteristics: Black glass rinds and basalt pillows with radial fractures filled with calcite; greenish gray (5GY 5/1) baked carbonate sediment and numerous calcite veins up to 3 mm thick. Most veins thin out - suggesting a contraction origin within basalt pillow; greenish gray baked sediment with some adhering black glass and glass rinds almost enclosing some baked sediment; a large (10 x 6 mm) phenocyrst of plagioclase at 100 cm in Sec. 3 and greenish black glass rinds and glass. Thin section 20.1-146-149. Petrographic description: EXTRUSIVE PILLOW BASALT.

Texture: Fine grained, hypocrystalline to holocrystalline, subophitic with subradiating plagioclase laths.

Phenocrysts: Rare (1-2% of whole rock) and average 0.5 mm in diameter. Consist of 90% equant pyroxene and 10% subequent plagioclase.

Plagioclase	55%	- zoned, some with pyroxene cores
Pyroxene	33%	- in shealthlike aggregates of fine-grained prismatic crystals (altered?).
Fe-Oxides	7%	
Chlorite	5%	
Olivine(?)	Trace	

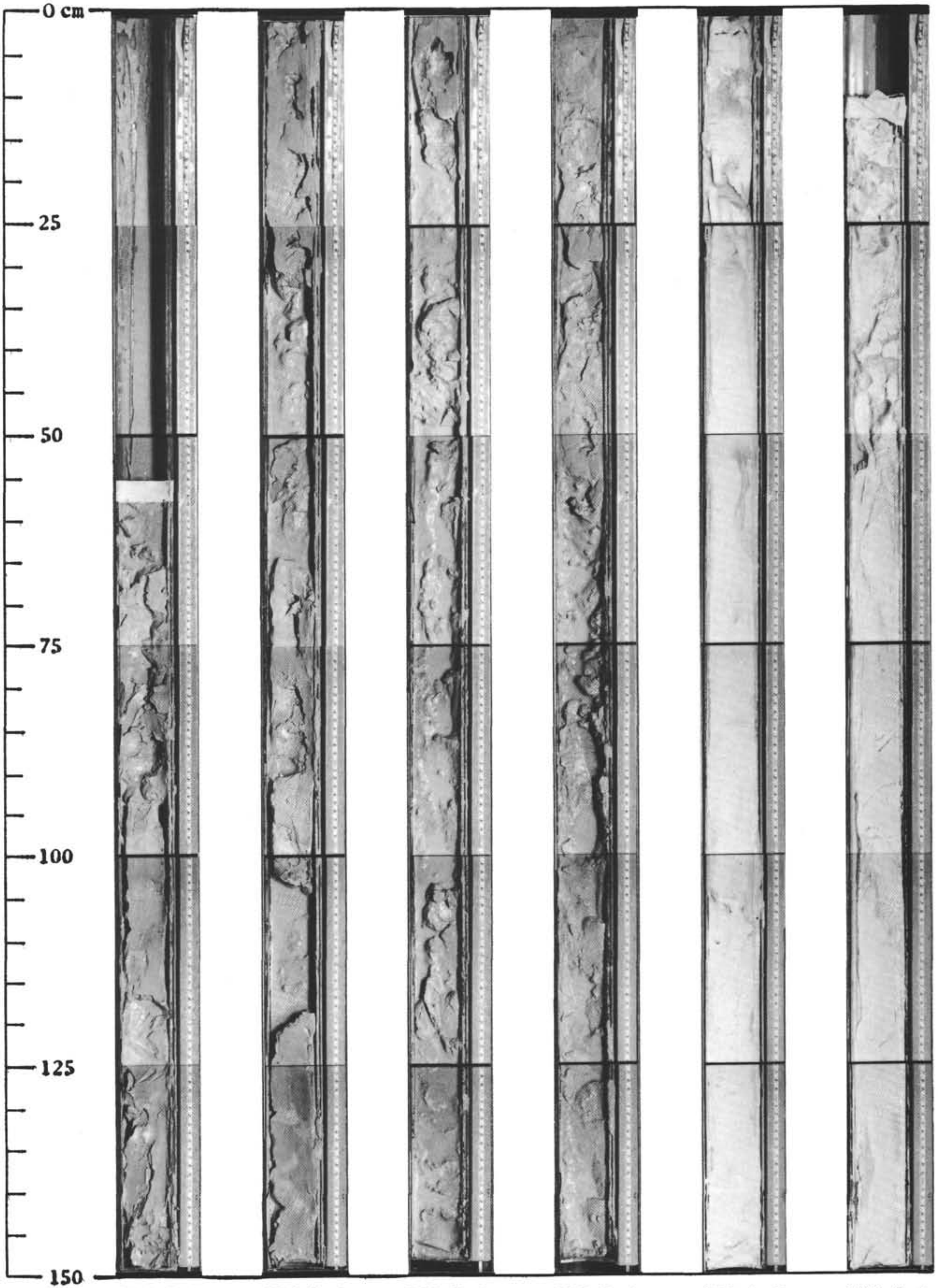
Calcite, chlorite, limonite alteration products.

Most plagioclase laths are 0.2 to 1.0 mm long and 0.03 to 0.06 mm thick. They have a composition of ~An_{50}.

Chlorite is interstitial (possibly after glass) and also fills rare vesicles (0.8 mm diameter).

Fe-Oxides are scattered throughout matrix and within the pyroxene.

Explanatory notes in Chapter 1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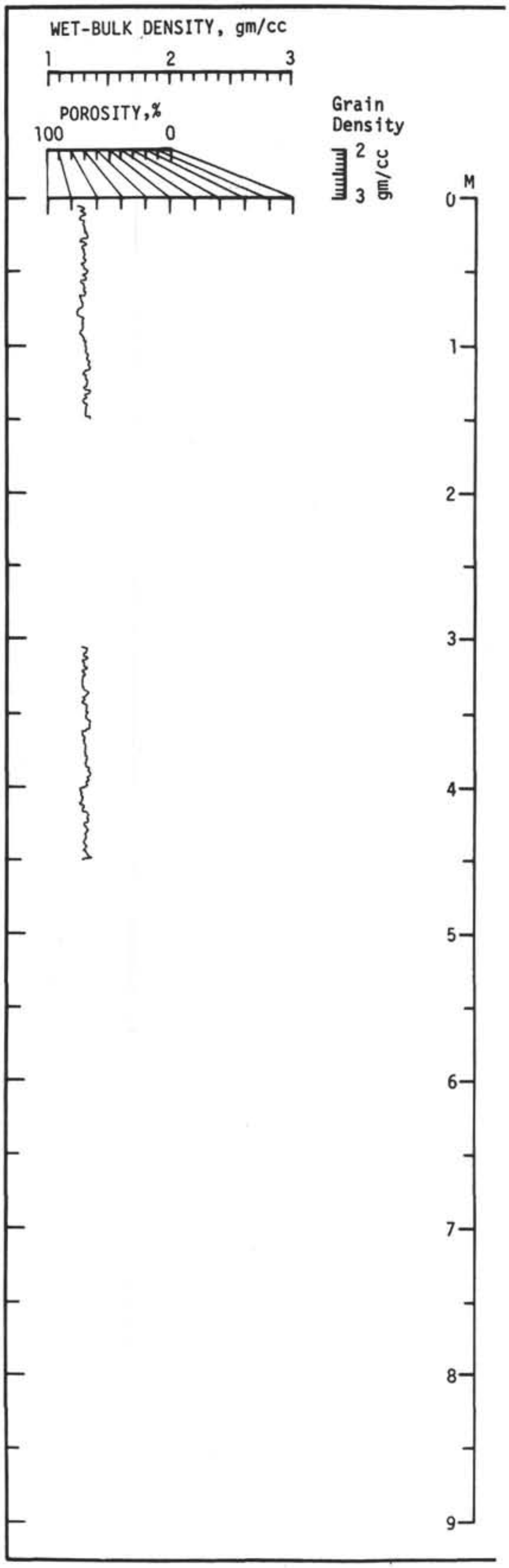
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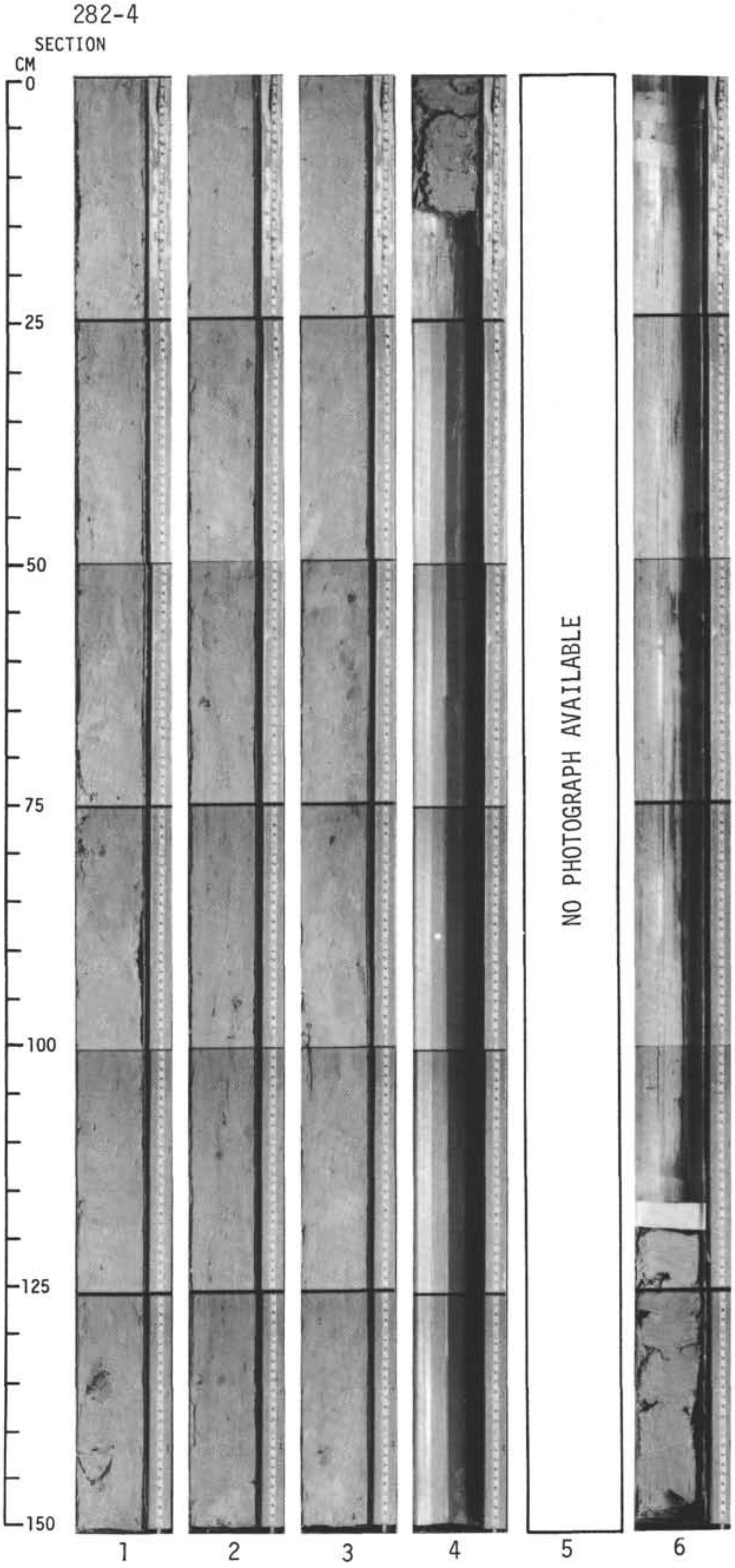
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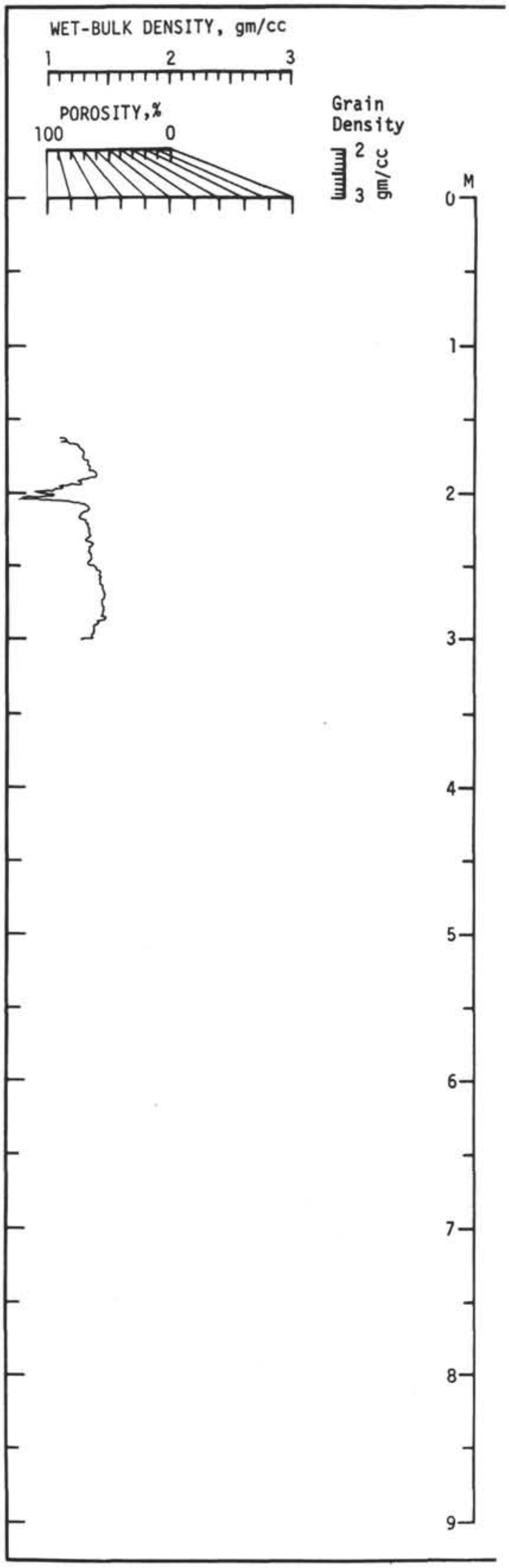
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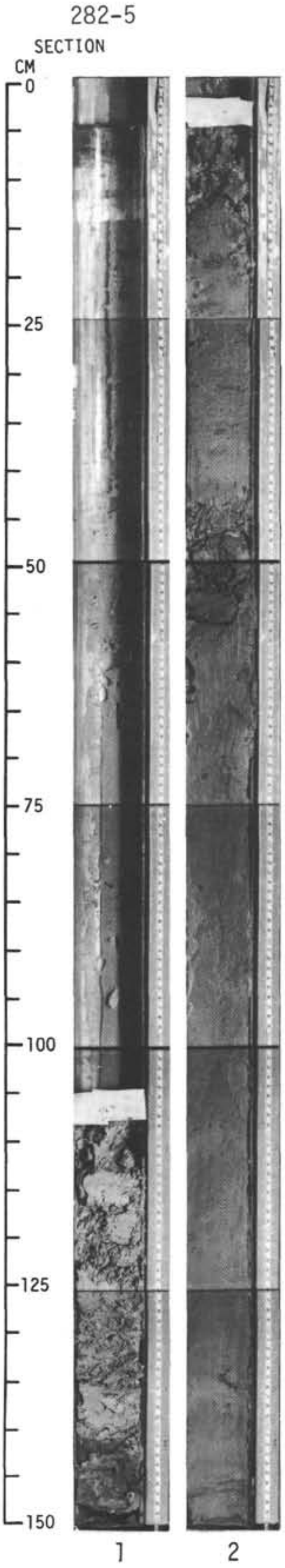
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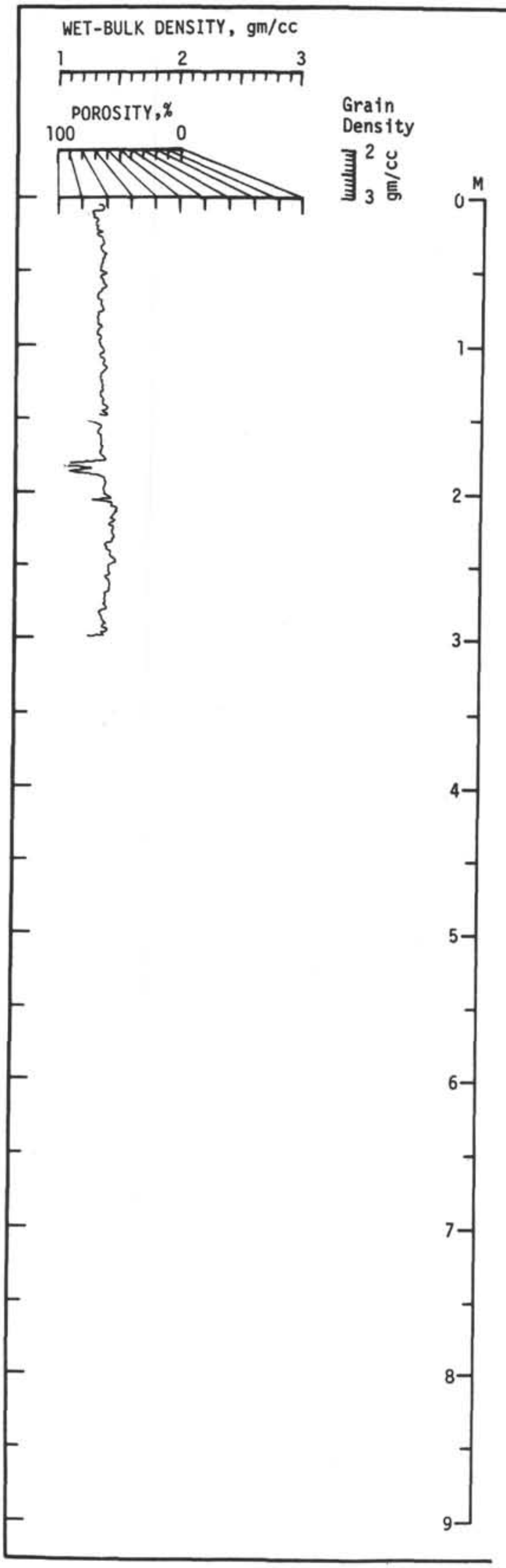
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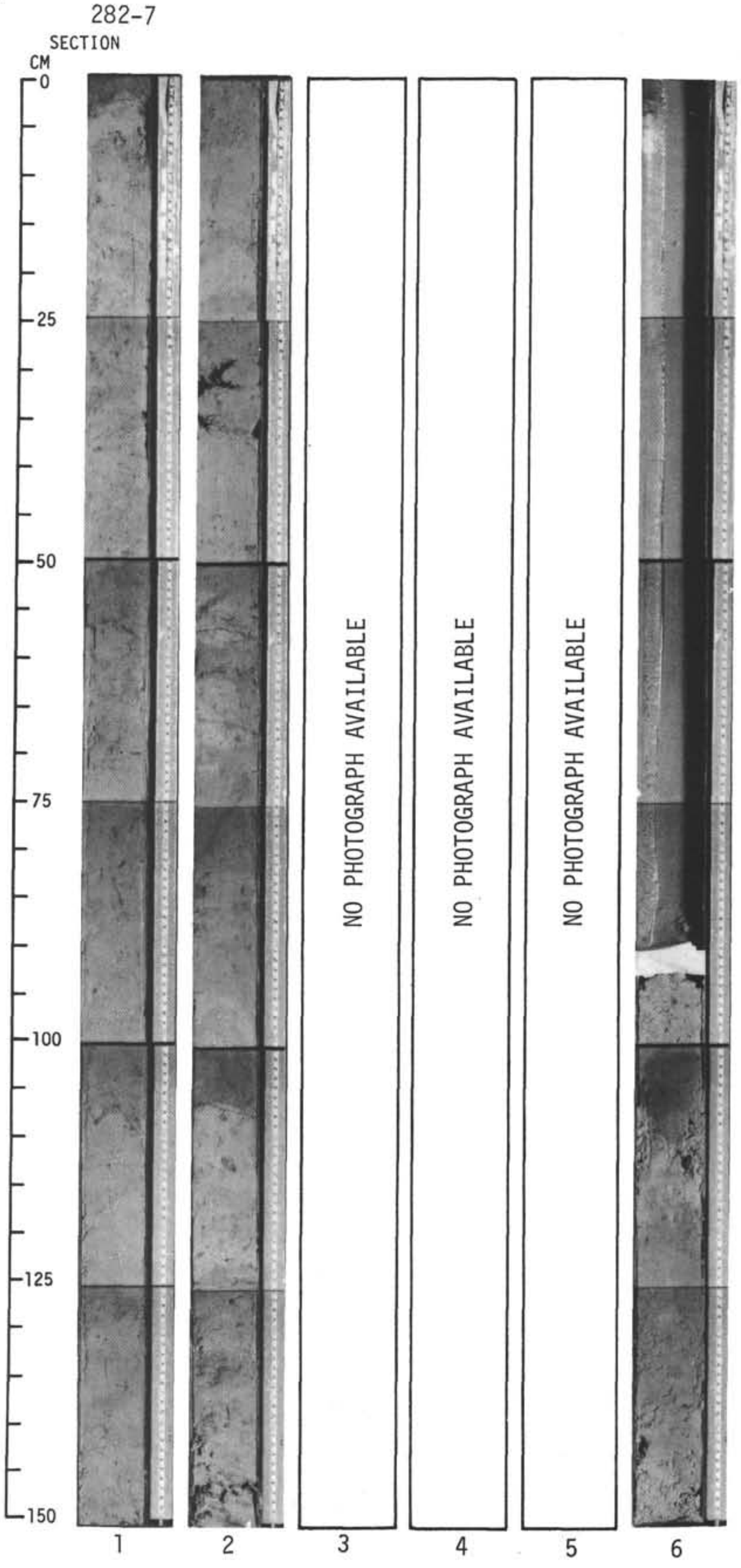
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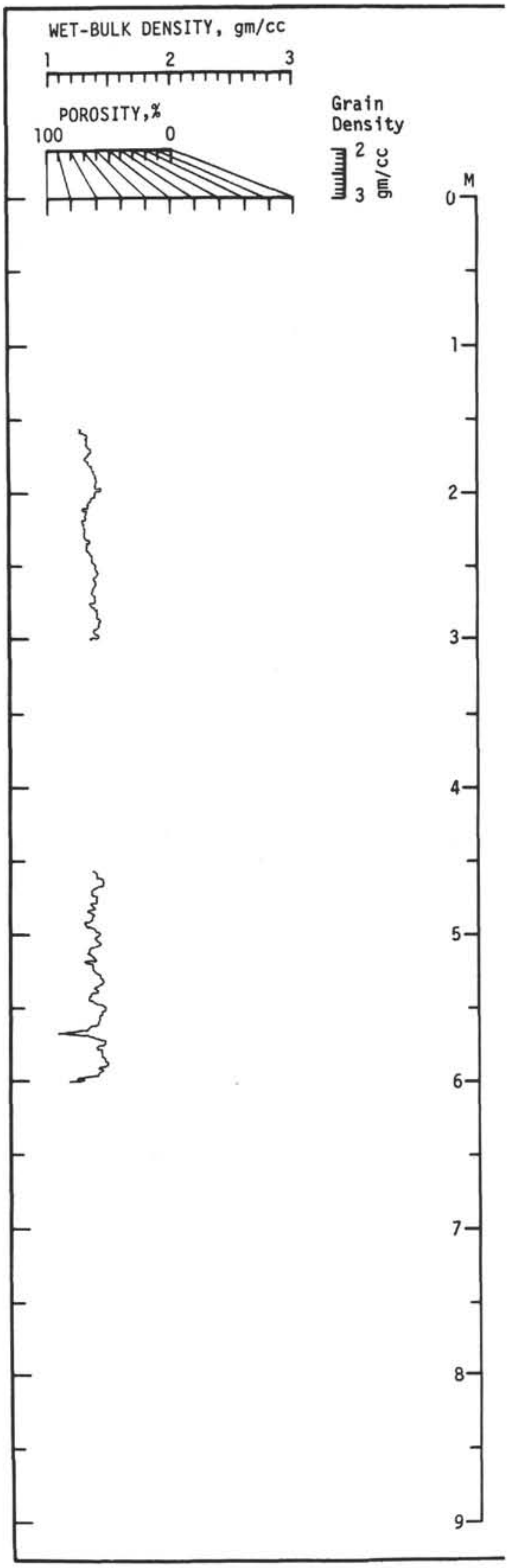
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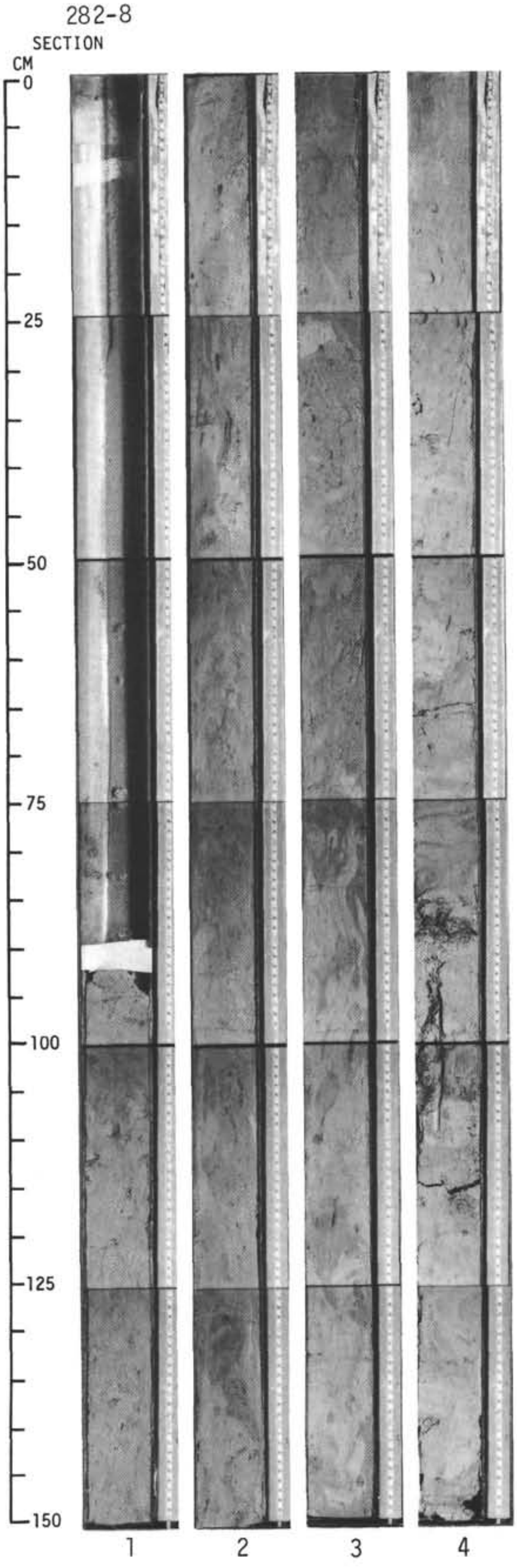
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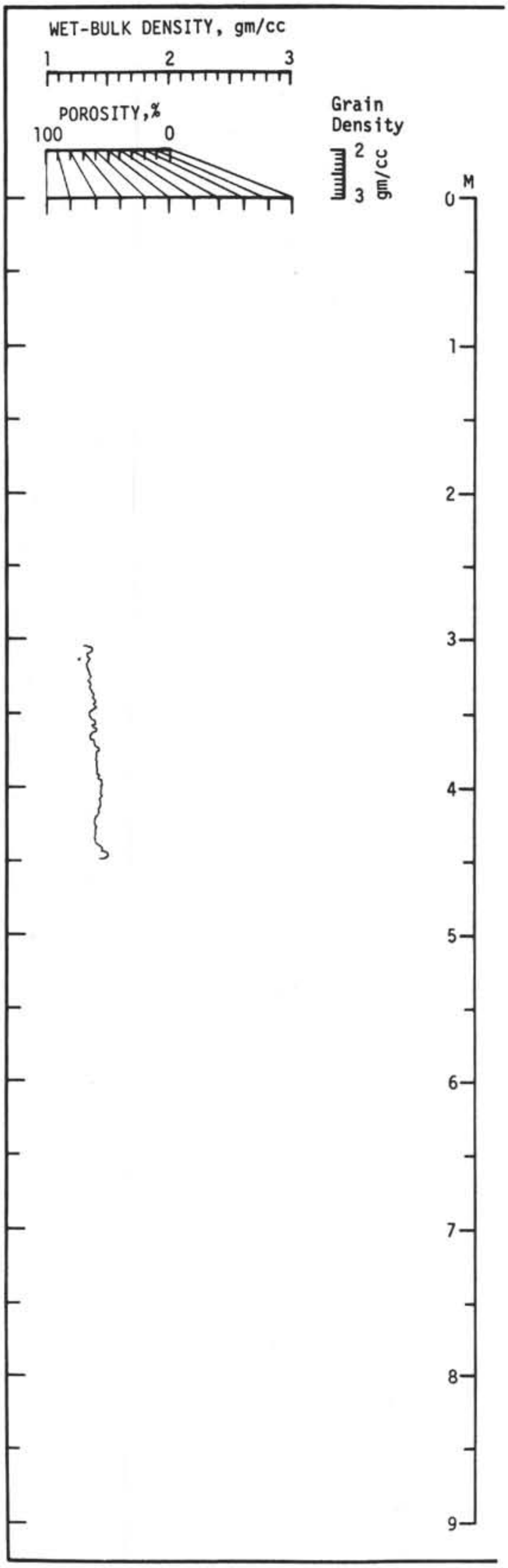
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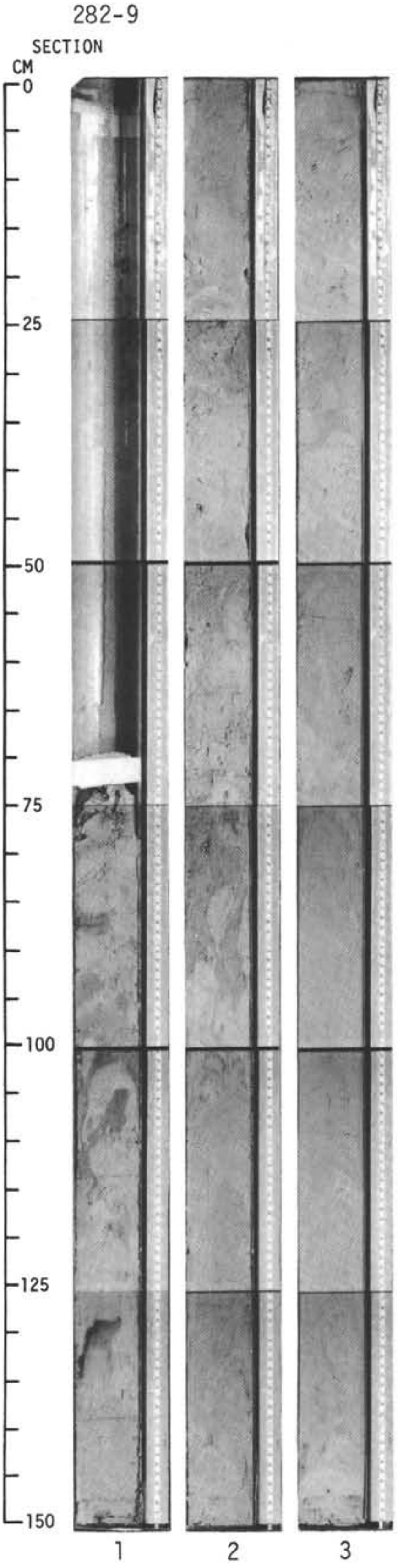
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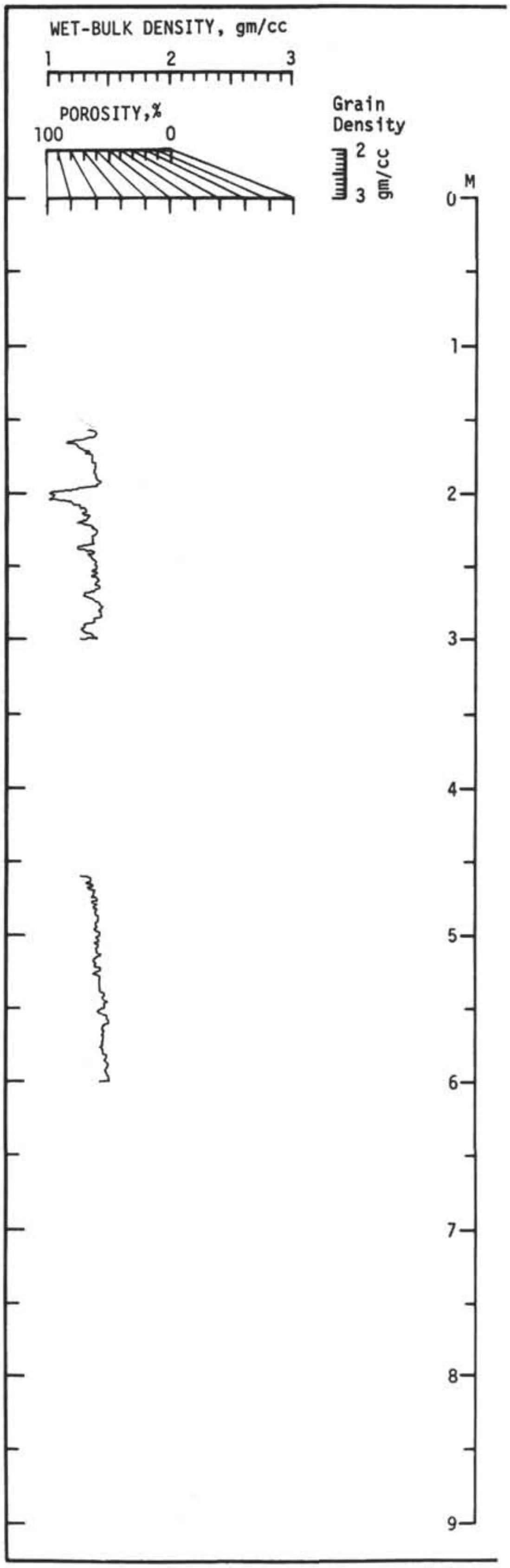
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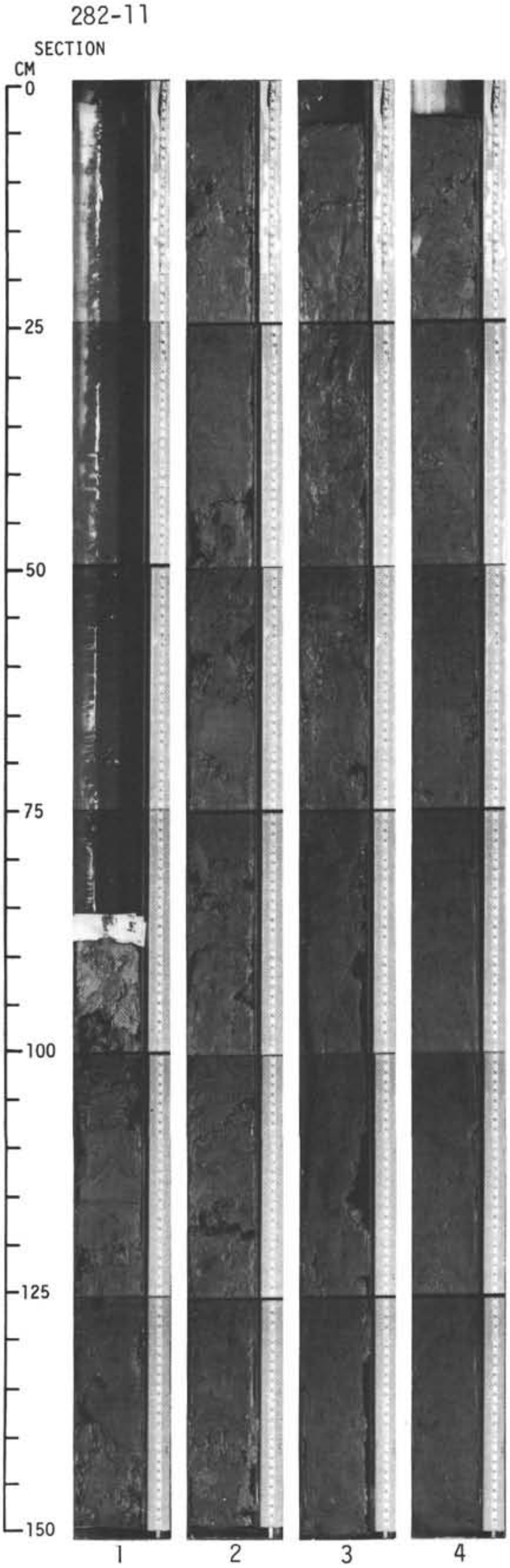
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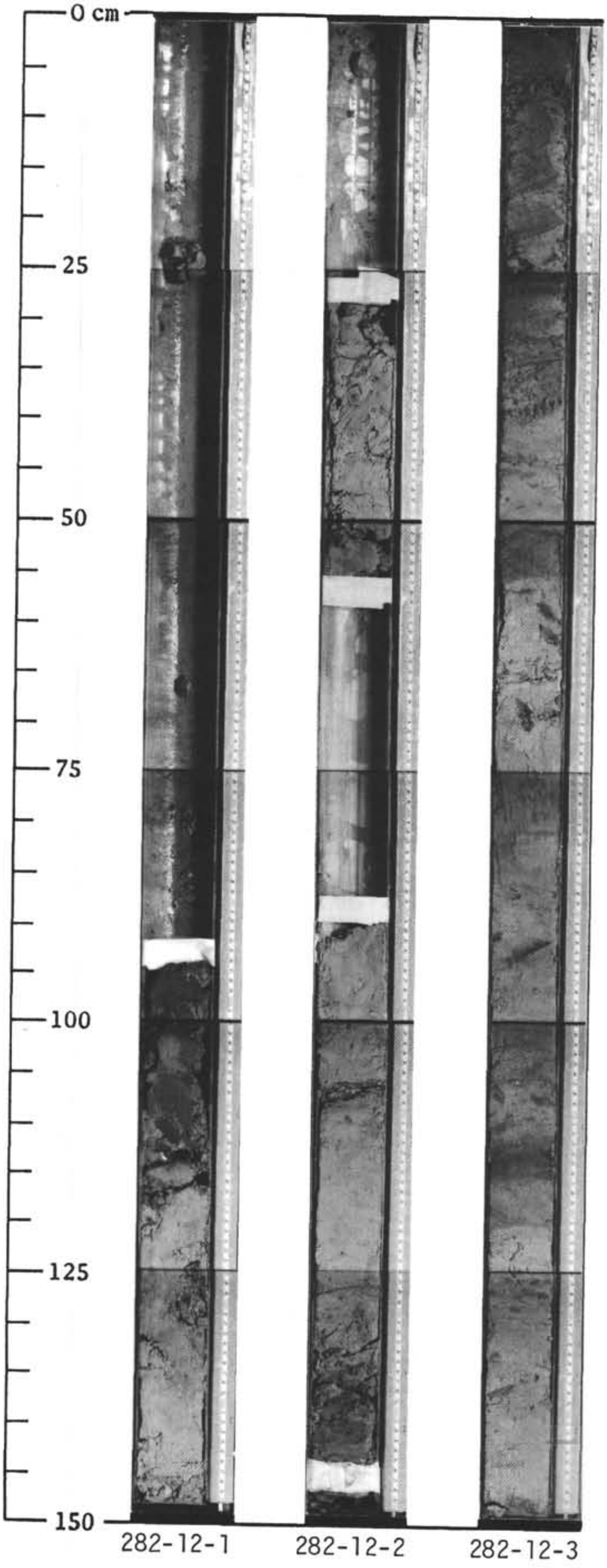
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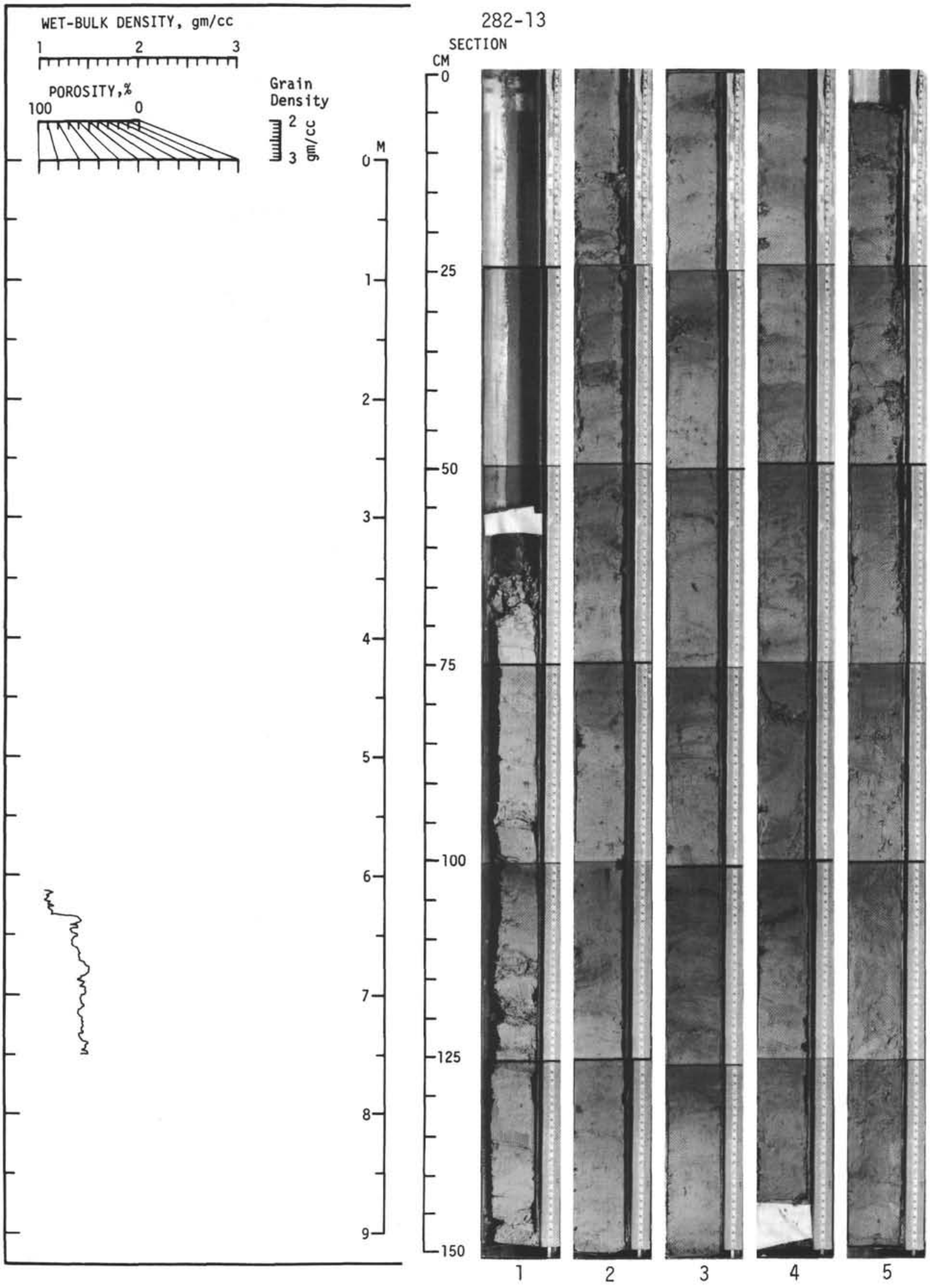
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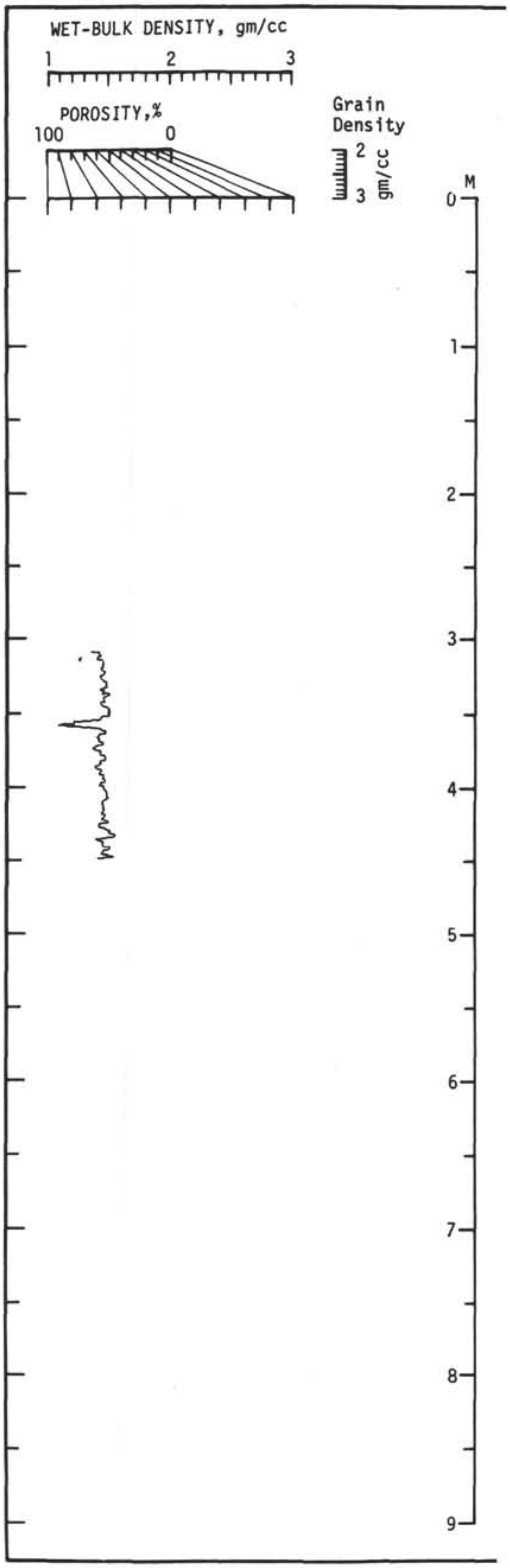
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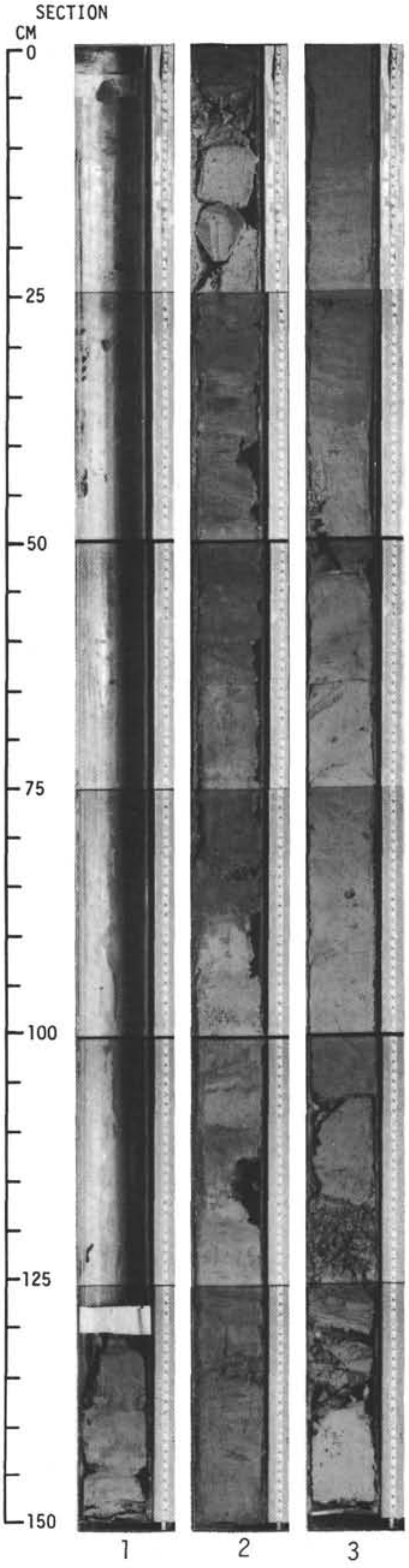
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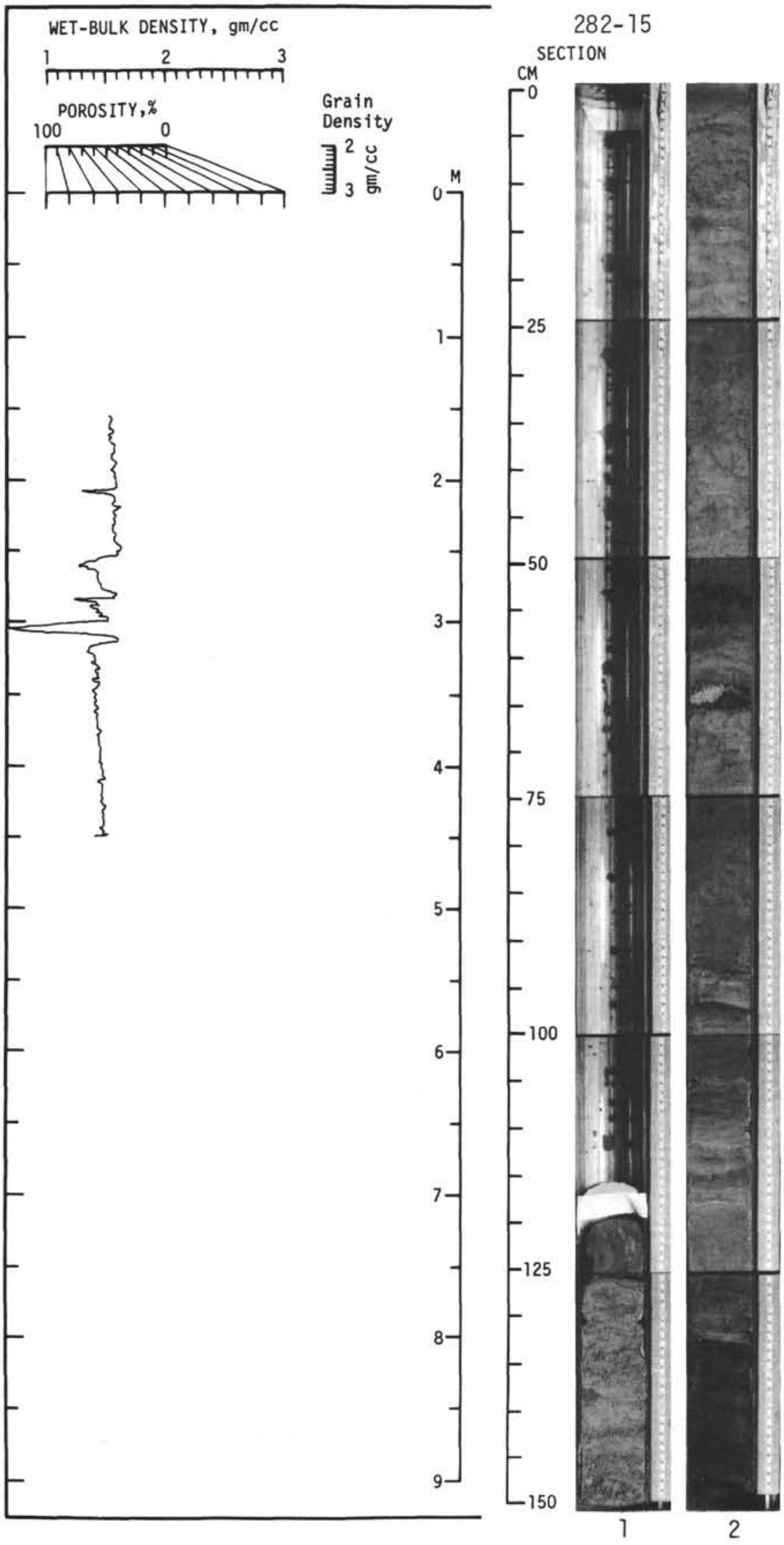
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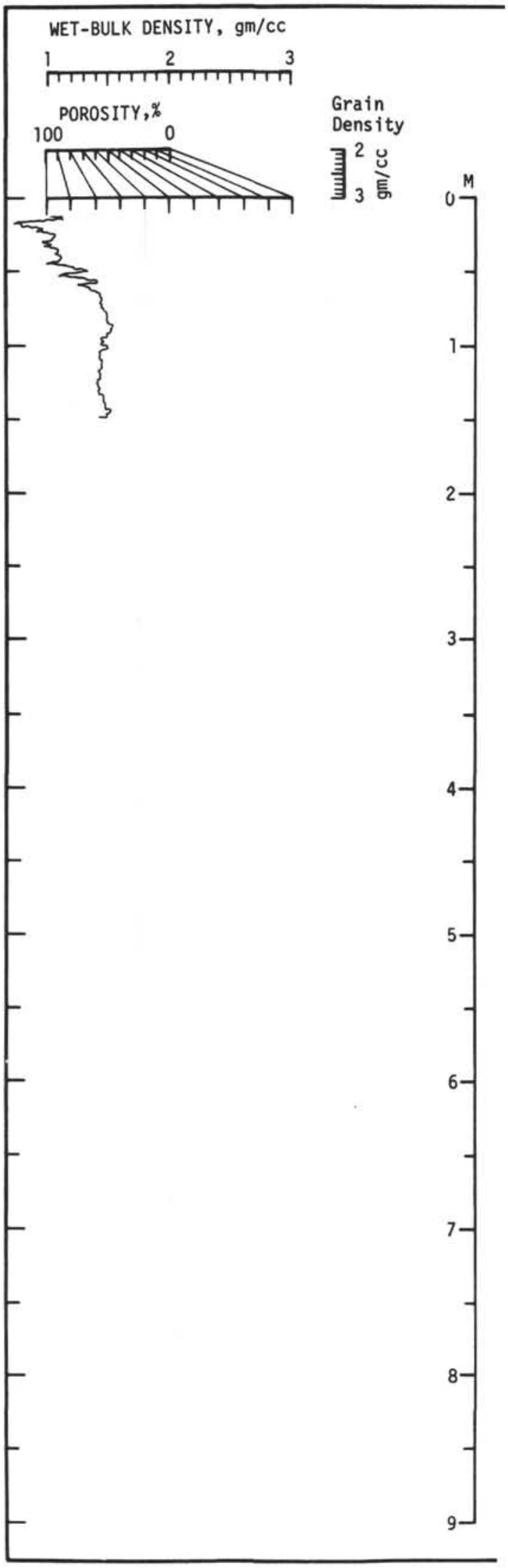
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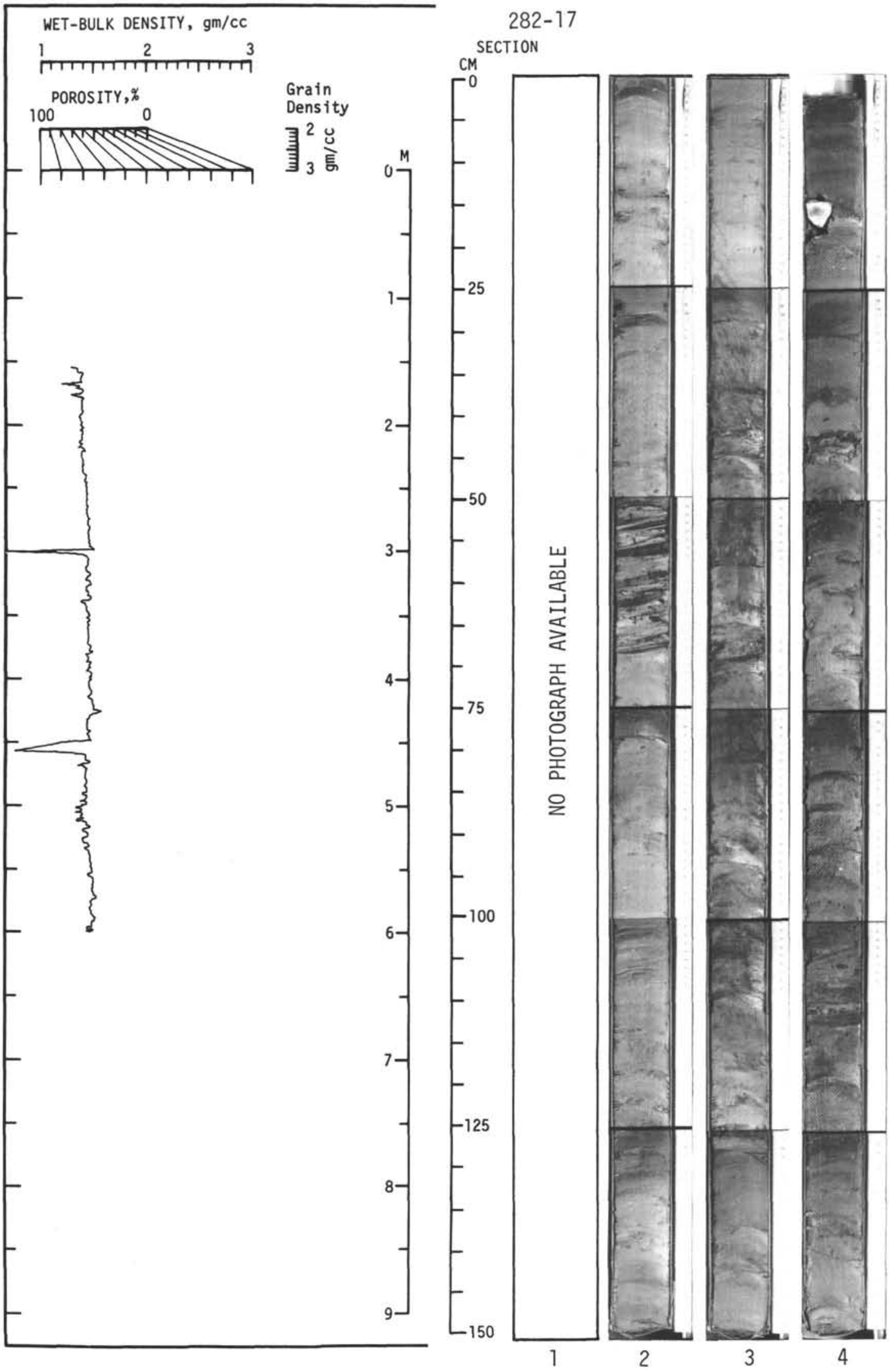
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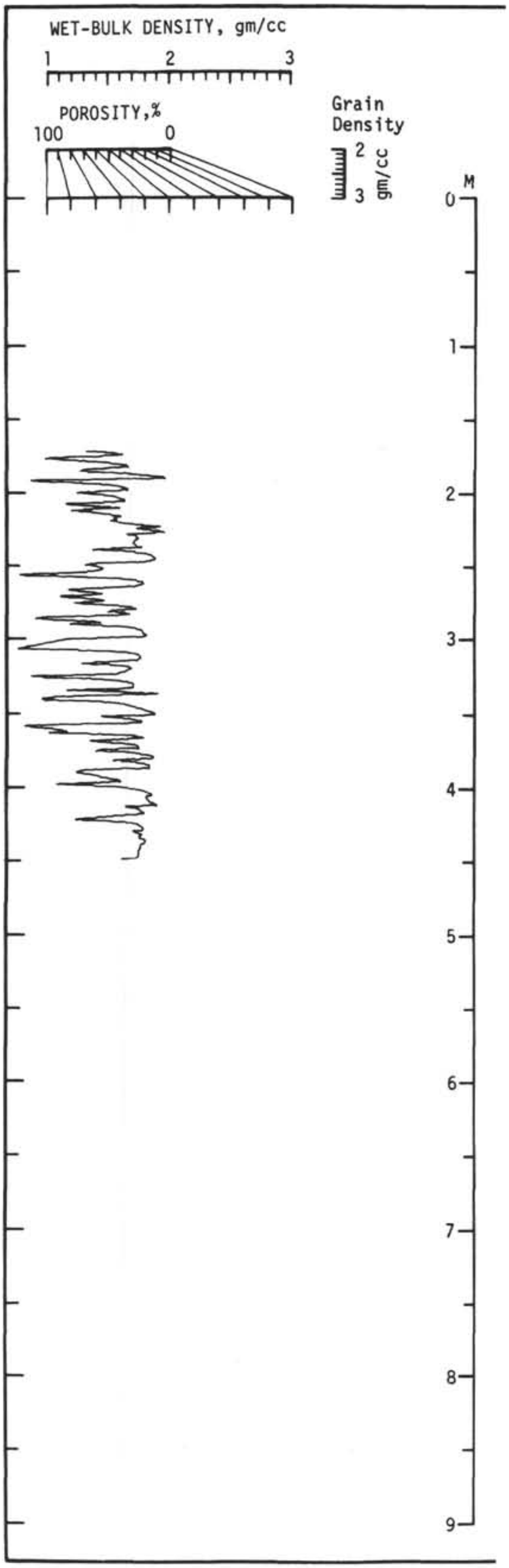
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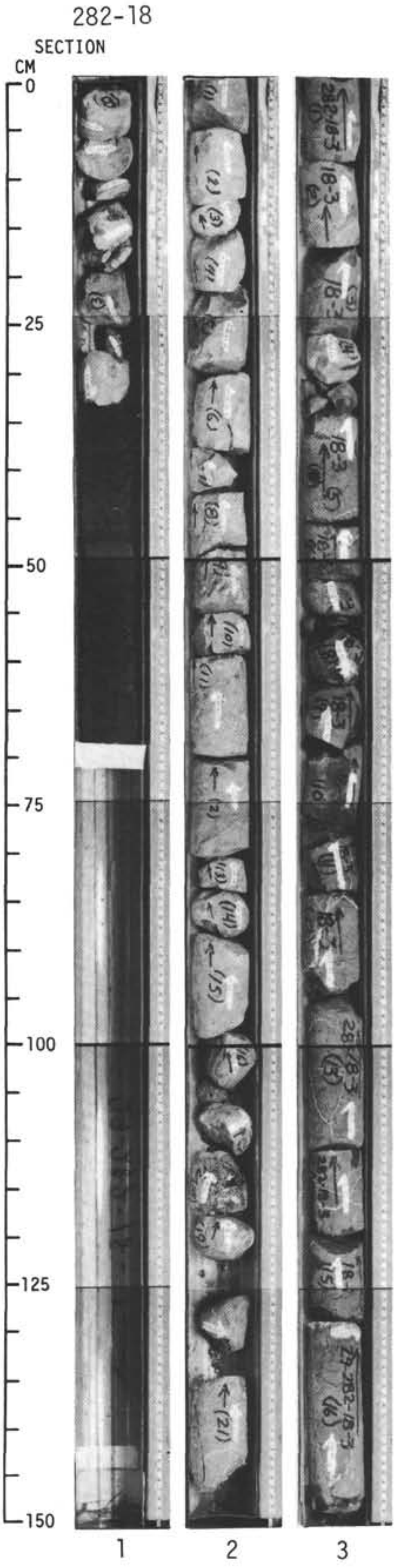
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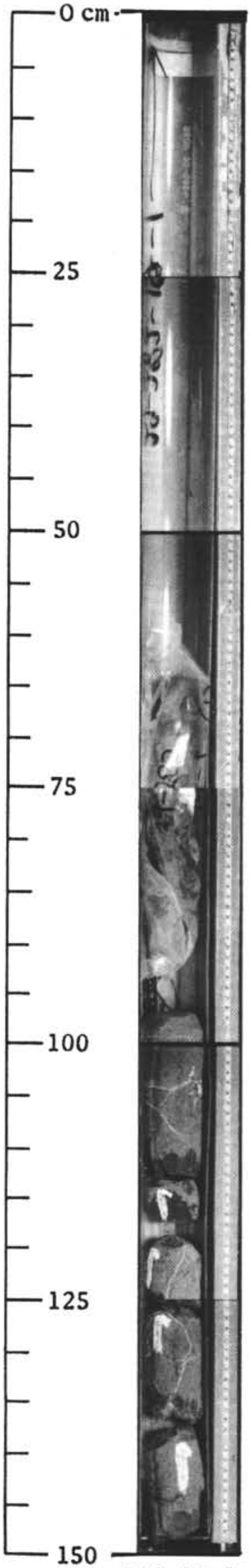
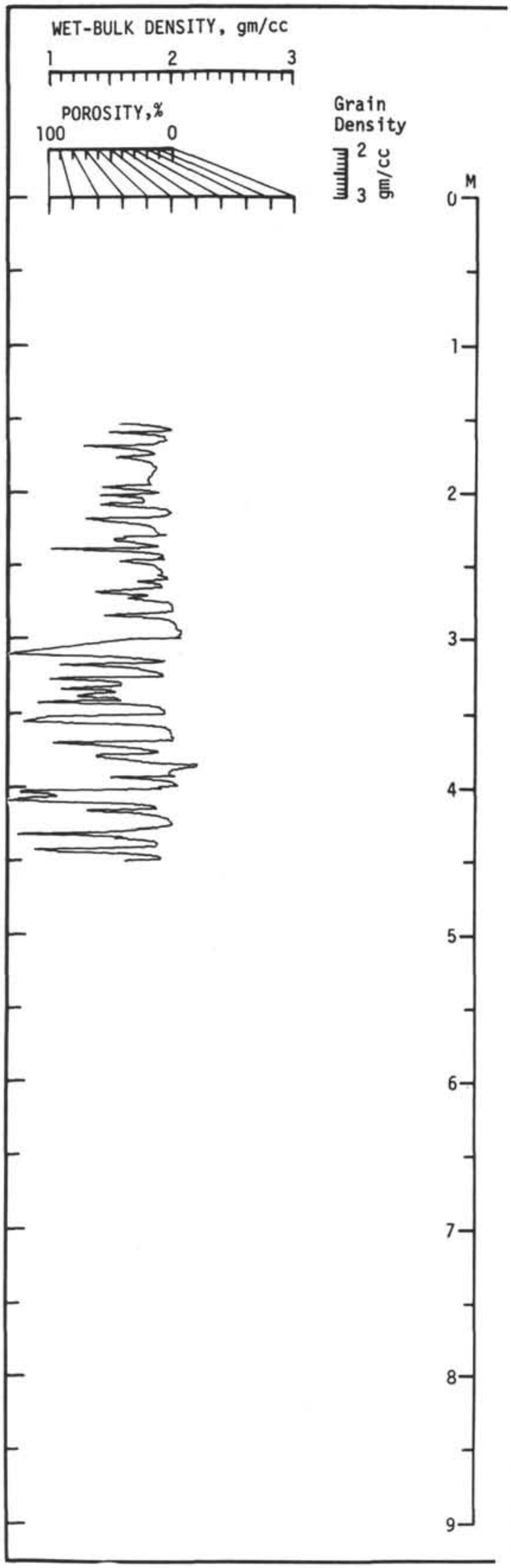
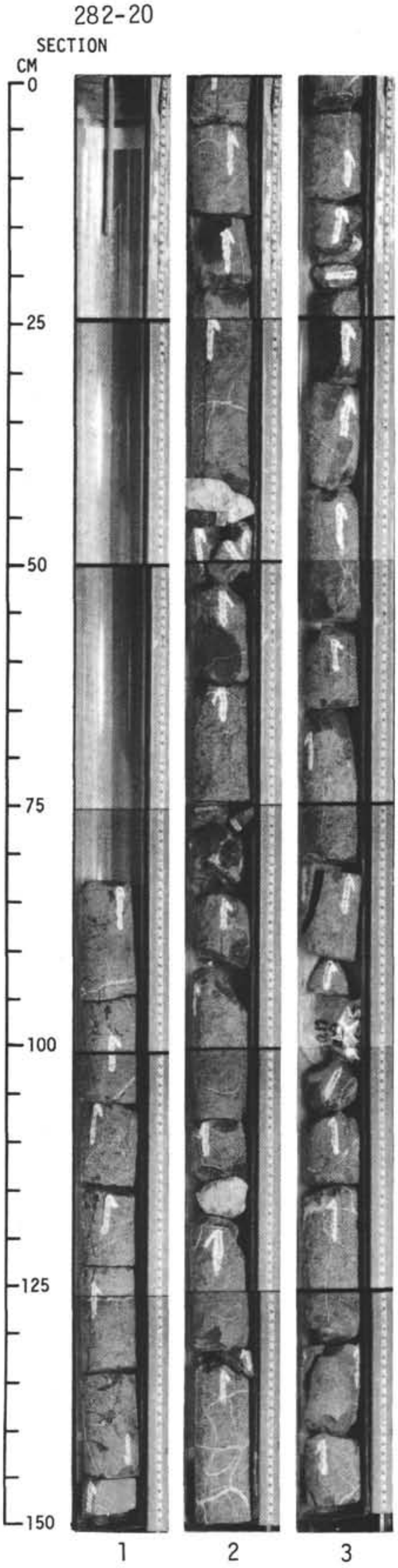


282-19-1


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


282-20
SECTION
CM
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25
50
75
100
125
150
1
2
3