8. SITE 38

The Shipboard Scientific Party[1]

SITE BACKGROUND

The nonfossiliferous nature of most of the thin sediment sequence at Site 37 had provided little biostratigraphic information for the northern end of the proposed section of sites along 140°W longitude. In an attempt to provide a biostratigraphically more meaningful hole as the high latitude terminus of the meridional section, an additional site (Site 38) was drilled between the Mendocino and Pioneer Fracture Zones. Although the sediment along most of the 140°W profile had been reported by the *Argo* survey to be very patchy and only rarely to reach thicknesses greater than 0.01 to 0.03 second, Site 38 was proposed on the basis of a local indication on an *Argo* seismic profile of sediment in excess of 0.1 second thickness.

Although no detailed survey had been made for Site 38, the *Argo* seismic profile between Sites 37 and 39 suggested that slightly thicker sediment occurred on a northward sloping region just north of the Pioneer Fracture Zone. A satellite-determined position at about the center of the thicker sediment band was indicated on the *Argo* profile. The specific location of the drilling site was made following a limited box-survey of the area by the *Glomar Challenger*. The sediment thickness over the survey area is rather consistently between 0.05 and 0.08 second and blankets the abyssal hills which have a major relief of approximately 100 meters. The on-site seismic profile indicates about 0.07 second of acoustically transparent material above a single strong reflector at basement on the flank of an abyssal hill.

The magnetometer was used to locate the site on a positive magnetic anomaly. Because the general approach to the site was from the north, parallel to the anomaly pattern, and also because the Mendocino Fracture Zone with its disruptive effect upon the magnetic anomaly pattern lay between Site 38 and the previous site, the magnetometer record could not be used to identify the anomaly number at Site 38. However, the location of the site is within the region surveyed magnetically by Vacquier *et al.* (1961), and by comparison with their anomaly profiles, it appears that Site 38 is located on Magnetic Anomaly 22 (56 million years).

Location

Site 38 is located at latitude 38° 42.12′N, longitude 140° 21.27′W on the flank of a 150-meter relief abyssal hill between the Mendocino and Pioneer Fracture Zones.

OPERATIONS

The 48 meters of sediment at Site 38 were continuously cored on 13 May. Sediment recovery was excellent until the bit reached 48 meters, where a hard layer stopped its advance. Since experience at earlier sites indicated that the prolonged coring attempts in hard material tended to result in loss of the overlying softer sediment, coring was stopped without attempting to go deeper. Recovery of a full interval (Core 6, 39 to 48 meters) of the sediment cored provided a good sample of the basal sediment at this site.

The drilling record for Site 38 is presented in Table 1.

LITHOLOGY

At Site 38, the sedimentary column, which is 48 meters thick, was continuously cored with 100 per cent recovery. For the most part, cores were badly disturbed during coring and interpretations of sedimentary structures were not possible.

Two sediment types occur at this site. A yellowish-brown mud, which is generally zeolitic and rich in amorphous iron oxides, forms most of the section. A nannofossil ooze pigmented with amorphous ferruginous material makes up the thin basal unit.

Core 1 (0 to 2 meters) consists of a yellow brown possibly zeolitic "red" clay containing what may be clinoptilolite. This zeolite mineral is replaced by phillipsite below 2 meters, and phillipsite continues as the dominant zeolite to the bottom of the hole. At a sediment depth of about 11 meters (in Core 2), the color of the sediment increases in intensity to dusky yellow brown. This color persists to the bottom of the hole. No noticeable mineralogical change accompanies this color change, although an increase in amorphous iron

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Sample 38-6-2, 10-12 cm:
Globorotalia aragonensis, Globorotalia caucasica Glaessner, *Globorotalia crassata* (Cushman), *Globorotalia wartsteinensis* Gohrbandt, *Globorotaloides turgida, Acarinina densa* (Cushman), *Acarinina quetra, Subbotina senni, Subbotina yequaensis* (Weinzierl and Applin).

Sample 38-6-2, 100-102 cm:
Globorotalia aragonensis, Globorotalia caucasica, Globorotalia wartsteinensis, Globorotaloides turgida, Acarinina densa, Acarinina quetra, Subbotina inaequispira (Subbotina), *Subbotina senni, Subbotina yequanensis.*

Sample 38-6-3, 15-17 cm:
Globorotalia aragonensis, Globorotalia caucasica, Globorotalia crassata, Globorotalia wartsteinensis, Globorotaloides turgida, Acarinina quetra, Subbotina higginsi (Bolli), *Subbotina inaequispira, Subbotina linaperta* Finlay, *Subbotina senni, Subbotina yequaensis.*

Sample 38-6-3, 98-100 cm:
Same as above.

Sample 38-6-4, 20-22 cm:
Globorotalia aragonensis, Globorotalia caucasica, Globorotalia crassata, Globorotalia wartsteinensis, Globorotaloides turgida, Acarinina quetra, Subbotina higginsi, Subbotina senni, Subbotina yequaensis.

Sample 38-6-4, 111-113 cm:
Globorotalia aragonensis, Globorotalia caucasica, Globorotalia wartsteinensis, Globorotaloides turgida, Acarinina quetra, Subbotina senni, Subbotina yequaensis.

Sample 38-6-4, 148-150 cm:
Same as above.

Sample 38-6-5, 28-30 cm:
Globorotalia aragonensis, Globorotalia caucasica, Globorotalia wartsteinensis, Acarinina quetra, Subbotina higginsi, Subbotina senni.

Sample 38-6-5, 102-104 cm:
Same as above.

Sample 38-6-6, 20-22 cm:
Globorotalia aragonensis, Globorotalia caucasica, Globorotalia wartsteinensis, Globorotaloides turgida, Subbotina senni, Subbotina yequaensis.

Sample 38-6, core catcher:
Globorotalia aragonensis, Globorotalia caucasica, Globorotalia wartsteinensis, Globorotaloides turgida, Acarinina angulosa (Bolli), *Acarinina quetra, Acarinina spinuloinflata* (Bandy), *Subbotina linaperta, Subbotina senni, Subbotina yequaensis.*

Radiolaria

Radiolaria were not found in any of the cores from Hole 38.

SUMMARY

At Site 38, the basement, which was not sampled, is overlain by 48 meters of sediment that is divisible into two stratigraphic units (Table 2). The lower unit, unit 2 (Core 6, 39 to 48 meters), is a nannofossil ooze mixed with abundant amorphous iron oxides. The dusky yellow brown color appears to be due to the iron oxide pigmentation, as in the overlying sediments. The shipboard paleontological study places the unit in the upper part of the Lower Eocene. Toward the top of the unit, the foraminifera are less abundant and have been partially dissolved.

Although the contact was not observed, there is an abrupt change in lithology between units 1 and 2. Unit 1 (Cores 1 through 5, 0 to 39 meters) is a yellow brown zeolitic pelagic clay. The zeolites, principally phillipsite, increase upward in abundance to a maximum of 10 to 25 per cent in Core 2 (2 to 12 meters). Pods of almost pure zeolites in Cores 3 and 5 (12 to 21 meters and 30 to 39 meters) may represent altered ash. The only identifiable ash occurs at 30 meters, and is possibly indicative of acidic vulcanism. No age assignment can be made for this unit at present.

The location of Site 38 with regard to the magnetic anomalies is only indirectly determined, but available information indicates that the site is on Anomaly 22 which is 56 million years old (upper part of the Paleocene). The oldest fossils, however, indicate an age for the basal sediments of only about 50 million years.

At Site 38, carbonate deposition was the dominant sedimentary process in the Early Eocene, although amorphous iron oxides were apparently deposited with the ooze. Some time later, a change in the sedimentary environment occurred. The accumulation of calcareous ooze ceased, and was followed by deposition of the amorphous iron oxides. Presumably this change in the sedimentary environment also initiated the dissolution of fossils in the upper part of the ooze, although this is speculation. During this period the environment appears to have been uniform, other than for ash falls near the site. As the time span represented by the iron oxide-rich sediment is not documented, only a crude estimate of rate of sedimentation can be made. Based on a 50 million year maximum year age for the ooze, and by assuming that continuous deposition has occurred to the present, an average rate for the upper 39 meters of the sediment column clay is 0.8 m/m.y.

The amorphous iron oxide sediment occurring at this site is discussed in detail in Chapter 26 of this volume.

TABLE 1
Drilling Summary of Leg 5, Site 38

Date	Core	Depth Below Sea Floor (m)	Depth Below Rig Floor (ft)	Core Cut (ft)	Core Cut (m)	Core Recovered (ft)	Core Recovered (m)	Per Cent Recovered
13 May	1	0-2	16,909-16,917	8	2.4	8	2.4	100
	2	2-12	16,917-16,947	30	9.1	30	9.1	100
	3	12-21	16,947-16,977	30	9.1	30	9.1	100
	4	21-30	16,977-17,007	30	9.1	30	9.1	100
	5	30-39	17,007-17,037	30	9.1	30	9.1	100
	6	39-48	17,037-17,065	28	8.5	28	8.5	100
			Totals	156	47.3	156	47.3	100

Note: Sonic water depth (corrected): 5134 meters; 16,849 feet; 2808 fathoms. Driller's depth: 16,909 feet.

oxide pigmentation is perceptible. Between 12 to 21 meters (Core 3), and in the vicinity of 30 meters, numerous "pods" and layers of almost monomineralic euhedral phillipsite occur within the zeolitic sediment. These may represent altered ash and pumice deposits. At about 30 meters, semi-indurated "pods" of volcanic ash occur. Their composition consists of feldspar, biotite euhedra, hornblende chips and phillipsite. From a depth of about 30 meters to the base of the sediment column at 39 meters the proportion of phillipsite in the sediment decreases markedly, from an estimated 10 to 20 per cent down to about 0 to 5 per cent.

There is an abrupt transition from the amorphous iron oxide sediment to the underlying nannofossil ooze–iron oxide mixture at about 39 meters (between Cores 5 and 6). The ooze is strongly colored by the iron oxides.

A hard layer at the base of the ooze (48 meters) terminated drilling. Although no samples were recovered, this hard layer may be the basement observed on the air-gun seismic reflection profiles.

PALEONTOLOGY

Nannoplankton

Calcareous nannoplankton occur in Core 6, but not in the higher cores. This core contains a rich and diversified assemblage of calcareous nannoplankton representing the *Discoaster lodoensis* Zone of the Lower Eocene. The nannofossils are fairly heavily calcified, probably indicating their association with carbonate-rich surroundings at some time in the past.

The identified forms include: *Campylosphaera bramlettei* Kamptner, *C. dela* (Bramlette and Sullivan), *Chiasmolithus grandis* (Bramlette and Riedel), *Coccolithus* aff. *C. bisectus* (Hay, Mohler, and Wade), *C. crassus* Bramlette and Sullivan, *C. eopelagicus* (Bramlette and Riedel), *Cyclococcolithus gammation* (Bramlette and Sullivan), *C. orbis* Gartner and Smith, *Discoaster barbadiensis* Tan, *D. deflandrei* Bramlette and Riedel, *D. lodoensis* Bramlette and Riedel, *D. mirus* Deflandre, *Discoasteroides kuepperi* (Stradner), *Helicopontosphaera seminulum lophota* (Bramlette and Sullivan), *Reticulofenestra* cf. *R. umbilica* (Levin), *Sphenolithus radians* Deflandre, *S. moriformis* (Bronnimann and Stradner) Bramlette and Wilcoxon, *Zygolithus concinnus* Martini, and *Zygrhablithus bijugatus* (Deflandre).

Foraminifera

Foraminifera are present only in Core 6, the lowermost core taken. The foraminifera show solution effects in Section 1 of Core 6; below this they are abundant and well-preserved.

Species recovered from Hole 38 include:

Sample 38-6-1, 13-15 cm:
Globorotalia aragonensis Nuttall, *Globorotaloides turgida* (Finlay), *Acarinina quetra* (Bolli), *Subbotina senni* (Beckmann).

Sample 38-6-1, 97-99 cm:
Globorotalia aragonensis, Acarinina quetra, Subbotina senni.

TABLE 2
Stratigraphic Units at Site 38

Unit	Depth (m)	Cores	Age	Description
1	0-39	1-5	?	Yellow brown zeolitic clay with one ash layer.
2	39-48	6	Lower Eocene	Foraminifera nannofossil ooze; dusky yellow brown. Iron oxide pigmentation 30 to 60 per cent.
3	48			Basement.

REFERENCE

Vacquier, V., Raff, A. D. and Warren, R. E., 1961. Horizontal displacements in the ocean floor of the northeastern Pacific Ocean. *Bull. Geol. Soc. Am.* 72, 1251.

THE CORES RECOVERED FROM SITE 38

The following pages present a graphic summary of the results of drilling and coring at Site 38. Fig. 1, a summary of Site 38 is at the back of the book. Figures 2 to 7 are summaries of the individual cores recovered. A key to the lithologic symbols is given in the Introduction (Chapter 1).

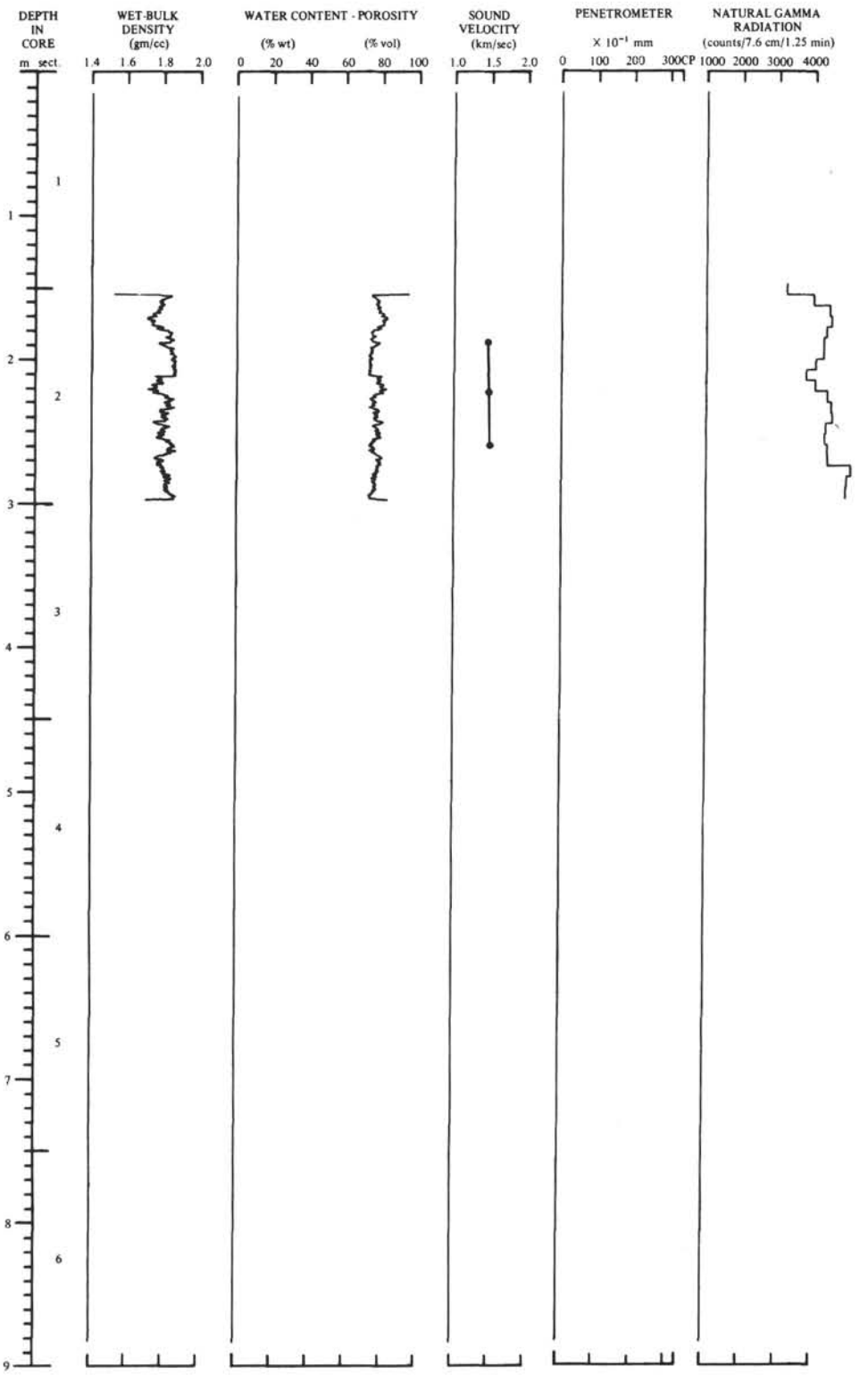

Figure 2A. *Physical Properties of Core 1, Hole 38*

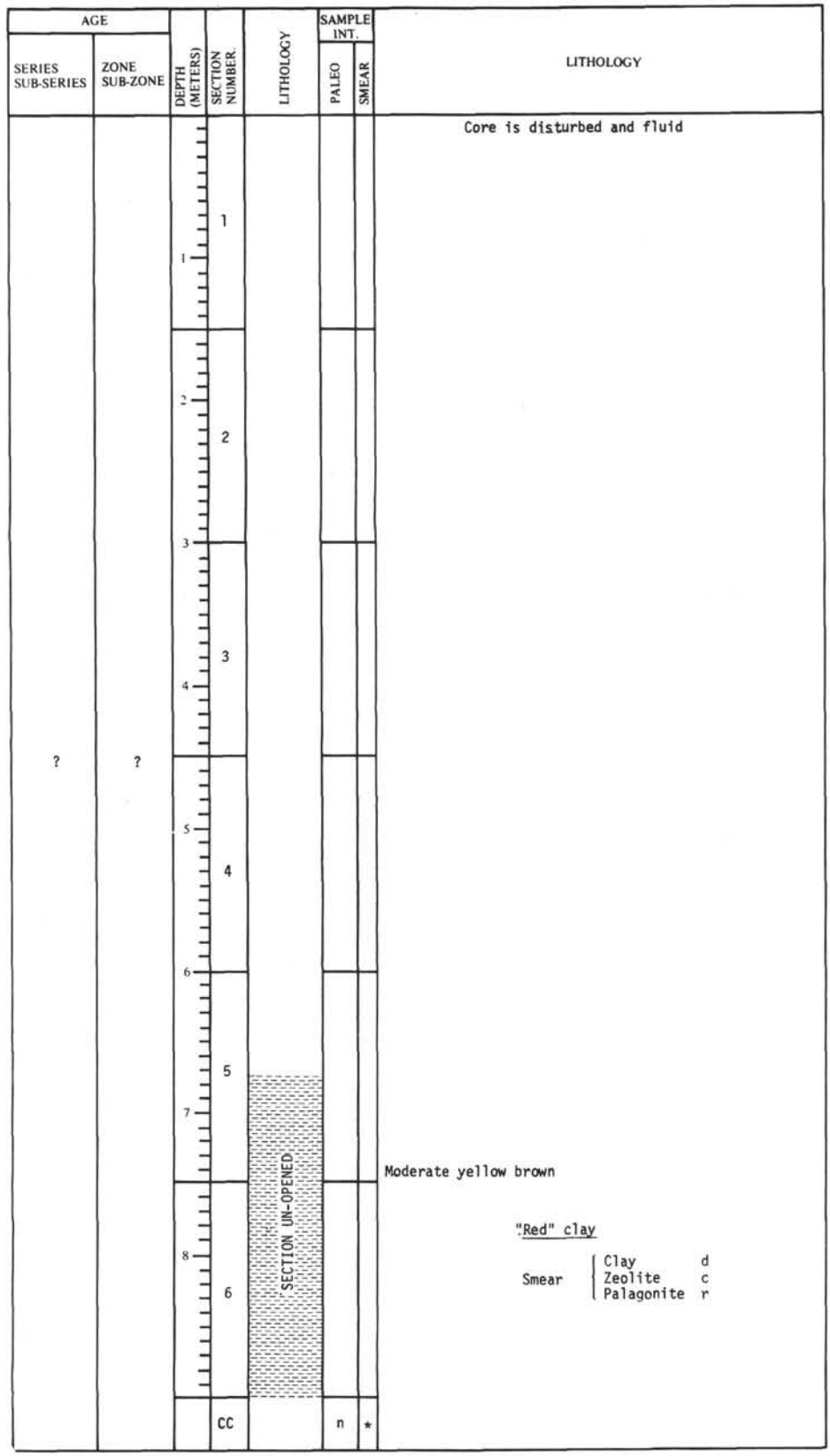

Figure 2B. *Core 1, Hole 38 (0-2 m Below Seabed)*

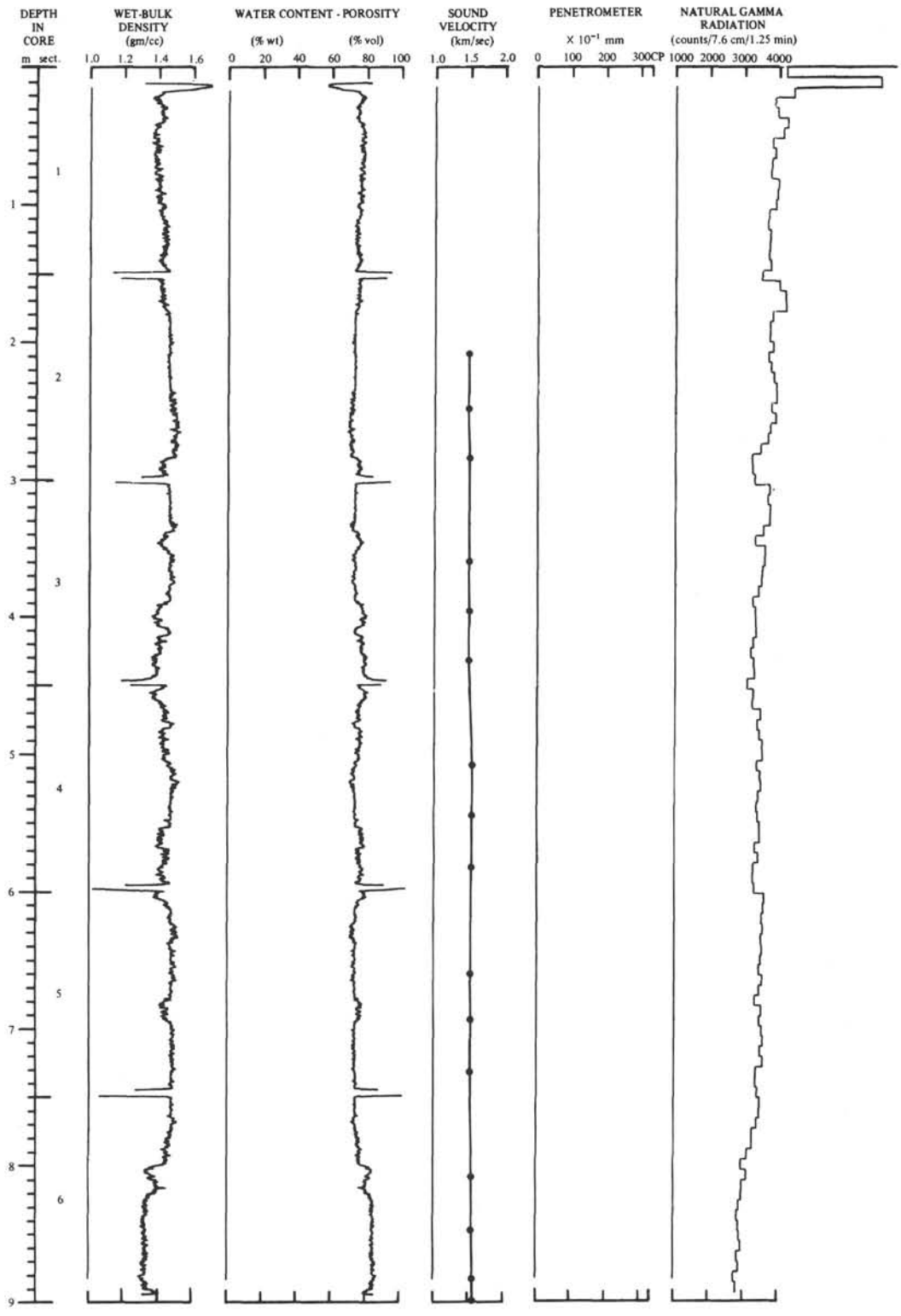

Figure 3A. *Physical Properties of Core 2, Hole 38*

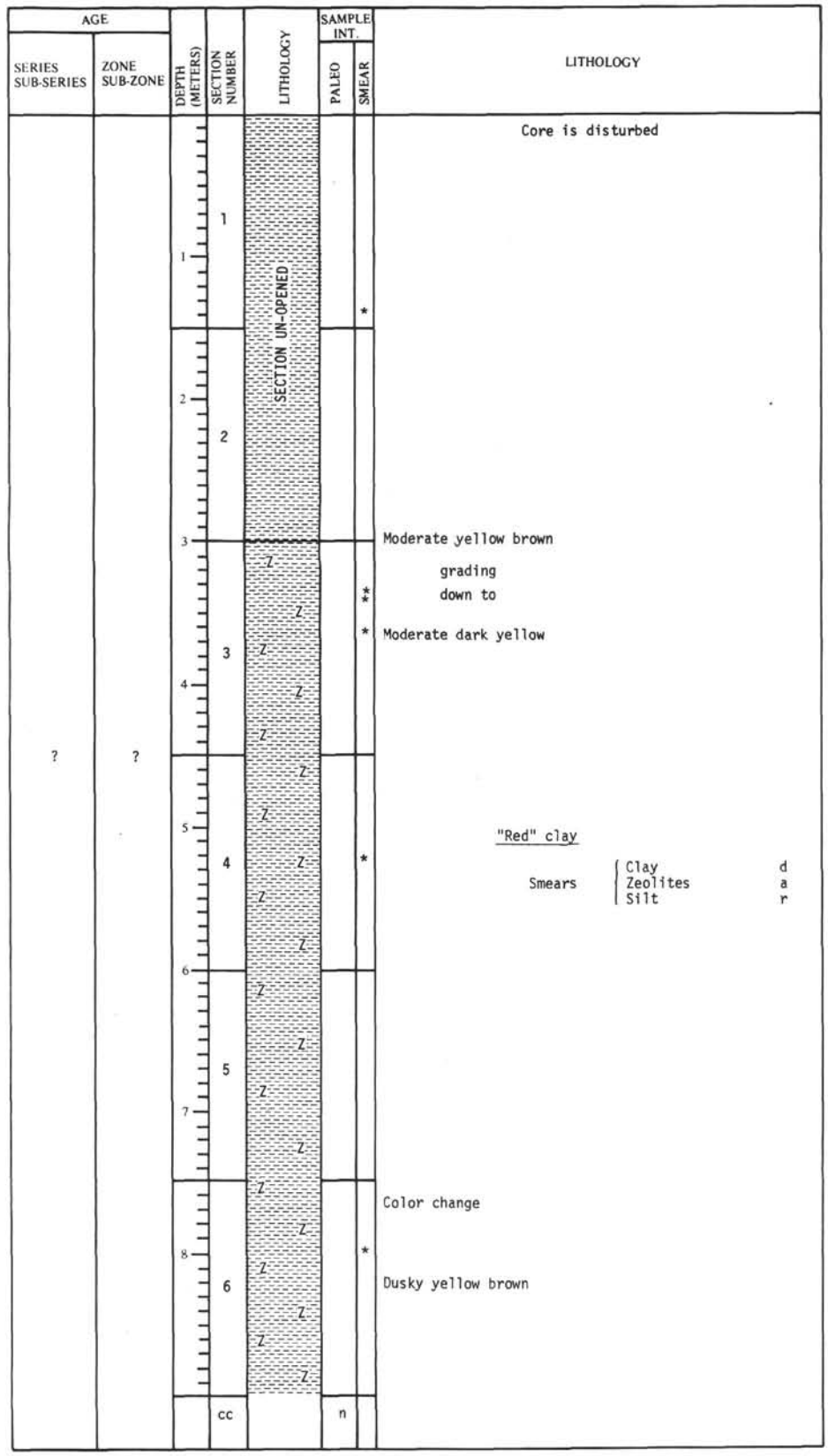

Figure 3B. *Core 2, Hole 38 (2-12 m Below Seabed)*

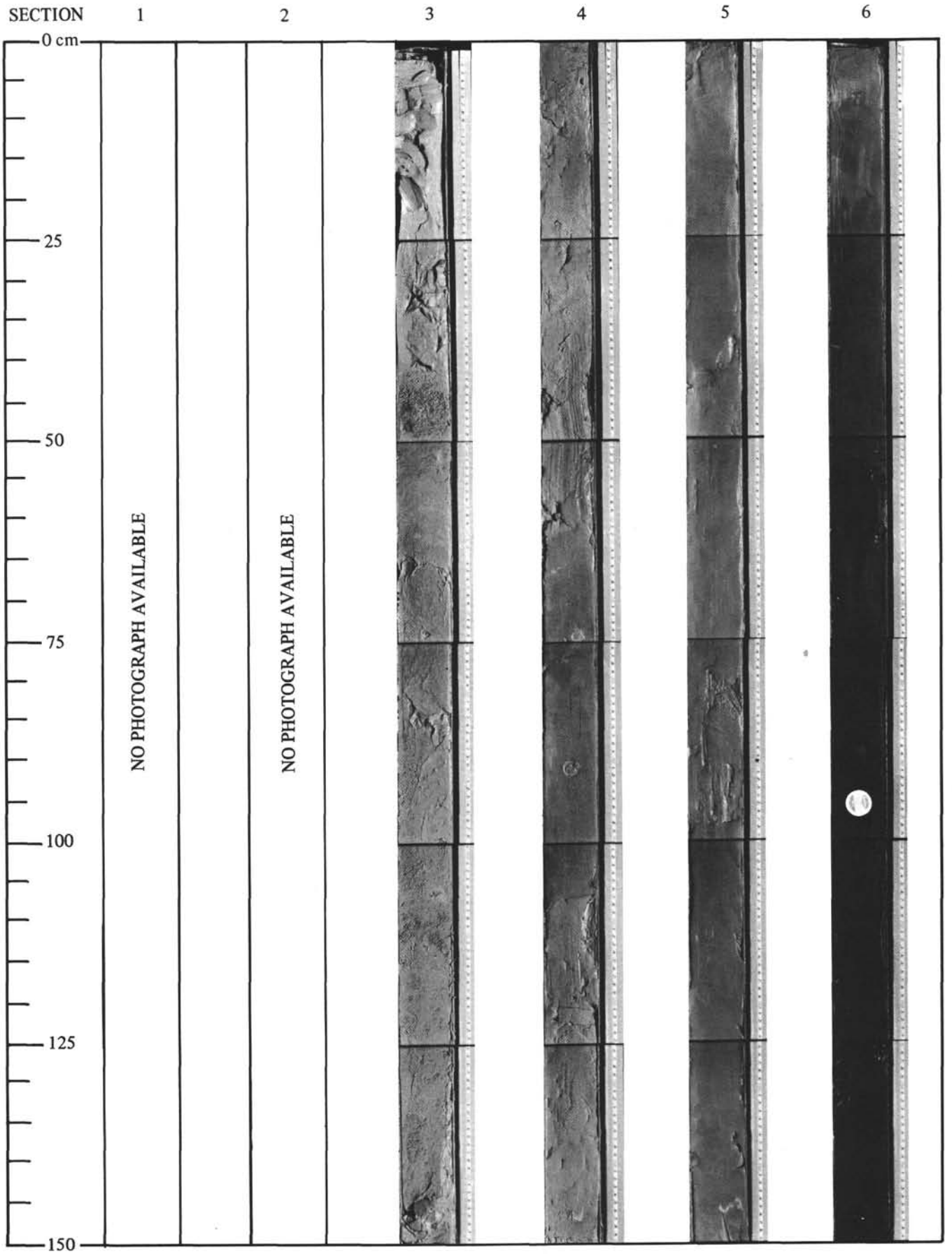

Plate 1. *Core 2, Hole 38*

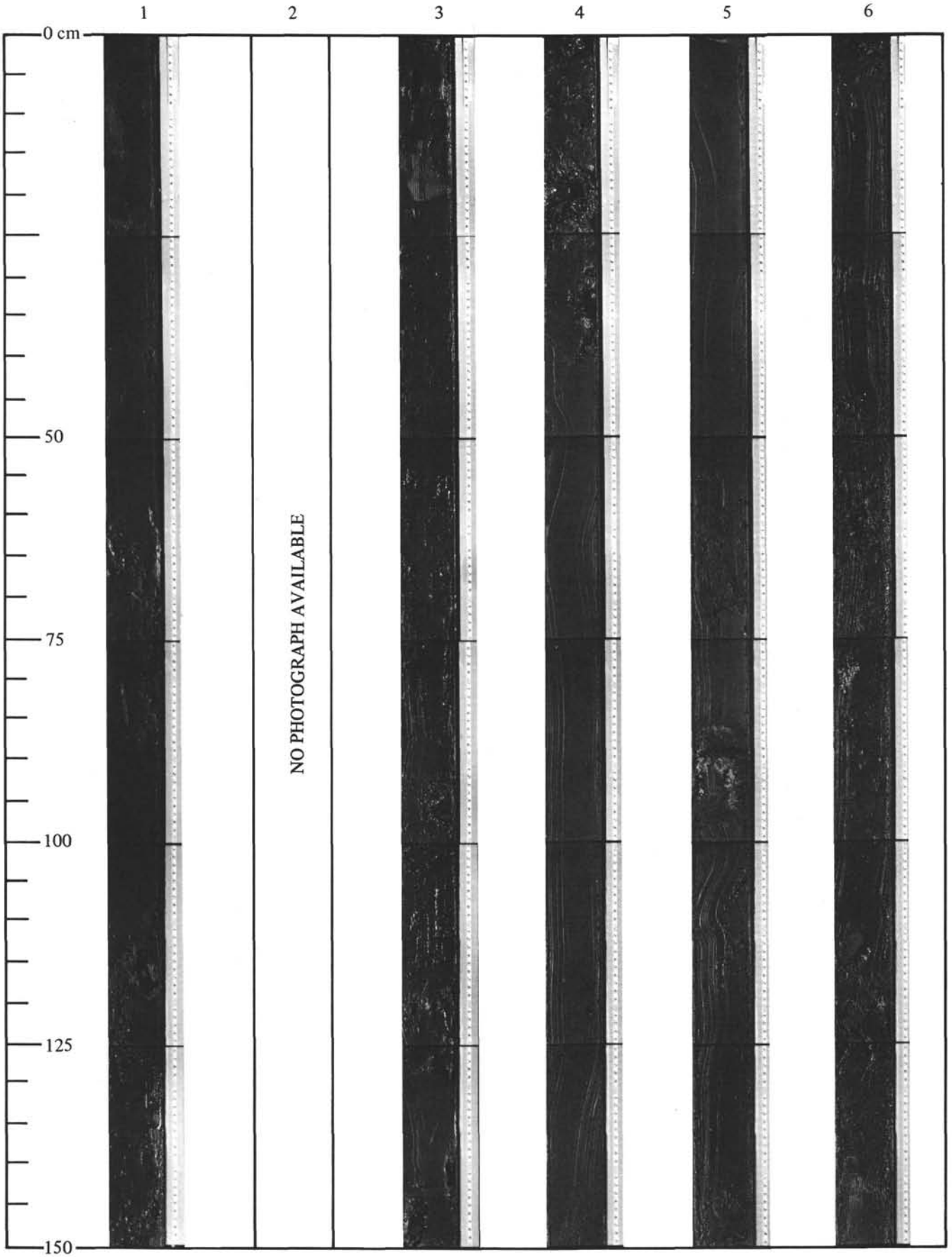

Plate 2. *Core 3, Hole 38*

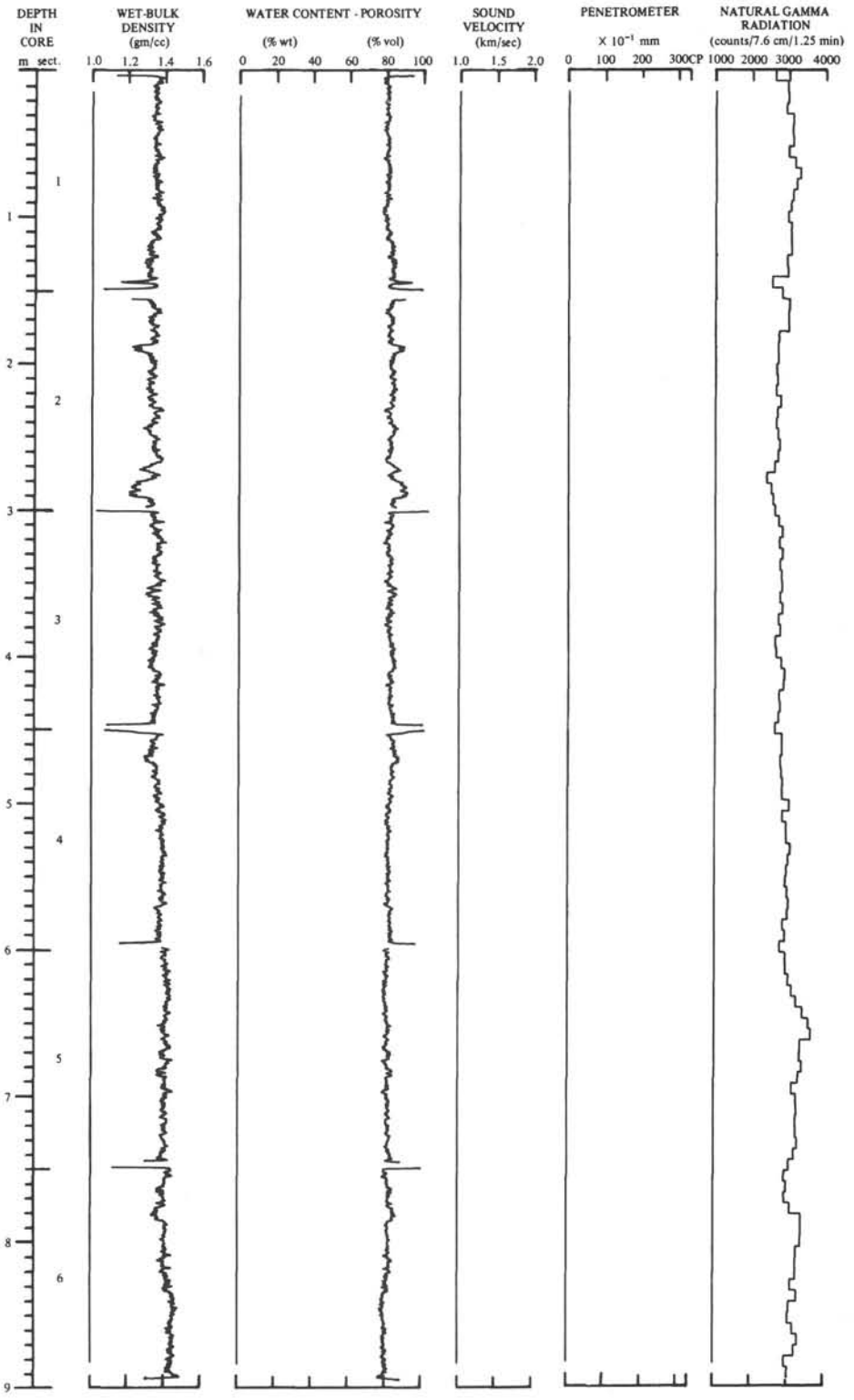

Figure 4A. *Physical Properties of Core 3, Hole 38*

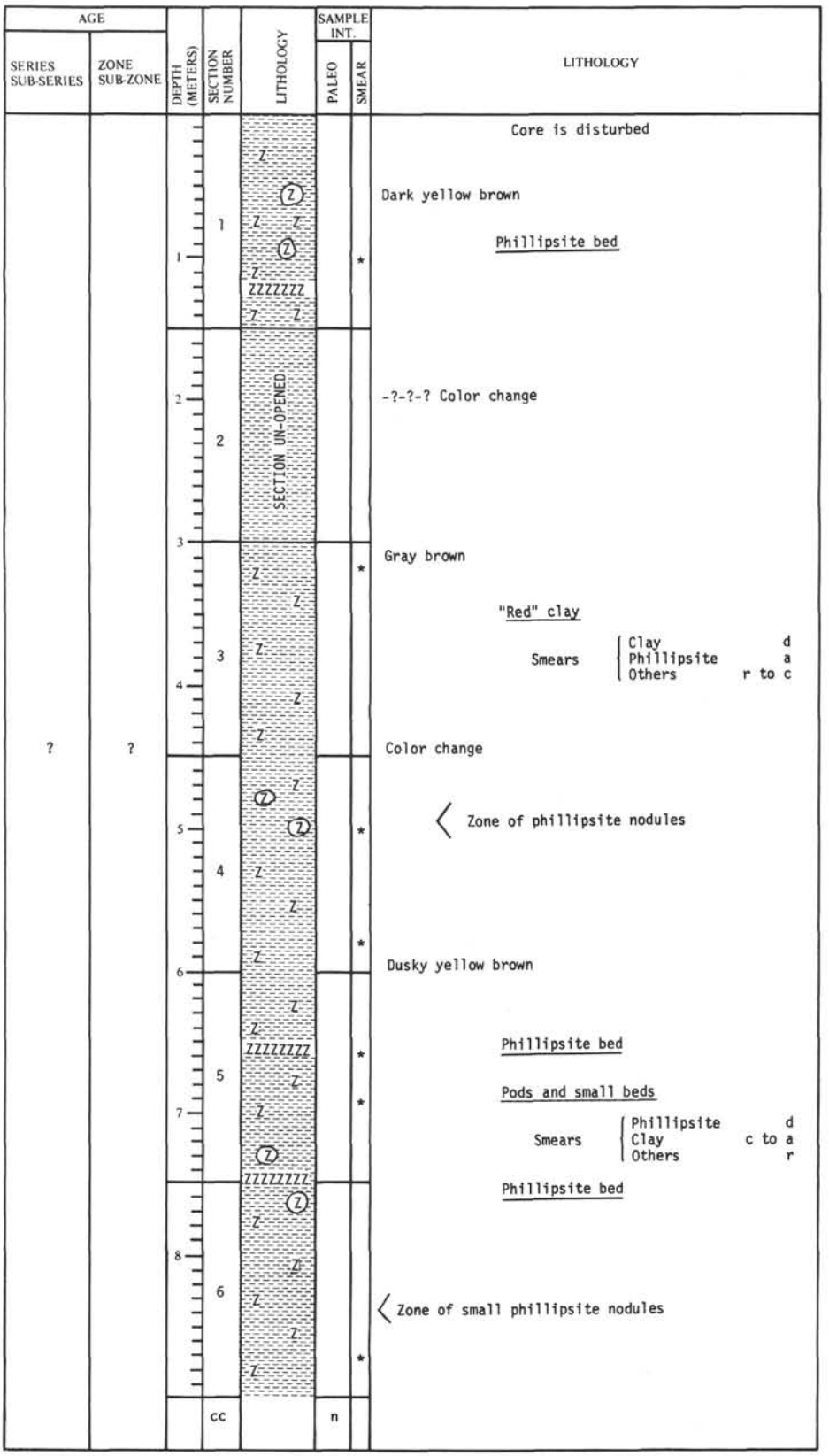

Figure 4B. *Core 3, Hole 38 (12-21 m Below Seabed)*

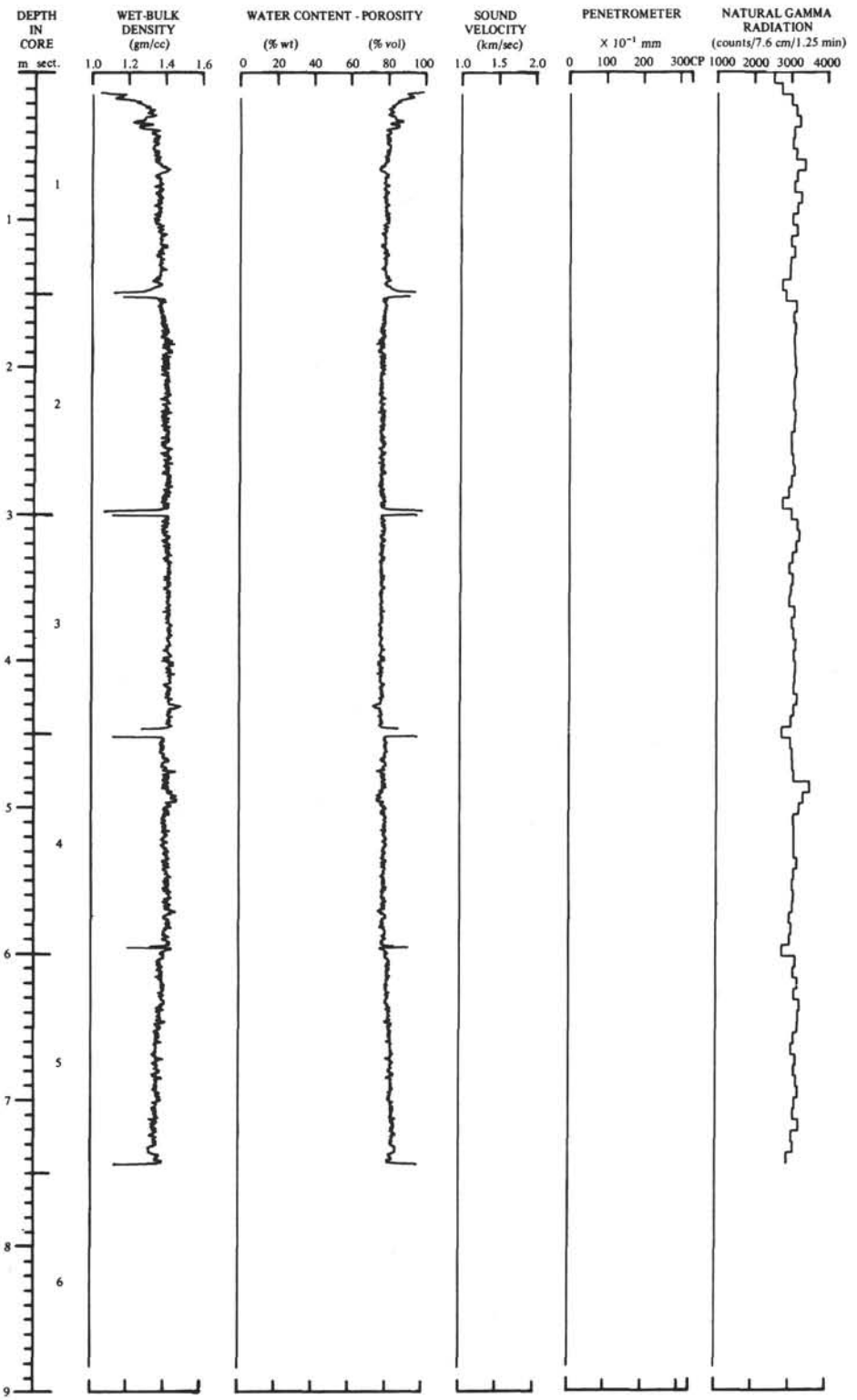

Figure 5A. *Physical Properties of Core 4, Hole 38*

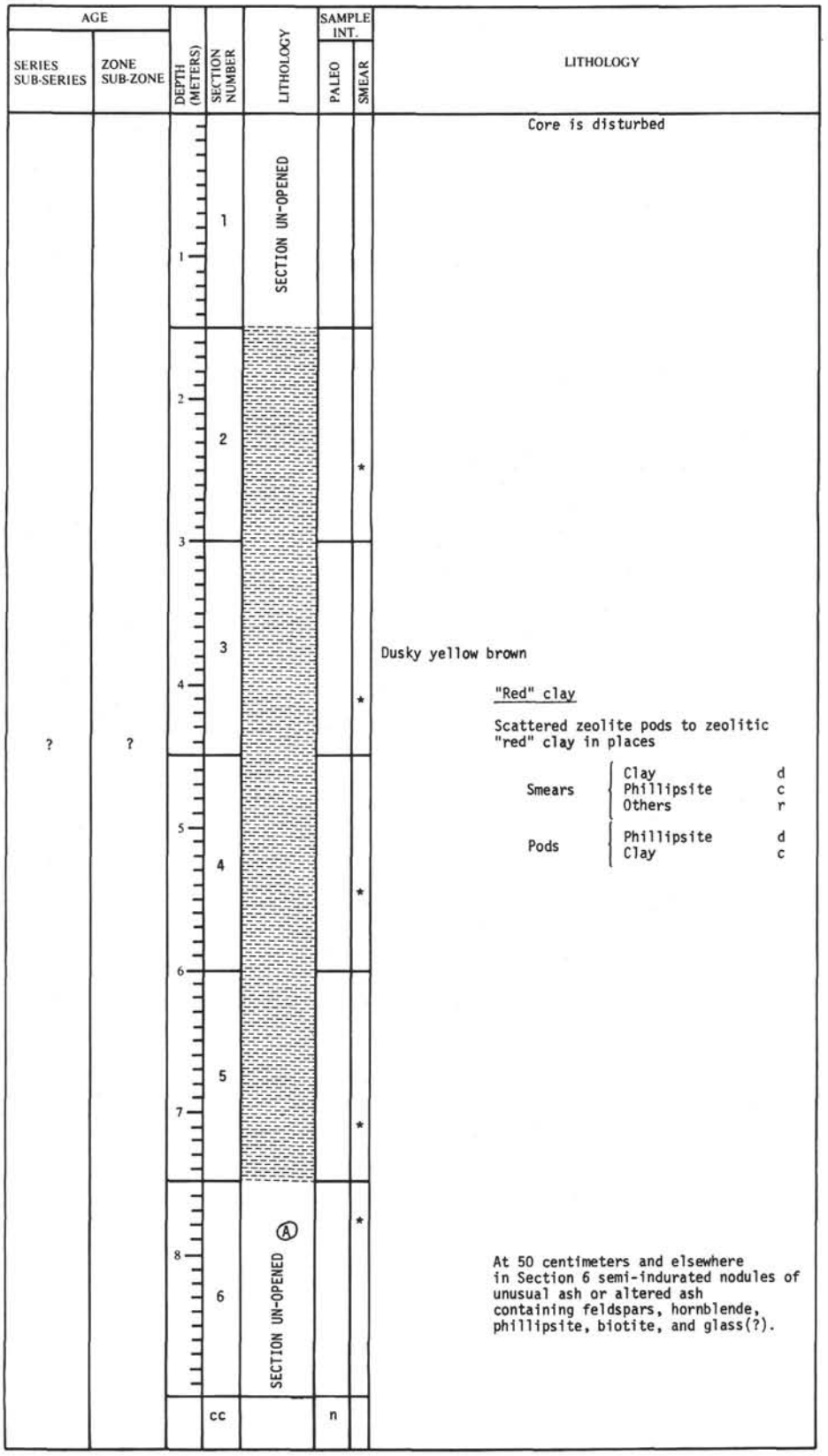

Figure 5B. *Core 4, Hole 38 (21-30 m Below Seabed)*

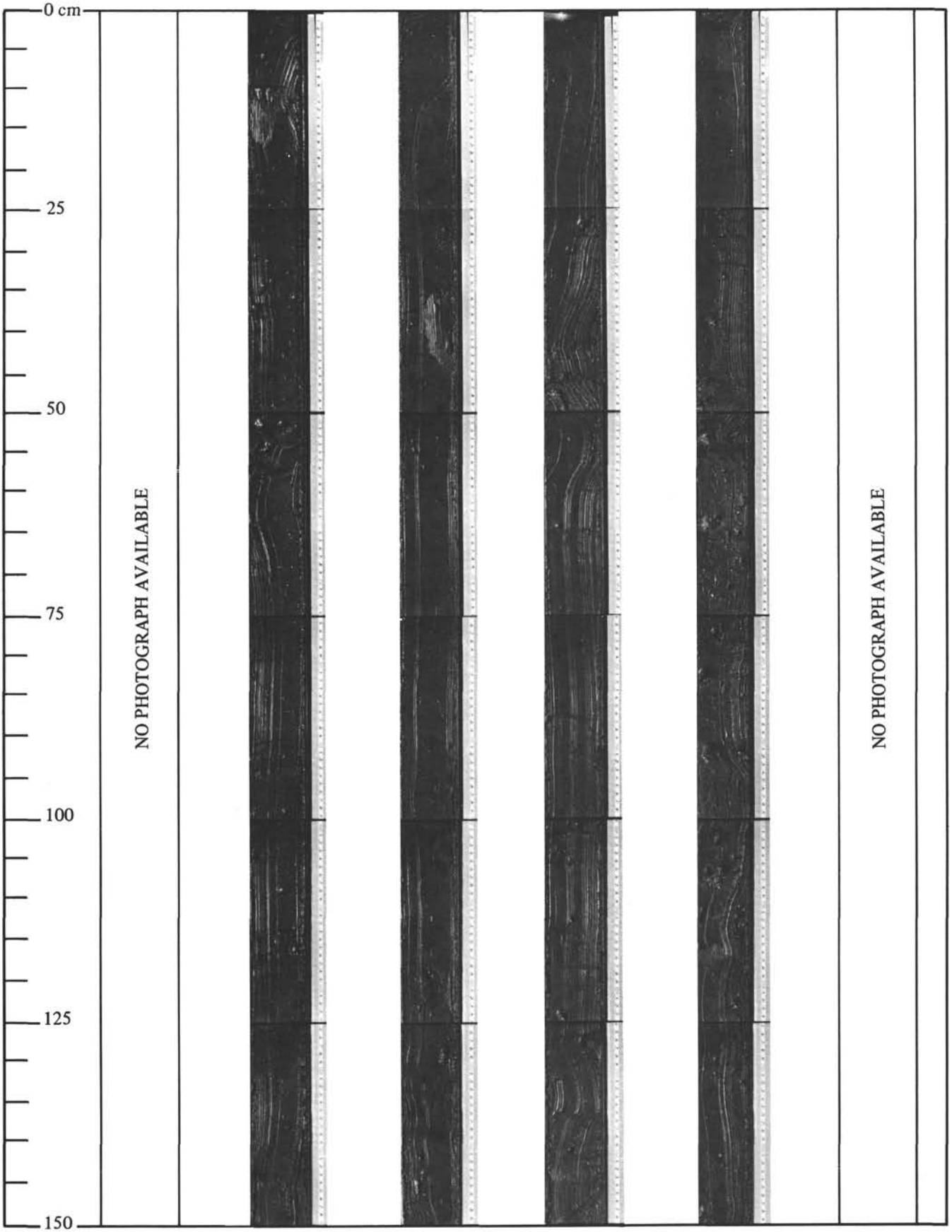

Plate 3. *Core 4, Hole 38*

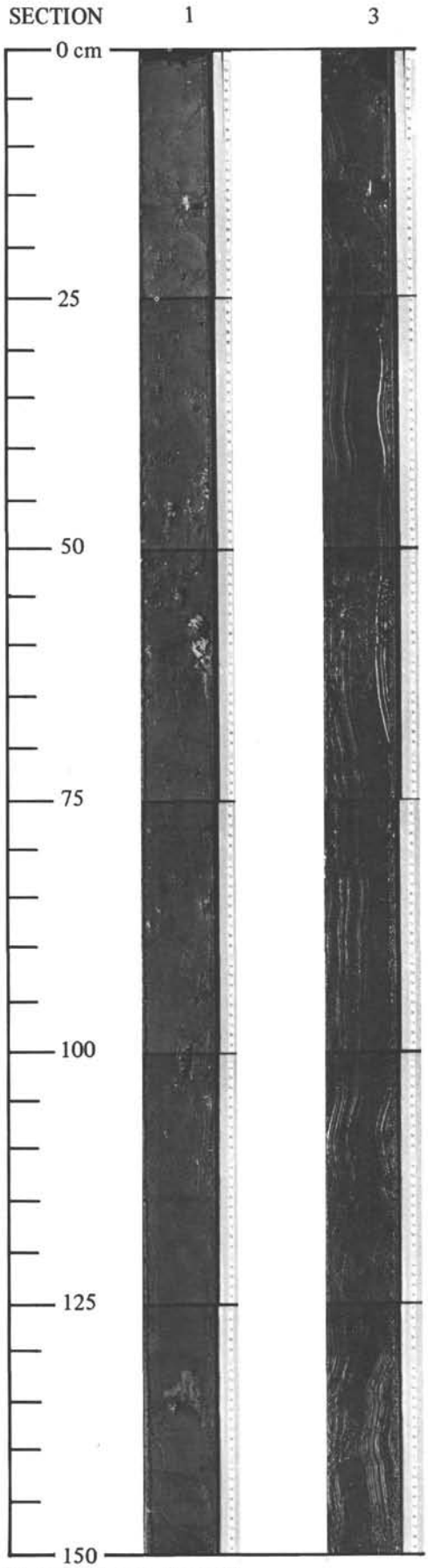

Plate 4. *Core 5, Hole 38*

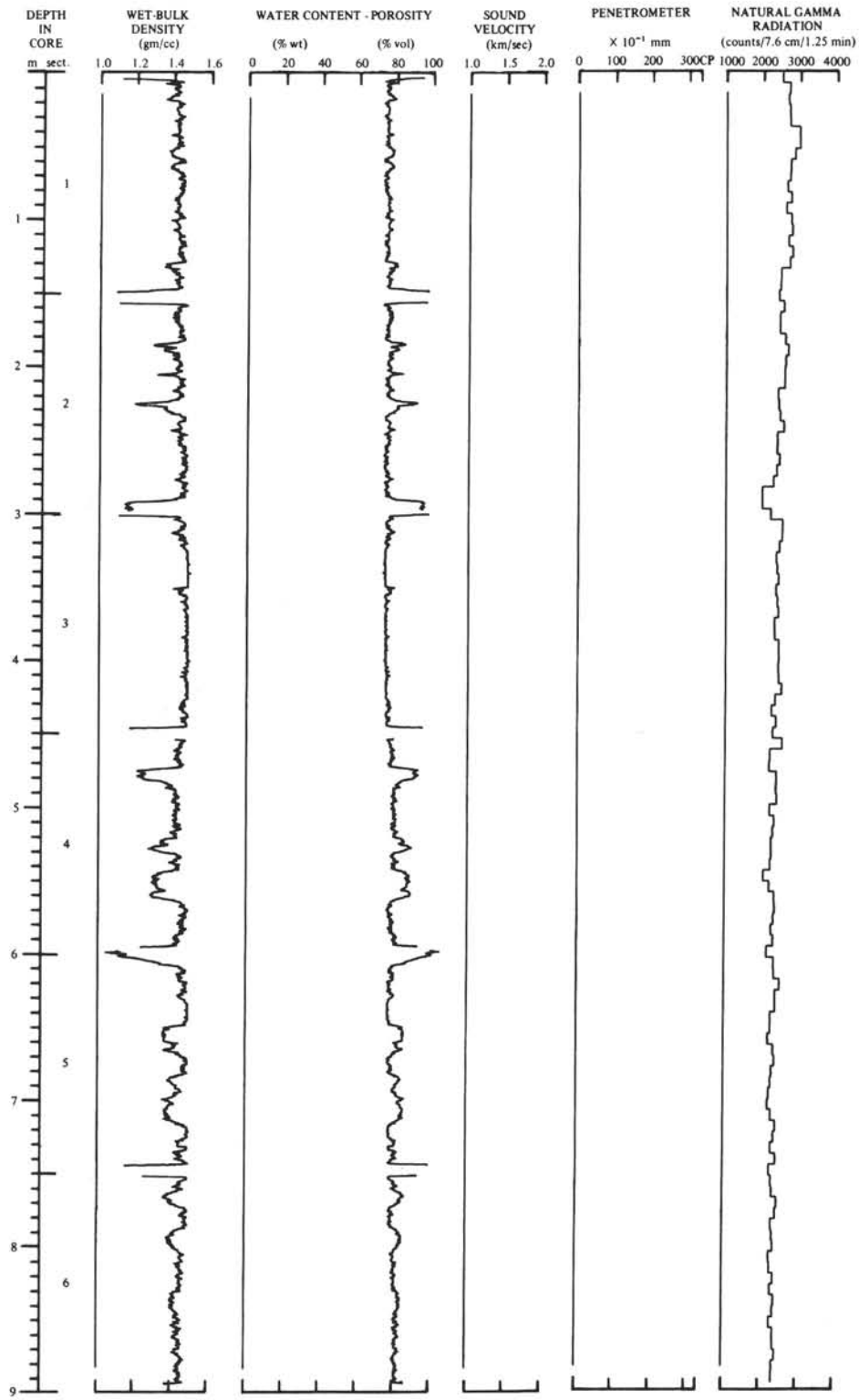

Figure 6A. *Physical Properties of Core 5, Hole 38*

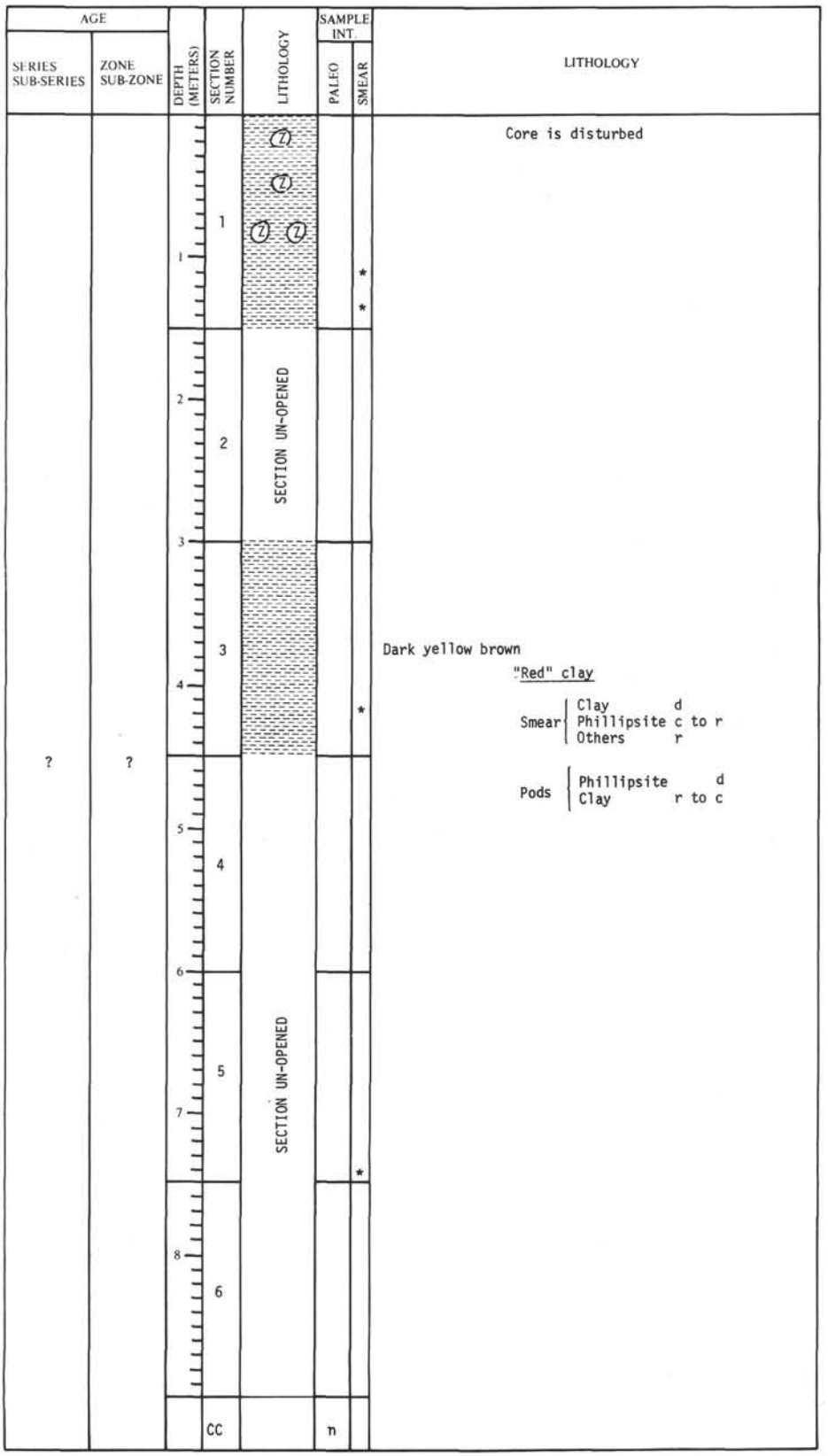

Figure 6B. *Core 5, Hole 38 (30-39 m Below Seabed)*

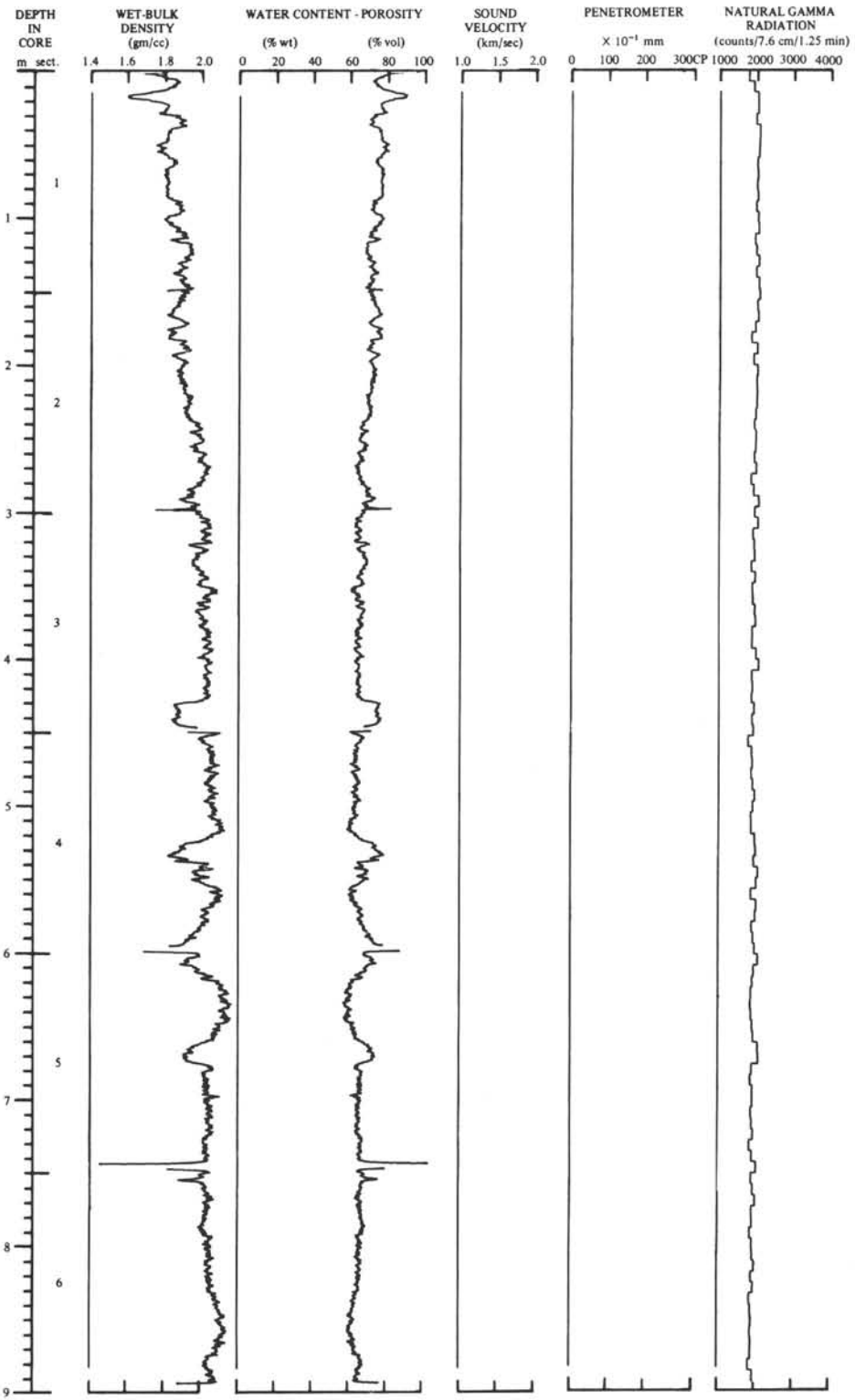

Figure 7A. *Physical Properties of Core 6, Hole 38*

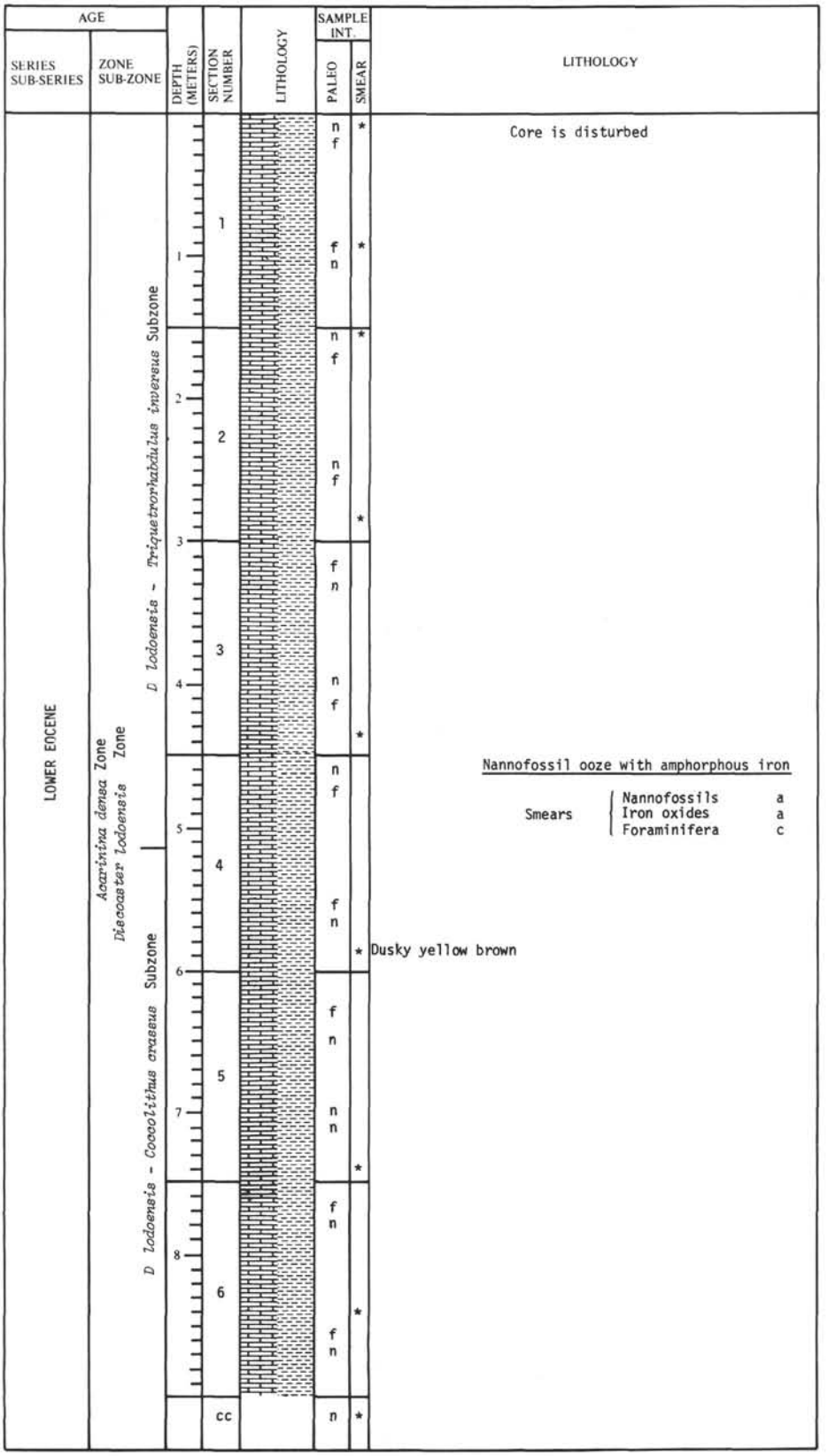

Figure 7B. *Core 6, Hole 38 (39-48 m Below Seabed)*

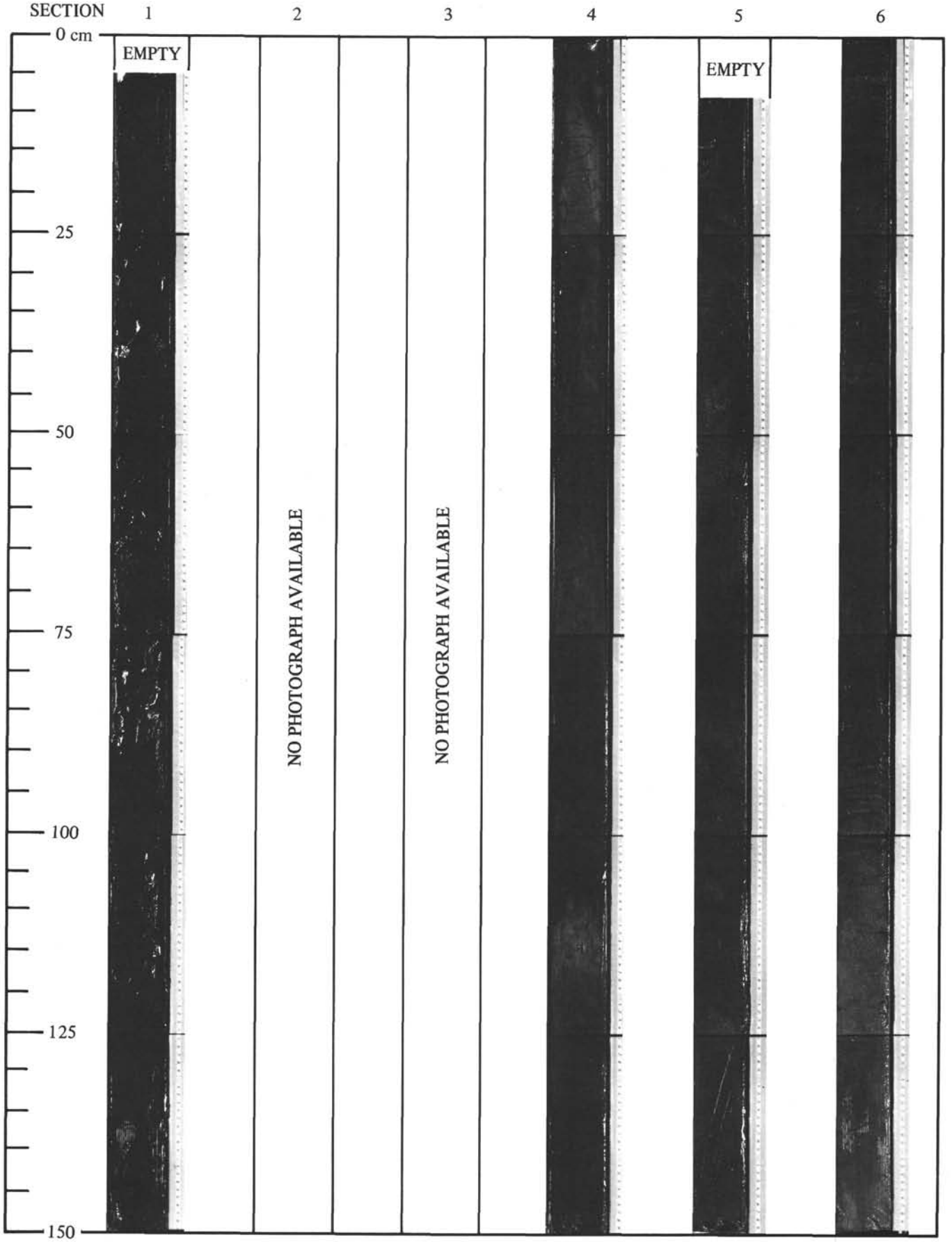

Plate 5. *Core 6, Hole 38*