5. SITE 381

The Shipboard Scientific Staff[1]

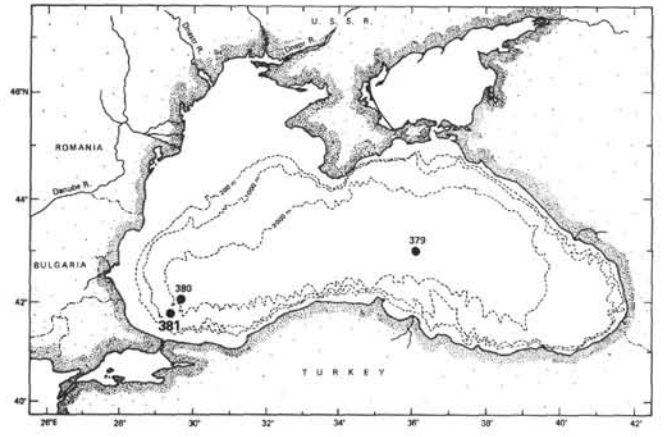


Figure 1. *Bathymetric chart showing the position of Site 381 and other Leg 42B sites in the Black Sea. Contour interval in meters.*

SITE DATA

Dates: 7 June-10 June 1975

Time: 74.5 hours (3.1 days)

Position (Figure 1): 41°40.25'N, 29°24.96'E

Holes Drilled: 1

Water Depth by Echo-Sounder: 1728 corr. meters

Maximum Penetration: 503.5 meters

Total Core Recovered: 269.5 meters from 54 cores

Age of Oldest Sediment: Upper Miocene?

Principal Results: Site 381 was drilled upslope of Site 380 in an area of possible unconformities. The site location is 40°40.25'N and 29°24.96'E, water depth was 1728 m (Figure 1). The hole was continuously cored to a depth of 503.5 meters and 269.5 meters of sediment were obtained from 54 cores. Four heat flow measurements were made. This site, chosen at sea, had a relatively thin sediment cover and thus we hoped to be able to continue the section

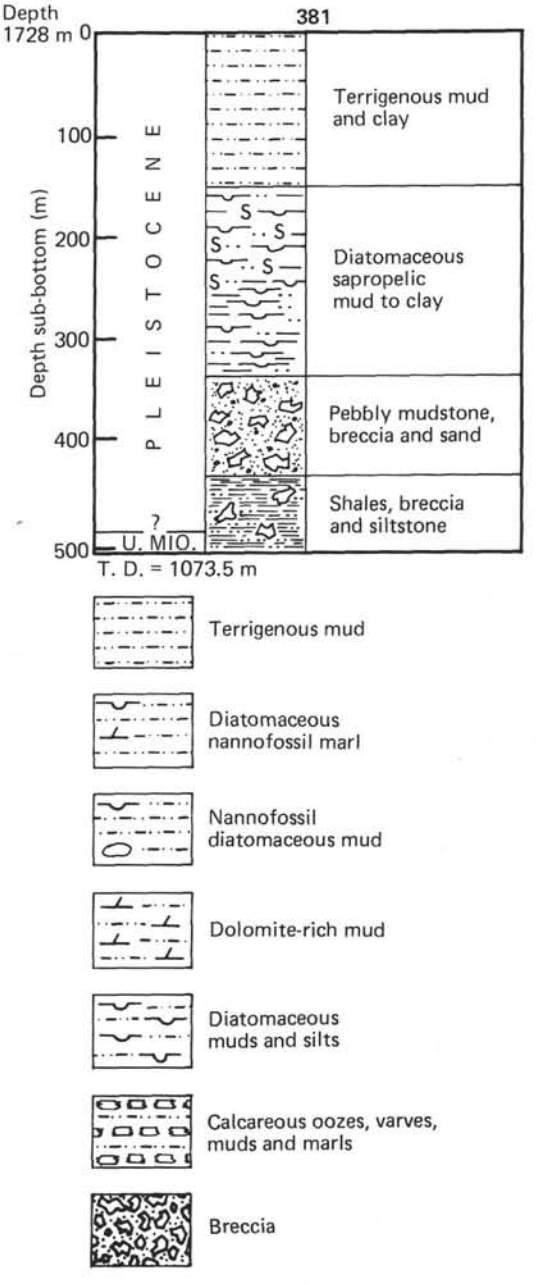


Figure 2. *Lithostratigraphic section recovered at Site 381.*

obtained at Site 380. This strategy was partially successful in that we obtained the oldest sediment yet reached in the Black Sea—upper Miocene.

Nine sedimentary units were described from this site (Figure 2), terrigenous muds and chemical sediments are common as at other sites, while the fauna and flora are

[1]Ross, David A., Woods Hold Oceanographic Institution, Woods Hole, Massachusetts; Neprochnov, Yuri, P. P. Shirshov Institute of Oceanology, Moscow; Degens, Egon T., Geological-Palaeontological Institute, Hamburg, Germany; Erickson, Albert J., University of Georgia, Athens, Georgia; Hsü, Kenneth, Geologisches Institut der Eidgenössiche Technische Hochschule, Zürich; Hunt, John M., Woods Hole Oceanographic Institution, Woods Hole, Massachusetts; Manheim, Frank, University of South Florida, St. Petersburg, Florida; Percival, Stephen, Mobile Oil Corporation, Dallas, Texas; Senalp, Muhitten, Petrol Yeralti Jeologisi Ve Offshore-Servis Sefi, Ankara, Turkey; Stoffers, Peter, Laboratorium fur Sedimentforschung, Heidelberg, Germany; Supko, Peter, National Research Institute for Oceanology, Stellenbosch, South Africa; Traverse, Alfred, Pennsylvania State University, University Park, Pennsylvania; Trimonis, E. A., P. P. Shirshov Institute of Oceanology, Moscow.

likewise not very useful. The presence of breccia, shellhash, and some fauna indicates extremely shallow water conditions during deposition of some of the sedimentary units, subareal exposure is possible.

The faunal record, especially the spores and pollen are not as complete as at Sites 379 and 380; the cool period Beta appears to be absent and Alpha is somewhat reduced—these data are useful but not conclusive in establishing correlation with the other two sites. Pore fluids did not show the fresh-water sequences common in the other sites—salinity decreased below 360 meters which is also different than that of the other sites. It could be concluded that some of the sedimentary section is missing—a point also possibly indicated by some stratigraphic evidence. Some seismic reflectors appear to correlate with stratigraphic units.

BACKGROUND AND OBJECTIVES

The Black Sea, as discussed in Sites 379 and 380, is an extremely large semi-enclosed marine basin. It is connected to the Mediterranean via the Bosporus, a narrow strait having a sill depth of about 50 meters. Because of the shallow connection, changes in sea level can easily cause environmental changes in the Black Sea. The study of the chemistry and paleontology of the Black Sea sediments thus can be very useful in furthering our understanding of the climatic and geologic history of this area and likewise clarify our knowledge of worldwide sea level and climatic changes.

Site 381 was not an originally planned site, but was drilled when we had to withdraw from Site 380 prematurely because of hole problems. Site 381 was chosen from examination of WHOI seismic profile A-II-49 Line 21 (Ross et al., 1974) and a site survey. We chose this area because it had a relatively thin sediment section and hopefully we could, with the short time available, continue the section drilled at Holes 380 and 380A. At the time of our drilling at Site 381 we believed we had only penetrated the uppermost Pliocene at Site 380. Thus our main objective at Site 381 was to continue our quest for a Pleistocene and Pliocene section.

OPERATIONS

This site, which was not a planned one, was chosen on the basis of a previous seismic line and a local survey. *Glomar Challenger* approached the area on a course of 203° T then turned to the northwest running 356°; both these lines passed over potential drilling areas, where the recent sediment section was relatively thin. A third pass at 195° and 6.6 knots resulted in the final site being chosen. A 16-kHz beacon was dropped at 1915Z (2215 LCT) on 7 June 1975 and the gear was quickly retrieved. Pipe was lowered at 2340 LCT and bottom was felt at 0415 LCT on 8 June. Bottom depth was 1728 corrected meters and felt at 1750 meters (Table 1).

The hole was continuously cored to 503.5 meters and 54 cores were taken. The pressure core barrel was given its eleventh test at 195.0 meters. Four heat flow measurements were tried: at 95.0, 190.0, 209.0, and 475 meters. The second was unsuccessful, probably because of too many washings in the hole. Circulation was broken during Cores 4-10 and 12-16. At about 0600 hours on 9 June problems started to develop with this hole, similar to those experienced at Hole 380A. Back pressures and torque built up, and 80,000 lb minimum of extra tension was needed to lift the pipe. One hundred and twenty-five barrels of mud were added, but it appeared that we were not adequately getting rid of cuttings as well as having formation problems. Core 28 was raised after the problem was detected. Back pressure and torque decreased and we continued coring. From Core 39 to Core 47 we encountered very hard brecciated limestone and had very low recovery. A total of 269 meters (53%) recovery was obtained. The last core was on deck at 1745 LCT on 10 June. The hole was filled with mud and we departed about 0100 LCT on 11 June for a 3-hour run to Istanbul and the end of the cruise. The seismic gear was streamed and used for part of the short run.

LITHOLOGY

Site 381 was continuously cored to a depth of 503.5 meters. Although it is the shortest sediment sequence penetrated, it seems that agewise we have encountered the oldest sediments of the three sites. Pollen data indicate a Miocene age for the lowermost cores (Traverse, this volume). Besides the normal terrigenous mud, there is a great variety of chemical sediments (Seekreide, aragonite, siderite, and dolomite). As at the other two sites, biogenic components are not very important sediment constituents. They are found in distinct intervals within the core. Based on shipboard examinations and shore laborary results, the sedimentary section at Site 381 can be divided into nine primary lithofacies (Table 2).

Unit 1—Terrigenous Mud (0-171 m)

This unit corresponds to the terrigenous mud unit encountered in Hole 379A (Subunit 3) and Site 380. Porewater and palynological data, however, suggest that much of the upper terrigenous section cored at Holes 379A and 380 is missing at this site. This is easily explained by the location of the site on the continental slope where removal of sediments by slumping is common. The sediment is a medium bluish gray to greenish black terrigenous mud. Occasionally the sediment has a pale brown color and streaks of pale brownish mud are found throughout the section. The upper 40 to 50 meters were highly disturbed by the drilling operations. The presence of occasional turbidites is indicated by graded bedding. However, the turbidites are mostly composed of silt- and clay-sized material. Basically, this unit is a silty clay which makes this unit much more fine grained than the corresponding units in 379A and 380. The sediment is principally composed of clay minerals (illite, smectite, kaolinite, and chlorite), quartz, feldspar, detrital carbonates (calcite and smaller amounts of dolomite), and some heavy minerals. Average carbonate content is about 17%. Feldspar is not so common as in Hole 379A and no K-feldspar was detected. Epidote, hornblende, and garnet are the most frequent heavy minerals. This heavy mineral assemblage most probably has its origin in the Danube.

Marine diatoms are restricted to the upper part of the unit. They are very abundant in Core 1. Besides

TABLE 1
Coring Summary, Site 381

Core	Date (June 1975)	Time	Depth From Drill Floor (m)	Depth Below Sea Floor (m)	Length Cored (m)	Length Recovery (m)	Recovery (%)
1	8	0450	1750.5–1760.0	0.0–9.5	9.5	5.8	61[a]
2	8	0530	1760.0–1769.5	9.5–19.0	9.5	4.6	48[a, b]
3	8	0615	1769.5–1779.0	19.0–28.5	9.5	5.8	61[b]
4	8	0700	1779.0–1788.5	28.5–38.0	9.5	3.4	36[b, c]
5	8	0747	1788.5–1798.0	38.0–47.5	9.5	5.2	55[b, c]
6	8	0840	1798.0–1807.5	47.5–57.0	9.5	5.65	59[b, c]
7	8	0930	1807.5–1817.0	57.0–66.5	9.5	7.75	82[c]
8	8	1015	1817.0–1826.5	66.5–76.0	9.5	7.6	80[c]
9	8	1105	1826.5–1836.0	76.0–85.5	9.5	9.5	100[b, c]
10	8	1300	1836.0–1845.5	85.5–95.0	9.5	8.5	89[b, c]
11	8	1345	1845.5–1855.0	95.0–104.5	9.5	1.8	19[b]
12	8	1445	1855.0–1864.5	104.5–114.0	9.5	9.1	96[b, c]
13	8	1535	1864.5–1874.0	114.0–123.5	9.5	2.2	23[b, c]
14	8	1630	1874.0–1863.5	123.5–133.0	9.5	9.5	100[b, c]
15	8	1730	1863.5–1893.0	133.0–142.5	9.5	7.5	79[b, c]
16	8	1825	1893.0–1902.5	142.5–152.0	9.5	9.5	100[b, c]
17	8	1930	1902.5–1912.0	152.0–161.5	9.5	8.2	86[c]
18	8	2025	1912.0–1921.5	161.5–171.0	9.5	7.9	83[c]
19	8	2120	1921.5–1931.0	171.0–180.5	9.5	8.8	93[c]
20	8	2302	1931.0–1940.5	180.5–190.0	9.5	0.6	6[c]
21	9	0015	1940.5–1945.5	190.0–195.0	5.0	0.15	3[d]
22	9	0100	1945.5–1950.0	195.0–199.5	4.5	4.3	96[b]
23	9	0245	1950.0–1959.5	199.5–209.0	9.5	8.9	94[b]
24	9	0330	1959.5–1969.0	209.0–218.5	9.5	3.4	36[b]
25	9	0430	1969.0–1978.5	218.5–228.0	9.5	6.4	67
26	9	0530	1978.5–1988.0	228.0–237.5	9.5	6.55	69[b]
27	9	0615	1988.0–1997.5	237.5–247.0	9.5	3.8	40[b]
28	9	0830	1997.5–2007.0	247.0–256.5	9.5	4.7	49[e]
29	9	0920	2007.0–2016.5	256.5–266.0	9.5	6.8	72[b]
30	9		2016.5–2026.0	266.0–275.5	9.5	2.7	28[b]
31	9	1105	2026.0–2035.5	275.5–285.0	9.5	6.2	65[b]
32	9	1200	2035.5–2045.0	285.0–294.5	9.5	9.0	95[b]
33	9	1250	2045.0–2054.5	294.5–304.0	9.5	7.8	82[b]
34	9	1405	2054.5–2064.0	304.0–313.5	9.5	7.5	97[b]
35	9	1505	2064.0–2073.5	313.5–322.0	9.5	8.2	86[b]
36	9	1605	2073.5–2083.0	322.0–332.5	9.5	3.3	35[b]
37	9	1655	2083.0–2092.5	332.5–342.0	9.5	5.0	53[b]
38	9	1800	2092.5–2102.0	342.0–351.5	9.5	0.5	5[b]
39	9	1900	2102.0–2111.5	351.5–361.0	9.5	1.6	17[b]
40	9	2000	2111.5–2121.0	361.0–370.5	9.5	0.5	5
41	9	2107	2121.0–2130.5	370.5–380.0	9.5	0.01	.1
42	9	2345	2130.5–2140.0	380.0–389.5	9.5	0.8	8[e]
43	10	0105	2140.0–2149.5	389.5–399.0	9.5	1.2	13
44	10	0230	2149.5–2159.0	399.0–408.5	9.5	0.1	1
45	10	0345	2159.0–2168.5	408.5–418.0	9.5	0.6	6
46	10	0550	2168.5–2178.0	418.0–427.5	9.5	0.25	25
47	10	0715	2178.0–2187.5	427.5–437.0	9.5	0.1	1
48	10	0830	2187.5–2197.0	437.0–446.5	9.5	8.0	84
49	10	0940	2197.0–2206.5	446.5–456.0	9.5	9.4	99[b]
50	10	1055	2206.5–2216.0	456.0–456.5	9.5	0.0	0
51	10	1215	2216.0–2225.5	465.5–475.0	9.5	7.3	77[b]
52	10	1440	2225.5–2235.0	475.0–484.5	9.5	2.2	23[b]
53	10	1610	2235.0–2244.5	484.5–494.0	9.5	3.8	40[b]
54	10		2244.5–2254.0	494.0–503.5	9.5	9.0	95[b]
Total						268.96	53

[a]Punch in core.
[b]Gassy with voids.
[c]Broke circulation.
[d]Pressure core barrel.
[e]Pumped mud.

TABLE 2
Lithologic Summary, Site 381

Unit	Lithology	Thickness (m)	Interval (m)	Core
1	Terrigenous mud	171	0-171	1-18
	Subunit 1a:terrigenous silty sand	9	161.5-171	
2	Seekreide	2	171-173	19
3	Diatomaceous sapropelic mud	112	173-285	19-31
4	Diatom-rich Seekreide	38	285-323	32-35
5	Aragonite-rich diatomaceous sapropelic mud	~30	~323-352	36-38
6	Pebbly mudstone, breccia, shellhash	~85	~352-437	39-47
7	Laminated black siltstone	~28	~437-465	48-50
8	Breccia	~10	~465-475	51
9	Siltstone	~30	~475-503	52-54

diatoms, *Ammonia beccarii* are also found in the same interval. No indigenous nannofossils are reported. The pollen data indicate a cold climate in Cores 1, 5, and 18; interglacial conditions are found in Cores 9 and 13 (Traverse, this volume).

Subunit 1A—Terrigenous Silty Sand (161.5-171 m)

The base of Unit 1 consists of a medium gray silty sand. The sand is composed of abundant mollusc fragments and well-rounded quartz and feldspar grains (Figure 3). Mica, which is common in the previously encountered sand layers, is totally missing. The sorting of the sand is extremely good with more than 85% of the grains in the interval from 315 to 500 μm. Because of these characteristics, this subunit may be interpreted as a beach deposit.

Unit 2—Seekreide (171-173 m) Core 19

This unit is composed of only 2 meters of *Seekreide*. There is a slight indication of a cyclic pattern (2 to 5 cm thick) of dark greenish gray and lighter greenish gray colors. Carbonate content in the lighter intervals is as high as 57%. The carbonate mineral is calcite. Throughout the section, mottling produced by organisms and occasional pyrite streaks occur. It seems that this unit is correlative with Unit III at Site 380 which implies a major unconformity as all the sideritic muds, the red varved clays and most of the *Seekreide* of Unit II and Unit III of Holes 380/380A is missing. The unconformity may correspond to the beach deposit of Subunit 1A.

Unit 3—Diatomaceous Sapropelic Mud (173-285 m) Cores 19-31

Unit 3 is a dark greenish gray to olive-gray diatomaceous sapropelic mud. Upon cutting the core liners, a faint to strong odor of "proto petroleum" was recognizable. This odor, however, was less pronounced than those released upon opening the sapropelic layers at Holes 380/380A. The unit is mainly composed of clay minerals, quartz, feldspar, siderite, and diatoms. In comparison to Units 1 and 2, a strong increase in the smectite content could be observed. The amount of quartz and feldspar is low (< 20%) with only very little plagioclase. Organic carbon content is about 1.7%. Fresh-water diatoms are abundant from Core 23 up to Core 33 (Schrader, this volume). In general, the diatom content is about 25%. Besides diatoms, siliceous spicules and fish bones are common.

Hardly any reworked coccoliths or detrital carbonates are encountered in this section. Only traces of aragonite needles are found. There is a strong indication that at times of sapropel formation, carbonates (with the exception of siderite or manganosiderite) are unstable and become dissolved. The organic-rich diatomaceous muds are predominantly found in Cores 20-27. Below these, the color gradually changes to light olive and grayish yellow. Two lithified carbonate layers, 3 to 5 cm thick, are present in Cores 26 and 27. X-ray diffraction and chemical data reveal that these layers are composed of manganosiderite. In addition to the two well-recognizable lithified layers, manganosiderite grains occur throughout the sapropelic sediments. They can be identified in smear slides by their morphology (wheat grains and high relief) and are clearly distinguishable from aragonite grains. Two lithified siderite layers were also encountered at Hole 380A, i.e., in Cores 40 to 41. This suggests that massive siderite deposition occurred twice during this time period and can serve as a marker bed for stratigraphic correlation. The presence of the lithified siderite layers as well as the same species of freshwater diatoms indicate a correlation between Unit 3 of Site 381 with Subunit IVa of Holes 380/380A. A cold period is suggested by the pollen data for Cores 19, 22, and 24. The climate was warm from Core 26 onwards.

Unit 4—Diatom-rich Seekreide (285-323 m) Cores 32-35

Unit 4 is a pale olive diatomaceous *Seekreide*. This unit is distinguished from the previous unit by the higher amount of calcite (up to 77%) and the smaller amount of diatoms (<15%). The calcite occurs in a finely laminated pattern which is the result of fluctuating concentrations of calcite, clay, and diatoms. Up to about 50 individual laminae per centimeter were counted. It is conceivable that the lamination is a

Figure 3. *Silty sand composed of abundant mollusc fragments and well-rounded to sub-rounded quartz and feldspar grains.*

consequence of seasonal changes. In addition to the fine lamination, beds of medium bluish gray to greenish gray sediment about 4 cm thick were observed. These larger beds show abundant burrows. A typical example is found in Core 32. Diatoms are present in the whole unit and are interpreted as marine (Schrader, this volume). Fish bones and stenohaline benthic foraminifers (*Bolivina*) (Core 35) are reported by Gheorghian (this volume). The pollen analysis indicate a warm period. This unit can be correlated with Unit IVb of Hole 380A.

Unit 5—Aragonite-rich Diatomaceous Sapropelic Mud (323-352 m) Cores 36-38

Unit 5 is an olive-gray diatomaceous sapropelic mud containing hardly any carbonates. Intercalated in the muds are finely laminated carbonates. Carbonate content in the individual layers ranges up to 69%. Basically, the carbonate consists of aragonite in typical needle-shaped crystals. Besides abundant aragonite, smaller amounts of Mg-calcite are also present. The average diatom percentage in the sapropelic mud is about 30% and organic carbon is as high as 6%.

In Core 37, nannofossils (e.g., *Braarudosphaera bigelowi*) are present and probably enriched in individual layers. It is of note that in all three sites, *Braarudosphaera* and aragonite needles coexist. This is probably a consequence of similar environmental conditions for the formation of aragonite and the optimal living conditions for *Braarudosphaera* which occur at the lower end of the marine salinity scale. The diatoms encountered in this unit are characteristic for a brackish-marine environment (Schrader, this volume). The occurrence of the benthic foraminifer *Bolivina* also indicates stenohaline conditions. The climate was warm as shown by the pollen data (Traverse, this volume). On the basis of lithology and fossil content, this unit can be correlated to Subunit IVc of Hole 380A.

Unit 6—Pebbly Mudstone, Breccia, Shellhash (~352-437 m) Cores 39-47

Unit 6 consists of a mixture of pebbly mudstone, breccia, shellhash, sand, and "drilling mud." Recovery was less than 10%. Often, only a few larger hard dolomitic pebbles were found in the core catcher. In the muds, angular dolomite fragments are common. Thin-section studies of the dolomite fragments reveal a great variety of criteria (e.g., intraclasts, crusts, pelletal dolomites, dolomitized oolites, etc.) indicating a shallow water or even supratidal origin (Stoffers and Müller, this volume). This unit is correlative to Unit IVd of Hole 380A. Pelletal dolomites are also present in

Subunit IVe of Hole 380A. It is suggested that Unit 6 of Site 381 corresponds to IVd and IVe of Hole 380A. The differences observed in both sites are interpreted as facies changes caused by the different location of the two sites (1750 m and 2115 m, respectively). Unit 6 of Site 381 was deposited in an intratidal to supratidal environment whereas at the same time Hole 380A was covered by shallow water. This is supported by the diatom data of Hole 380A (Schrader, this volume). The presence of the pebbly mudstone in Hole 380A in Unit IVd might indicate a shallowing of the sea level with a corresponding subaerial exposure and erosion at Site 381. Whether the upper part of Unit V of Hole 380A can also be correlated to Unit VI of 381 is uncertain.

Marine diatoms occur in Core 41 (Schrader, this volume). The climate was warm as indicated by the pollen data (Traverse, this volume).

Unit 7—Laminated, Black Siltstone (437-465 m) Cores 48-50

Unit 7 is an olive-gray to olive-black, finely laminated siltstone with occasional intercalations of thin silty sand layers. The unit is characterized by abundant quartz and feldspar (>25%) with the feldspar often higher than the quartz content. The clays are predominated by smectite with only minor amounts of illite, kaolinite, and chlorite. No carbonates were found in this unit. The organic carbon content is about 1%.

Besides fish teeth and fish remains, diatoms occur in Core 48 which are thought to indicate a fresh-water environment (Schrader, this volume). The pollen data correspond to a warm climate (Traverse, this volume). This unit was not encountered in Hole 380A.

Unit 8—Breccia (465-475 m) Core 51

Unit 8 is a breccia showing abundant evidence of soft sediment deformation. Clasts indiciate initial flowage deformation. They range in color from olive to gray with some lighter colored ones rich in carbonate. The sediment consists of clay minerals (very abundant smectite, little illite, chlorite, and kaolinite), quartz and feldspar.

Unit 9—Siltstone (475-503 m) Cores 52-54

Unit 9 is mainly a dark greenish gray to olive-gray finely laminated siltstone. It is distinguished from the very similar Unit 7 by the presence of small bands (up to 2 cm) of siderite. No other carbonates were found. The sediment is composed of abundant clay mineral, quartz, and feldspar and smaller amounts of pyrite. Smectite is found in very high concentrations (>80%) and is characterized by an extremely good crystallinity. Hardly any fossil material is present in this unit. Based on the occurrence of a Pine-grass-*Engelhardia* vegetation, this unit is thought to be of late Miocene age which makes the unit the oldest one cored during Leg 42B in the Black Sea.

BIOSTRATIGRAPHY

Calcareous Nannoplankton

One hundred forty-one samples from Site 381 were examined for calcareous nannoplankton for purposes of making age, zonal, and paleoenvironmental determinations. The majority of samples studied were either barren or contained only reworked Cretaceous and Eocene to Oligocene species. Only one interval from Cores 36 through 38 contained indigenous calcareous nannoplankton (see Table 3). Five samples (381-36, CC, 381-37-2, 116-118 cm, 381-37-5, 112-114 cm, 381-37, CC, and 381-38, CC) from this interval had very rare to floods of *Braarudosphaera bigelowi* (Gran and Braarud) together with very rare Cretaceous and Eocene to Oligocene reworked species. No age or zonal determinations can be made based on the stratigraphically long ranging (Jurassic to Recent) *B. bigelowi*. However, Bukry's (1974) data suggest that a nannoflora comprised of only *B. bigelowi* indicates a brackish-water environment.

Other Groups

One hundred and forty samples were examined for planktonic foraminifers for determining paleoenvironment, age, and zonal assignment. No indigenous planktonic foraminifers were observed in any of the samples. Only one sample (381-11, CC) contained a small (juvenile) globigerinid (see foraminifer report by Gheorghian, this volume). In the process of examining the samples for planktonic foraminifers, estimates were noted by the author of other microfossil groups (see Table 3).

The benthic foraminifer, *Ammonia beccarii* (Linne), was found to be present in two samples (381-3, CC [rare] and 381-4, CC [very rare]) (see Table 3). The core-catcher sample from Core 12 contained a very rare benthic foraminifer fauna. The core-catcher sample from Core 43 had species of *Elphidium* which may be reworked.

Diatoms are restricted to two intervals—Cores 1 through 4 and Cores 22 through 38 (see Table 3). In the first interval diatoms occur abundantly or in floods in samples from Core 1; but are very rare in samples from Cores 2 and 4, and are absent in samples from Core 3. Much of the interval from Cores 22 through 38 contains floods of diatoms (see separate reports by Jousé and Mukhina and Schrader for detailed analysis of the diatom flora).

Ostracodes are restructed to two intervals—Cores 1 through 19 and Cores 30 through 37 (see Table 3). Although the frequencies vary from barren to abundant, most samples contain frequent ostracodes. Olteanu and Schneider have each examined selected samples from this site and their analysis can be found in another section of this volume.

Molluscs are found primarily in the upper 18 cores, although they are present in floods in Sample 381-37-2, 112-116 cm and in the core-catcher sample from Core 39 (see Table 3). In many samples, where molluscs are present, they are abundant. The remainder of the core interval, excluding the above-mentioned intervals, is barren of molluscs.

Siliceous spicules occur rarely in the uppermost portion (Cores 1 and 2) of the hole (see Table 3). From Cores 3 through 18 they are absent. They become a more important part of the biota from Cores 19 through 38 and are absent from Cores 39 through 54.

The only other microfossils present are fish teeth and fish remains. The former are found rare in two samples (381-23, CC and 381-28-5, 54-56 cm). Fish remains are frequent in Sample 381-32, CC; common in Sample 381-35-5, 59-61 cm; and occur in floods in Samples 381-37-2, 116-118 cm and 381-49-3, 130-132 cm.

PALYNOLOGY

All core-catcher samples recovered, Cores 1-54, contained palynomorphs, extracted by conventional palynological methods. Shipboard, the procedure consisted of prolonged heating in 20% HCl, followed by heating in Calgon detergent, and a float-sink procedure with $ZnCl_2$ specific gravity 2.0 shore procedure was the same, except that 52% HF digestion was substituted for detergent-dispersion. This produced cleaner and more concentrated residues, but an interesting aspect of the shipboard work was that acceptable preparations were obtained from all samples without the use of HF.

"Steppe-Forest Index" (SFI) as a general climatic indicator, was calculated for each core-catcher sample, using the following ratio:

$$\frac{\textit{Artemisia} + \text{Chenopodiaceae} + \text{Amaranthaceae}}{(\text{The above} + \textit{Pinus} + \textit{Cedrus} + \textit{Picea} + \textit{Abies} + \textit{Quercus} + \textit{Alnus} + \text{Ulmaceae (and other tree fenera)}}$$

The larger the number obtained, the more indication of comparatively cool/dry conditions in the Black Sea drainage. Modern surface sediments of the Black Sea yield a SFI of about 10%.

A "Marine-Influence Index" (MI) was calculated as the following ratio:

$$\frac{\text{Dinoflagellates} + \text{Acritarchs}}{\text{Dinoflagellates} + \text{Acritarchs} + \text{Total pollen}}$$

Note, however, that some dinoflagellates are fresh-water forms, and "acritarchs," while presumably algal, are by definition a heterogeneous group of unknown exact relationship, and presumably include fresh-water forms. Even the modern Black Sea is far from fully marine and yet surface sediments produce a high (ca. 40%) MI. A very low MI does indicate fully non-marine environment, however. One especially characteristic bag-like dinoflagellate, as yet unnamed ("dinoflagellates 19-20"), is plotted separately as a percent of dinoflagellates and acritarchs because its appearance in the record is characteristically sudden and dramatic. (This fossil was known shipboard as "bag 51".)

The general palynological results obtained are shown in Figure 4. It appears that the record at Site 381 is interrupted—incomplete as compared to Holes 380/380A. The SFI shows that Cores 1-6 represent a cool period, probably "Gamma." The comparatively high MI and the abundance of "dinoflagellates 19-20" quite clearly mark Core 11 as the upper limit of cool period "Alpha." Core 27 marks the end of "Pre-Alpha," equivalent to Core 35 of Hole 380A. Cool period "Beta" of 380-380A is missing, and "Alpha" is somewhat reduced. Core 35 of Site 381 seems clearly equivalent to Core 54 of Hole 380A. According to interpolations from standards suggested by van der Hammen and others (1971) at Core 43 (based on occurrence of *Engelhardia* pollen), and Cores 48-54 are Miocene, based especially on *very* abundant *Engelhardia*, abundant palm pollen, and several *Tricolpites* spp. The palynomorphs in Cores 43-54 of Site 381 and Cores 70-80 of Hole 380A also agree in having a very characteristic, unusual greenish color.

GEOCHEMISTRY

Gas Analysis

Methane was present in most of the cores at Site 381 as in the previous Black Sea sites. The methane to ethane mole ratio varied from about 15,000 near the top to about 1,250 at the bottom. Carbon dioxide was also present as at the other sample sites.

Pore Fluids

At Site 381 the fresh-water sequences noted at other sites and in virtually all piston cores were completely absent. Salinity began increasing immediately with depth. By Core 3 interstitial salinites had exceeded Mediterranean levels. However, at 100 meters depth and 65‰, salinities leveled out and remained essentially unchanged until below 360 meters. At this point salinities as well as calcium and magnesium concentrations declined to lower levels. The core samples were of excellent quality, and contamination was excluded as a significant factor in this reversal. Site 381 is not far from *Atlantis* II Core 1460, which alone among all Black Sea piston cores showed an increase, rather than a decrease in salinity with depth (see Fig. 1, Manheim and Schug, this volume).

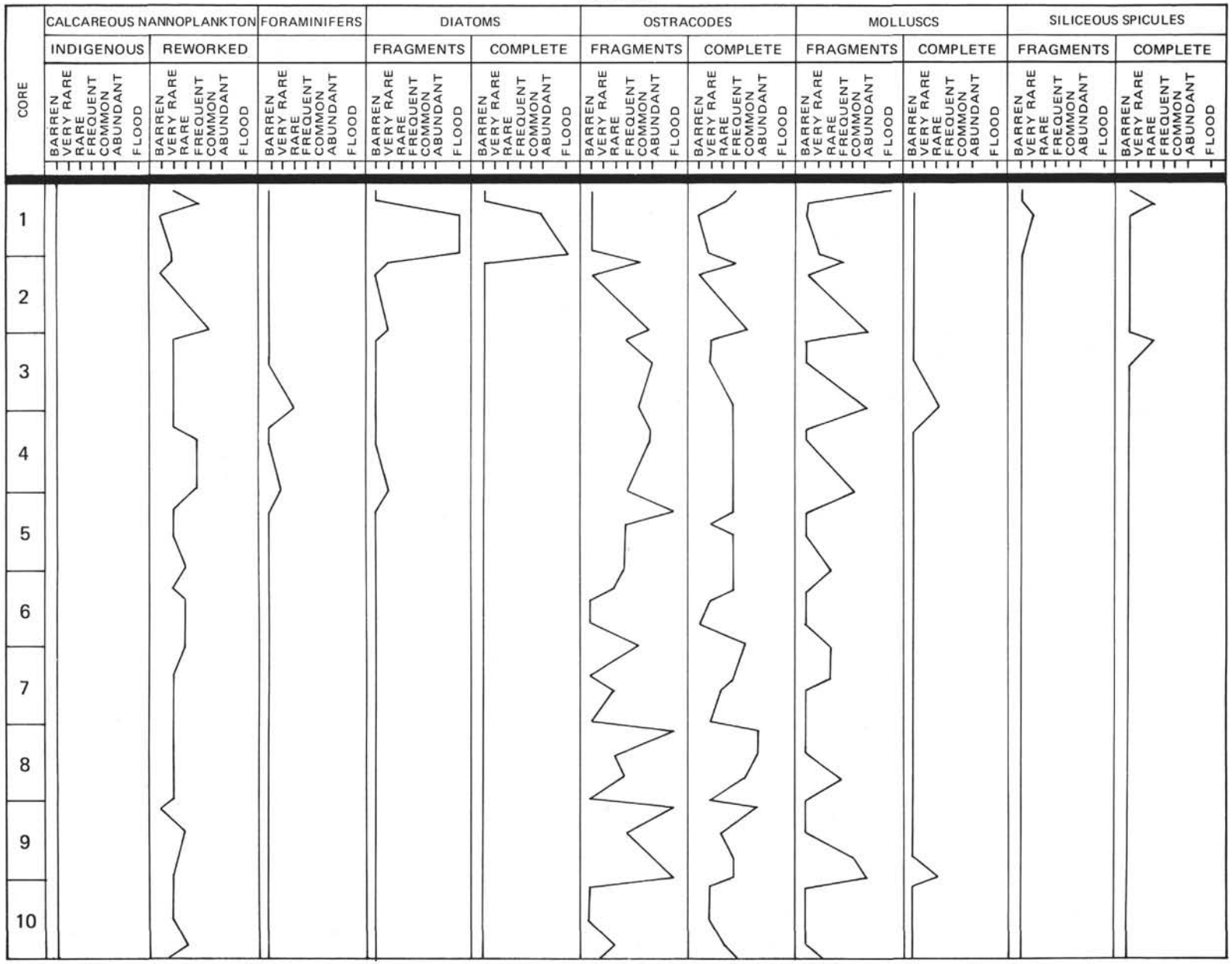
The conclusions from the interstitial profiles are that the upper sediment section has either been eroded away or was not deposited. In addition, the reversal in salinity below the dense cemented limestones and dolomites in the lower part of the hole indicate that the hypersaline episode is not due to deeper lying evaporitic strata but was generated within the Plio-Pleistocene section of the Black Sea.

One should also comment on the relatively low salinities, as well as lower Ca and Mg values, encountered at Site 381 in comparison with Site 380. These may be explained by the thinness of the evaporite section representing the hypersaline period, and the resulting diffusive loss of interstitial salt.

Formation factors at Site 381 follow the typical pattern of increasing from 3-5 near sea floor strata, to 6-10 in intermediate strata. However, in the hard, cemented limestone and dolomitic section below 350 meters (Core 38) a value of 256 was measured in a conglomeratic carbonate rock of very low water content (1.0%). We do not have good information on the continuity of the 80-90-meter section of tightly cemented and highly lithified sediments, but we must assume that it is considerable. Though the rocks in

TABLE 3
Distribution of Various Fossil Groups in Hole 381 at Site 381 (RW = Reworked)

HOLE 381



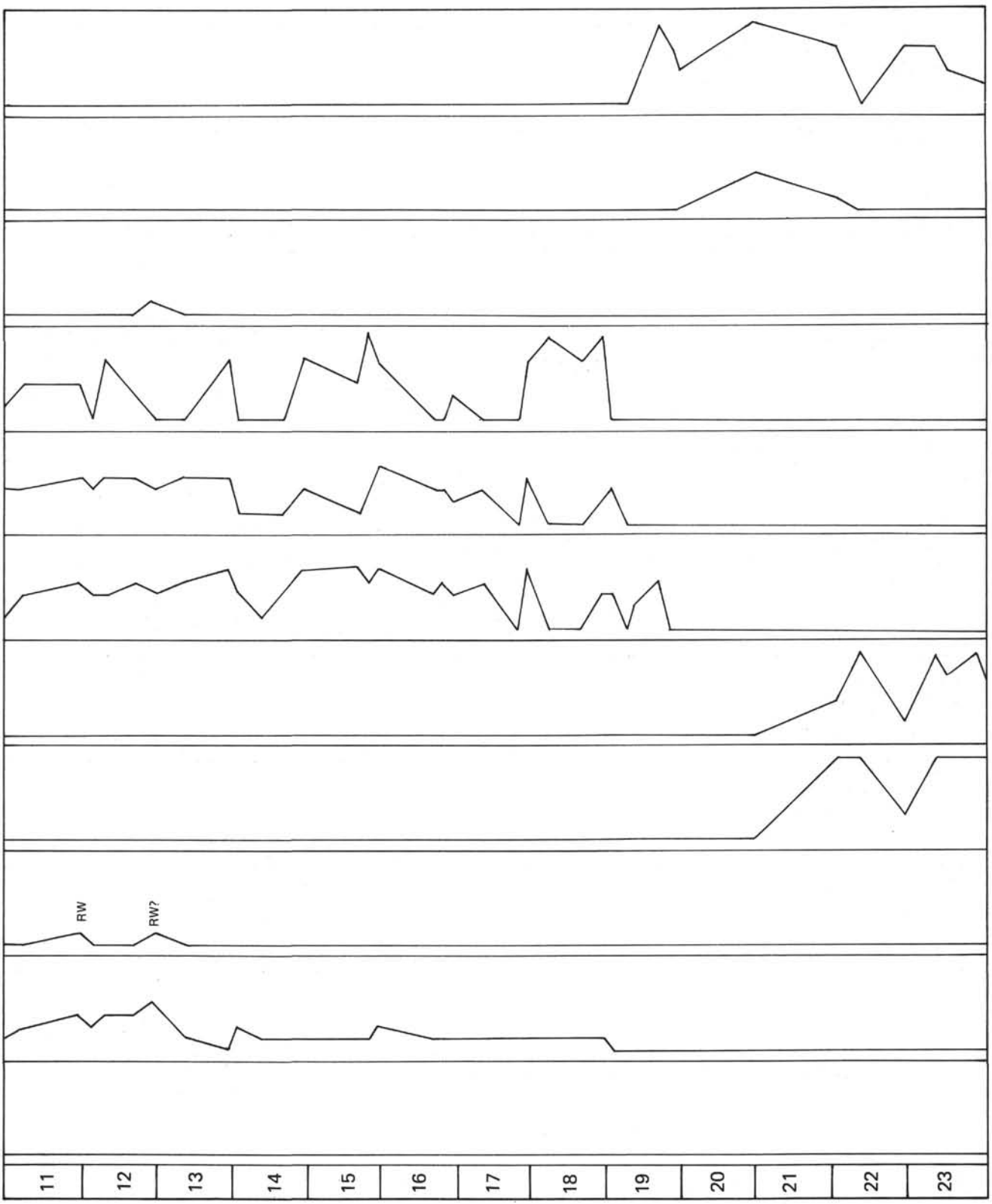

RW
RW?
11
12
13
14
15
16
17
18
19
20
21
22
23

TABLE 3 – *Continued*

HOLE 381

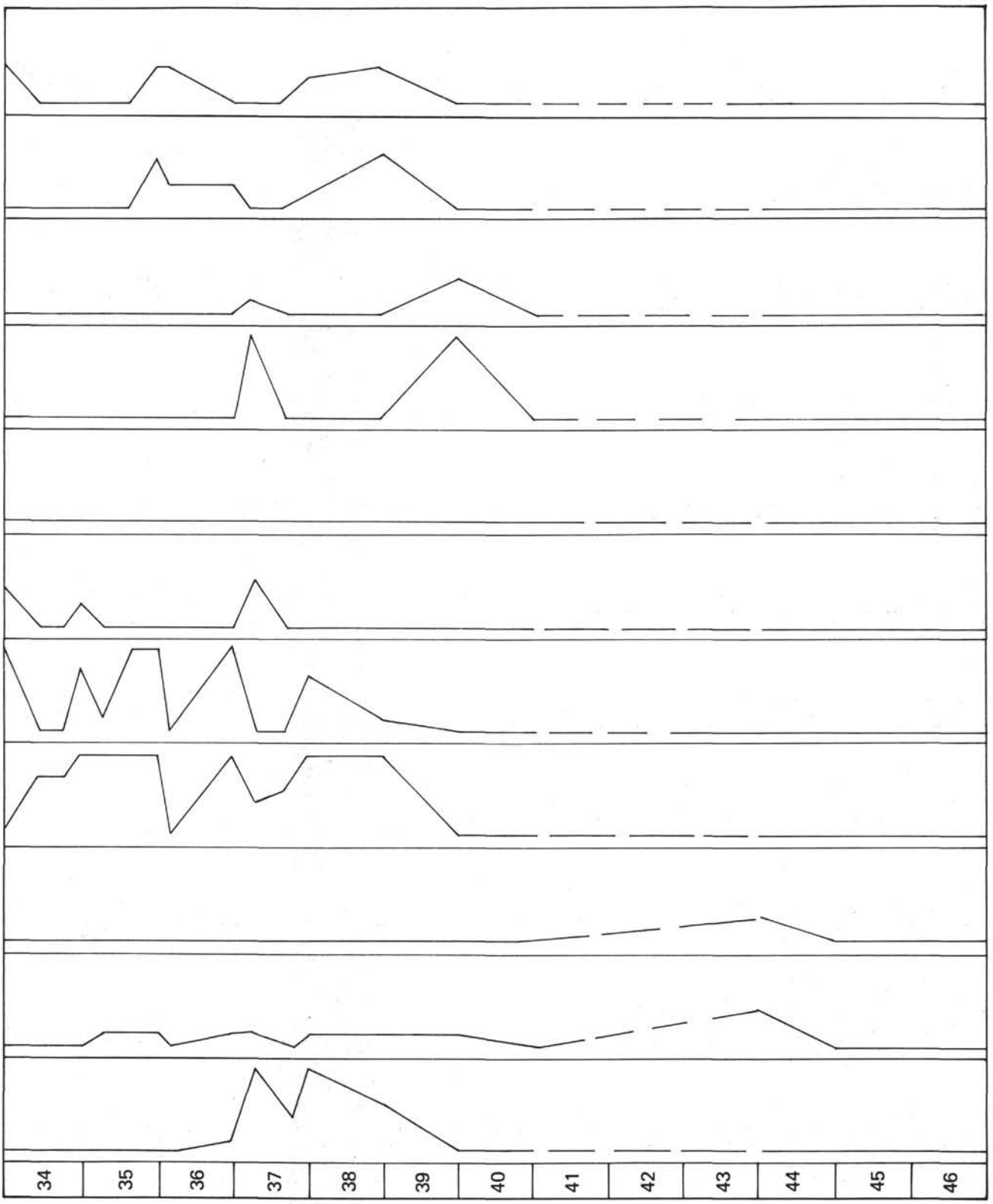

34
35
36
37
38
39
40
41
42
43
44
45
46

TABLE 3 – *Continued*

HOLE 381

CORE	CALCAREOUS NANNOPLANKTON		FORAMINIFERS	DIATOMS		OSTRACODES		MOLLUSCS		SILICEOUS SPICULES	
	INDIGENOUS	REWORKED		FRAGMENTS	COMPLETE	FRAGMENTS	COMPLETE	FRAGMENTS	COMPLETE	FRAGMENTS	COMPLETE
	BARREN, VERY RARE, RARE, FREQUENT, COMMON, ABUNDANT, FLOOD	BARREN, VERY RARE, RARE, FREQUENT, COMMON, ABUNDANT, FLOOD	BARREN, VERY RARE, RARE, FREQUENT, COMMON, ABUNDANT, FLOOD	BARREN, VERY RARE, RARE, FREQUENT, COMMON, ABUNDANT, FLOOD	BARREN, VERY RARE, RARE, FREQUENT, COMMON, ABUNDANT, FLOOD	BARREN, VERY RARE, RARE, FREQUENT, COMMON, ABUNDANT, FLOOD	BARREN, VERY RARE, RARE, FREQUENT, COMMON, ABUNDANT, FLOOD	BARREN, VERY RARE, RARE, FREQUENT, COMMON, ABUNDANT, FLOOD	BARREN, VERY RARE, RARE, FREQUENT, COMMON, ABUNDANT, FLOOD	BARREN, VERY RARE, RARE, FREQUENT, COMMON, ABUNDANT, FLOOD	BARREN, VERY RARE, RARE, FREQUENT, COMMON, ABUNDANT, FLOOD
47											
48											
49											
50											
51											
52											
53											
54											

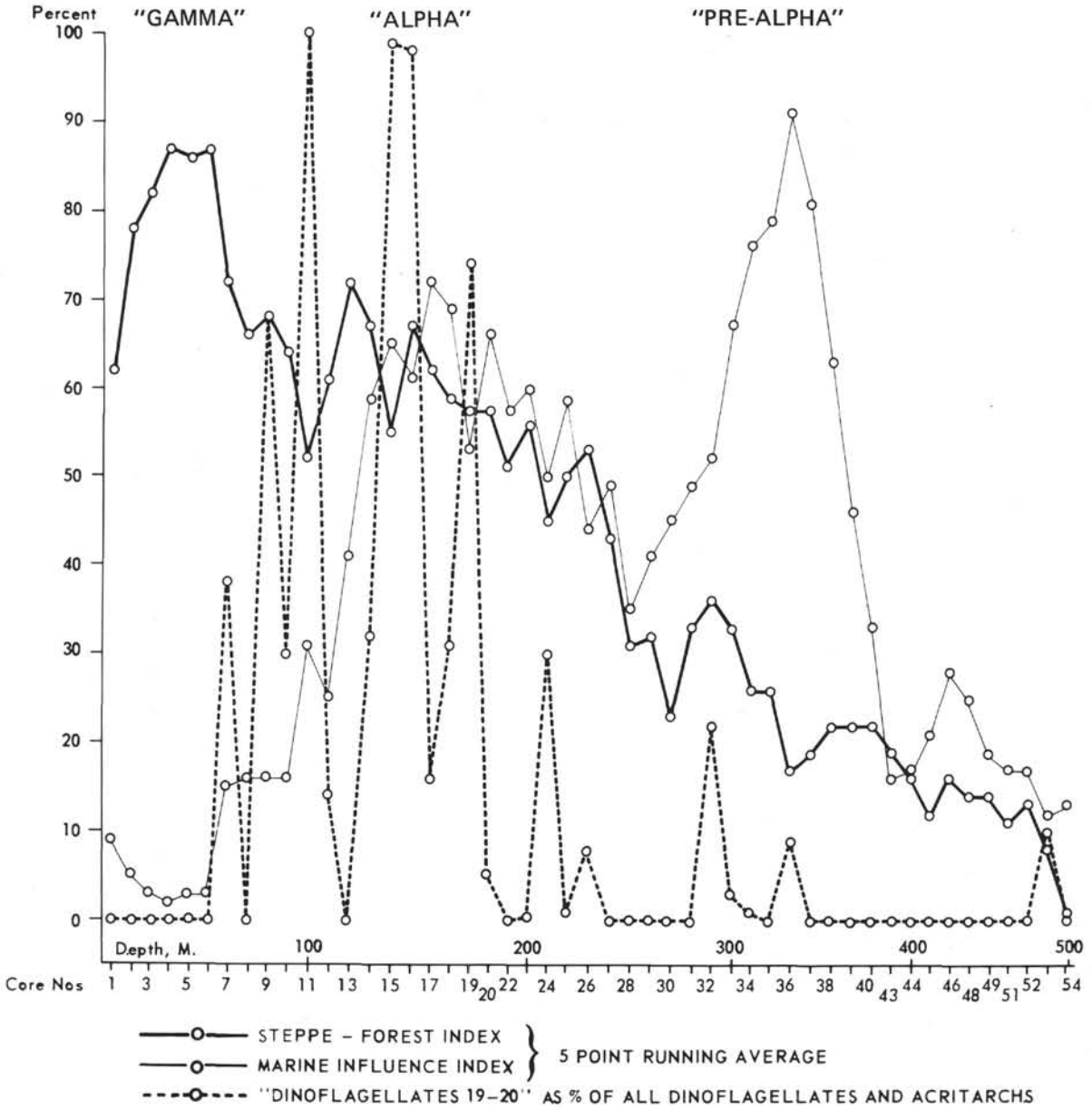


Figure 4. *Basic palynological data, Site 381, based on core-catcher samples (see similar chart for Site 380).*

question have a measurable permeability, diffusive communication in this zone may be estimated to be reduced by at least a factor of 10 over overlying sediments, with a distinct possibility that diffusive permeabilities in the section are reduced as much as fifty-fold over normal sediments in the section.

PHYSICAL PROPERTIES

Sound Velocity, Water Content, Wet Bulk Density, and Thermal Conductivity

No sound velocity data were obtained between 20 and 382 meters subbottom, nor below 399 meters. Velocities determined in the terrigenous and diatomaceous muds recovered from the uppermost 20 meters were in the range 1.47 to 1.56 km/sec. Velocities between 5.95 and 6.50 km/sec were measured on dolomite cobbles recovered in the core catcher at 382 and 399 meters subbottom.

Water content decreases from values as high as 52% just below the mudline to about 25% just above the base of the terrigenous mud and clay layer at about 150 meters. Water content then increases downwards in the diatomaceous sapropelic muds to about 300 meters subbottom, where, on the basis of only a few widely separated measurements, water content appears to once again decrease to about 20% in the siltstones and breccias near the bottom of the hole (Figure 5).

Wet bulk density values are unusually low at this site, and show a weak tendency to decrease with depth to the base of the diatomaceous sapropelic mud at 280 meters subbottom. A slight increase from 1.45 to about 1.60 g/cc occurs in the diatomaceous micrite between 280 and 335 meters subbottom. Density data are missing between 335 and 443 meters subbottom, but are much higher in the interval from 443 to 501 meters subbottom (1.85 to 2.03 g/cc) than were measured above (Figure 6).

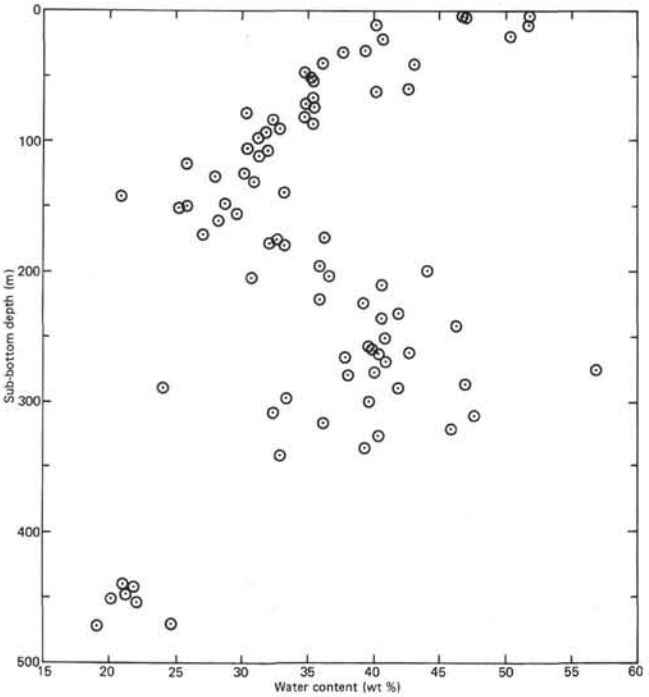


Figure 5. *Plot of water content data versus subbottom depth at Site 381. Water content data were calculated by weighing sediment samples obtained by the syringe technique before and after drying.*

Thermal conductivity data between the mudline and 166 meters subbottom are highly variable and low (2.32 ±0.25 mcal/cm sec°C, n * 34). The mean of 18 values between 5 and 66 meters subbottom (2.21 ±0.21 mcal/cm sec°C) is only slightly lower than the mean of 16 values between 107 and 167 meters subbottom (2.43 ±0.25 mcal/cm sec°C), thus the usual tendency for conductivity to increase downwards is poorly documented at this site.

CORRELATION OF REFLECTION PROFILES AND LITHOLOGY

The seismic profile taken by *Glomar Challenger* on a northerly approach to Site 381 is shown in Figure 7 (left part). On the basis of these data the sedimentary column was divided into four units which show good correlation with the main lithological division (see right part in Figure 7). Reflector A corresponds to the boundary between terrigenous and diatomaceous mud

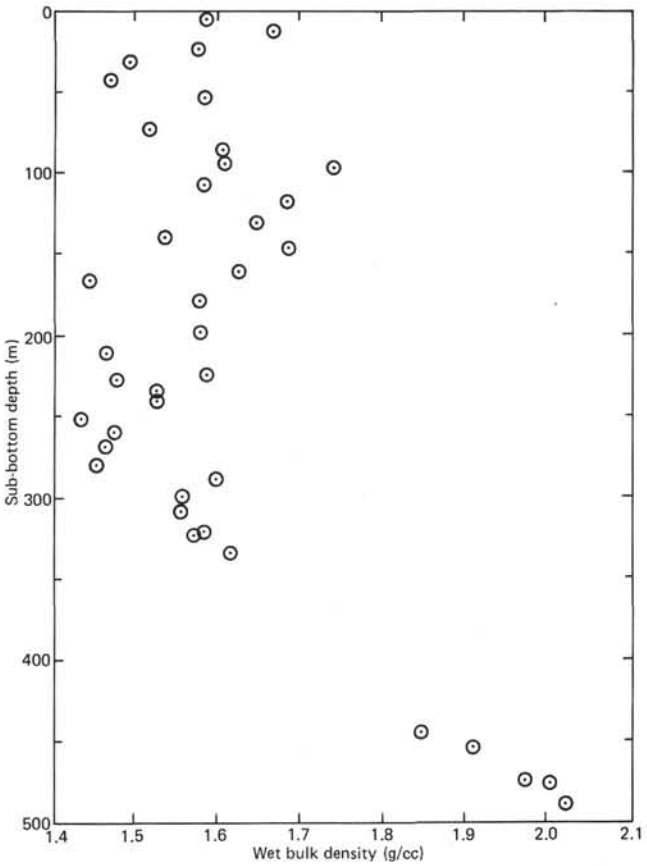


Figure 6. *Plot of wet bulk density data versus subbottom depth at Site 381. Wet bulk density data were obtained using the gamma ray attenuation technique.*

and clay. Reflectors B and C correspond, respectively, to the top of the mudstone and siltstone breccia.

REFERENCES

Bukry, D., 1974. Coccoliths as paleosalinity indicators—evidence from Black Sea. *In* Degens, E.T. and Ross, D.A. (Eds.), The Black Sea—geology, chemistry, and biology: Am. Assoc. Petrol. Geol. Mem. 20, p. 353-363.

Ross, D.A., Uchupi, E., and Bowin, C.O., 1974. Shallow structure of Black Sea. *In* Degens, E.T. and Ross, D.A. (Eds.), The Black Sea—geology, chemistry, and biology: Am. Assoc. Petrol Geol. Mem. 20, p.

Van der Hammen, T., et al., 1971. The floral record of the Late Cenozoic of Europe. *In* K.K. Turekian, (Ed.), The Late Cenozoic Glacial Ages: Yale University Press, p. 391-424.

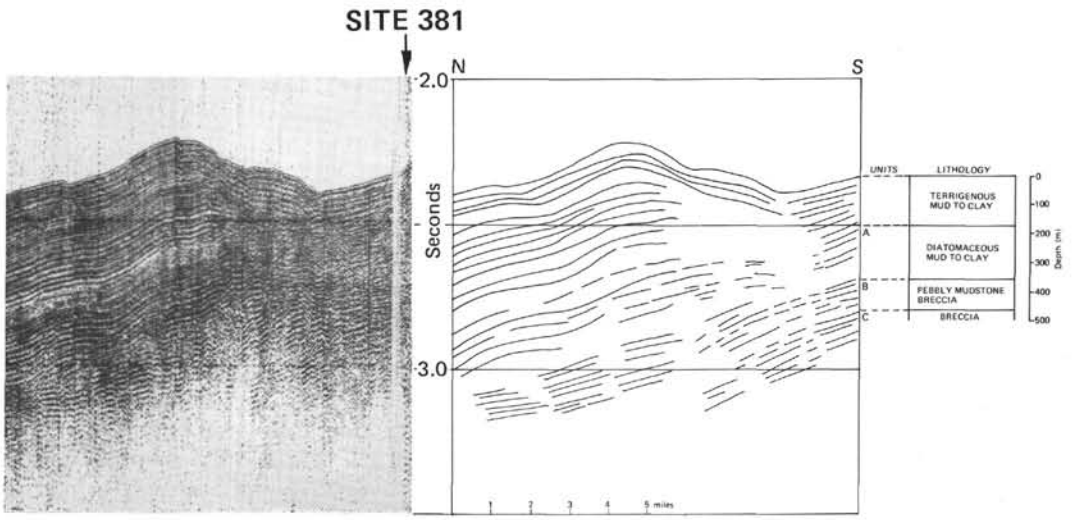


Figure 7. *Seismic profile record made approaching Site 381 and interpretation.*

Site 381 Hole Core 1 Cored Interval: 0.0-9.5 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5	VOID		60	5GY 6/1
							1.0				Bands of 5B 6/2 & 5G 4/1
										130	
						2					5GY 6/1
										60	5B 7/1 to 5B 5/1
											2.5Y 4/0
										130	
						3				20	
										80	5Y 4/1
						4		ORG. CH.			
						Core Catcher					
		S	I	I	A						

Greenish gray (5GY 6/1) to dark gray (2.5Y 4/0) TERRIGENOUS MUD. Lower part of the core is a dark gray (5Y 4/1) DIATOMACEOUS MUD.

DOMINANT LITHOLOGY:
SS 2-60 cm
[0, 30, 70]
20% Quartz and Feldspar
70% Clay
<5% Pyrite
10% Carb. unspec.
Tr Nannos

SS 3-80 cm
25% Quartz and Feldspar
35% Clay
10% Pyrite
10% Carb. unspec.
30% Diatoms

Site 381 Hole Core 2 Cored Interval: 9.5-19.0 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5			27	Medium bluish gray (5B 5/1) to dark gray (5Y 4/1) TERRIGENOUS MUD with some DIATOMACEOUS MUD intervals.
							1.0				5Y 4/1
										140	5Y 5/1
											5GY 6/1
											5B 7/1
						2					5B 5/1
											5Y 4/1
						3		ORG. CH.			
						Core Catcher					
			–	–	A						

DOMINANT LITHOLOGY:
SS 1-140 cm
[10, 25, 65]
20% Quartz and Feldspar
70% Clay
5% Pyrite
5% Carb. unspec.
Tr Nannos

Explanatory notes in Chapter 1

Site 381 Hole Core 3 Cored Interval: 19.0-28.5 m

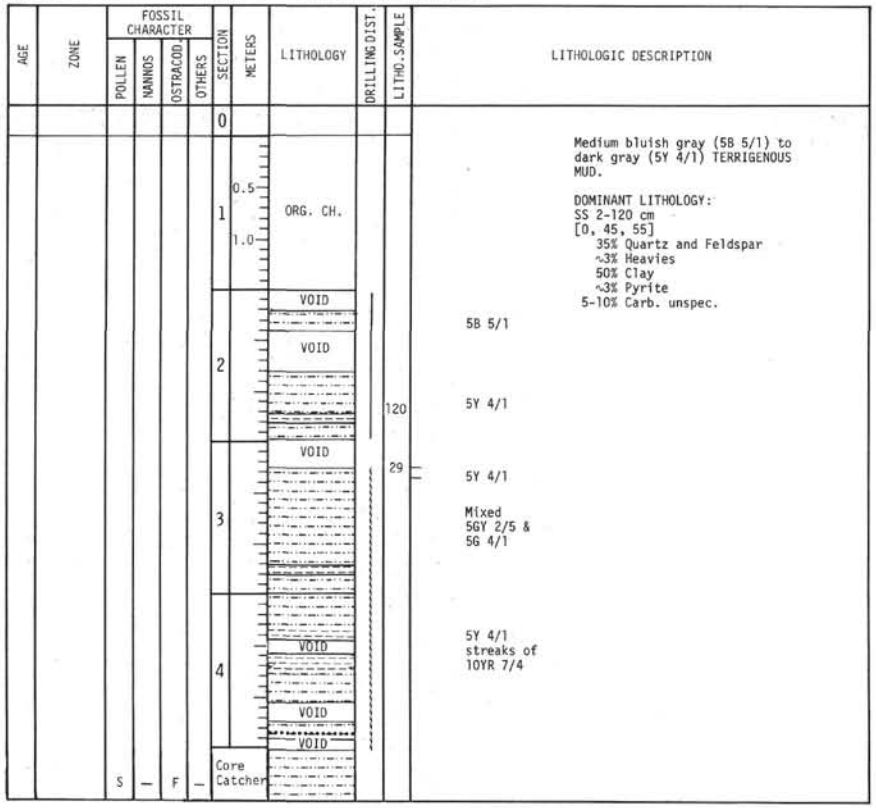
AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5	VOID			Medium bluish gray (5B 5/1) to greenish black (5G 2/1) TERRIGENOUS MUD to CLAY. 5B 5/1 5G 5/1 Lower part of Section 3 is a DIATOMACEOUS MUD. 5G 2/1 DOMINANT LITHOLOGY: 5G 5/1 SS 1-115 cm 5Y 5/2 [5, 30, 65] 5B 5/1 25% Quartz and Feldspar Tr Heavies 5B 5/1 60% Clay 5% Pyrite 10% Carb. unpsec. Tr Nannos 5G 2/1 MINOR LITHOLOGY: SS 3-130 cm 5B 5/1 [10, 30, 40] 15% Quartz and Feldspar 55% Clay 5% Pyrite 5% Carb. unspec. 20% Diatoms Grades into, and is interbedded (1-2 cm) with 5G 2/1 5Y 4/1
							1.0			115	
						2				60	
						3				130	
						4		ORG. CH.			
						Core Catcher					
			I	A	A						

Site 381 Hole Core 4 Cored Interval: 28.5-38.0 m

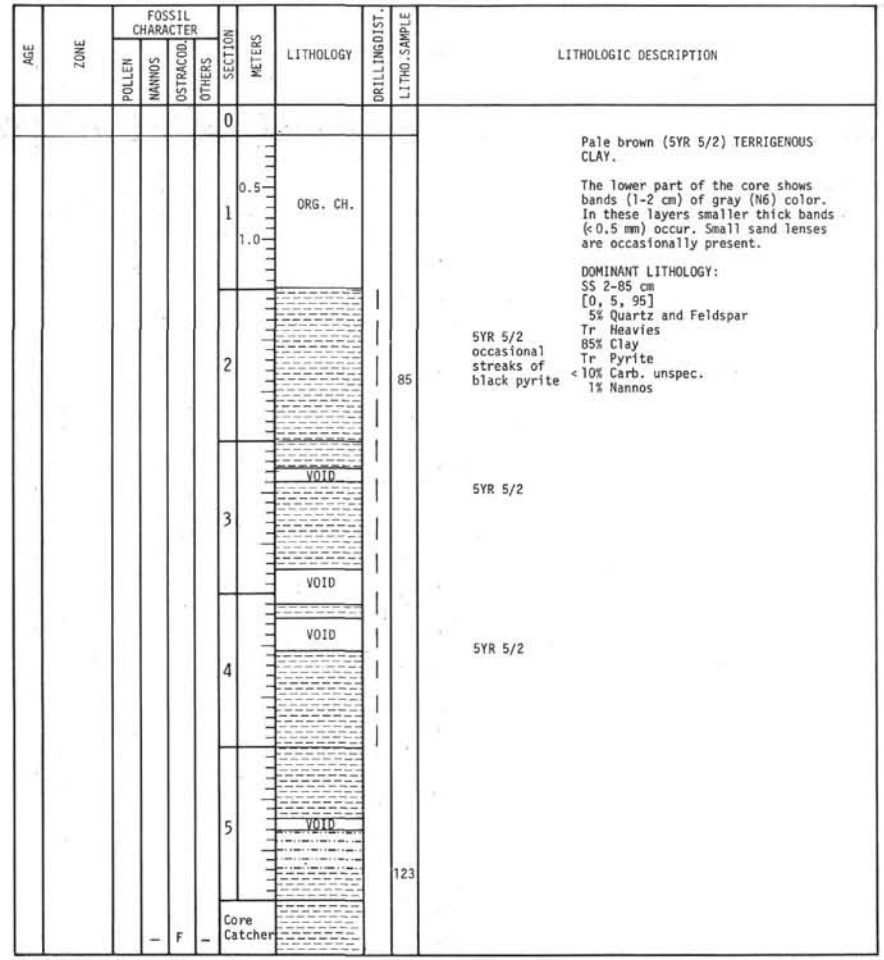
AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5	ORG. CH.			Medium bluish gray (5B 5/1) TERRIGENOUS MUD to CLAY. DOMINANT LITHOLOGY: SS 2-100 cm [0, 30, 70] 20% Quartz and Feldspar 70% Clay < 10% Carb. unspec. Tr Nannos
							1.0				
						2		VOID VOID		5B 5/1 100	
						3		VOID VOID VOID		5B 5/1 120	
						Core Catcher					
			—	F	—						

Explanatory notes in Chapter 1

Site 381 Hole Core 5 Cored Interval: 38.0-47.5 m

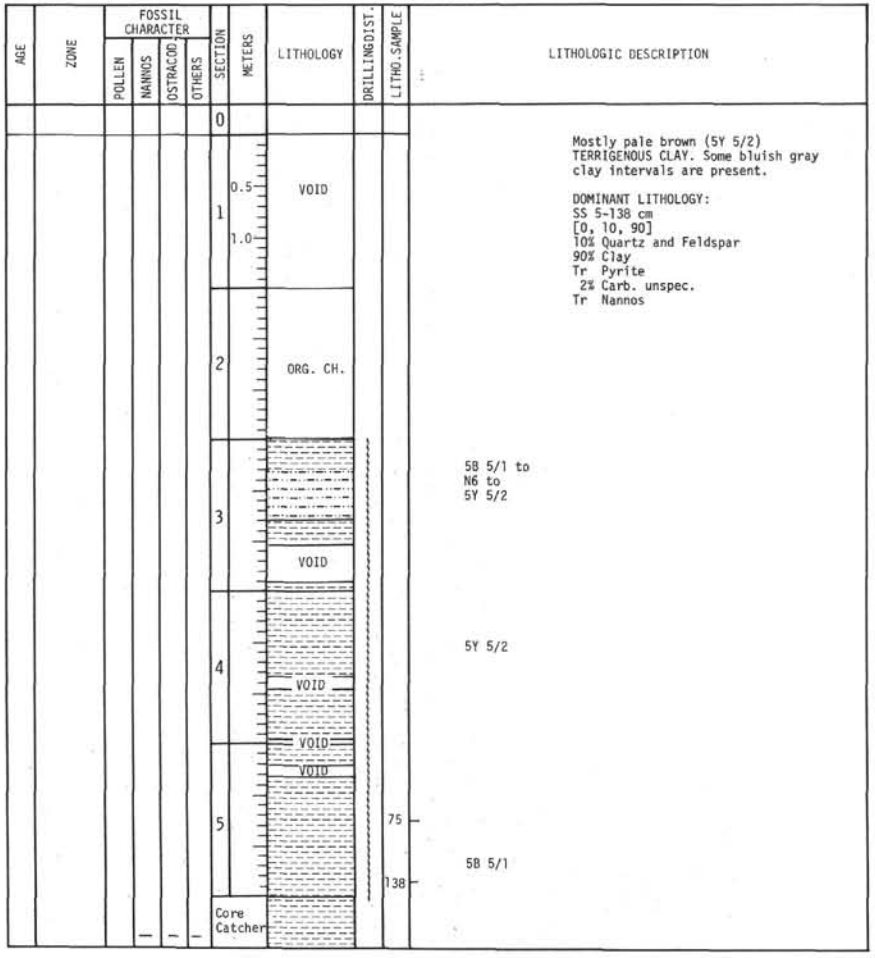


Site 381 Hole Core 6 Cored Interval: 47.5-57.0 m

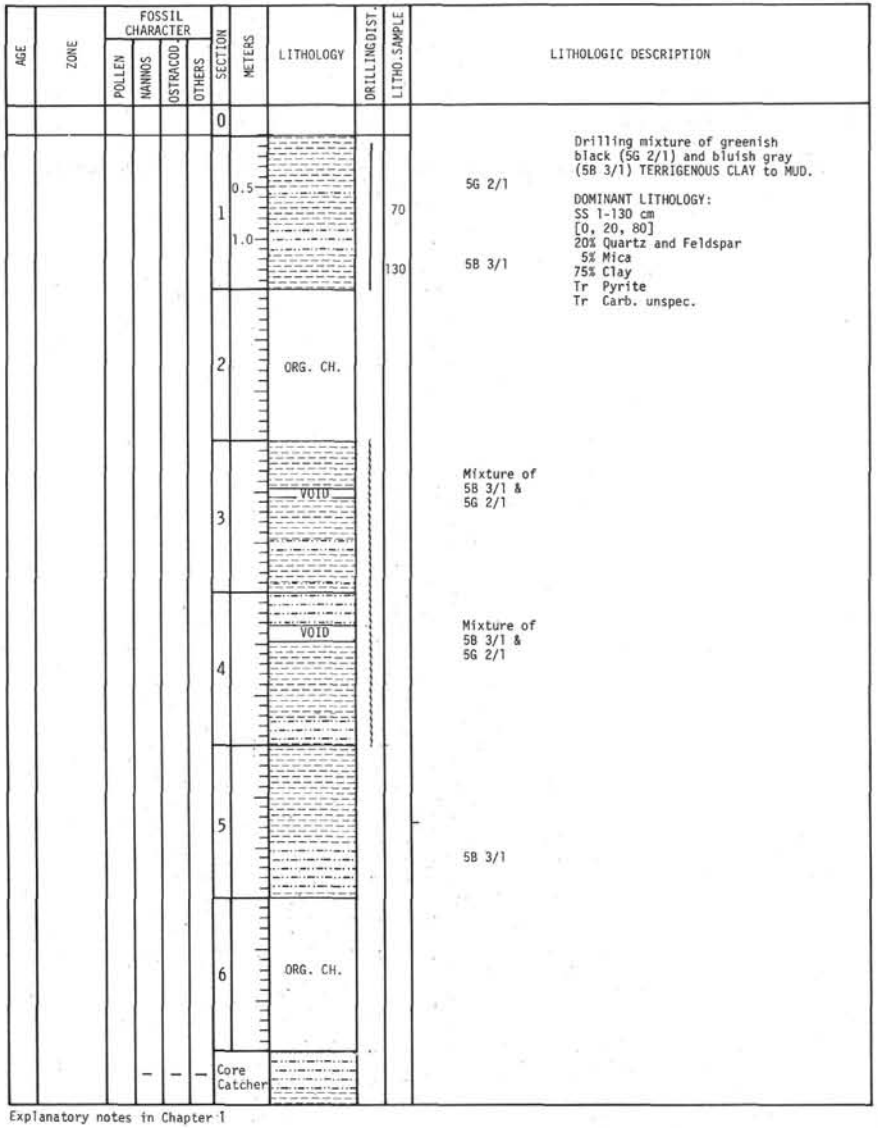


Explanatory notes in Chapter 1

Site 381 Hole Core 7 Cored Interval: 57.0-66.5 m



Site 381 Hole Core 8 Cored Interval: 66.5-76.0 m



Explanatory notes in Chapter 1

Site 381 Hole Core 9 Cored Interval: 76.0-85.5 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0		ORG. CH.			
						1	0.5	VOID		80	Medium bluish gray to dark greenish gray TERRIGENOUS MUD. 5G 2/1 DOMINANT LITHOLOGY: SS 1-80 cm [0, 40, 60] 10% Quartz and Feldspar Tr Mica Tr Heavies 55% Clay 5% Pyrite 30% Carb. unspec.
							1.0				5GY 5/1
						2		VOID		149	
						3		VOID VOID VOID VOID		85	
						4		VOID			Color between 5B 5/1 & 5G 4/1
						5		VOID VOID VOID VOID VOID			
						6					
		T	—	A	A	Core Catcher					

Site 381 Hole Core 10 Cored Interval: 85.5-95.0 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0		ORG. CH.			
						1	0.5			90	Basic color olive gray (5Y 4/1) grading over to a color between olive gray (5Y 4/1) and brownish gray (5YR 4/1) at about Section 3. TERRIGENOUS CLAY DOMINANT LITHOLOGY: SS 5-99 cm [0, 5, 95] 2% Quartz and Feldspar Tr Mica 95% Clay Tr Pyrite 3% Carb. unspec. Tr Nannos
							1.0				
						2					5Y 4/1
						3					
						4					
						5				99	
						6					
			—	A	—	Core Catcher					

Explanatory notes in Chapter 1

Site 381 Hole Core 11 Cored Interval: 95.0-104.5 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5 1.0	VOID		128	Bluish gray (5B 3/1) TERRIGENOUS MUD with blebs of sand. *DOMINANT LITHOLOGY:* SS 1-128 cm [0, 70, 30] 15% Quartz and Feldspar Tr Mica 35% Clay Tr Pyrite 50% Carb. unspec. Tr Nannos
						2				12	
			–	A	F	Core Catcher					

Site 381 Hole Core 12 Cored Interval: 104.5-114.0 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5 1.0			12	Medium bluish gray (5B 5/1, 5B 3/1) TERRIGENOUS CLAY. Occasional pods of greenish gray (5GY 6/1) and light olive gray (5Y 6/1). Very hard concretions occur in Section 3 (30 and 65 cm) (possible siderite or dolomite) occasional very small pods of TERRIGENOUS CALCAREOUS SILT. Several voids (2-10 cm) due to gas expansion. DOMINANT LITHOLOGY: SS 2-80 cm 4% Quartz and Feldspar 90% Clay 1% Pyrite 5% Carb. unspec.
						2				31	
										80	
						3		ORG. CH.			
						4					
						5					
						6					
			–	–	A	Core Catcher					

Explanatory notes in Chapter 1

Site 381 Hole Core 13 Cored Interval: 114.0-123.5 m

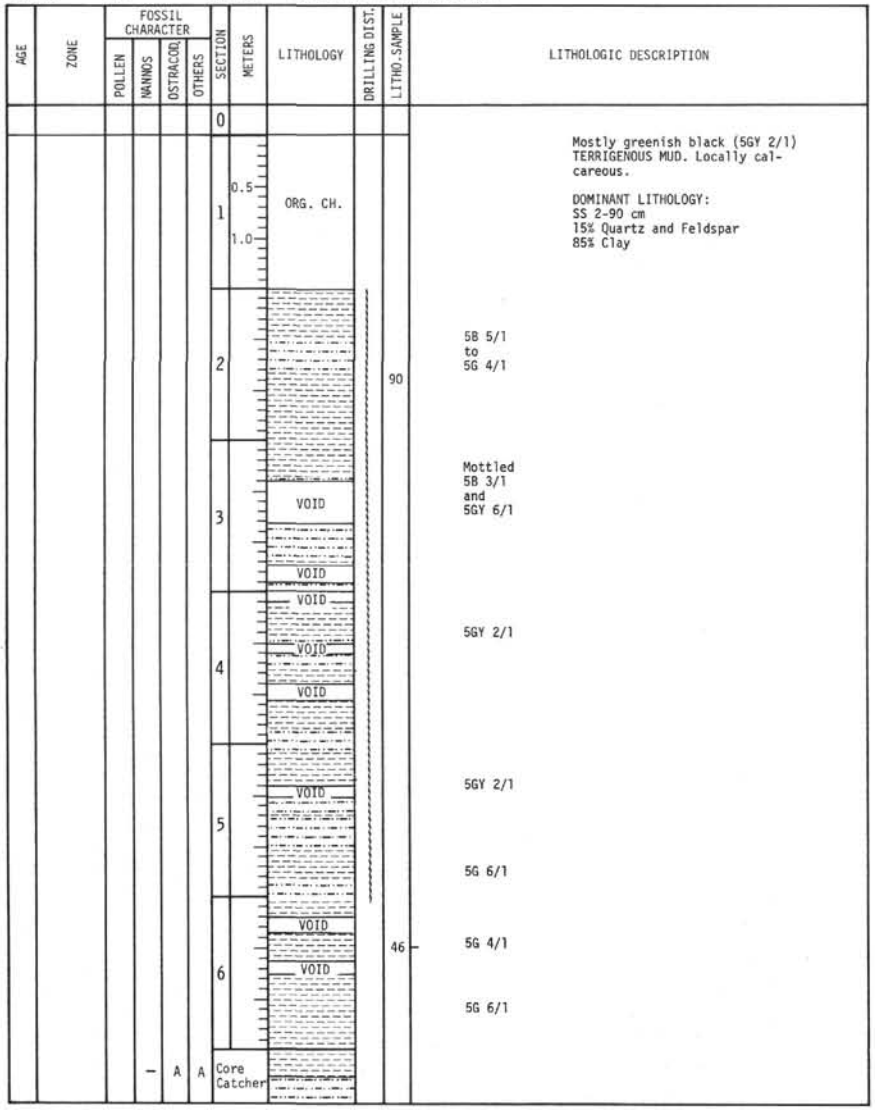
AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5 1.0			13 75	Bedding in shades of bluish gray (5B 5/1 - 3/1) TERRIGENOUS MUD. DOMINANT LITHOLOGY: SS 1-75 cm [0, 45, 55] 5% Quartz and Feldspar 50% Clay <5% Pyrite 40% Carb. unspec.
		T	—	C	A	Core Catcher					

Site 381 Hole Core 14 Cored Interval: 123.5-133.0 m

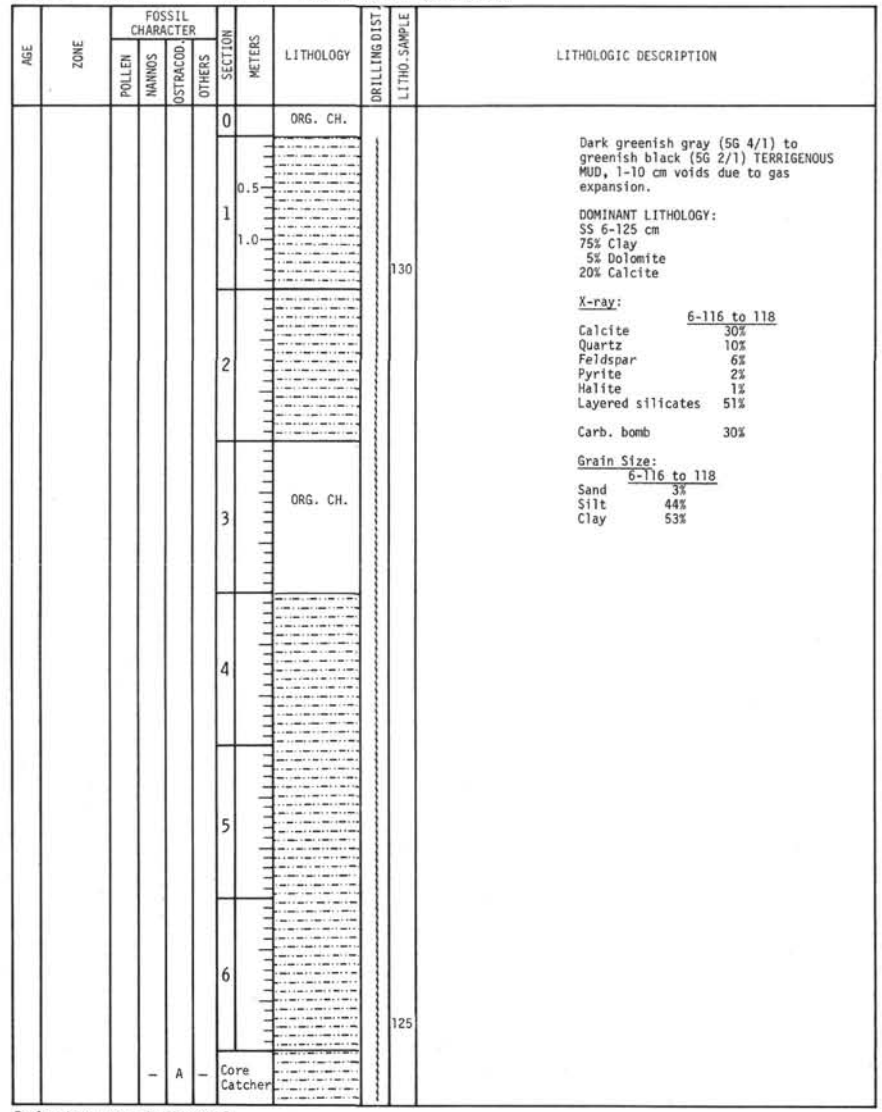
AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5 1.0			72	Uniform dark greenish gray (5GY 4/1) TERRIGENOUS MUD, 2-5 cm voids due to gas expansion. DOMINANT LITHOLOGY: SS 4-72 cm [0, 50, 50] 5% Quartz and Feldspar 50% Clay 5% Pyrite 40% Carb. unspec. Tr Calc. nannos
						2		ORG. CH.			
						3					
						4					
						5					
						6		ORG. CH.			
			—	C	A	Core Catcher					

Explanatory notes in Chapter 1

Site 381 Hole Core 15 Cored Interval: 133.0-142.5 m



Site 381 Hole Core 16 Cored Interval: 142.5-152.0 m



Explanatory notes in Chapter 1

Site 381 Hole Core 17 Cored Interval: 152.0-161.5 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5			90	Predominantly greenish black (5G 2/1) TERRIGENOUS CLAY with mottles of dark greenish gray (5GY 6/1). Lower part of the Section is a TERRIGENOUS CARBONATE MUD. DOMINANT LITHOLOGY: SS 1-90 cm 2% Quartz and Feldspar Tr Mica 90% Clay 4% Pyrite 4% Carb. unspec. Tr Nannos MINOR LITHOLOGY: SS 6-80 cm 5% Quartz and Feldspar 30% Clay 65% Carb. unspec.
							1.0				
						2		ORG. CH.			5G 2/1
						3					
						4					
						5					5G 6/1
						6				89	
		T	—	A	A	Core Catcher					

Site 381 Hole Core 18 Cored Interval: 161.5-171.0 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5				Coarse medium gray (N5) TERRIGENOUS CALCAREOUS SILT with abundant mollusc fragments. Lower part of the core is a finer greenish gray (5GY 6/1) TERRIGENOUS CARBONATE MUD. Several 5-10 cm voids due to gas expansion. DOMINANT LITHOLOGY: SS 2-30 cm [0, 85, 15] 7% Quartz and Feldspar Tr Mica 15% Clay 3% Pyrite 75% Carb. unspec. SS 5-80 cm [0, 50, 50] 10% Quartz Tr Mica 30% Clay Tr Pyrite 60% Carb. unspec.
							1.0				
						2				30	
						3					
						4		ORG. CH.			
						5				80	
						6					
			—	—	—	Core Catcher					

Explanatory notes in Chapter 1

Site 381 Hole Core 19 Cored Interval: 171.0-180.5 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5			5	Greenish gray (5GY 6/1) to darker greenish gray (5GY 5/1) in alternating beds (2-5 cm), but no really apparent cycles. Both colors contain "CHONDRITES" type burrowing, SEEKREIDE. The lower part of the core (Sections 3, 4, 5, and 6) are mainly a dark greenish gray (5G 4/1) medium bluish gray (5B 5/1) TERRIGENOUS CLAY. DOMINANT LITHOLOGY: SS 2-120 cm [0, 10, 90] 2% Quartz and Feldspar 3% Mica 90% Clay 5% Pyrite Tr Nannos MINOR LITHOLOGY: SS 2-40 cm 5% Quartz and Feldspar Tr Heavies 80% Carb. unspec. X-ray: Calcite 1-76 to 78: 42% 6-86 to 88: 0% Quartz 7% 13% Feldspar 0% 5% Pyrite 3% 0% Halite 2% 2% Layered silicates 46% 80% Carb. bomb 42% 0% Grain Size: 1-76 to 78 / 6-86 to 88 Sand 0% 0% Silt 51% 15% Clay 49% 85%
							1.0				
						2		VOID		8	
										40	
										50	
										120	
						3		VOID		45	
								VOID			
						4				10	
										50	5B 5/1 to 5G 4/1
						5		VOID			5B 5/1
								VOID			
								VOID			
						6		VOID			
								VOID			
								VOID			5G 4/5
		TS	—	—	F	Core Catcher					

Site 381 Hole Core 20 Cored Interval: 180.5-190.0 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5	VOID		110	Dark greenish gray (5G 4/1) TERRIGENOUS CLAY. DOMINANT LITHOLOGY: SS 1-110 cm [0, 10, 90] 5% Quartz and Feldspar 85% Clay Tr Pyrite <10% Carb. unspec. Site 381, Core 21, 190.0-195.0 m: Same facies, 15 cm recovered.
							1.0				
		—	—	—	A	Core Catcher					

Site 381 Hole Core 22 Cored Interval: 195.0-199.5 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5			80	Uniform olive gray (5Y 4/1) TERRIGENOUS CLAY grading over to DIATOMACEOUS MUD. DOMINANT LITHOLOGY: SS 1-80 cm [0, 10, 90] 5% Quartz and Feldspar 2% Mica 90% Clay 2% Pyrite Tr Carb. unspec. 1% Diatoms SS 3-133 cm [0, 55, 45] 1% Quartz and Feldspar Tr Mica 40% Clay 2% Pyrite 7% Carb. unspec. (Aragonite?) 50% Diatoms X-ray: 1-76 to 78 Quartz 13% Feldspar 4% Halite 2% Layered silicates 81% Carb. bomb 0% Grain Size: 1-76 to 78 Sand 0% Silt 17% Clay 83%
							1.0				5Y 4/1
						2					
						3				133	
		TS	—	—	A	Core Catcher					

Explanatory notes in Chapter 1

Site 381 Hole Core 23 Cored Interval: 199.5-209.0 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5	VOID		35	Dark greenish gray to olive gray organic rich DIATOMACEOUS MUD. A pale olive sideritic(?) interval occurs in Section 4 (80 to 100 cm).
							1.0	VOID			DOMINANT LITHOLOGY: SS 2-145 cm [0, 50, 40] 4% Quartz and Feldspar 40% Clay 5% Pyrite and Opaque Tr Zeolites 1% Carb. unspec. 50% Diatoms
						2		VOID			5G 4/1
								VOID			X-ray: 4-90 to 92 Quartz 6% Siderite 27% Layered silicates 67% Carb. bomb 0%
						3		VOID		145	Grain Size: 4-90 to 92 Sand 1% Silt 56% Clay 43%
						4		VOID		85	10Y 6/2
										130	
						5		VOID			5G 4/1
								VOID			
						6		ORG. CH.			
			—	—	A	Core Catcher					

Site 381 Hole Core 24 Cored Interval: 209.0-218.5 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5	VOID		90	Olive gray (5Y 4/1) to dark greenish gray (5G 4/1) organic rich DIATOMACEOUS MUD.
							1.0				DOMINANT LITHOLOGY: SS 1-90 cm [0, 55, 45] 1% Quartz and Feldspar Tr Mica 45% Clay 4% Pyrite 50% Diatoms
						2		VOID		52	X-ray: 1-76 to 78 Quartz 15% Feldspar 6% Halite 2% Layered silicates 77% Carb. bomb 0%
						3		ORG. CH.			Grain Size: 1-76 to 78 Sand 0% Silt 41% Clay 59%
						4		VOID			
						5					
		S	—	—	A	Core Catcher					

Explanatory notes in Chapter 1

Site 381 Hole Core 25 Cored Interval: 218.5-228.0 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	DSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5 1.0	ORG. CH.			Olive gray (5Y 4/1) to dark greenish gray (5G 4/1) DIATOM-RICH MUD. DOMINANT LITHOLOGY: SS 3-75 [0, 30, 70] 10% Quartz and Feldspar Tr Mica Tr Heavies 70% Clay 5% Pyrite 5% Carb. unspec. 10% Diatoms X-ray: 2-76 to 78 Quartz 14% Feldspar 3% Halite 2% Layered silicates 81% Carb. bomb 0% Grain Size: 2-76 to 78 Sand 1% Silt 20% Clay 79%
						2				73	
						3				75	
						4					
						5					
		—	—		A	Core Catcher					

Site 381 Hole Core 26 Cored Interval: 228.0-237.5 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	DSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5 1.0	ORG. CH.			Dark greenish gray (5G 4/1) organic rich DIATOMACEOUS MUD to CLAY. DOMINANT LITHOLOGY: SS 3-48 cm [0, 45, 55] 5% Quartz and Feldspar Tr Mica 55% Clay <2% Pyrite Tr Carb. unspec. 40% Diatoms A lithified siderite interval occurs in Section 2 (90 to 95 cm). X-ray: 3-106 to 108 Quartz 12% Feldspar 4% Halite 2% Layered silicates 82% Carb. bomb 0% Grain Size: 3-106 to 108 Sand 0% Silt 31% Clay 69%
						2		VOID			5GY 4/1
						3		VOID		48	
						4		VOID			
						5		VOID		39	
		T	—	—	A	Core Catcher					

Explanatory notes in Chapter 1

Site 381 Hole Core 27 Cored Interval: 237.5-247.0 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5	VOID			5Y 4/1
							1.0			114	
						2					
			—	—	A	Core Catcher					

Olive-gray (5Y 4/1) organic rich DIATOMACEOUS MUD. A lithified siderite layer occurs at 60 cm. The lower section shows pods of sideritic(?) "Wheat grains".

DOMINANT LITHOLOGY:
SS 1-114 cm
[0, 50, 50]
3% Quartz and Feldspar
2% Mica
50% Clay
5% Pyrite
10% Carb. unspec. (Siderite?)
30% Diatoms

X-ray:

	3-108 to 110
Quartz	10%
Feldspar	3%
Halite	2%
Layered silicates	85%
Carb. bomb	0%

Grain Size:

	3-108 to 110
Sand	3%
Silt	32%
Clay	65%

Site 381 Hole Core 28 Cored Interval: 247.0-256.5 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5	VOID			Grayish olive (10Y 4/2) organic rich DIATOMACEOUS MUD.
							1.0	VOID			
						2		VOID		75	DOMINANT LITHOLOGY: SS 6-134 cm 40% Clay 60% Diatoms
								VOID			
						3		VOID			SS 2-75 cm [0, 60, 35] 2% Quartz and Feldspar Tr Mica 35% Clay 1% Pyrite 2% Carb. unspec. 60% Diatoms
								VOID			
						4		VOID			X-ray:
								VOID			
						5		VOID		75	
								VOID			
						6		VOID			
		T	—	—	A	Core Catcher				134	

	3-41 to 43
Quartz	11%
Feldspar	2%
Halite	1%
Layered silicates	86%
Carb. bomb	0%

Grain Size:

	3-41 to 43
Sand	0%
Silt	40%
Clay	60%

Explanatory notes in Chapter 1

Site 381 Hole Core 29 Cored Interval: 256.5-266.0 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5	VOID		130	Light olive gray (5Y 5/2) grading down to yellowish gray (5Y 7/2) DIATOMACEOUS MUD to CLAY. Diatom percent varies from 10 to 60.
							1.0				DOMINANT LITHOLOGY: SS 1-130 cm 55% Clay 15% Carb. unspec. 30% Diatoms
						2		VOID			X-ray:
						3		VOID			Grain Size:
						4		VOID		55	
						5		VOID VOID			
						6		VOID		21	
			—	—	A	Core Catcher					

	2-34 to 36	4-66 to 68
Calcite	0%	17%
Dolomite	0%	0%
Quartz	11%	8%
Feldspar	3%	0%
Halite	1%	1%
Pyrite	0%	Tr
Layered silicates	85%	74%
Carb. bomb	0%	17%

	5-30 to 32	6-50 to 52
Calcite	12%	14%
Dolomite	0%	1%
Quartz	9%	8%
Feldspar	3%	2%
Halite	7%	7%
Pyrite	0%	0%
Layered silicates	75%	74%
Carb. bomb	12%	15%

Grain Size:

	2-34 to 36	4-66 to 68
Sand	1%	0%
Silt	46%	53%
Clay	53%	47%

	5-30 to 32	6-50 to 52
Sand	1%	0%
Silt	61%	44%
Clay	38%	56%

Site 381 Hole Core 30 Cored Interval: 266.0-275.5 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5	VOID			Light olive gray (5Y 5/2) to yellowish gray (5Y 7/2) DIATOMACEOUS CLAY to MUD. Laminated on mm to cm scale.
							1.0	VOID		138	5Y 5/2
						2		VOID			DOMINANT LITHOLOGY: SS 2-135 cm [0, 40, 60] 10% Quartz and Feldspar 50% Clay 15% Carb. unspec. 25% Diatoms
						3				135	X-ray:
		T	—	F	A	Core Catcher					Grain Size:

	2-130 to 132	3-46 to 48
Calcite	23%	14%
Quartz	7%	7%
Feldspar	2%	2%
Halite	1%	1%
Pyrite	0%	Tr
Layered silicates	67%	76%
Carb. bomb	23%	14%

	2-130 to 132	3-46 to 48
Sand	0%	1%
Silt	42%	58%
Clay	58%	41%

Explanatory notes in Chapter 1

Site 381 Hole Core 31 Cored Interval: 275.5-285.0 m

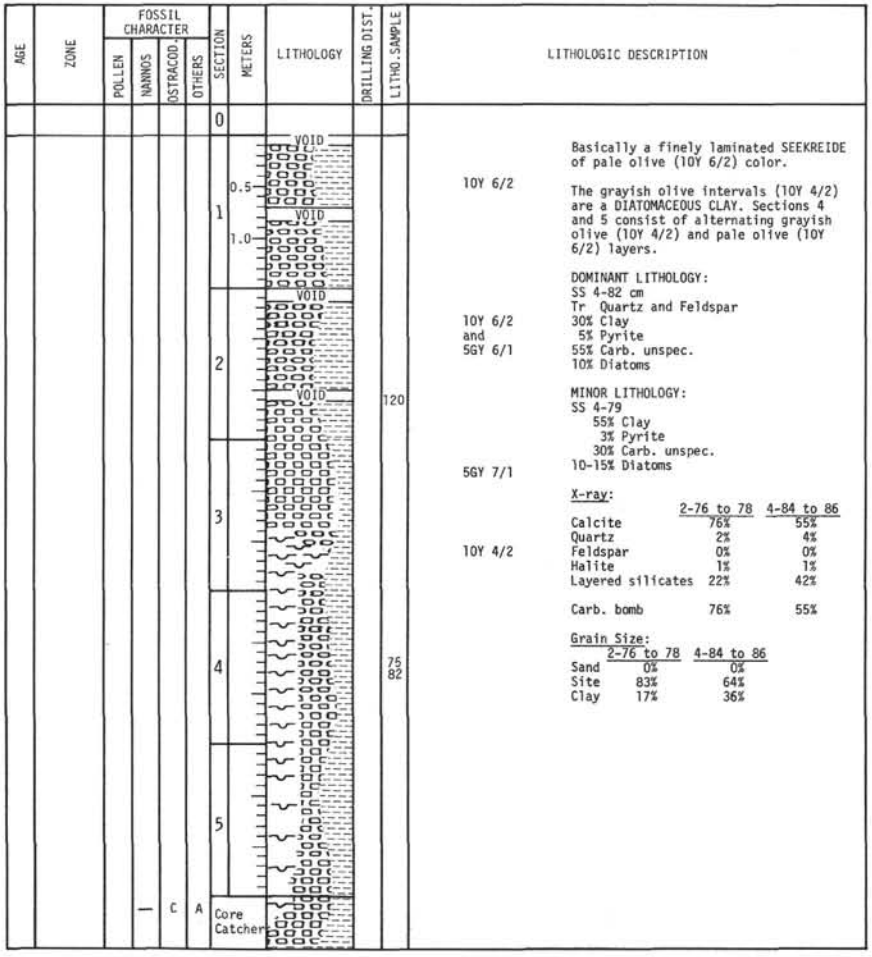
AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5 1.0	VOID			Grayish olive (10Y 4/2) laminated DIATOMACEOUS CLAY to DIATOM-RICH CLAY. DOMINANT LITHOLOGY: SS 2-75 cm [0, 20, 80] 5% Quartz and Feldspar 75% Clay 2% Pyrite 5% Carb. unspec. 15% Diatoms X-ray: 2-82 to 84: Calcite 24%; Quartz 7%; Feldspar 2%; Halite 1%; Layered silicates 67%; Carb. bomb 24% 3-44 to 46: Calcite 2%; Quartz 13%; Feldspar 3%; Halite 1%; Layered silicates 81%; Carb. bomb 2% Grain Size: 2-82 to 84: Sand 0%; Silt 40%; Clay 60% 3-44 to 46: Sand 0%; Silt 51%; Clay 49%
						2				75	10Y 6/2 to 5Y 6/1
						3				63	10Y 4/2
						4					
						5					10Y 4/2
						6					
		—	—		A	Core Catcher					

Site 381 Hole Core 32 Cored Interval: 285.0-294.5 m

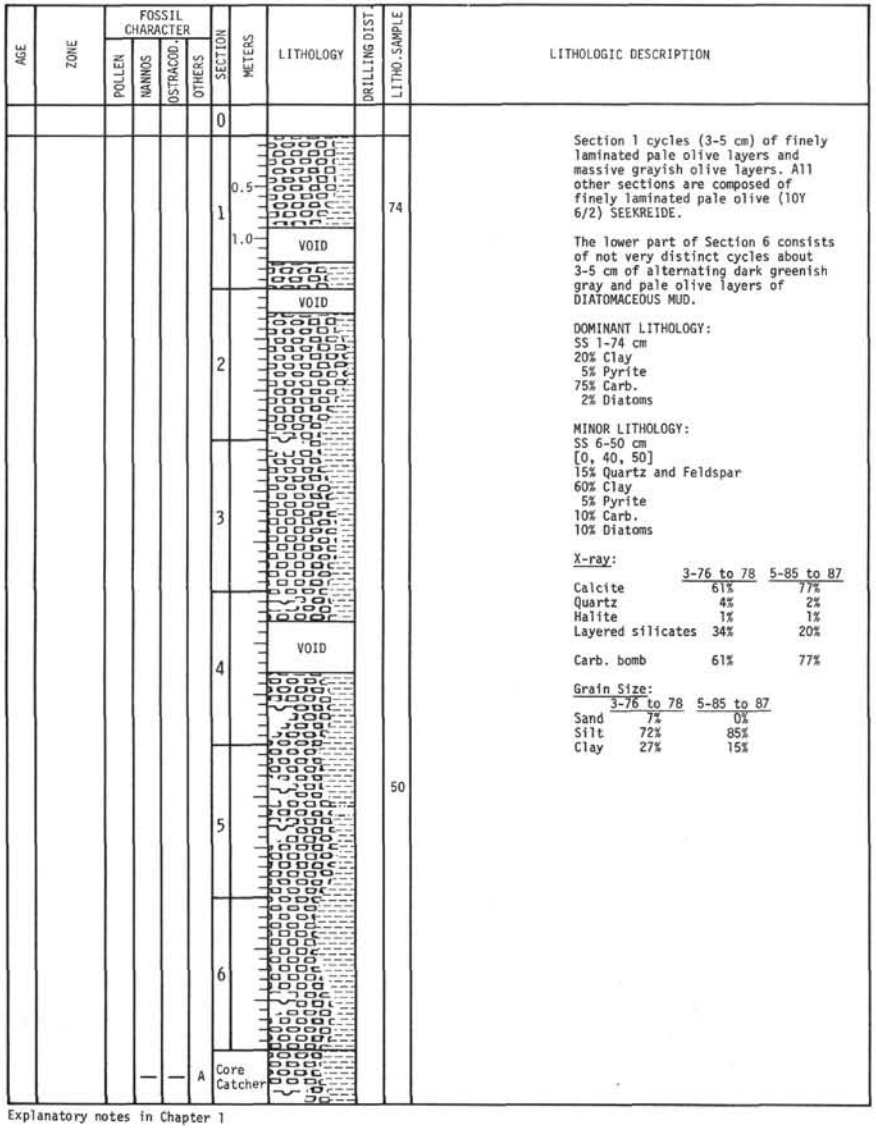
AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5 1.0			66 118 120	The top part of Section 1 is a greenish olive (10Y 4/2) DIATOMACEOUS CLAY. The rest of the core (Sections 1-6) is a SEEKREIDE of light olive gray (5Y 6/1) to yellowish gray (5Y 8/1) color. Varves in a ~4 cm cycle of medium bluish gray (5B 5/1) and greenish gray (5GY 6/1) color are present in Section 1. Burrowing occurs in the greenish gray intervals. The darker parts are composed of a pyrite bearing silty SEEKREIDE. A 0.5 cm thick sand layer is found in Section 4 at 88 cm. The rest of the core is very faintly laminated (0.1 to 1 cm).
						2		VOID		32 64 73	10Y 4/2 10Y 6/2 to 10Y 4/2 DOMINANT LITHOLOGY: SS 1-118 cm 3% Quartz and Feldspar 20% Clay 2% Pyrite 75% Carb. unspec. MINOR LITHOLOGY: SS 1-66 cm 5% Quartz and Feldspar 55% Clay 15% Carb. unspec. 25% Diatoms
						3		VOID VOID			10Y 6/2 to 5Y 8/4 N8 X-ray: 1-59 to 61: Calcite 5%; Dolomite 0%; Quartz 10%; Feldspar 3%; Halite 2%; Layered silicates 80%; Carb. bomb 5% 2-74 to 76: Calcite 51%; Dolomite 0%; Quartz 3%; Feldspar 0%; Halite 1%; Layered silicates 45%; Carb. bomb 51% 4-3 to 5: Calcite 76%; Dolomite 0%; Quartz 2%; Feldspar 0%; Halite 1%; Layered silicates 21%; Carb. bomb 76%
						4		VOID		91	5B 5/1 5B 5/1 5Y 8/1 5G 4/1 5YR 8/1 with some 5B 7/1 layers 5Y 6/1 alternating downwards 5Y 8/1 4-47 to 49: Calcite 37%; Dolomite 0%; Quartz 8%; Feldspar 2%; Halite 1%; Layered silicates 51%; Carb. bomb 37% 4-91 to 93: Calcite 38%; Dolomite 2%; Quartz 9%; Feldspar 2%; Halite 1%; Layered silicates 48%; Carb. bomb 40% Grain Size: 1-59 to 61: Sand 1%; Silt 52%; Clay 47% 2-74 to 76: Sand 0%; Silt 53%; Clay 47% 4-3 to 5: Sand 0%; Silt 55%; Clay 45% 4-47 to 49: Sand 1%; Silt 54%; Clay 45% 4-91 to 93: Sand 1%; Silt 53%; Clay 46%
						5		VOID			5B 5/1 5Y 6/1
						6		VOID			
		T	—	—	C	Core Catcher					

Explanatory notes in Chapter 1

Site 381 Hole Core 33 Cored Interval: 294.5-304.0 m



Site 381 Hole Core 34 Cored Interval: 304.0-313.5 m



Explanatory notes in Chapter 1

Site 381 Hole Core 35 Cored Interval: 313.5-323.0 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5, 1.0	VOID, VOID, VOID			10Y 6/2; 5Y 4/2
						2				30	10Y 6/2 to 10Y 4/2; 5Y 6/1; 5Y 4/2
						3				40	10Y 4/2; 5GY 4/1
						4		VOID, VOID		13, 38	5Y 4/1
						5				35	Shades of olive and greenish gray
						6					5Y 4/4; 5Y 4/1; 5GY 6/1; 5G 4/1; 5Y 4/1; 5Y 4/1 and 5Y 4/4
			—	—	A	Core Catcher					

Basically a olive to greenish gray DIATOMACEOUS MUD with interbeds of massive and laminated SEEKREIDE and pyrite rich CLAY.

The darker (5Y 4/1) DIATOM intervals suggest a sapropel.

SAND layers occur at the top of Section 4.

DOMINANT LITHOLOGY:
SS 2-30 cm
[0, 70, 30]
2% Quartz and Feldspar
1% Mica
25% Clay
10% Pyrite
2% Zeolite
Tr Carb.
60% Diatoms

MINOR LITHOLOGY:
SS 3-113 cm
[0, 25, 75]
5% Quartz and Feldspar
75% Clay
Tr Glass
15% Pyrite
2% Carb.
5% Diatoms

X-ray:

	2-76 to 78	5-63 to 65
Calcite	27%	1%
Quartz	12%	14%
Feldspar	2%	3%
Halite	1%	1%
Pyrite	1%	Tr
Layered silicates	58%	81%
Carb. bomb	27%	1%

Grain Size:

	2-76 to 78	5-63 to 65
Sand	1%	1%
Silt	69%	48%
Clay	30%	51%

Site 381 Hole Core 36 Cored Interval: 323.0-332.5 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5, 1.0	VOID		40, 70	10Y 4/2
						2		VOID		80	
						3		VOID			
			R	—	A	Core Catcher					

Grayish olive (10Y 4/2) DIATOMACEOUS CLAY.

DOMINANT LITHOLOGY:
SS 1-40 cm
60% Clay
40% Diatoms

X-ray:

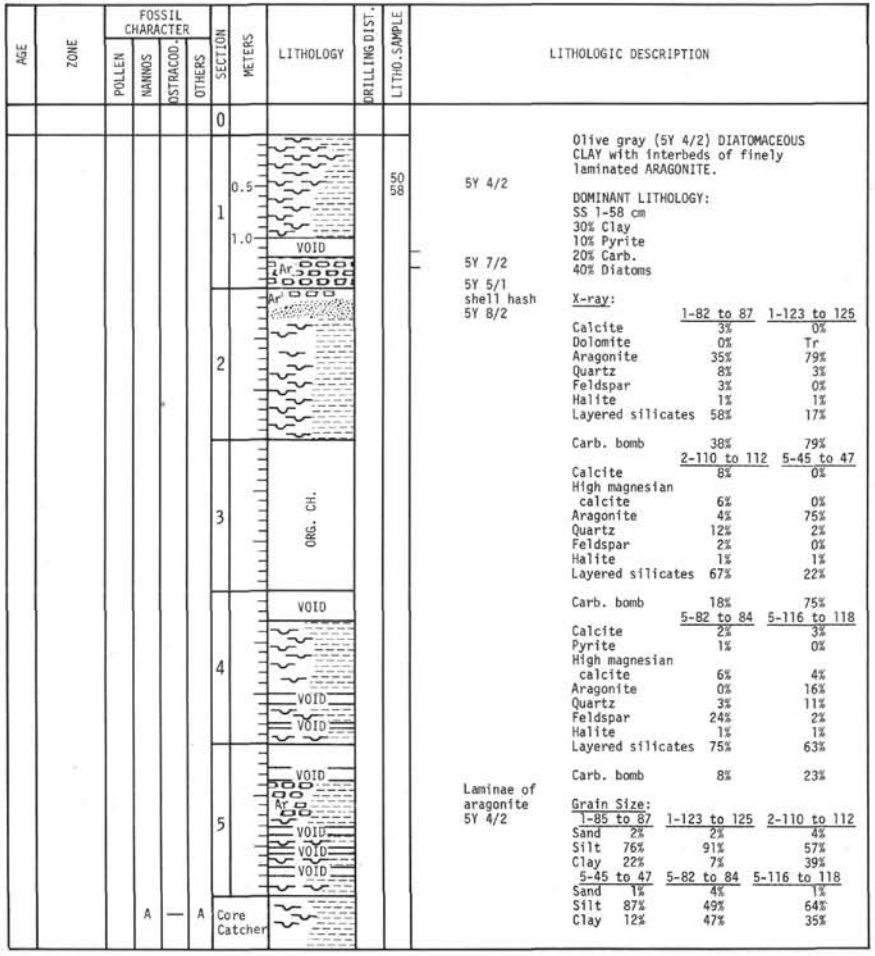
	2-56 to 58
Quartz	13%
Feldspar	3%
Halite	1%
Pyrite	1%
Layered silicates	82%
Carb. bomb	0%

Grain Size:

	2-56 to 58
Sand	0%
Silt	50%
Clay	50%

Explanatory notes in Chapter 1

Site 381 Hole Core 37 Cored Interval: 332.5-342.0 m



Olive gray (5Y 4/2) DIATOMACEOUS CLAY with interbeds of finely laminated ARAGONITE.

DOMINANT LITHOLOGY:
SS 1-58 cm
30% Clay
10% Pyrite
20% Carb.
40% Diatoms

X-ray:

	1-82 to 87	1-123 to 125
Calcite	3%	0%
Dolomite	0%	Tr
Aragonite	35%	79%
Quartz	8%	3%
Feldspar	3%	0%
Halite	1%	1%
Layered silicates	58%	17%
Carb. bomb	38%	79%

	2-110 to 112	5-45 to 47
Calcite	8%	0%
High magnesian calcite	6%	0%
Aragonite	4%	75%
Quartz	12%	2%
Feldspar	2%	0%
Halite	1%	1%
Layered silicates	67%	22%
Carb. bomb	18%	75%

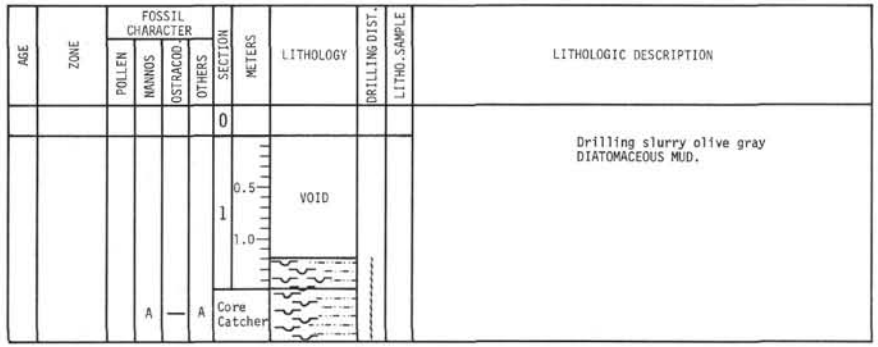
	5-82 to 84	5-116 to 118
Calcite	2%	3%
Pyrite	1%	0%
High magnesian calcite	6%	4%
Aragonite	0%	16%
Quartz	3%	11%
Feldspar	24%	2%
Halite	1%	1%
Layered silicates	75%	63%
Carb. bomb	8%	23%

Grain Size:

	1-85 to 87	1-123 to 125	2-110 to 112
Sand	2%	2%	4%
Silt	76%	91%	57%
Clay	22%	7%	39%

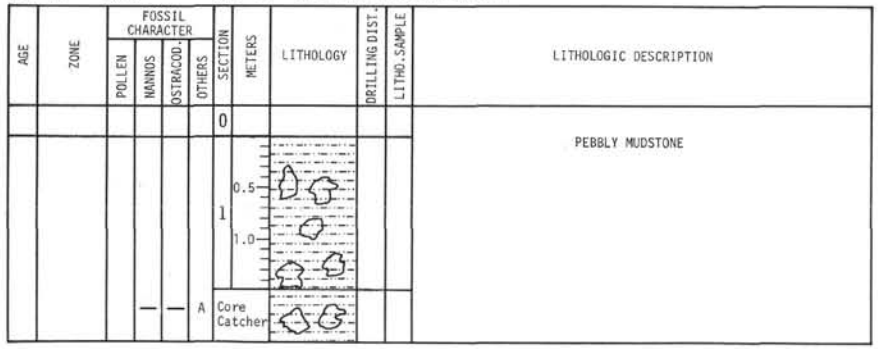
	5-45 to 47	5-82 to 84	5-116 to 118
Sand	1%	4%	1%
Silt	87%	49%	64%
Clay	12%	47%	35%

Site 381 Hole Core 38 Cored Interval: 342.0-351.5 m



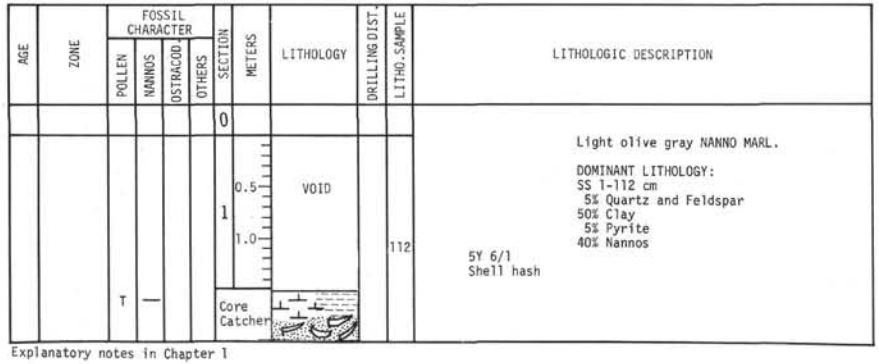
Drilling slurry olive gray DIATOMACEOUS MUD.

Site 381 Hole Core 39 Cored Interval: 351.5-361.0 m



PEBBLY MUDSTONE

Site 381 Hole Core 40 Cored Interval: 361.0-370.5 m



Light olive gray NANNO MARL.

DOMINANT LITHOLOGY:
SS 1-112 cm
5% Quartz and Feldspar
50% Clay
5% Pyrite
40% Nannos

5Y 6/1
Shell hash

Explanatory notes in Chapter 1

Site 381 Hole Core 41 Cored Interval: 370.5-380.0 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						Core Catcher					Only Core Catcher: 1 limestone pebble 1 mud ball

Site 381 Hole Core 42 Cored Interval: 380.0-399.5 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5 1.0	VOID			Pebble, sand, mud X-ray: CC Dolomite 93% Quartz 1% Feldspar 1% Layered silicates 5% Carb. bomb 93%
						Core Catcher					

Site 381 Hole Core 43 Cored Interval: 389.5-399.0 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
			—	—	C	1	0.5 1.0	VOID	~~~	10	TERRIGENOUS MUD, DOLOMITE AND SHELL HASH X-ray: 2-142 to 145 Dolomite 98% Quartz 1% Layered silicates Tr Carb. bomb 98%
						2		SHELL HASH			
						Core Catcher					

Site 381 Hole Core 44 Cored Interval: 399.0-408.5 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						Core Catcher					Only a few hard dolomitic pebbles in the Core Catcher.

Site 381 Hole Core 45 Cored Interval: 408.5-418.0 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5 1.0	SHELL HASH DRILL MUD			Sand and shell hash
						Core Catcher					

Site 381 Hole Core 46 Cored Interval: 418.0-427.5 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						Core Catcher					Some hard dolomitic rocks in the Core Catcher. X-ray: CC Dolomite 47% Quartz 31% Feldspar 11% Layered silicates 11% Carb. bomb 47%

Explanatory notes in Chapter 1

Site 381 Hole Core 47 Cored Interval: 427.5-437.0 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					Lithified dolomitic rock pieces.
						Core Catcher					X-ray: CC Dolomite 60% Quartz 31% Feldspar 9% Carb. bomb 60%

Site 381 Hole Core 48 Cored Interval: 437.0-446.5 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5 1.0	ORG. CH.			Laminated (mm to cm) olive gray (5Y 4/1) to olive black (5Y 2/1) organic rich CLAY. The darker layers are enriched in pyrite (~20%). Occasional thin layers of silt and sand occur. The lower part of Section 6 is pebbly mudstone (drilling artifact?). DOMINANT LITHOLOGY: SS 5-80 cm 5% Quartz and Feldspar 85% Clay 5% Pyrite 5% Organic matter
						2				20	
						3					5Y 4/1 to 5Y 2/1
						4					
						5				80	
						6					
			–	–	–	Core Catcher					

Explanatory notes in Chapter 1

Site 381 Hole Core 49 Cored Interval: 446.5-456.0 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	FOSSIL CHARACTER: NANNOS	FOSSIL CHARACTER: OSTRACOD.	FOSSIL CHARACTER: OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5 1.0				Laminae (mm to cm) of olive gray (5Y 4/1) to olive black (5Y 2/1) organic rich CLAY. Occasional thin 1-2 mm thick silt and sand layers. Drilling slurry ispresent below 80 cm Section 6. Site 381, Core 50, 456.0-465.5 m: NO RECOVERY
						2					
						3					
						4					
						5					
						6					
			—	—	—	Core Catcher					

Site 381 Hole Core 51 Cored Interval: 465.5-475.0 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	FOSSIL CHARACTER: NANNOS	FOSSIL CHARACTER: OSTRACOD.	FOSSIL CHARACTER: OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					
						1	0.5 1.0	ORG. CH.			The whole core is a BRECCIA showing abundant evidence of soft sediment deformation. Casts show internal flowage deformation. Mostly TERRIGENOUS MUD, some light colored layers (within the clasts) of carbonate are present. Clasts are in various shades of olive and gray. The lower part of Section 6 is a medium bluish gray (5B 5/1) SANDY CLAY.
						2					
						3				9	
						4				45	
						5				51	
						6				120	5B 5/1
			—	—	—	Core Catcher					

Explanatory notes in Chapter 1

Site 381 Hole Core 52 Cored Interval: 475.0-484.5 m

AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					Dark greenish gray (5GY 4/1) *TERRIGENOUS CLAYEY SILTSTONE* with occasional small yellowish gray (5Y 7/2) siderite bands. DOMINANT LITHOLOGY: SS 2-149 cm [5, 45, 50] 35% Quartz and Feldspar 1- 2% Mica 5% Heavies 50% Clay 1- 2% Glauconite 3- 5% Pyrite
		P & MF	—	—	—	1	0.5 1.0	VOID		120	
						2				65 128 149	
						Core Catcher					

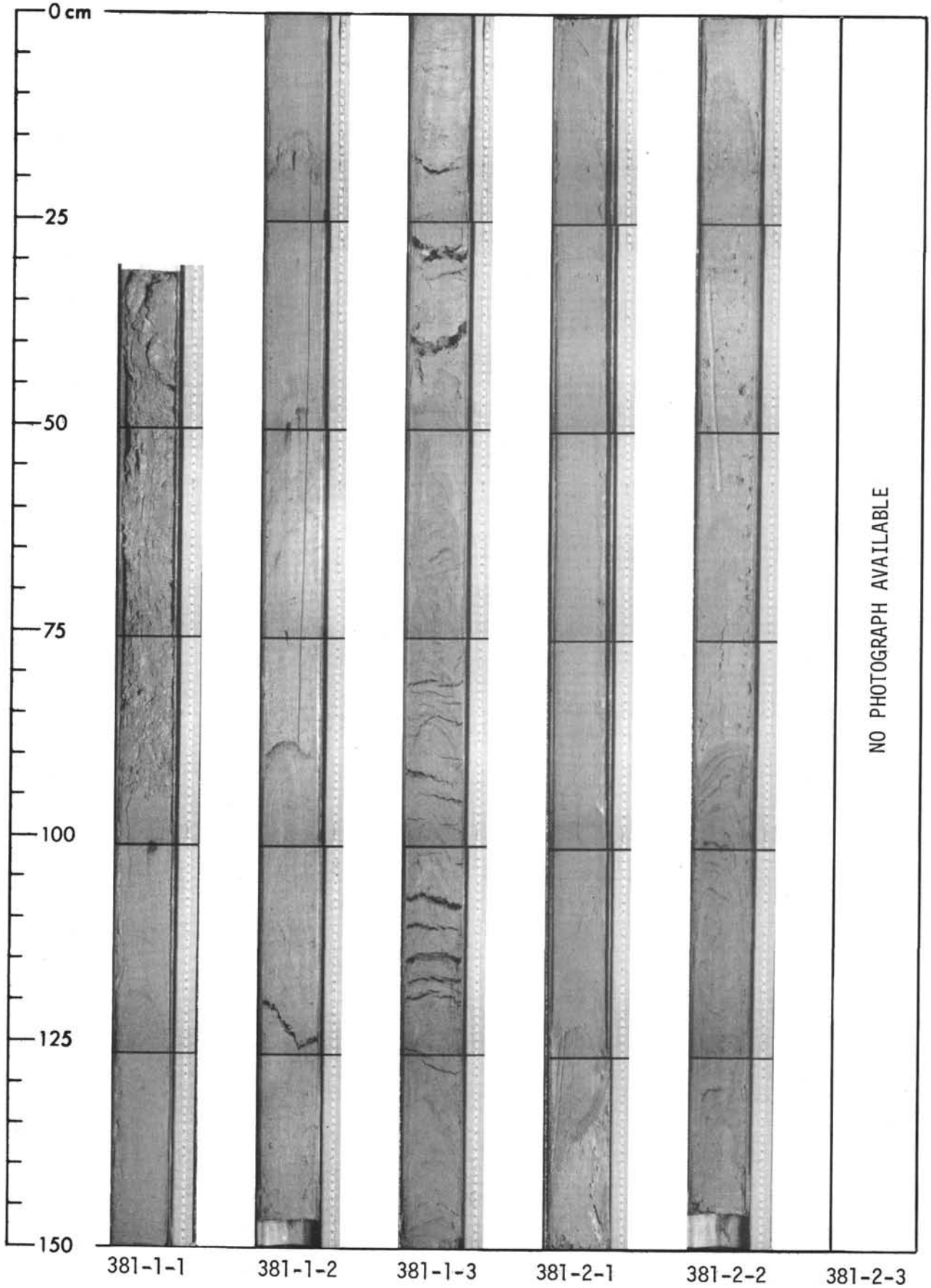
Site 381 Hole Core 53 Cored Interval: 484.5-494.0 m

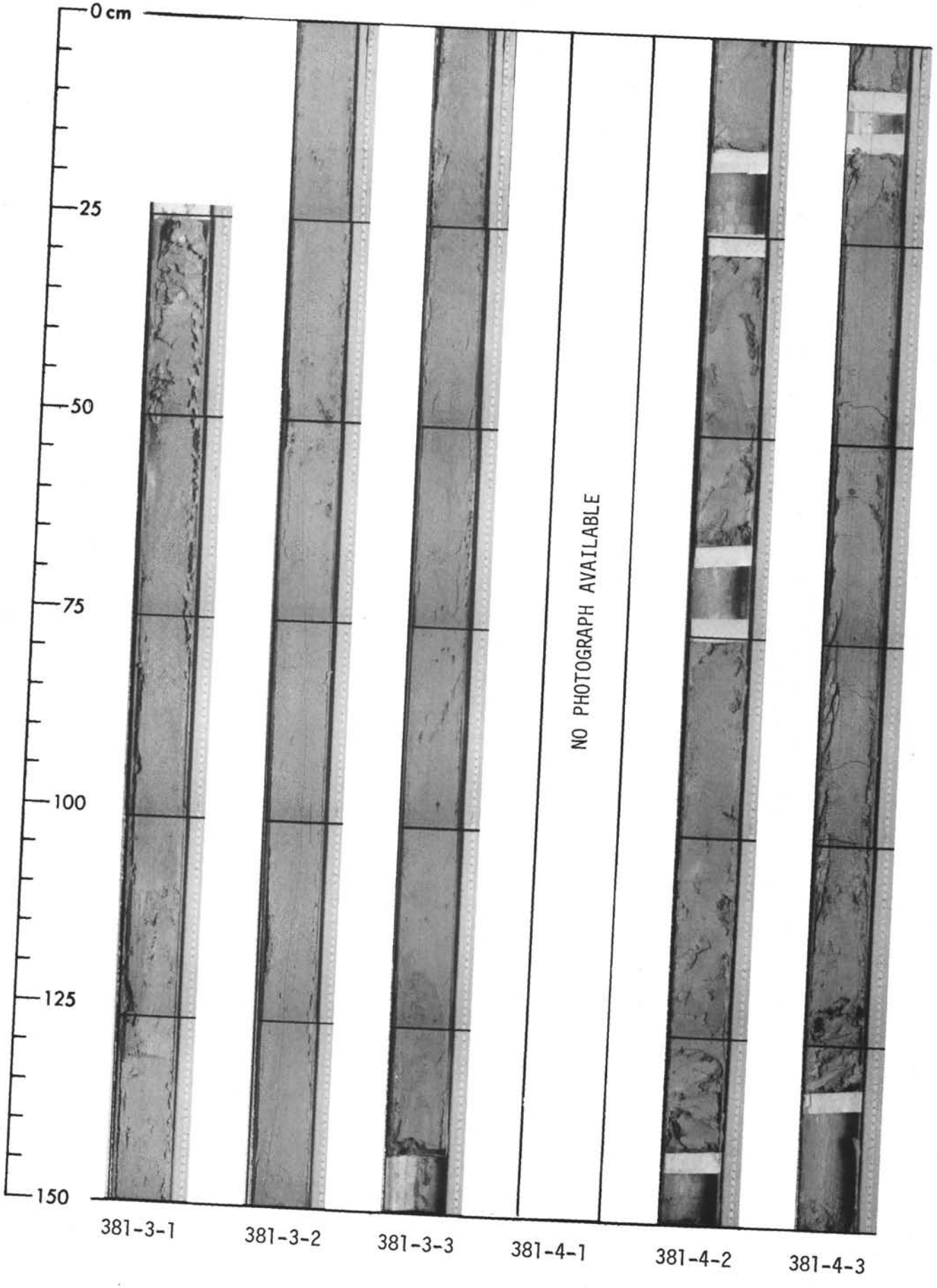
AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					Dark greenish gray (5GY 4/1) TERRIGENOUS CLAYEY SILTSTONE. Lower part of Section 3 is of olive gray (5Y 4/1) color and is finely laminated. Numerous dolomite layers of "crinkly" appearance are present. Some indicate soft sediment deformation.
		P & MF	—	—	—	1	0.5 1.0	ORG. CH.			
						2					
						3					
						Core Catcher					

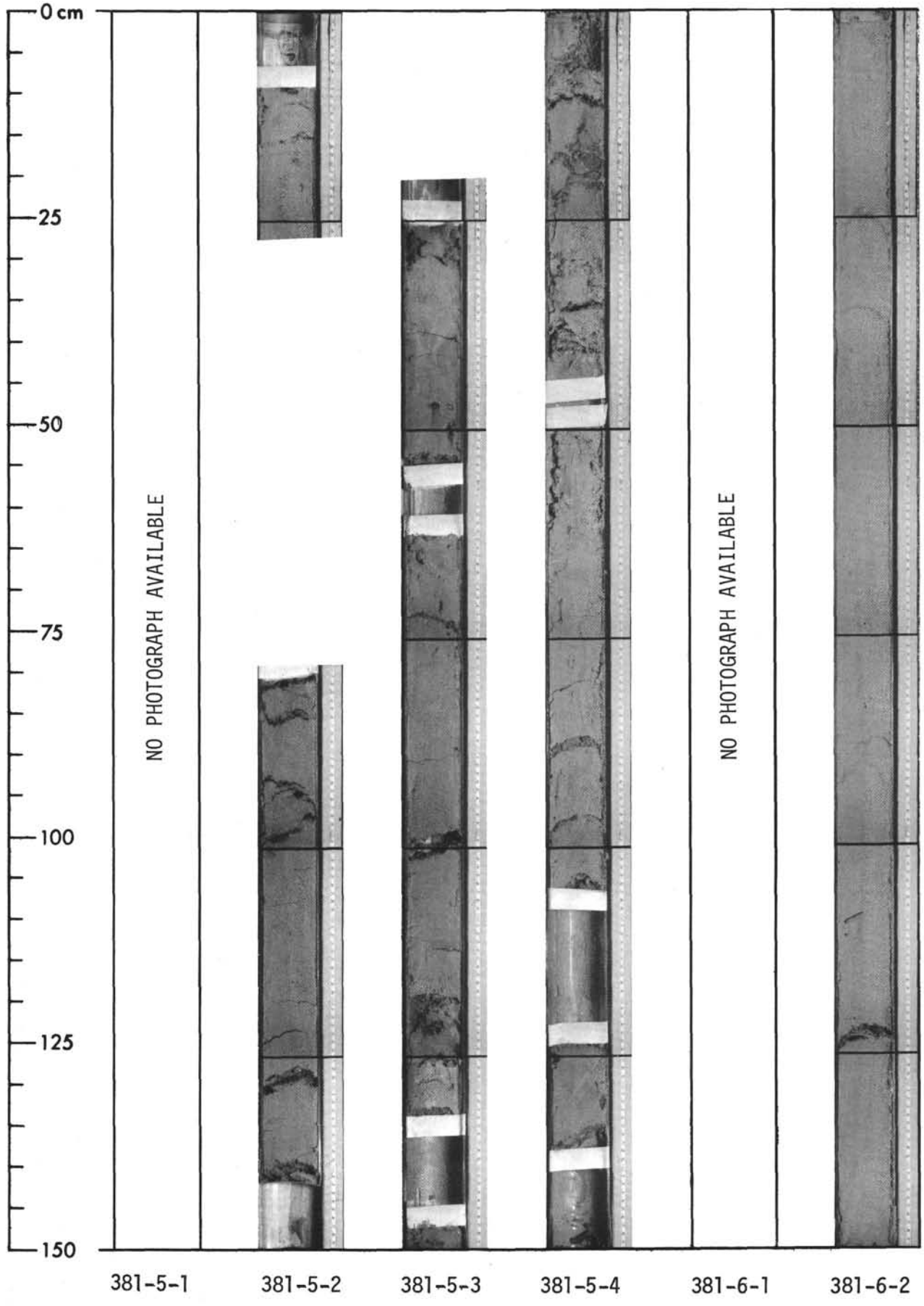
Site 381 Hole Core 54 Cored Interval: 494.0-503.5 m

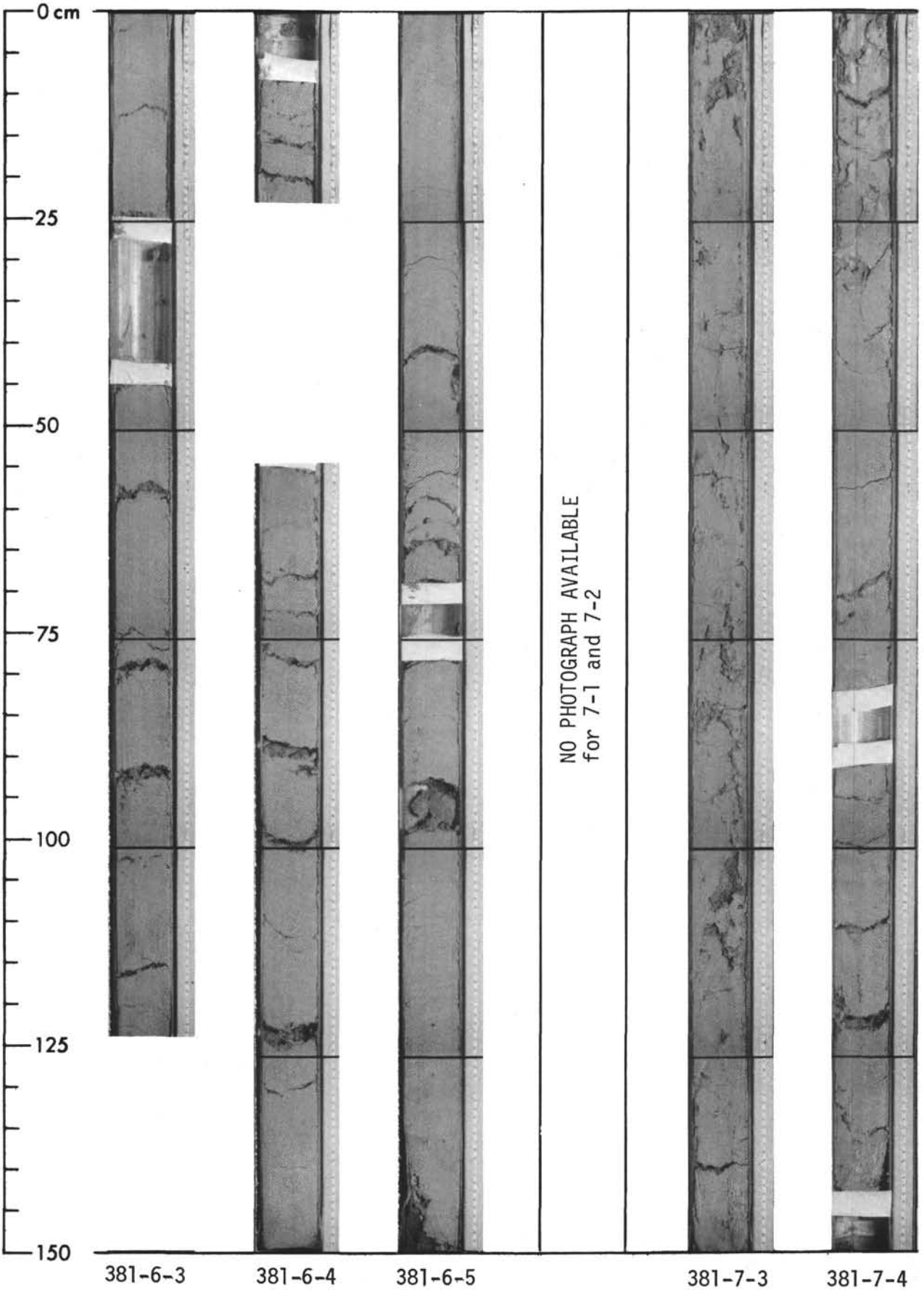
AGE	ZONE	FOSSIL CHARACTER: POLLEN	NANNOS	OSTRACOD.	OTHERS	SECTION	METERS	LITHOLOGY	DRILLING DIST.	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
						0					Medium gray (N4) to medium dark gray (N3) finely laminated (≤ 1 mm) TERRIGENOUS CLAYEY SILSTONE. Section 6 shows some brecciation indicating 2 siderite clasts. Some small sand layers are present.
						1	0.5 1.0	ORG. CH.			
						2					
						3				T38	
						4					
						5		ORG. CH.			
						6					
		—	—	—	—	Core Catcher					

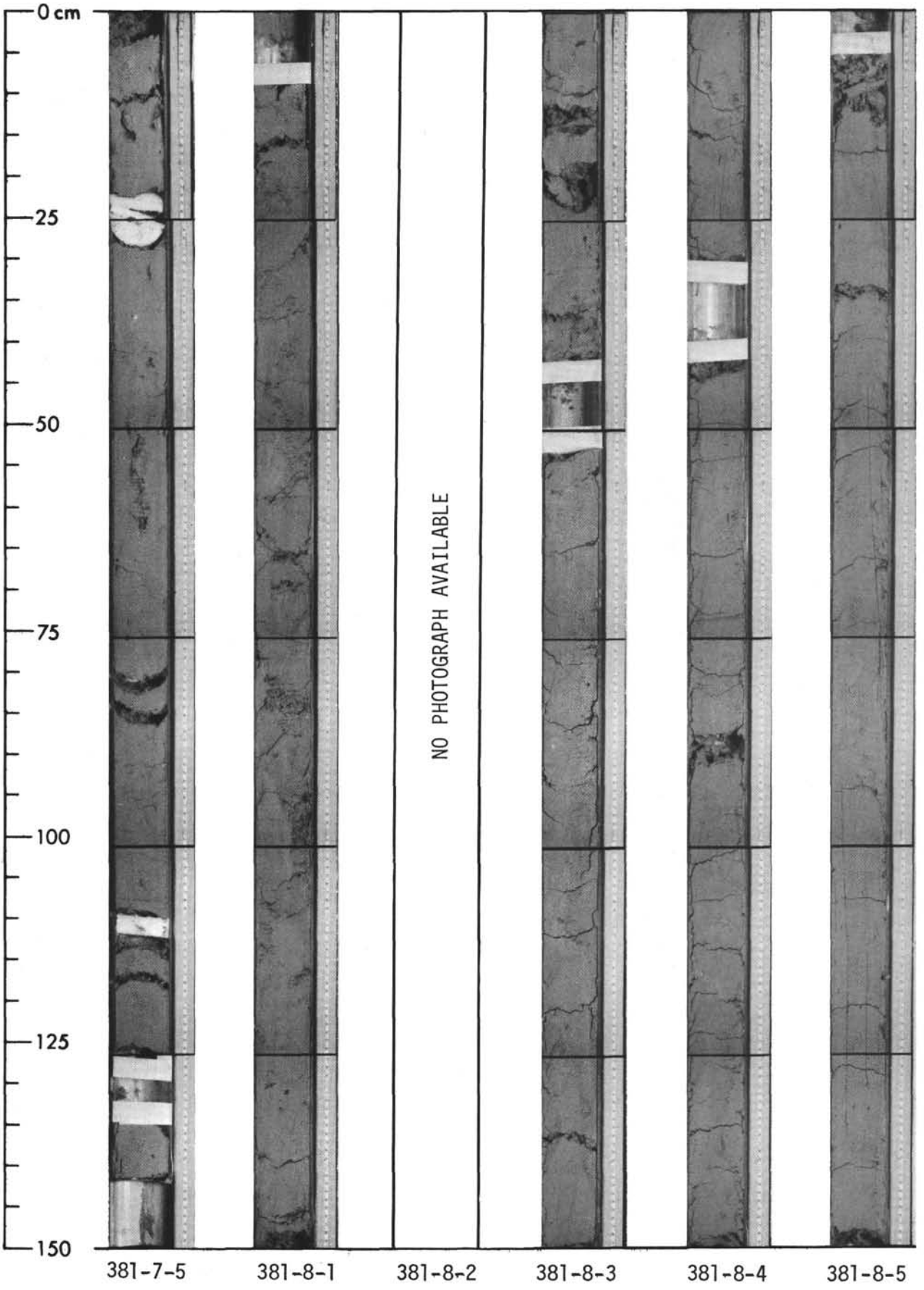
Explanatory notes in Chapter 1

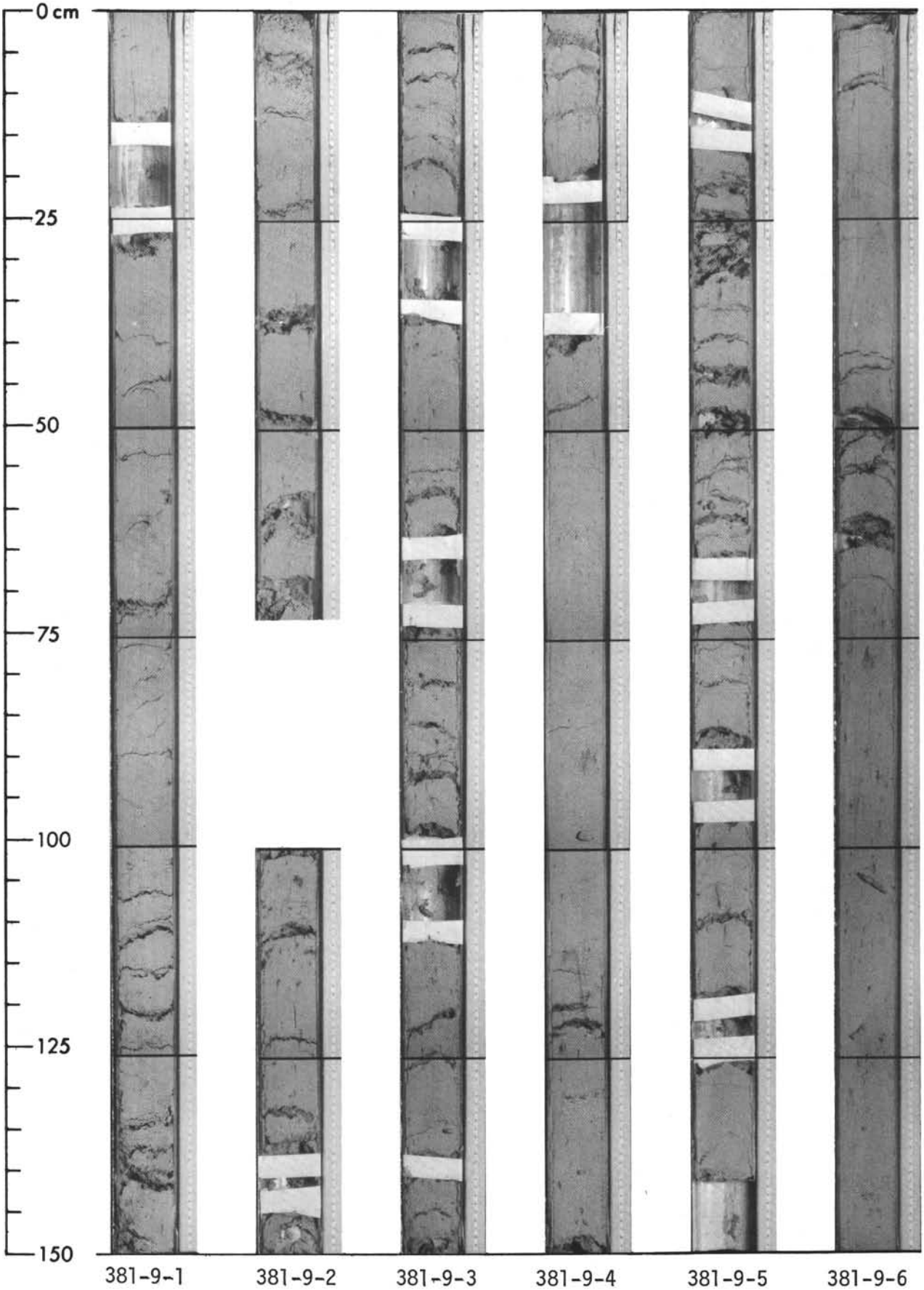

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
381-1-1
381-1-2
381-1-3
381-2-1
381-2-2
381-2-3

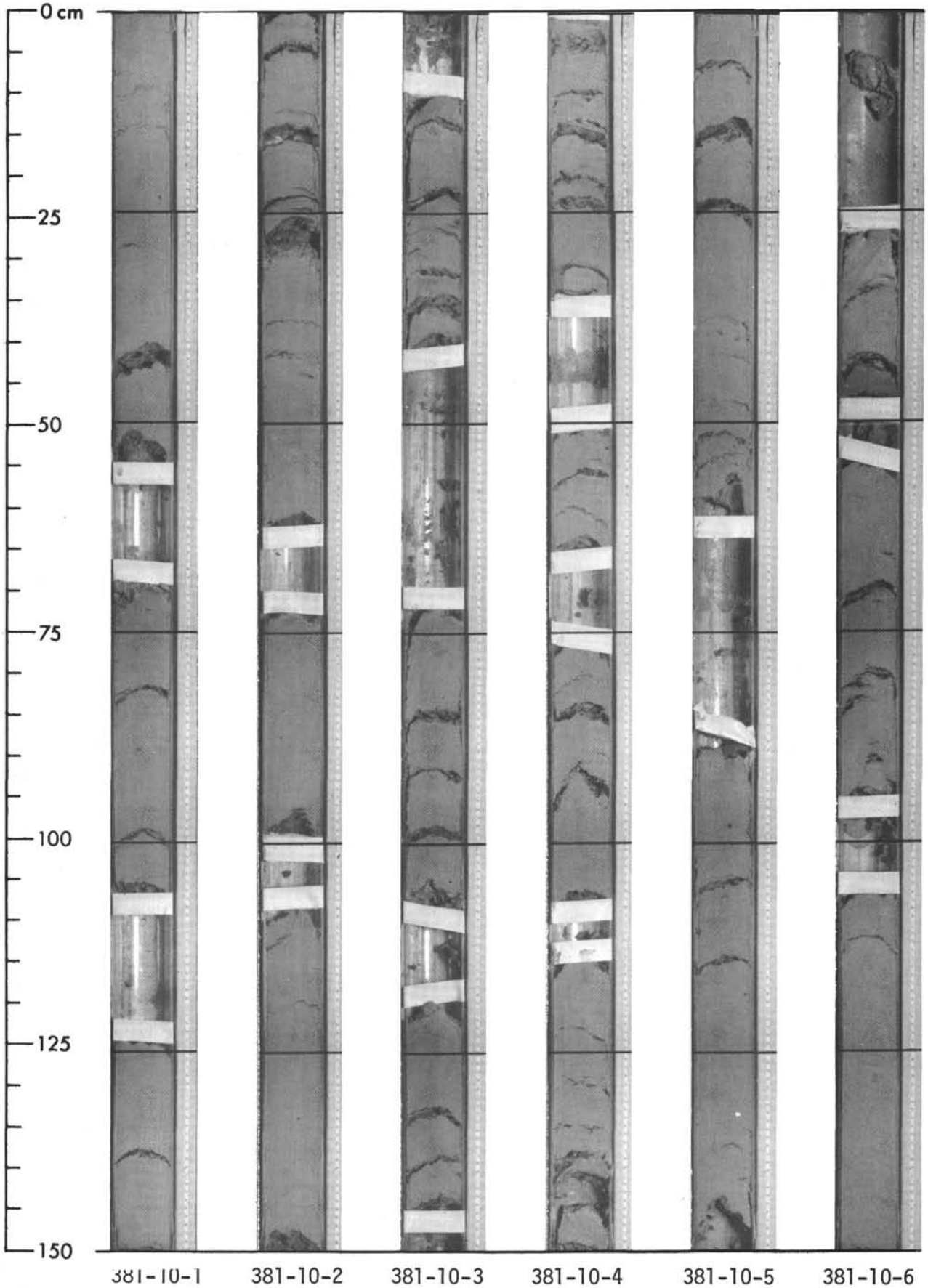

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
381-3-1
381-3-2
381-3-3
381-4-1
381-4-2
381-4-3

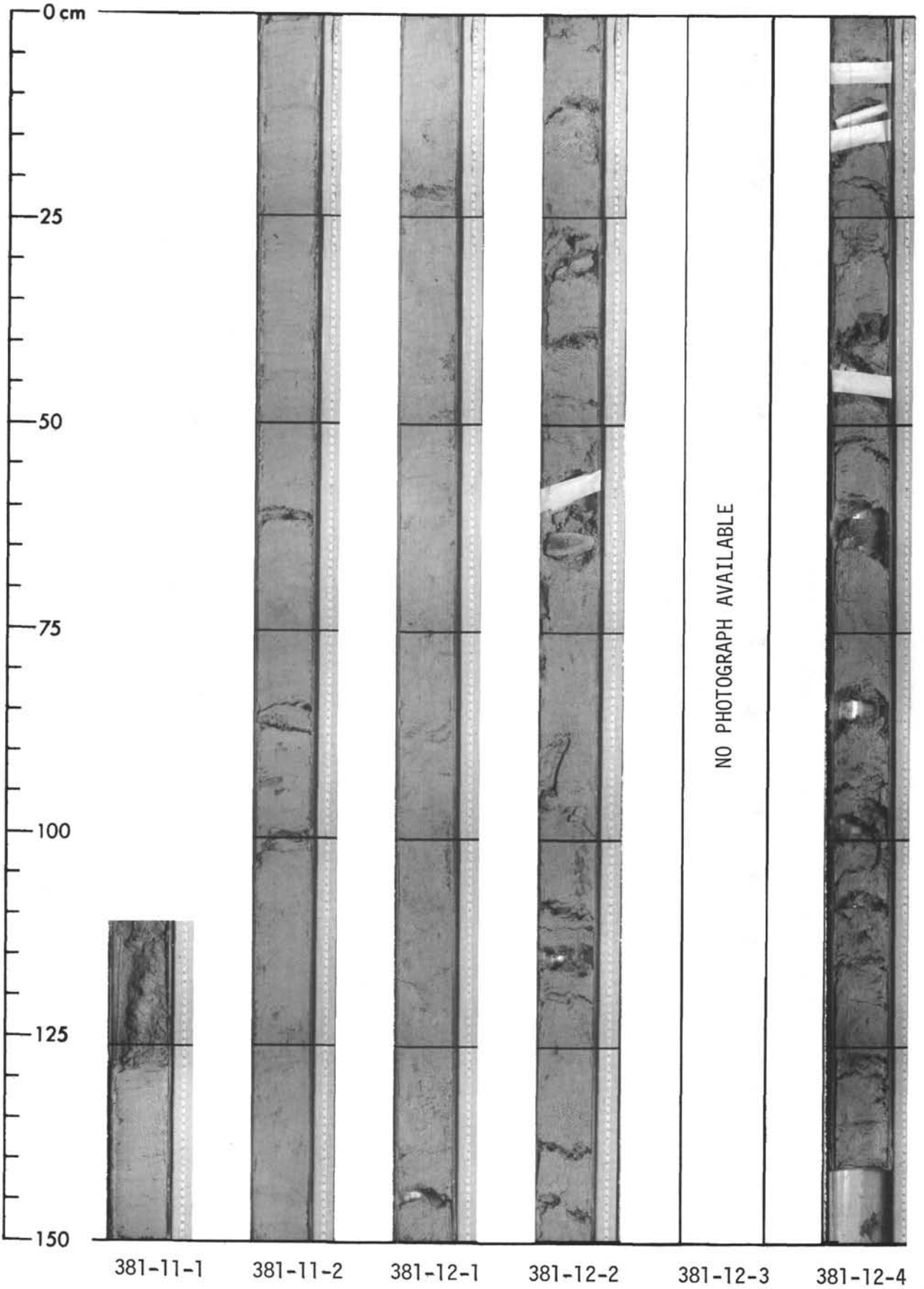

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
NO PHOTOGRAPH AVAILABLE
381-5-1
381-5-2
381-5-3
381-5-4
381-6-1
381-6-2

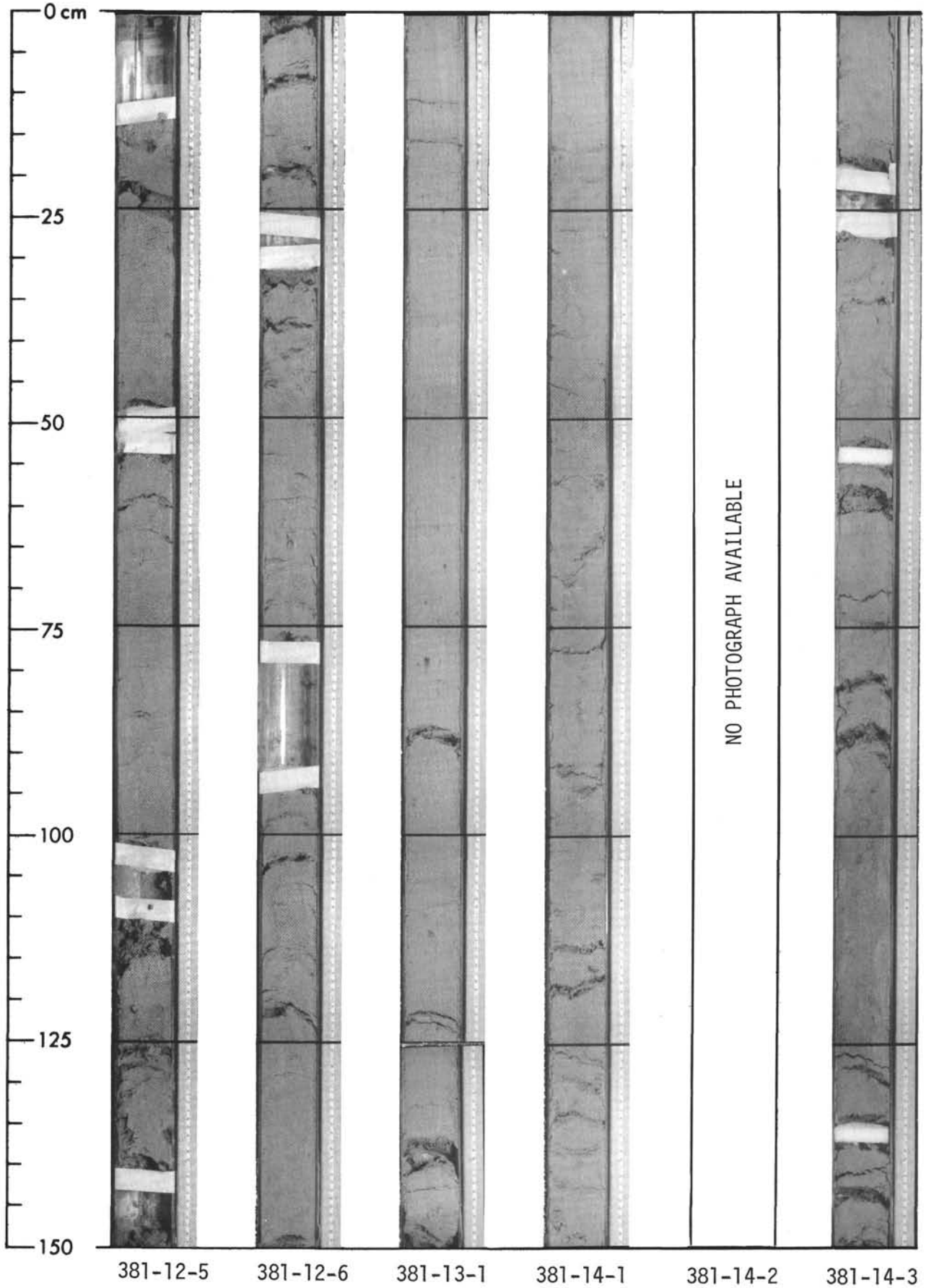

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
for 7-1 and 7-2
381-6-3
381-6-4
381-6-5
381-7-3
381-7-4

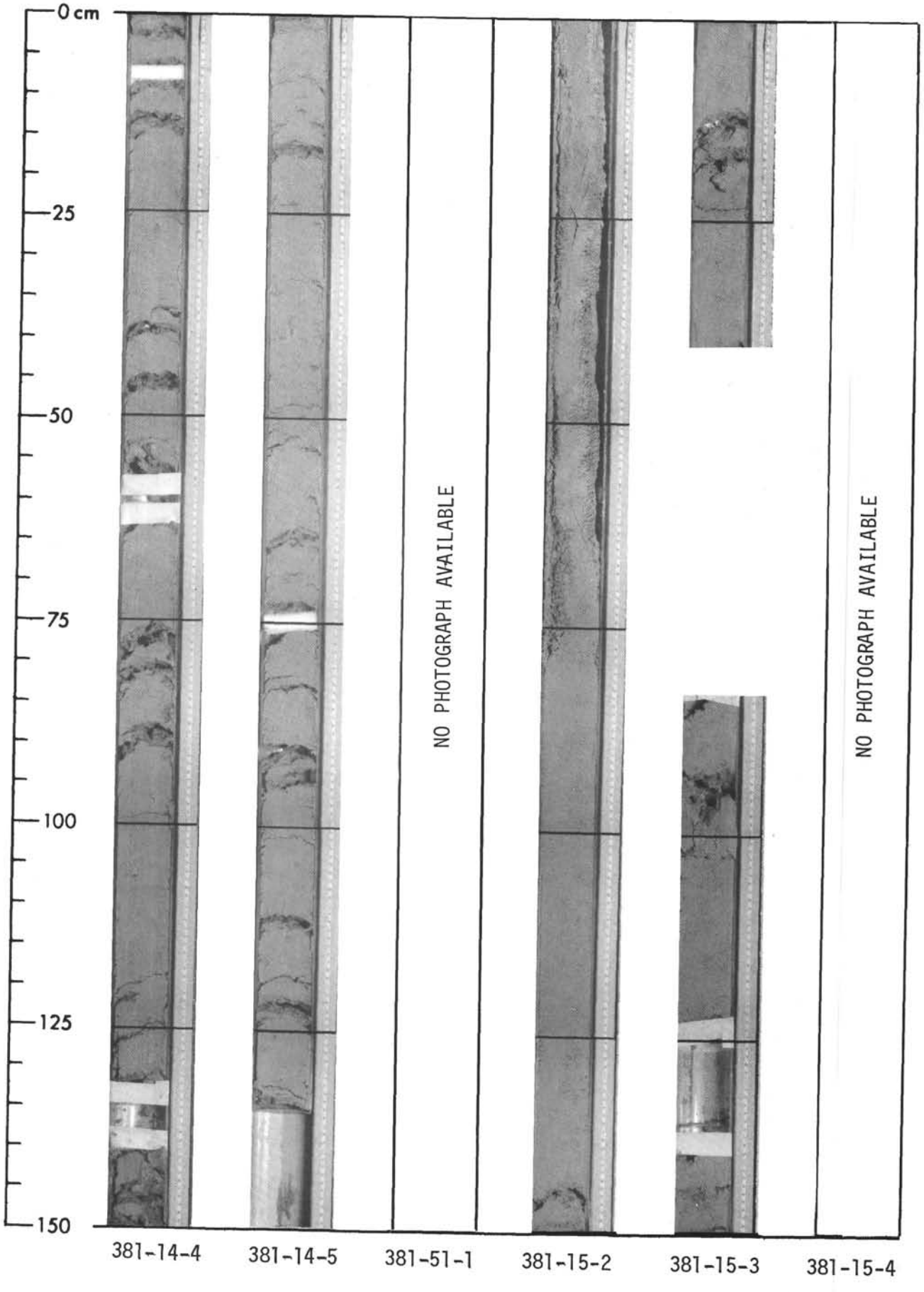

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
381-7-5
381-8-1
381-8-2
381-8-3
381-8-4
381-8-5

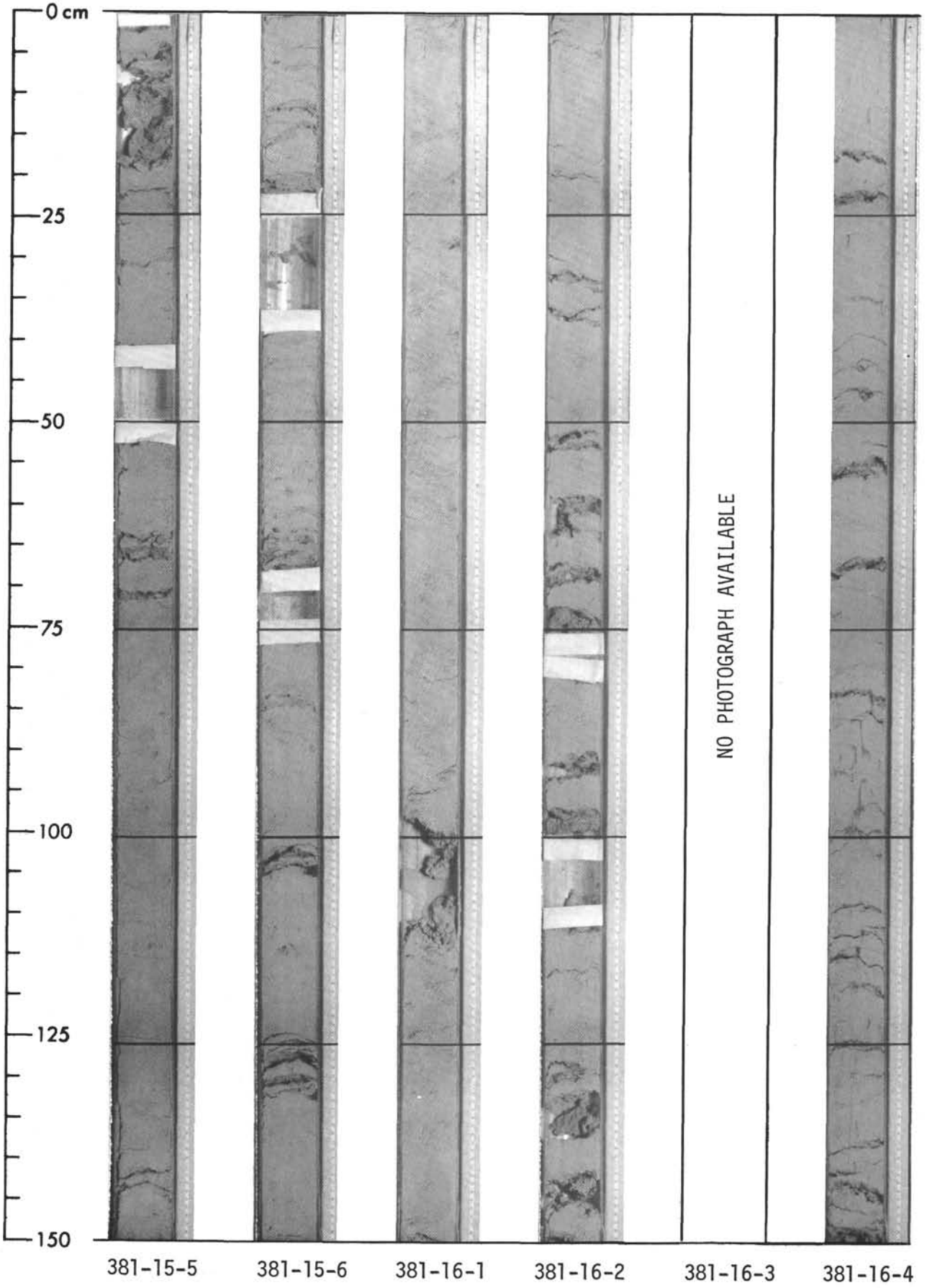

0 cm
25
50
75
100
125
150
381-9-1
381-9-2
381-9-3
381-9-4
381-9-5
381-9-6

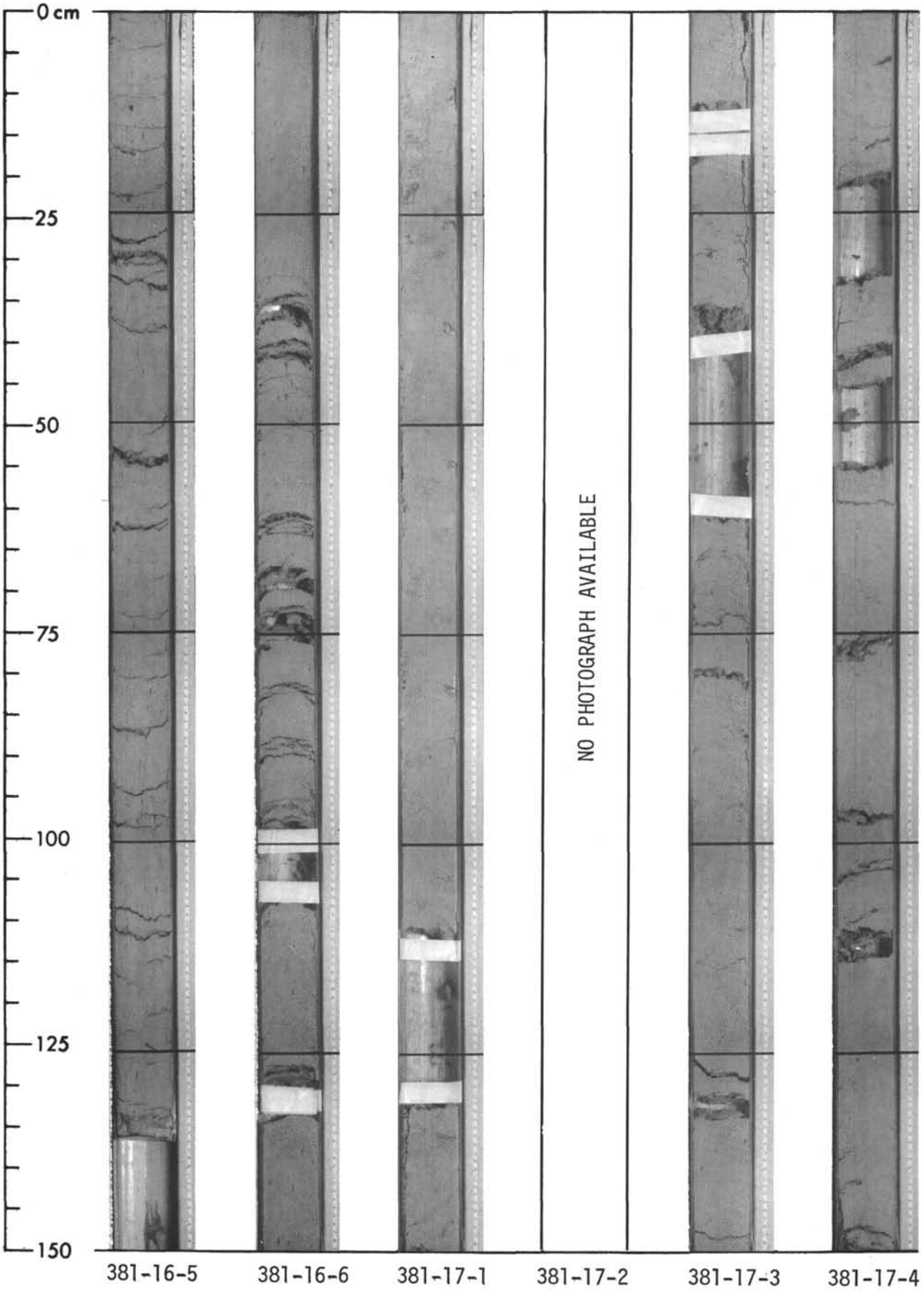

0 cm
25
50
75
100
125
150
381-10-1
381-10-2
381-10-3
381-10-4
381-10-5
381-10-6

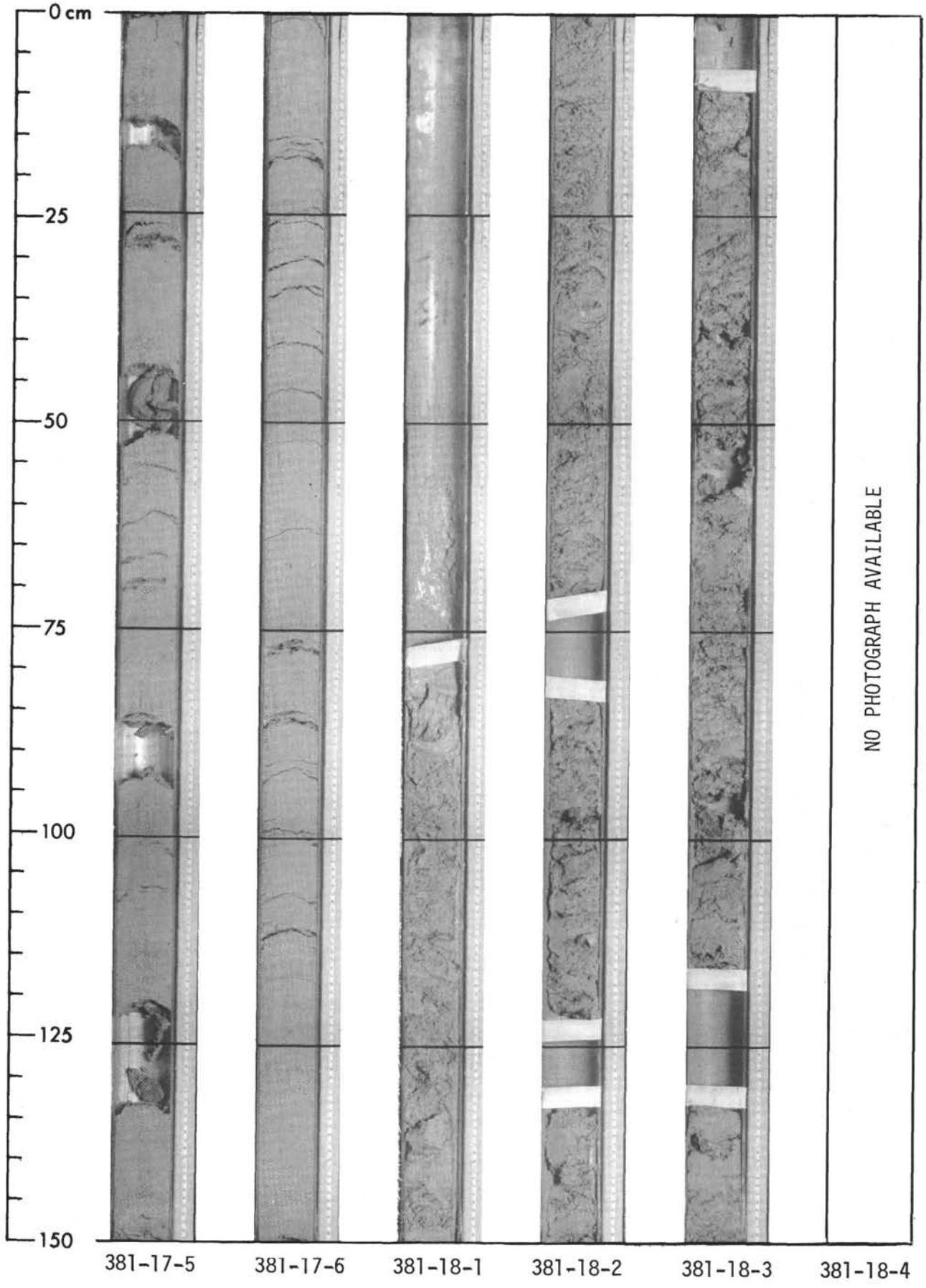

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
381-11-1
381-11-2
381-12-1
381-12-2
381-12-3
381-12-4


0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
381-12-5
381-12-6
381-13-1
381-14-1
381-14-2
381-14-3

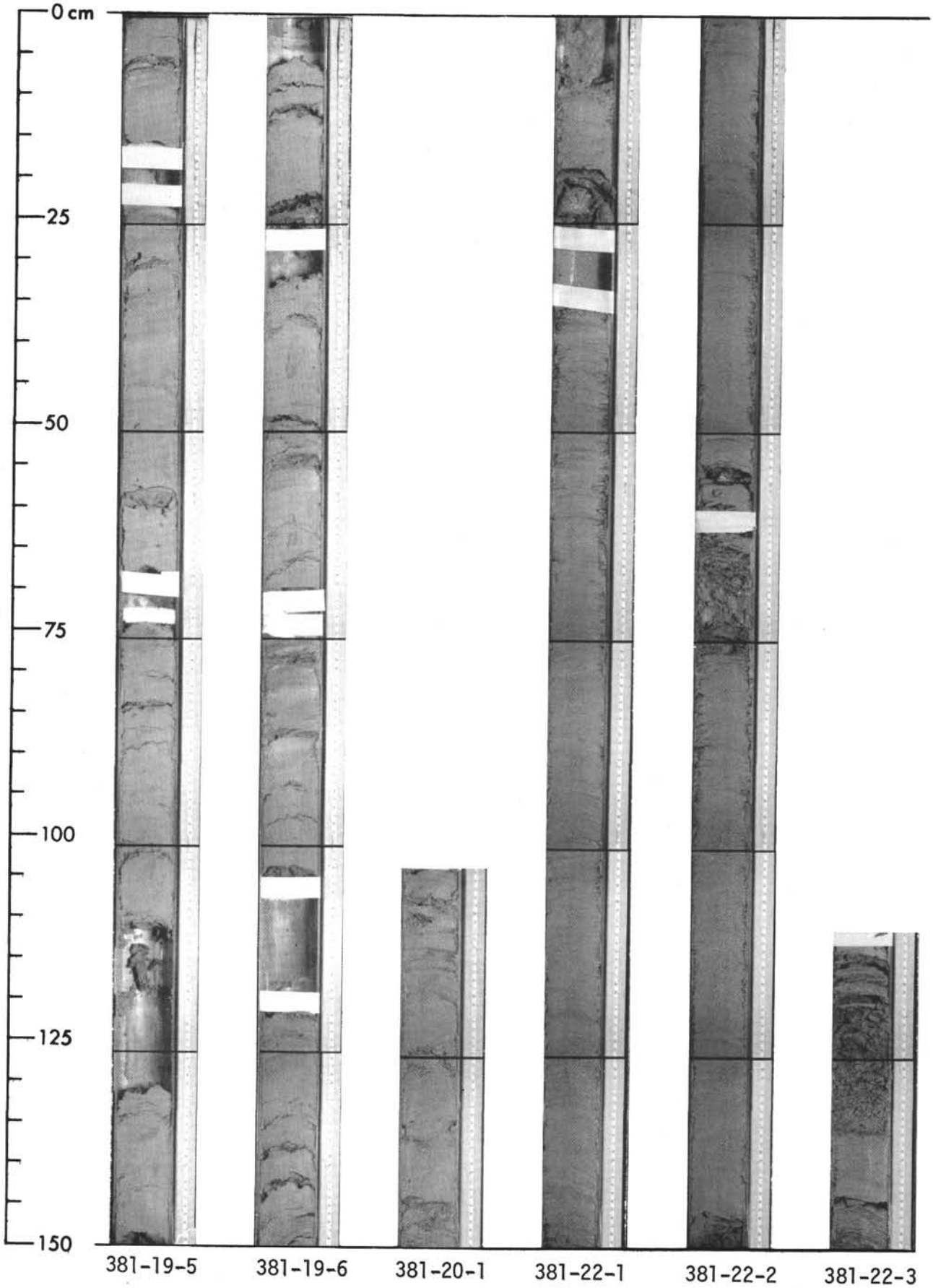

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
NO PHOTOGRAPH AVAILABLE
381-14-4
381-14-5
381-51-1
381-15-2
381-15-3
381-15-4

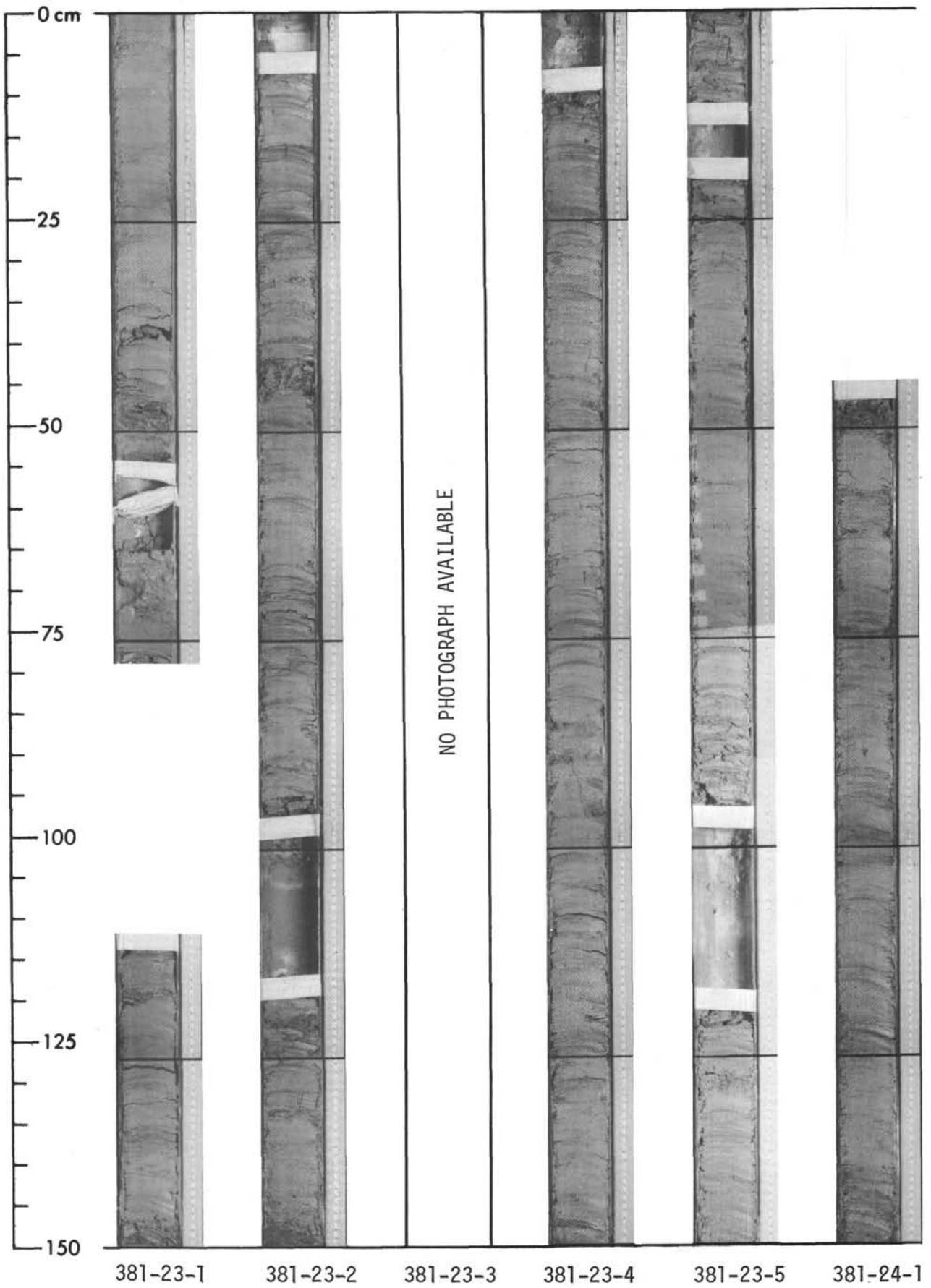

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
381-15-5
381-15-6
381-16-1
381-16-2
381-16-3
381-16-4

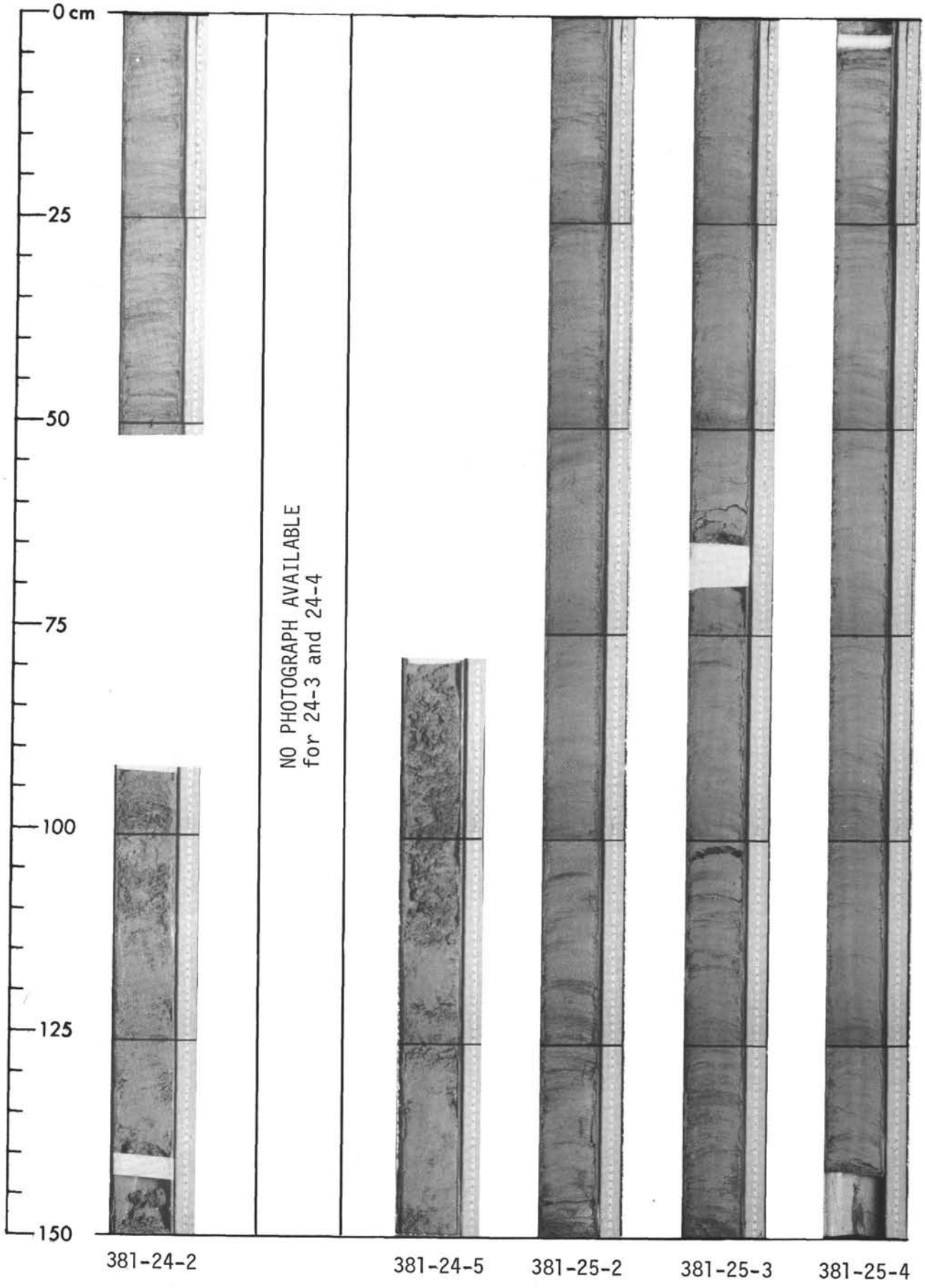

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
381-16-5
381-16-6
381-17-1
381-17-2
381-17-3
381-17-4

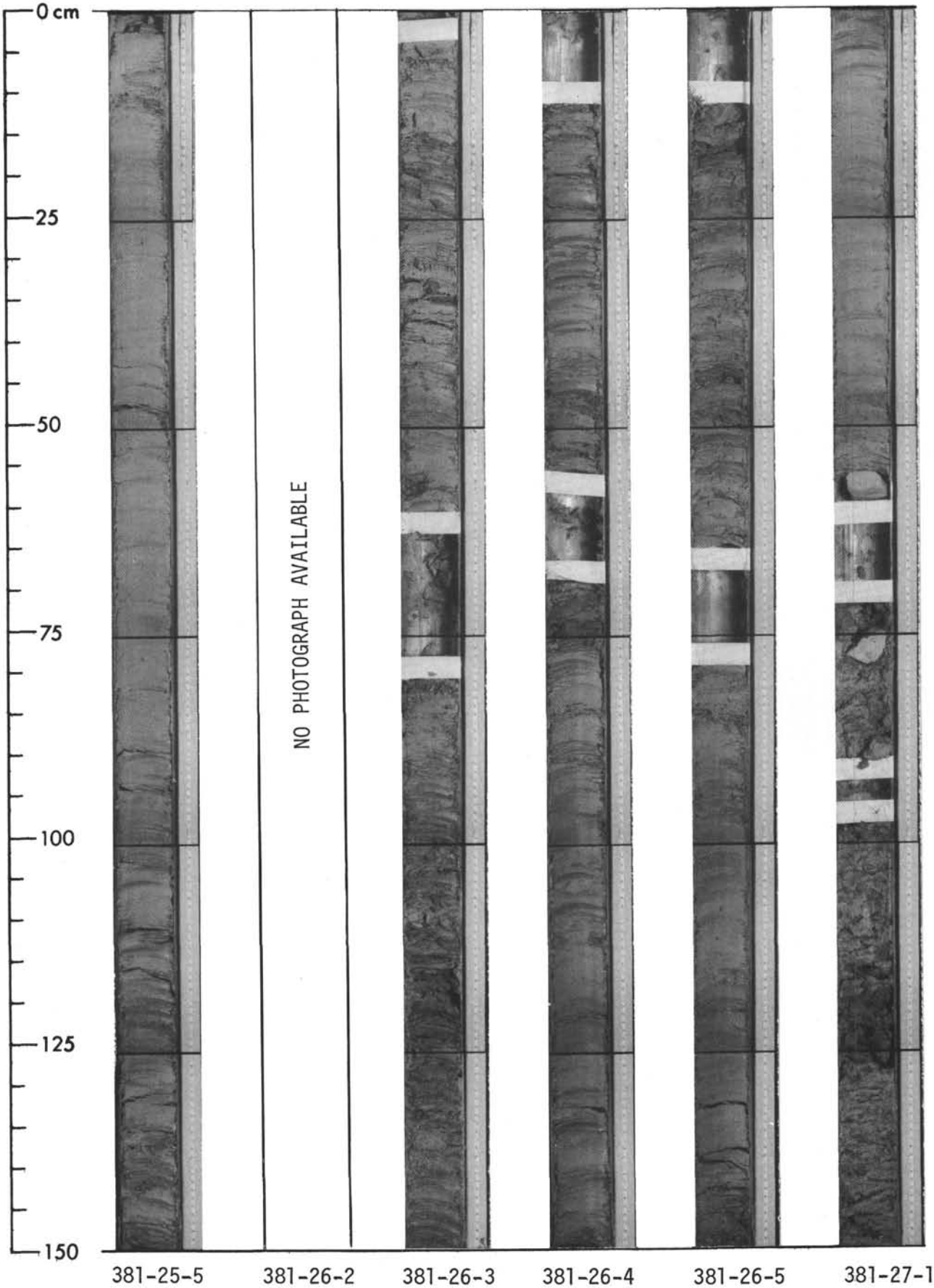

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
381-17-5
381-17-6
381-18-1
381-18-2
381-18-3
381-18-4

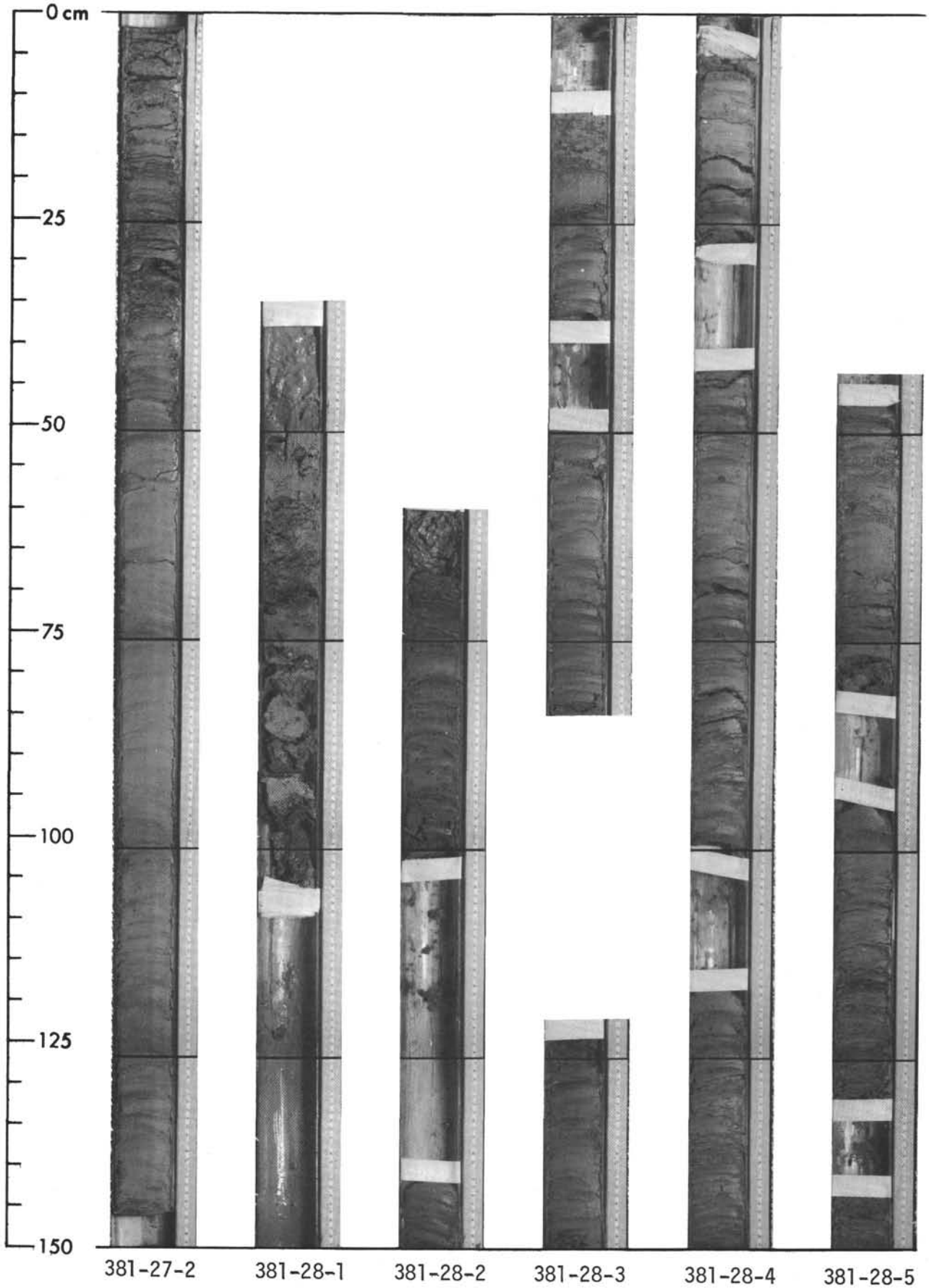

0 cm
25
50
75
100
125
150
381-18-5
381-18-6
381-19-1
381-19-2
381-19-3
381-19-4

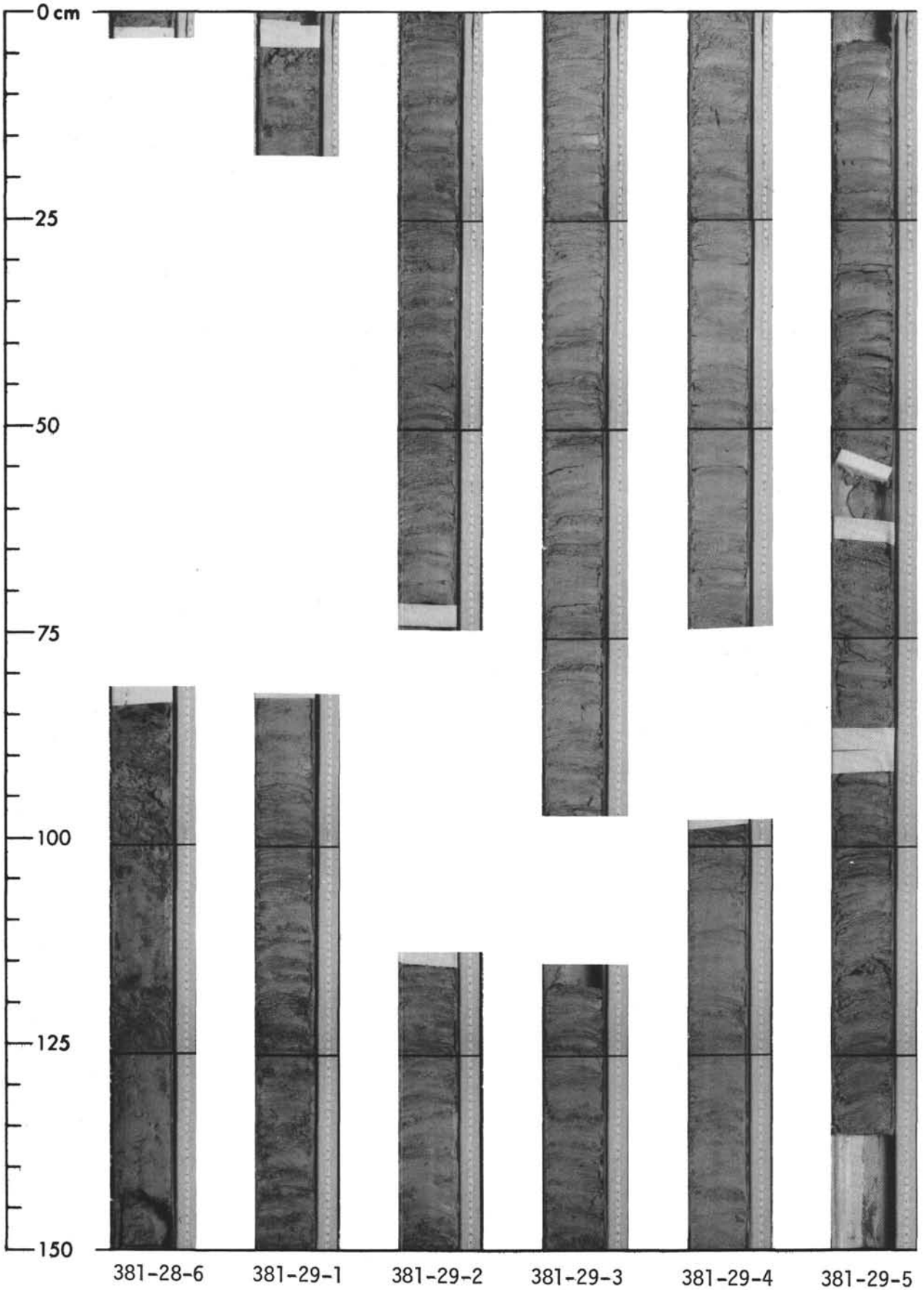

0 cm
25
50
75
100
125
150
381-19-5
381-19-6
381-20-1
381-22-1
381-22-2
381-22-3

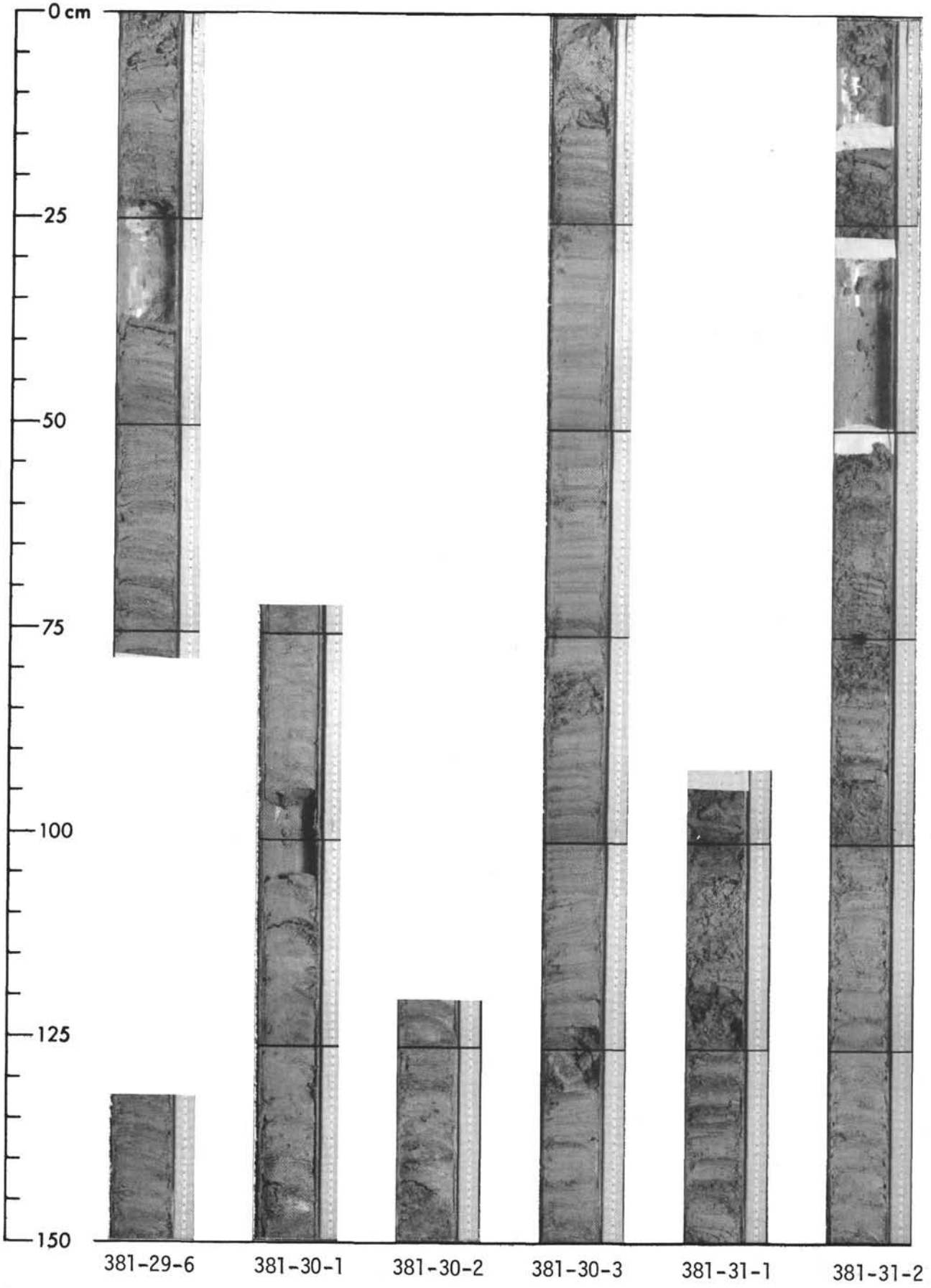

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
381-23-1
381-23-2
381-23-3
381-23-4
381-23-5
381-24-1

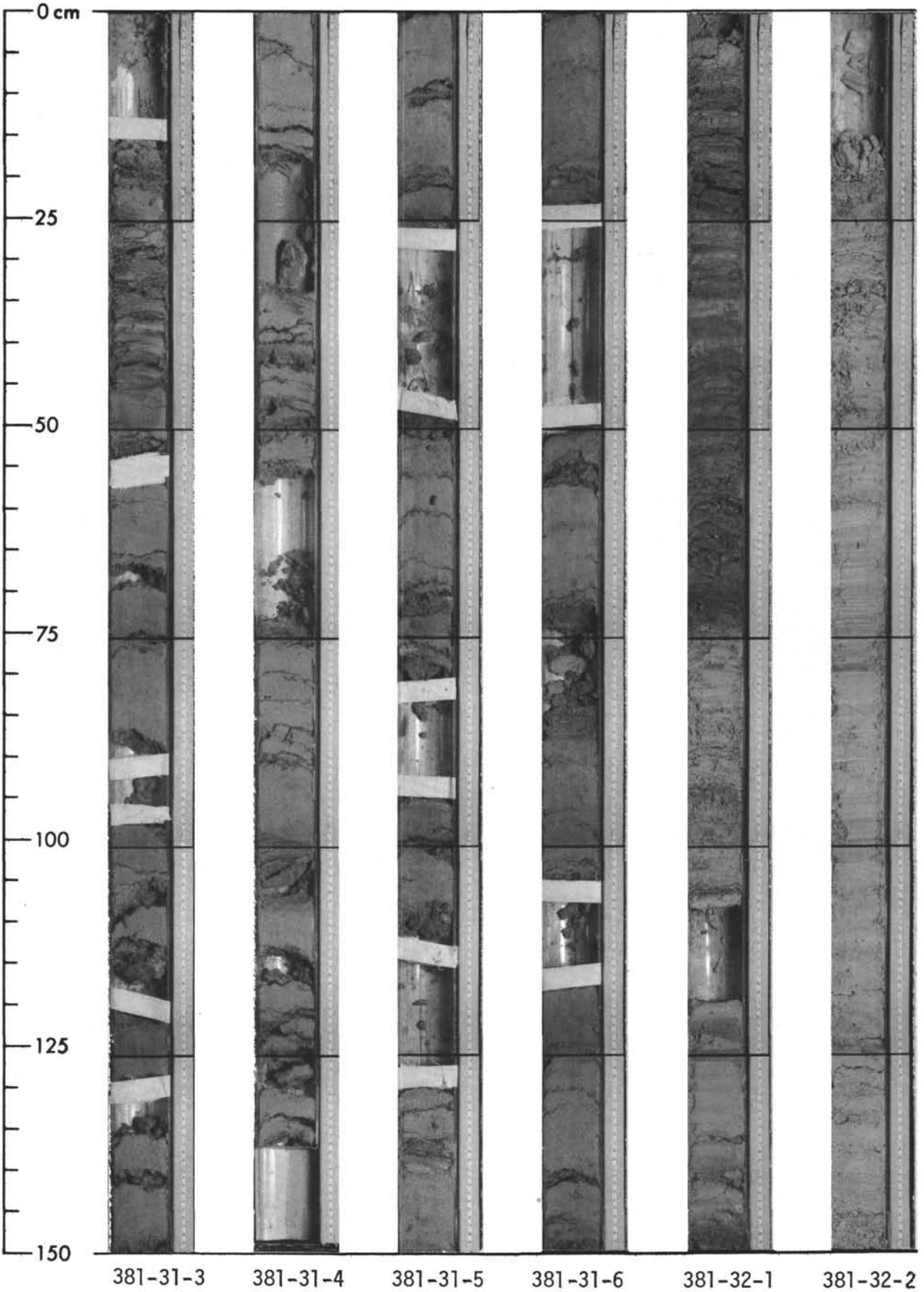

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
for 24-3 and 24-4
381-24-2
381-24-5
381-25-2
381-25-3
381-25-4

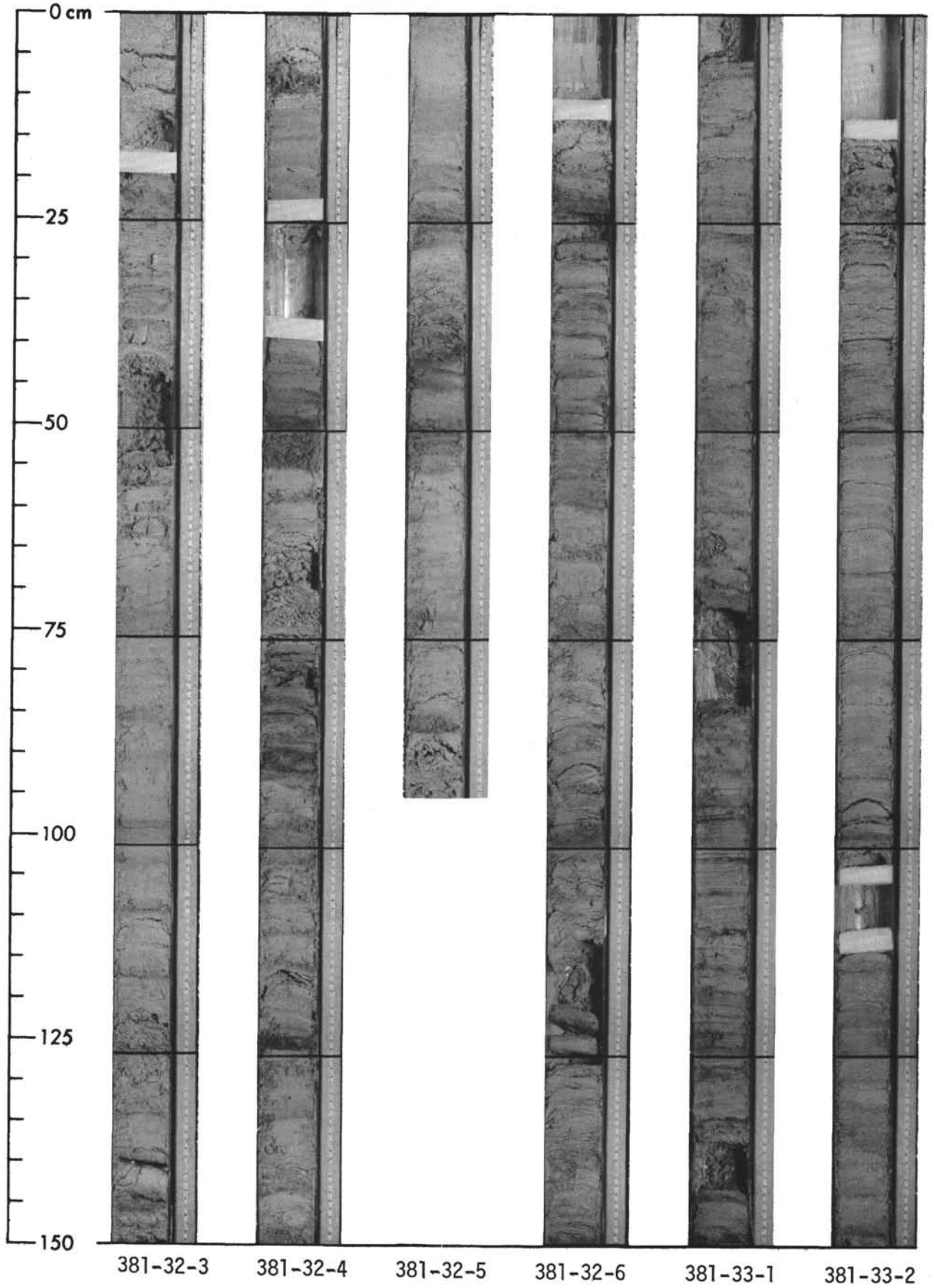

0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
381-25-5
381-26-2
381-26-3
381-26-4
381-26-5
381-27-1

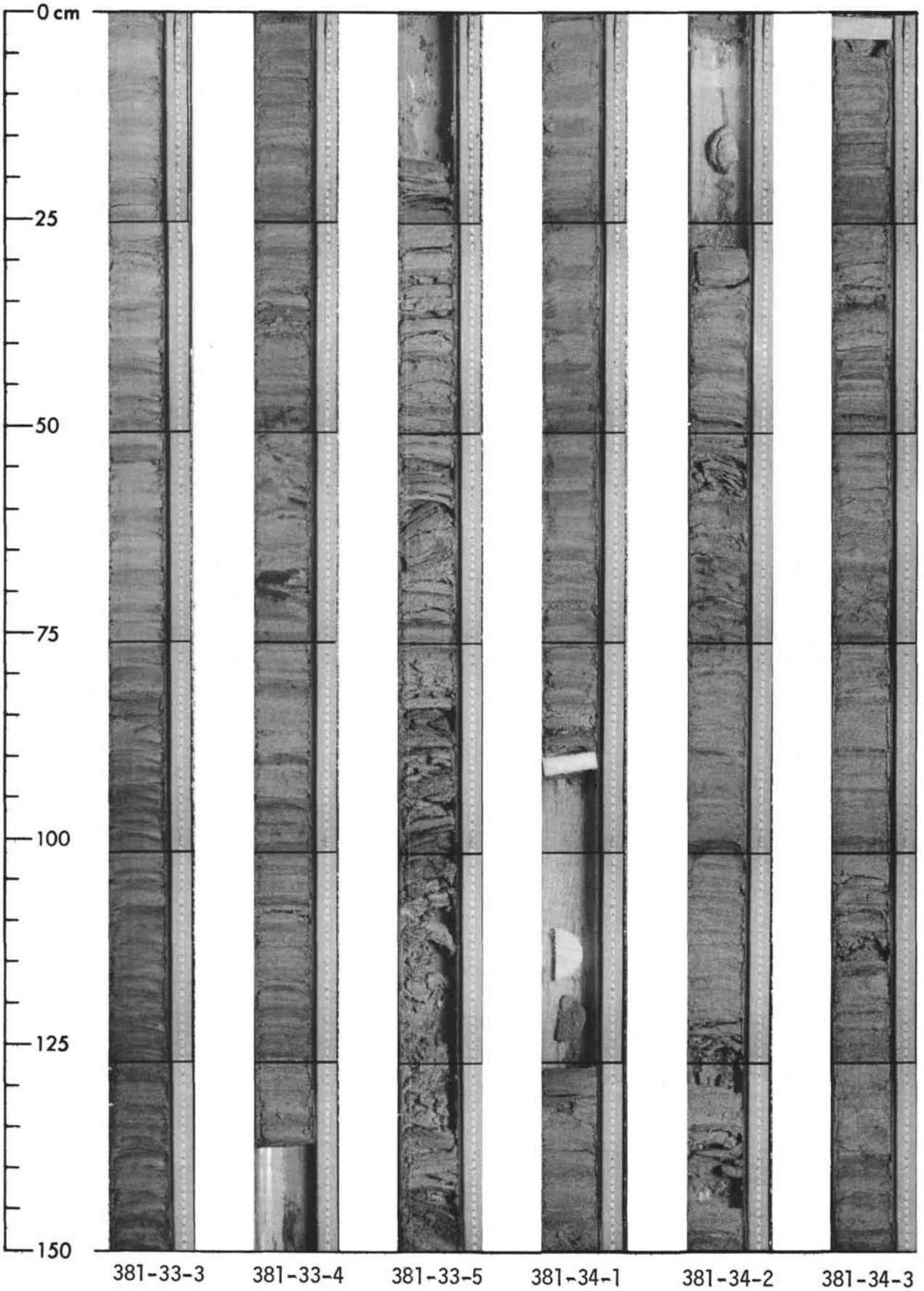

0 cm
25
50
75
100
125
150
381-27-2
381-28-1
381-28-2
381-28-3
381-28-4
381-28-5

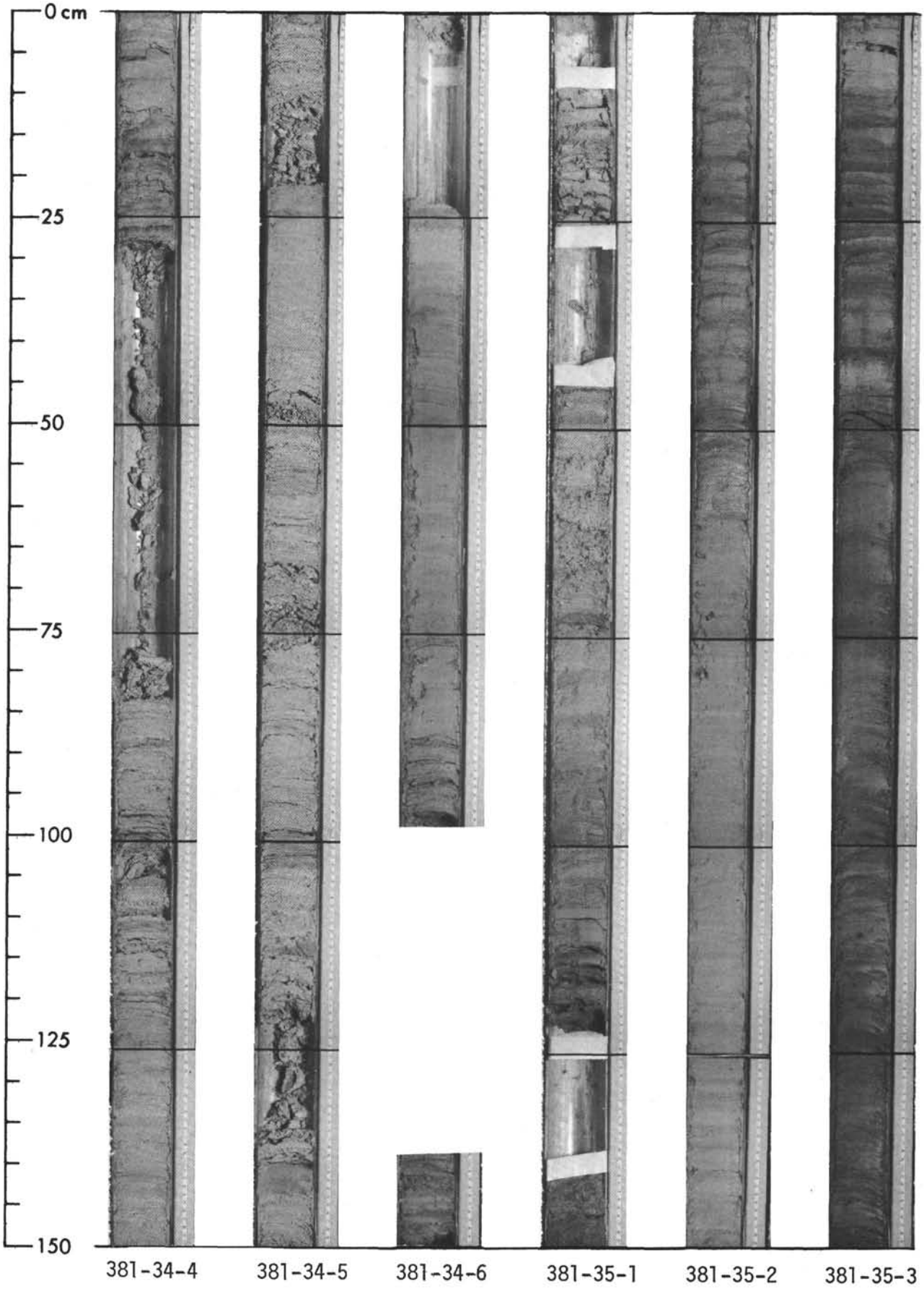

0 cm
25
50
75
100
125
150
381-28-6
381-29-1
381-29-2
381-29-3
381-29-4
381-29-5

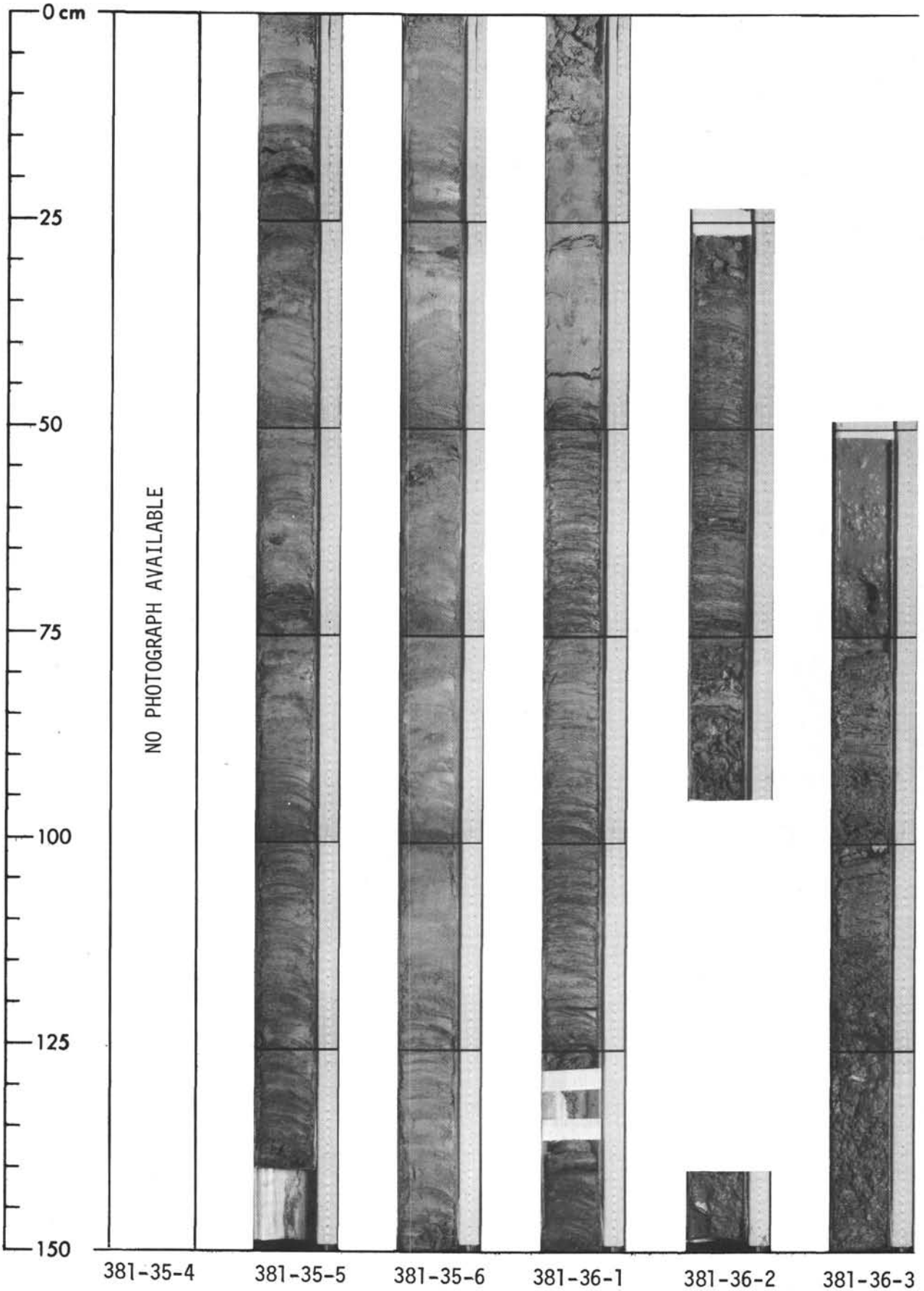

0 cm
25
50
75
100
125
150
381-29-6
381-30-1
381-30-2
381-30-3
381-31-1
381-31-2


0 cm
25
50
75
100
125
150
381-31-3
381-31-4
381-31-5
381-31-6
381-32-1
381-32-2


0 cm
25
50
75
100
125
150
381-32-3
381-32-4
381-32-5
381-32-6
381-33-1
381-33-2


0 cm
25
50
75
100
125
150
381-33-3
381-33-4
381-33-5
381-34-1
381-34-2
381-34-3


0 cm
25
50
75
100
125
150
381-34-4
381-34-5
381-34-6
381-35-1
381-35-2
381-35-3


0 cm
25
50
75
100
125
150
NO PHOTOGRAPH AVAILABLE
381-35-4
381-35-5
381-35-6
381-36-1
381-36-2
381-36-3