5. SITE 47

Shipboard Scientific Party[1]

SITE DATA

Occupied: June 28-30, 1969.

Position: Crest of Shatsky Plateau:
Latitude 32° 26.9′N
Longitude 157° 42.7′E

Water Depth: 2689 meters.

Total Depth Subbottom: 129 meters cherty Maestrichtian chalk.

Hole 47.0: One core; abandoned due to beacon failure.

Hole 47.1: Two cores, stopped in chert.

Hole 47.2: Fourteen cores, stopped at total depth of 129 meters due to chert (Maestrichtian).

MAIN RESULTS

Late Miocene and younger calcareous oozes with well-preserved siliceous skeletons rest unconformably on Eocene-Paleocene-Maestrichtian chalk oozes.

The Cretaceous chalks are cherty.

Excellent planktonic faunas provide a new biostratigraphic standard for the Northwest Pacific.

BACKGROUND

The Shatsky Rise is a major feature, over 240 miles wide and several hundred miles long, rising from depths of around 6000 meters to 3000 meters and less. It is cut into several disunited blocks by ENE-trending fracture zones. DSDP drilling took place in the southernmost and highest of these blocks known as the Shatsky Plateau.

The geology of the Shatsky Rise had been probed by traverses of the *Vema,* the *Conrad,* and the *Argo* Scan 3 Site Survey, and had been touched on in several papers (Ewing, Saito, Ewing and Burckle, 1966; Ewing, Ewing, Aitken and Ludwig, 1968). The authors' data were mainly the *Argo* profiles, and the published material of particular significance–namely the Albian core obtained by *Vema,* and a basalt core obtained by *Argo.*

The abyssal sea floor around the Shatsky Rise shows the normal acoustostratigraphy of some 0.3 to 0.4 second of sediment (upper transparent, upper opaque, lower transparent layers) resting on a smooth opaque substratum (Horizon B′). Locally hills or mountains, with or without a sedimentary cover, rise above the floor.

On the Shatsky Plateau the sedimentary cover reaches a thickness of one second double travel time, or something in excess of one kilometer.

The sedimentary section on the Plateau can be differentiated into several layers on the acoustic profiles, but the stratigraphy is complicated by a number of discordances–horizons of onlap and truncation–as well as by interruptions where B′ or basement crops out or comes close to the surface (Figure 1).

A near-surface reflection, termed α by Ewing *et al.,* at a depth of 0 to 0.06 second, is generally obscured by artifacts on the *Argo* profiles, but shows up in places. Piston cores suggested that this surface layer thus defined is of Neogene age, and the drilling program has verified this. Its base is a pre-late-Miocene depositional hiatus.

Below this lies a lenticular body of sediment, up to 0.4 second thick on the crest, thinning rapidly or pinching out altogether on the upper flanks (Figure 1). In some areas, such as east of DSDP Site 48, the unit is thinned by loss of beds at the top, below the Neogene unconformity (Figure 1); whereas, farther down the west flank, beds pinch out progressively at the base (a case of down-dip "onlap"). Internally this body of sediment is characterized by a multitude of rather weak reflectors, especially well shown on the west flank. No cores had been obtained from this unit. Drilling into the upper portion at Sites 47 and 48 recovered sediments which were Paleogene and Late Cretaceous in age.

The next lower (and lowest) unit of the sediments is defined at the top of a very strong reflector. Other strong reflectors occur deeper down in this sequence, which reaches a thickness of about 0.4 second on the crest. The unit thins down-dip, but not so rapidly as does the overlying one. The *Argo's* reflection profiles show that the Cretaceous outcrop, where the Albian

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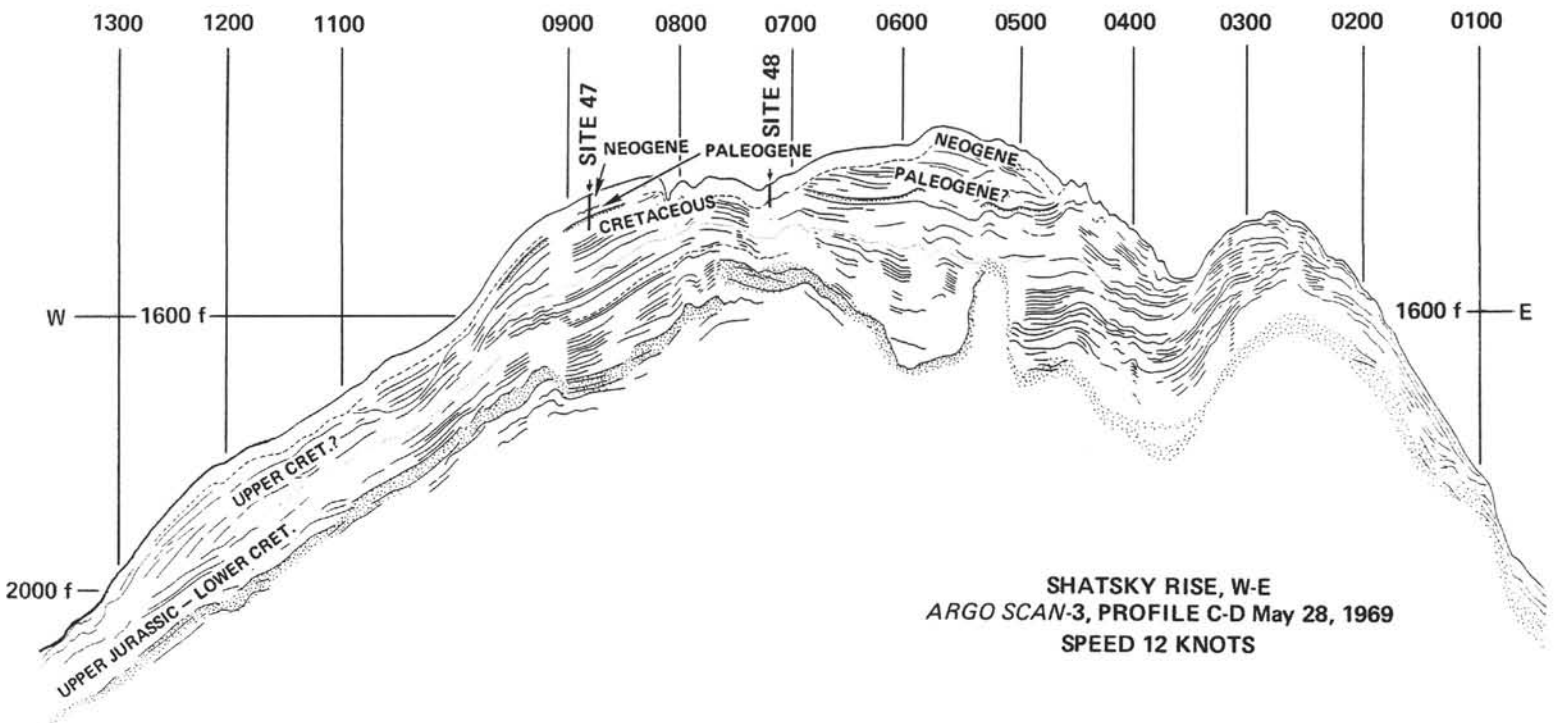

Figure 1. *Drawing of* Argo *four-second profile across Shatsky Rise.*

core was obtained by the *Vema,* is capped by the reflector at the top of this lower sedimentary section. The authors therefore, believe the top of this section to be of Aptian-Albian age, a view reinforced by the discovery of Aptian-Albian detrital chert cobbles at Site 50, below an extensive outcrop of this unit. Sites 49 and 50 sampled the lower part of the unit, and found it to be of Tithonian-Neocomian age.

The lowest acousto-stratigraphic unit is B′, the lower layer. The *Argo* cored it at a site near the *Vema* Albian core, and found weathered basalt (George Shor, personal communication). The reason for not calling it basement outright is twofold: (1) the general observation that its surface is much smoother than is that of fresh oceanic basement; and, (2) the impression that beds pass into it laterally, and coherent reflections can be seen in it in places (Figure 1).

Objectives

The general objectives in the Shatsky Rise area were the following:

(1) To date the sedimentary sequence, presumably largely carbonate on the plateau, and to establish here a standard paleontological-biostratigraphic reference section for the Northwest Pacific.

(2) To date the age of the ocean floor here by dating the oldest sediments.

(3) To establish the nature of Horizon B′ and, if possible, of basement proper.

(4) Of further interest were the dating of the stratigraphic discordances on the Rise, and the investigation of facies changes–for example, the question of whether the Rise was ever a site of shallow water sedimentation, and the question of changes with time in the carbonate compensation depth along its flanks.

Strategy

After experiences at previous sites the authors recognized the chief problems as being technological ones: (1) To find sites with sufficient cover of soft sediments to bury the vulnerable bottom-hole assembly of drill-collars, and (2) to achieve penetration in a section which was known to be cherty in part (the *Vema's* Albian core contained chert), and which might be cherty throughout. The hope was to drill two or three sites, and choose them so as to explore the section to progressively deeper levels. Thus, Site 47 was chosen on the Plateau, high on the edge of the west flank, (Figures 1, 2 and Chapter 6, Figure 1) where the sedimentary section appeared to be relatively complete, yet thin enough to penetrate with a single hole should it prove drillable.

OPERATIONS

The site was picked mainly on the basis of the *Argo's* lines, with some supplementary data from the *Glomar Challenger's* own profile. A Burnett beacon was dropped at 1410 hours on June 28, but began to malfunction (intermittent receipt) on the way down. Therefore, the ship moved three miles to the west and dropped an ORE beacon at 1630 hours, spudded with a heavy diamond bit at 2300 hours, and took a core at a subbottom depth of 0 to 9 meters in the Pleistocene. The beacon began to malfunction badly. The hole was drilled to 90 meters when beacon reception ceased, and a decision was made to drift to a new location. Tools were pulled up above bottom, and the ship was allowed to drift for one hour, at which time the beacon signal came in loud and clear once again.

Hole 47.1 was spudded at 0400 hours. A single core was recovered (96 to 105 meters subbottom) before massive chert was encountered at 112 meters, and this put an end to further progress.

The tools were brought back to the mudline and Hole 47.2 was spudded, and was cored continuously to a total depth of 129 meters subbottom, when chert again stopped further progress. This site was abandoned at 1700 hours on June 30.

The behavior of the beacons deserves special comment. Whether the failure of the Burnett beacon was instrumental, or resulted from fluttering and laying over in a current remains uncertain. The ORE beacon was evidently inclined, and the authors suspect that this was due to a steady and constant bottom current. The shape of the Burnett beacon and its lesser buoyancy may render it more vulnerable to inclination in a current. If so, the ORE beacon may have advantages in current swept areas.

NATURE OF THE SEDIMENTS

Hole 47.0

In the one core from this hole, nine meters of sediment were recovered between the sea floor and 9 meters subbottom depth. The sediment is interlayered white, gray and brown nannoplankton-foraminiferal and nannoplankton chalk ooze with siliceous microfossils.

The following variations were noted:

(1) From the top of the core to a depth of 2.75 meters (Section 1, top two-thirds of Section 2) the sediment is interlayered light olive gray, greenish-gray and gray nannoplankton-foraminiferal chalk ooze containing abundant nannofossils, common planktonic foraminifera, and lesser amounts of well-preserved diatoms, Radiolaria and sponge spicules. The sediment is highly contorted by coring, but individual layers of

differing colors appear to average 30 to 35 centimeters in thickness.

(2) From 2.75 to 5.70 meters below the top of the core (lower third of Section 2, Section 3, upper two-thirds of Section 4) the sediment is interlayered gray, light gray, dark gray, pale olive and yellow-brown, sandy nannoplankton-foraminiferal chalk ooze with common to rare, well-preserved diatom and radiolarian tests. This interval is similar to the previous one except that the layers of different colors, although likewise highly disturbed during coring, appear to be thinner and to average about 10 to 15 centimeters in thickness. From 3.70 to 4.80 meters (bottom of Section 3, top of Section 4) there is "cyclic" bedding of light gray, dark gray and brown chalk ooze; this three-fold division is repeated about five times, and the average thickness of each "cycle" is 20 to 25 centimeters. Pebble-size fragments of light gray pumice occur in the top part of Section 3 and the bottom part of Section 4.

(3) From 5.70 to 9.00 meters (bottom third of Section 4, Sections 5 and 6) is a highly contorted interval of gray, light gray, and white nannoplankton chalk ooze containing abundant nannofossils, rare planktonic foraminifera, common to rare diatoms, and very small amounts of Radiolaria and volcanic glass. X-ray diffraction studies by Rex (this volume) show small amounts of quartz, plagioclase, and montmorillonite in these calcareous oozes.

Hole 47.1

One core was drilled between 91.4 and 100.6 meters subbottom depth in this hole, and recovered about 2.4 meters of white nannoplankton chalk ooze. This sediment contains abundant nannofossils, common clay minerals, rare planktonic foraminifera, and common to rare diatoms, Radiolaria, and sponge spicules. Mixed ages of microfossils (see Biostratigraphy Summary) suggest considerable caving from uphole, and all of the siliceous microfossils appear to have been introduced by this means as they are younger than the Paleocene age assigned to the sediment. Scattered through the sediment are occasional pellet-like grains of more consolidated chalk ooze. Silt-size aggregations of elongate calcite crystals—probably fragments of mollusk shells—are a rare component in the ooze of this core, except near the bottom of Section 2 where they are abundant.

Hole 47.2

Fourteen cores were recovered from this hole during continuous coring between 9.1 and 129.2 meters below mudline. The sediment is almost entirely very soft nannoplankton chalk ooze of a variety of mostly light colors: white, gray, light gray, light yellow, gray-brown, dark gray, and yellowish-brown. Most of the sediment was very water-rich upon recovery, consequently some core sections were not split open and those opened were highly deformed.

Sediment characteristics and the estimated average composition of the sediment in each core barrel are given in Table 2.

These estimates show an increase in the calcium carbonate content (nannofossils, foraminifera, shell fragments) from the top of Core 7 (64 meters subbottom depth) downward in the hole, and a corresponding decrease in silicate components (siliceous microfossils, volcanic glass, quartz and feldspar). This trend is also recorded in the measurements of natural gamma radiation (see section on Physical Properties) which show high values down to the top part of Core 7, and markedly lower values below this point. This change probably reflects the lesser amounts of volcanic glass present from Core 7 downward.

TABLE 1
Summary of Coring at Site 47

	Interval Cored (Below Mudline)		Recovery	
Core No.	(ft)	(m)	(ft)	(m)
47.0-1	0-30	0.0-9.1	30	9.1
47.1-1	315-345	96.0-105.2	8	2.4
47.1-2	365-369	111.3-112.5	0	0.0
47.2-1	30-60	9.1-18.3	15	4.6
47.2-2	60-90	18.3-27.4	26	7.9
47.2-3	90-120	27.4-36.6	17	5.2
47.2-4	120-150	36.6-45.7	30	9.1
47.2-5	150-180	45.7-54.9	30	9.1
47.2-6	180-210	54.9-64.0	20	6.1
47.2-7	210-240	64.0-73.2	30	9.1
47.2-8	240-270	73.2-82.3	30	9.1
47.2-9	270-300	82.3-91.4	30	9.1
47.2-10	300-330	91.4-100.6	30	9.1
47.2-11	330-360	100.6-109.7	30	9.1
47.2-12	360-390	109.7-118.9	17	5.2
47.2-13	390-420	118.9-128.0	30	9.1
47.2-14	420-424	128.0-129.2	4	1.2

Water depth: 2689.2 meters (8823 feet)

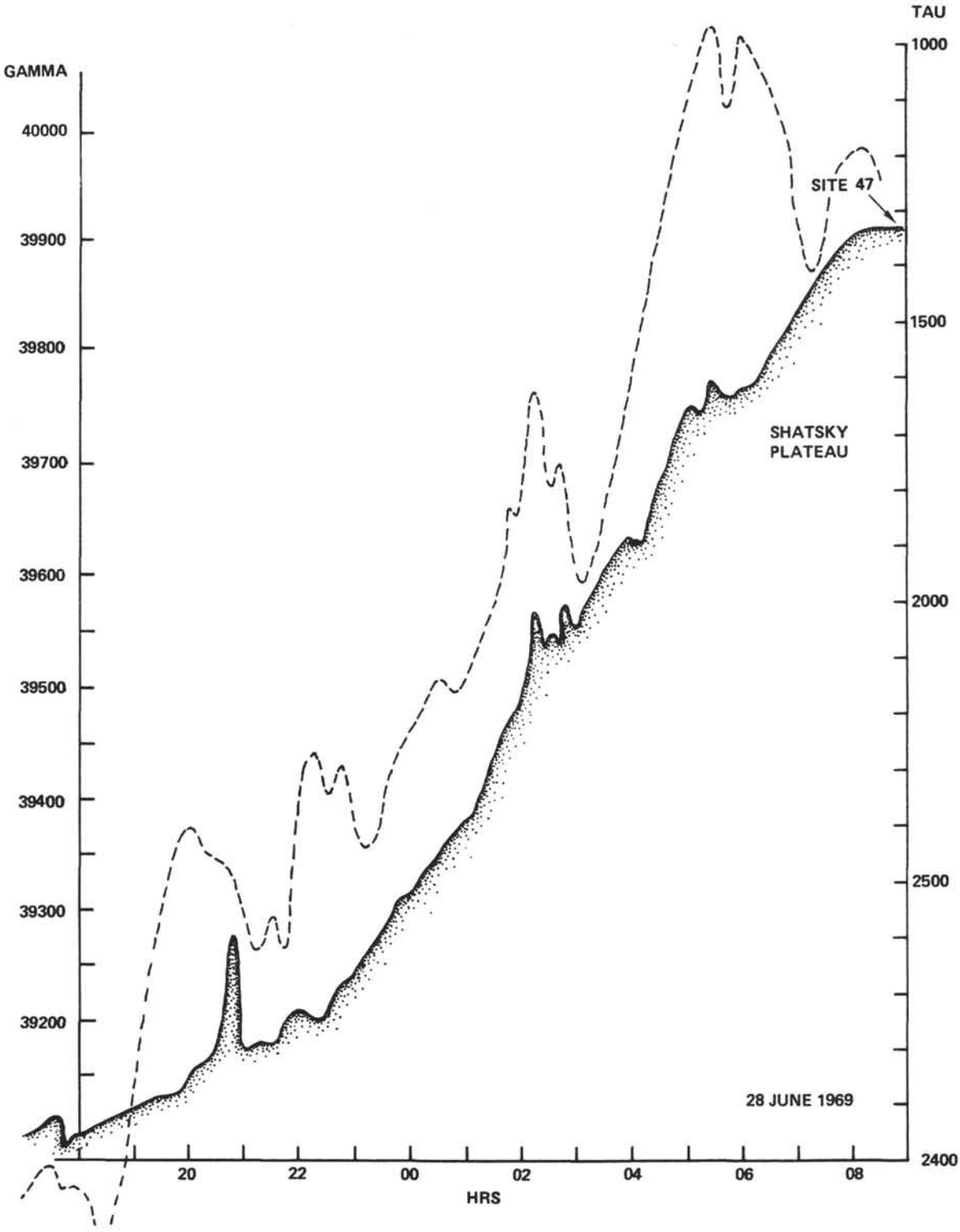

Figure 2. Challenger *profile at Site 46.*

The top part of Core 7 and bottom of Core 6 delineate the approximate position of an unconformable surface between sediments of late Miocene and Paleogene age. Sediment lodged in the core catcher of Core 6 is apparently from along this surface; it consists of highly burrowed, light brown zeolitic nannoplankton marl ooze that contains abundant large phillipsite crystals and fish debris. The phillipsite crystals are prominently zoned and have complex intergrowth twins (Chapters 22 and 38).

In addition to the small amounts of volcanic glass present in the chalk ooze of Cores 1 through 6, thin (3 to 5 centimeters) volcanic ash layers containing 80 to 90 per cent glass are observed in Cores 2, 3 and 6. A few scattered pieces of pumice 1 to 3 millimeters across occur in Cores 1, 3 and 4.

Towards the lower part of the cored interval in this hole (Cores 12, 13 and 14) small angular fragments of chert occur in the chalk ooze. These fragments vary from 1 to 10 millimeters across, and the chert is vitreous, brown or light brownish-gray, and has a subconchoidal fracture. A hard layer, probably chert, terminated drilling at 129.2 meters below mudline.

PHYSICAL PROPERTIES

Coring operations in all three holes at this site deformed the sediment so that the physical property measurements may not accurately reflect *in situ* conditions.

Natural Gamma Radiation

Hole 47.0

Only one core of Pleistocene foraminiferal-nannoplankton and nannoplankton chalk ooze was recovered from the mudline to a depth of 9.1 meters in Hole 47.0. Natural gamma radiation from the ooze ranged from 300 to 2300 counts/7.6 cm core segment/1.25 minutes. On closer examination of the radiation counts, it can be seen that the foraminiferal-nannoplankton chalk ooze–0 to 6.1 meters below the sediment surface–emitted twice as much radiation as the nannoplankton ooze in the lower two sections (6.1 to 9.1 meters)–about 1400 counts against 700 counts (see hole and core plots). These lower radiation values are similar to those emitted from the Pleistocene nannoplankton ooze obtained in Hole 47.2.

From a cursory core inspection, the source of the high gamma emissions from the Pleistocene foraminiferal-nannoplankton chalk ooze was not overtly evident. Some possible explanations for these high gamma counts might be: (1) the presence of radionuclides in the interstitial water; (2) a particular type or amount of minerals, such as clay; (3) volcanic pumice; or, (4) perhaps some radionuclide concentrations via diatoms, radiolarians or foraminifera. X-ray mineralogy indicates relatively high montmorillonite content in both the low and high gamma-emitting sediments. Some Pleistocene diatom-radiolarian-rich sediments at other sites also seem to be associated with high gamma radiation counts. These gamma counts may have been emitted from some radioactive mineral or ion with a short half-life, which would have partly decayed with increasing depth, as the high counts did not occur in the other cores

Hole 47.1

Only one core was recovered from a depth of 95 to 99 meters in Hole 47.1. The natural gamma radiation averaged 150 counts from this Paleocene nannoplankton chalk ooze (see core plots). The same interval was drilled in Hole 47.2 (Core 10).

Hole 47.2

The natural gamma radiation at Hole 47.2 ranged from 0 to 1600 counts/7.6 cm core segment/1.25 minutes. The sediment throughout this hole, from 9 to 130 meters below the sediment surface, is Pleistocene to Cretaceous nannoplankton chalk ooze. There is a noticeable contrast between the stratigraphic section from 9 meters to 65.5 meters where counts averaged 300 to 500, and that from 65.5 to 130 meters where counts averaged about 150 (see hole and core plots). These higher counts in the upper part of the hole were probably caused by the presence of volcanic glass (see Lithological Summary) in the chalk compared with the lower part which has no glass. This depth of 65.5 meters also corresponds to the Upper Miocene/Middle Eocene unconformity. The high gamma spikes at 22 meters and 30 meters in the Tertiary sections were emitted by thin layers of volcanic ash.

Porosity, Wet-Bulk Density and Water Content

Hole 47.0

Pleistocene foraminifera-nannoplankton and nannoplankton chalk ooze comprise the only core recovered in Hole 47.0 from the mudline to a depth of 9 meters. Wet-bulk densities and porosities measured by the GRAPE ranged from 1.42 to 1.68 g/cc (average 1.53 g/cc) and 56 per cent to 72 per cent (average 66 per cent). The water content averaged 46 per cent, ranging from 40 to 49 per cent. The porosity measured 67 per cent and wet-bulk density 1.48 g/cc on sediment samples taken from the core. Water content and porosity decrease at a depth of 6 to 7 meters below the sediment surface (see hole and core plots) where the lithology changes from foraminiferal-nannoplankton chalk ooze to a nannoplankton chalk ooze. Below this interval, in Hole 47.2 nearby, the similar low porosities and water contents typically occur in sediments recovered from 13 to 65 meters.

TABLE 2
Percentage Compositional Estimates for Cores Recovered at Hole 47.2
(based on visual observations of smear slides)

Core No.	Age	Predominant Color	Nanno-fossils	Foraminifera (mainly planktonics)	Siliceous microfossils[a]	Clay minerals	Shell[c] fragments	Volcanic glass
1	Pleistocene	White to light brown	70	5	10	10*	5	0
2	Pleistocene	White to light gray	40	15	15	10*	5-20	10-20
3	Pliocene	White to light gray	55	10	15	5*	5-10	5-10
4	Pliocene	White to gray	60	6	12	5*	12	5
5	Pliocene-Miocene	White to dark gray	60	10	11	5*	11	3
6	Miocene	Yellow-brown to yellow-white	55	7	10	5*	18	5
7	Eocene	Yellow to brown	65	5	5	5	10	0-10
8	Eocene-Paleocene	White to brown	80	13	0	5	2	0
9	Paleocene	Light brown	70-90	5-20	0	5	0	0
10	Paleocene	White to light brown	60-80	10	0-5	5	5-30	0
11	Paleocene-Upper Cretaceous	White	40-80	5-35[b]	0	5	10-20	0
12	Upper Cretaceous	White	70-80	5[b]	0	2	15	0
13	Upper Cretaceous	White	65	10	0	5	10-20	0
14	Upper Cretaceous	White	50	10-25	0	5	30	0

[a]Diatoms, Radiolaria, sponge spicules.
[b]Contains abundant benthonic foraminifers.
[c]Mainly mollusks and foraminifera.
*These cores also contain 2 to 10 per cent quartz and feldspar according to X-ray studies by Rex.

Hole 47.1

Only three meters of Paleocene nannoplankton chalk ooze were recovered from 95 to 99 meters below the mudline in Hole 47.1. The porosity averaged about 61 per cent and ranged from 52 to 72 per cent; and, wet-bulk density averaged about 1.60 g/cc and ranged from 1.42 to 1.70 g/cc. The single water content sample measured 35 per cent water.

Hole 47.2

At Hole 47.2, cores from 91 to 130 meters are mainly Pleistocene to Miocene and Eocene to Cretaceous nannoplankton chalk oozes. The porosities of the ooze decreased, within 9 to 20 meters, from 74 per cent (1.38 g/cc) to a mode of about 58 per cent (1.60 g/cc), which remained fairly constant to a depth of 65.5 meters (see hole and core plots). Porosity values within the 0 to 65.5 meter interval spanned 52 to 74 per cent (1.30(?) to 1.69 g/cc).

At 65.5 meters there was an abrupt decrease in porosity to a mode of about 47 per cent (1.80 g/cc). This decrease in porosity coincided with the occurrence of a

coarser sediment. The range in porosity values in this lower half of the hole was 47 to 67 per cent (1.60 to 1.82 g/cc). The wet-bulk density, of course, also had a corresponding increase below 65.5 meters.

This significant change in porosity and wet-bulk density at 65.5 meters occurs at the upper Miocene-Eocene unconformity. Sediment is finer and contains some terrigenous minerals above the unconformity; and, below the unconformity it is coarser and consists almost entirely of calcareous microfossils and shell fragments (see detailed lithology).

At the Tertiary-Cretaceous boundary at 105 meters (Core 11) there appears to be another contrast between porosity values which was probably artificial. Porosity tended to increase again from 50 per cent (1.82 g/cc) to 65 per cent (1.60 g/cc), and within about 6 meters below the Cretaceous-Tertiary contact decrease back to 52 per cent (1.79 g/cc). This core was not split because it appeared artificially disturbed, and contained an apparent excess of water. Samples from the end of the core indicate that it is probably coarser than the sediment above or below it.

The water content in samples from 9 to 65 meters below the mudline ranged from 37 to 44 per cent with an average of 40 per cent. From 65 to 130 meters the water content ranged from 28 to 33 per cent, with an average of 31 per cent. The Upper Miocene/mid-Eocene unconformity at 65.5 meters therefore, was clearly indicated by the sudden decrease in water content in the sediments at this point.

Sound Velocity

Hole 47.0

Nine meters (0 to 9.1 meters below sediment surface) of Pleistocene foraminiferal-nannoplankton and nannoplankton chalk ooze were all that was recovered from Hole 47.0. Sound velocities ranged from 1.46 to 1.60 km/sec with an average of 1.48 km/sec. The higher values occurred in nannoplankton chalk ooze from the lower part of the core.

Hole 47.1

Only 2.4 meters of Paleocene nannoplankton chalk ooze were recovered from 96 to 99 meters at Hole 47.1, which had an average sound velocity of 1.57 km/sec with a range of 1.53 to 1.70 km/sec. The higher velocity of 1.70 km/sec occurred through the light gray nannoplankton chalk ooze with an estimated 40 per cent of authigenic calcite. In some areas the ooze appears as consolidated pellet grains (disturbed?) which may indicate a drilling breccia.

Hole 47.2

Pleistocene to Miocene and Eocene to Cretaceous nannoplankton chalk oozes were recovered from 9 to 130 meters sediment depth from Hole 47.2. Sediment sound velocities ranged from 1.49 to 1.70 km/sec with an average of 1.54 km/sec. Pleistocene to Miocene sediment sound velocities were very consistent down to a depth of 65.5 meters below mudline and averaged 1.52 km/sec (see core and hole plots). From 65.5 to 82 meters (Cores 7 and 8) sound velocities averaged 1.59 km/sec. This marked increase in sound velocities across the upper Miocene/mid-Eocene unconformity at 65.5 meters associated with a decrease in porosity (increase in wet-bulk density), is caused by an increase in particle size. From 82 to 100 meters (Cores 9 and 10) velocities averaged 1.54 km/sec in finer sediment, but at 100 to 107 meters (Core 11, Sections 1 through 4) high velocities of 1.62 km/sec are again associated with coarse, highly disturbed sediments (core not split). From 107 to 130 meters (Core 11, Sections 5 and 6; Cores 12, 13 and 14) the velocities returned to the more typical 1.54 km/sec of the finer-grained sediment. The Tertiary/Cretaceous boundary occurred at 106.7 meters, where the sound velocities changed markedly from 1.62 to 1.54 km/sec; this also directly coincided with the occurrence of coarser sediments.

By comparing the wet-bulk density to the sound velocity versus depth, it can be seen that there is generally a direct variation. Sound velocity also was directly similar to the penetration measurements and thermal conductivity.

Penetrometer

Hole 47.0

Pleistocene foraminiferal-nannoplankton and nannoplankton chalk oozes recovered from Hole 47.0 (0 to 9.1 meters below mudline) had a range of penetrometer measurements from 56 to 270 $\times 10^{-1}$ mm (see core and hole plots). The foraminiferal-nannoplankton chalk ooze was penetrated easier (60 to 270 $\times 10^{-1}$ mm) than the nannoplankton chalk ooze (56 to 57 $\times 10^{-1}$ mm).

Hole 47.1

Only one section of Paleocene nannoplankton chalk ooze was tested with the penetrometer in Hole 47.1 (92.0 meters to 94.5 meters). Values ranged from 65 to 110 $\times 10^{-1}$ mm.

Hole 47.2

Penetrometer measurements of the Pleistocene to Miocene and the Eocene to Cretaceous nannoplankton chalk oozes from Hole 47.2 are summarized in hole and core plots. Note that the range of penetration was

less in the Pleistocene to Miocene nannoplankton chalk oozes with ash and terrigenous material (9 to 65 meters) than the penetration range in Eocene to Cretaceous coarser nannoplankton ooze with shell material, Cores 7 to 13 (65 to 124 meters). In general, higher penetrometer readings were obtained in the coarser Eocene-Cretaceous sediments.

Sediments from Hole 47.2 had penetrometer readings that tended to associate directly to wet-bulk density, sound velocity, and thermal conductivity which in turn related to the porosity and grain size variations of the sediments.

Thermal Conductivity

Hole 47.0

One thermal conductivity measurement was made in Pleistocene foraminiferal-nannoplankton chalk ooze (5.2 meters below the sediment surface in Hole 47.0). The conductivity was 2.51×10^{-3} cal-°C^{-1} cm^{-1} sec^{-1}.

Hole 47.1

Highly disturbed Paleocene nannoplankton chalk ooze from Core 1 (92.1 meters below mudline in Hole 47.1) had a thermal conductivity of 2.69×10^{-3} cal-°C^{-1} cm^{-1} sec^{-1}.

Hole 47.2

One thermal conductivity measurement was made on each core of sediment recovered from Hole 47.2. Pleistocene-Miocene nannoplankton ooze recovered from 9 to 65 meters had a range of thermal conductivity from 2.44 to 3.02×10^{-3} cal-°C^{-1} cm^{-1} sec^{-1}, with an average value of 2.66 (see hole and core plots). From 65 meters, Eocene-Cretaceous nannoplankton ooze had a range of 3.33 to 4.37×10^{-3} cal-°C^{-1} cm^{-1} sec^{-1} with an average value of 3.71.

As was seen in many other physical properties measured on sediments from Hole 47.2, there is a contrast between heat conductivity values above and below the Upper Miocene/mid-Eocene unconformity. No significant differences were seen across the Tertiary/Cretaceous boundary. In general, conductivity was inversely related to porosity.

CONCLUSIONS

The drilling at Site 47 shows that the Shatsky Rise has a thin veneer of late Miocene-Pliocene-Pleistocene carbonate ooze with well-preserved siliceous fossils. The aspect is that of a high-latitude biota with some admixture of tropical species, and this material offers a new insight into the paleobiogeography of the northwestern Pacific, and important material for analysis with the California Neogene.

A distinct hiatus, representing most of the Miocene, all the Oligocene, and part of Eocene time separates this veneer at Site 47 from the next-lower unit. This disconformity corresponds to Ewing *et al.,* (1966) reflector.

The underlying section is an apparently continuously deposited sequence of Maestrichtian, Paleocene and Eocene carbonate oozes, unfortunately badly disturbed in the process of coring. This section is the first good carbonate sequence of these ages from the northwestern Pacific, and is of great biostratigraphic and paleontologic interest. The foraminifera and coccoliths are remarkably well-preserved, and contain numerous benthonic as well as planktonic species. Siliceous fossils are absent, while *Inoceramus* prisms are common.

Cretaceous chert occurs in lenticular masses, and was encountered at different depths in each hole.

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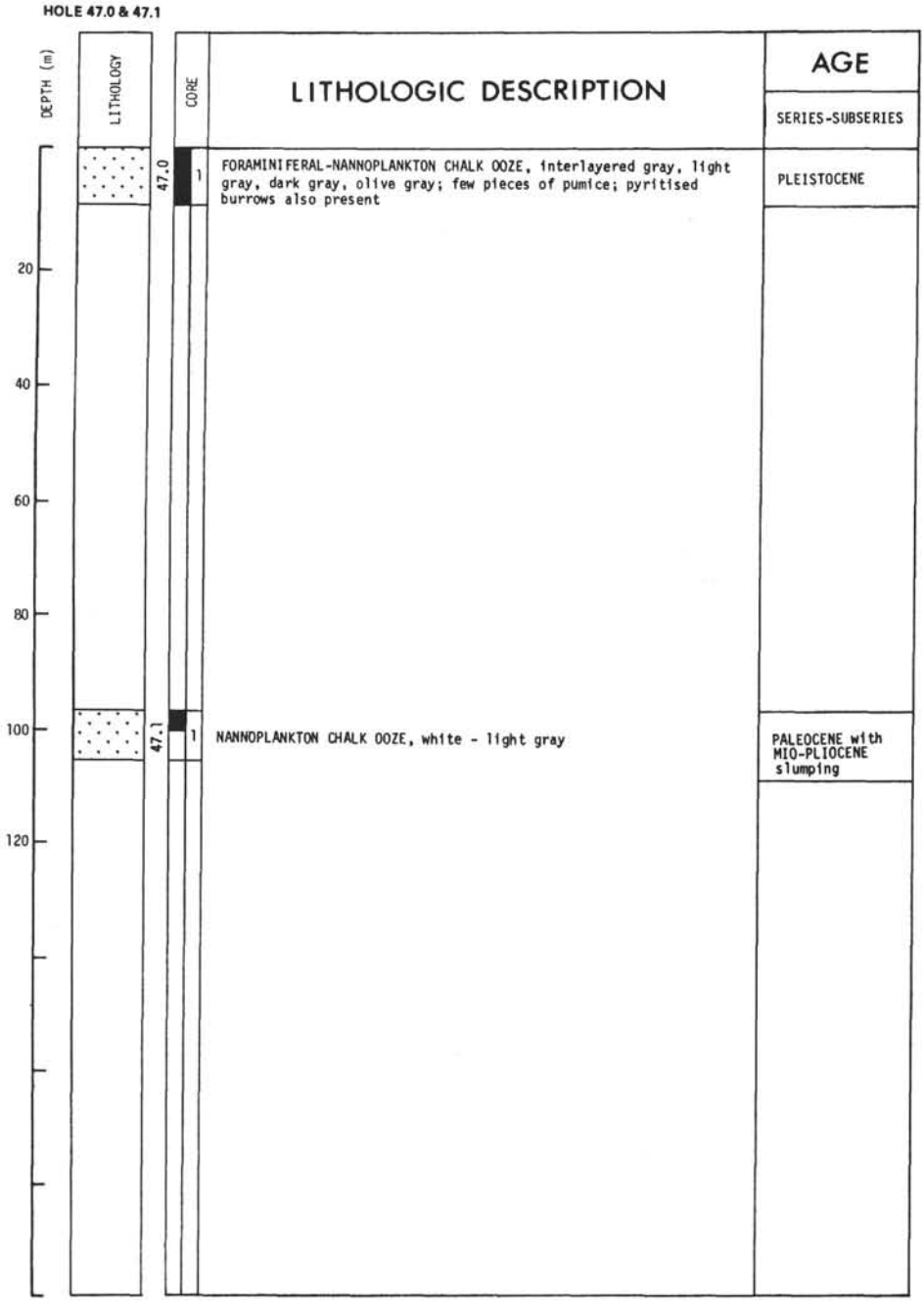


Figure 3. *Summary of lithology in Hole 47.0 and 47.1.*

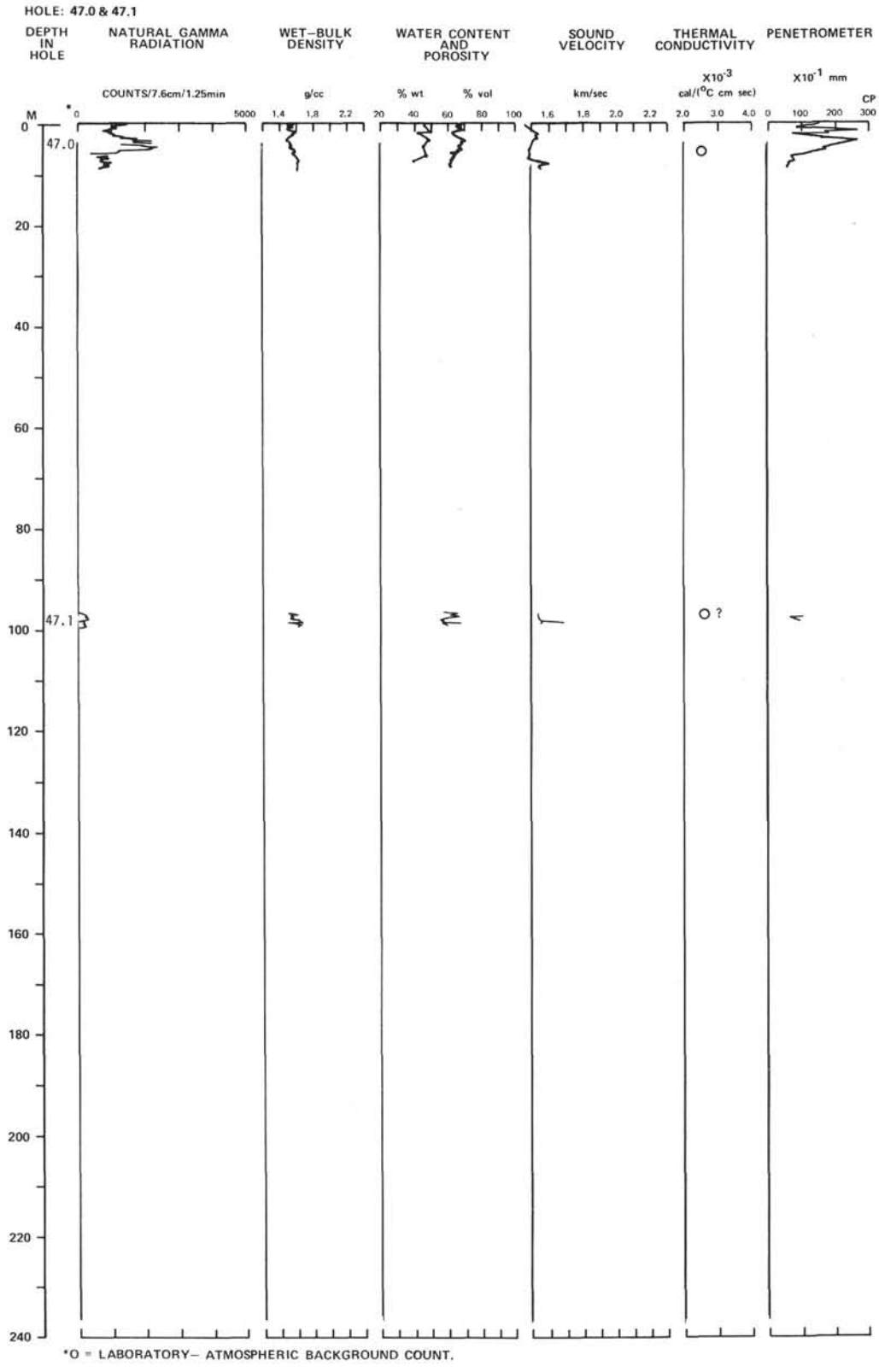


Figure 4. *Summary of physical properties in Hole 47.0 and 47.1.*

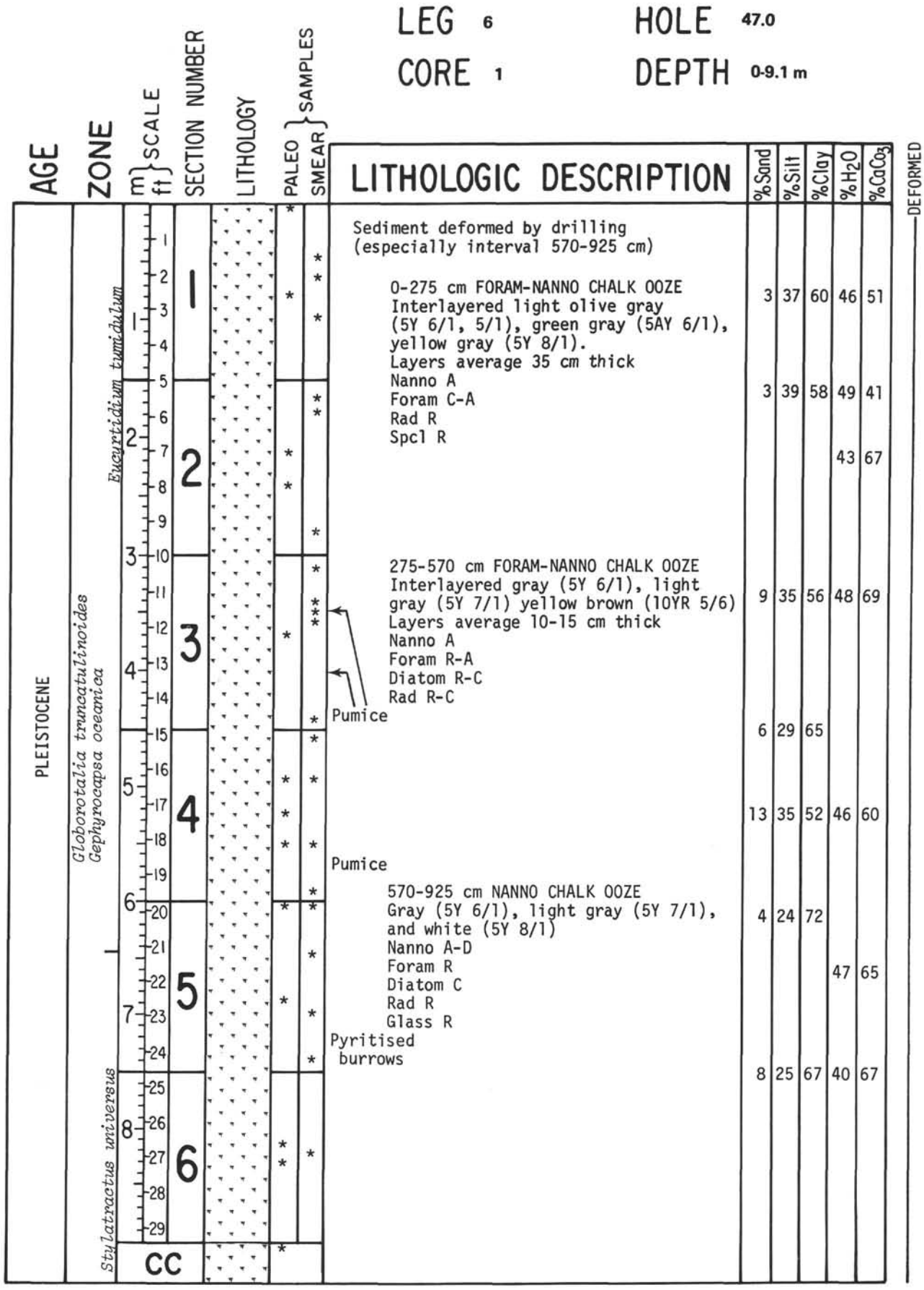


Figure 5. *Summary of lithology in Hole 47.0 Core 1.*

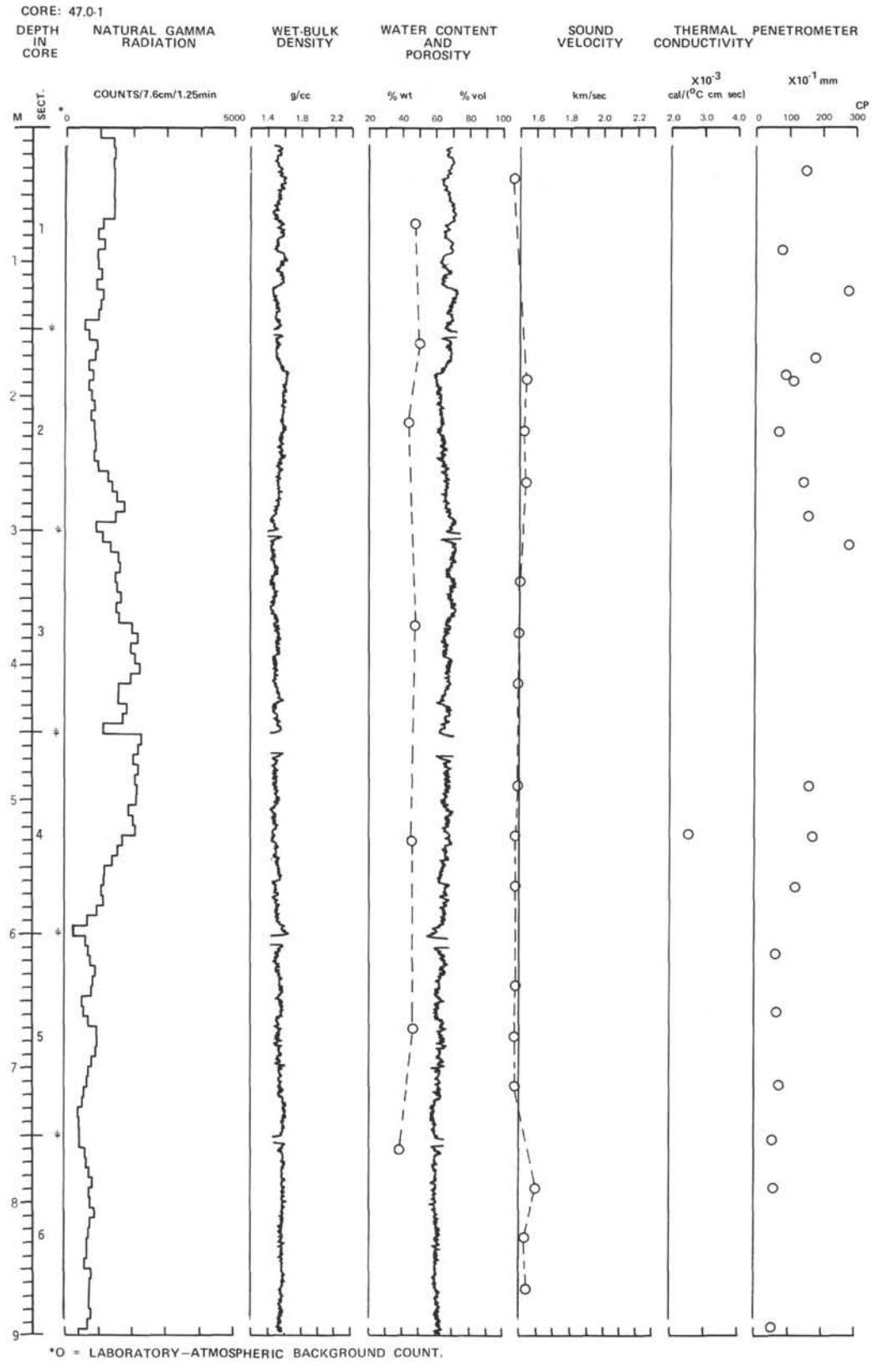


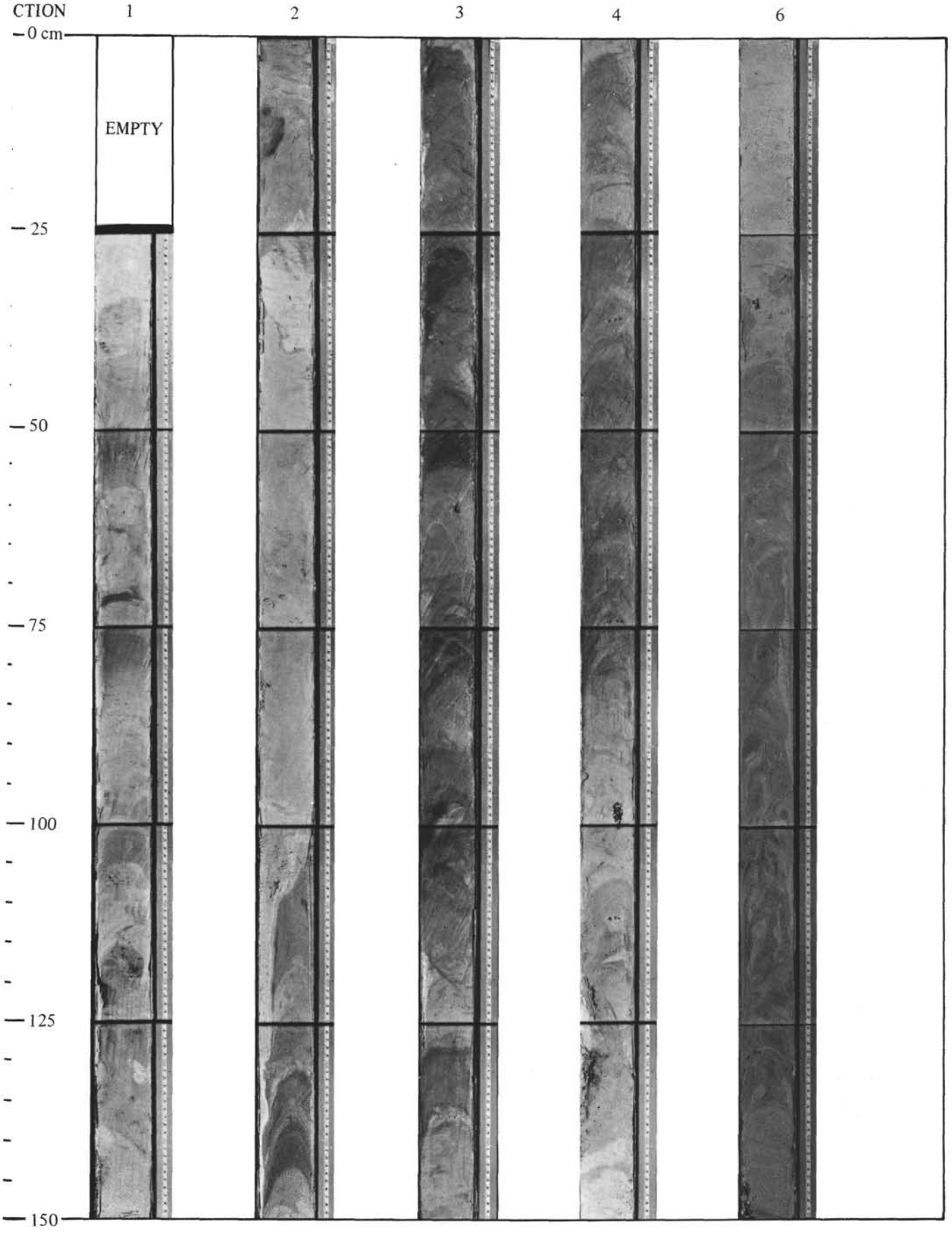
Figure 6. *Summary of physical properties in Hole 47.0 Core 1.*

LEG 6 HOLE 47.0

CORE 1 DEPTH 0.0-9.1 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
Pleistocene assemblages of planktonic Foraminifera are present throughout the core. They include abundant *Globorotalia truncatulinoides, G. inflata, G. punticulata, G. crassaformis oceanica, Globigerina bulloides, G. quinqueloba, G. concinna,* subordinate *Globorotalia tumida tumida, G. cultrata, G. acostaensis humerosa, G. dutertrei, G. crassaformis crassaformis, Orbulina universa, Globigerinita glutinata, Globigerinoides sacculifera, G. ruber* and rare *Pulleniatina obliquiloculata, Sphaeroidinella dehiscens, Globorotalia hirsuta, Hastigerina siphonifera.*	Upper Pleistocene assemblages of the *Gephyrocapsa oceanica* Zone are present throughout this core. Species present include *Ceratolithus cristatus, Coccolithus* sp. cf. *C. doronicoides, C. pelagicus, Cyclococcolithina leptoporus, Gephyrocapsa oceanica, Helicopontosphaera kamptneri, Rhabdosphaera clavigera, Scapholithus fossilis,* and *Umbilicosphaera mirabilis.*	The first four sections of this core contain an assemblage of the upper Pleistocene *Eucyrtidium tumidulum* Zone. The last two sections contain species of the middle Pleistocene *Stylatractus universus* Zone. TOP: *Eucyrtidium tumidulum, Druppatractus acquilonius,* and *Eucyrtidium calvertense.* BOTTOM: *Eucyrtidium tumidulum, Druppatractus acquilonius, Stylatractus universus,* and *Eucyrtidium calvertense.*

Figure 7. *Summary of biostratigraphy in Hole 47.0 Core 1.*



ate 1. *Photographs Hole 47.0 Core 1.*

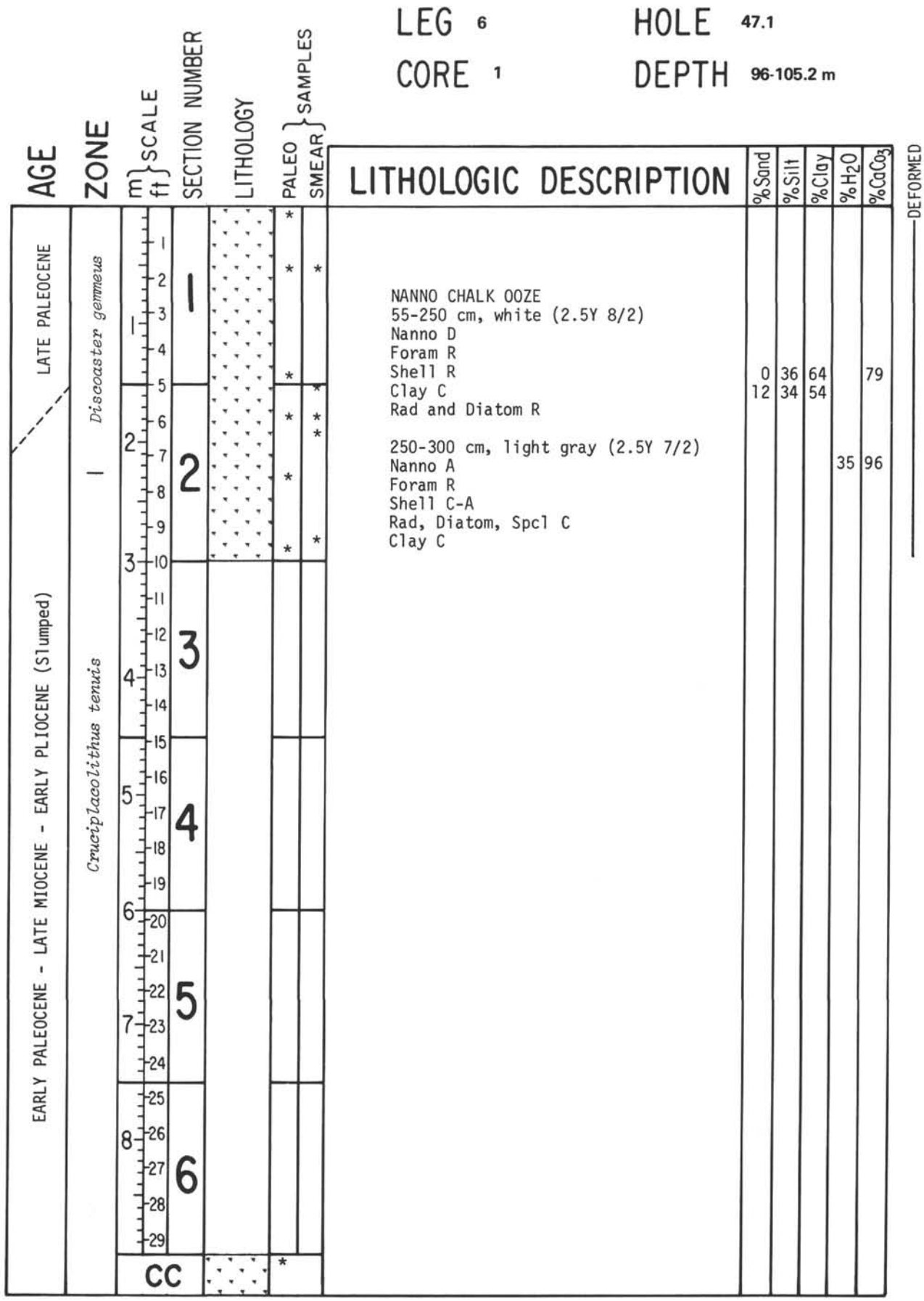


Figure 8. *Summary of lithology in Hole 47.1 Core 1.*

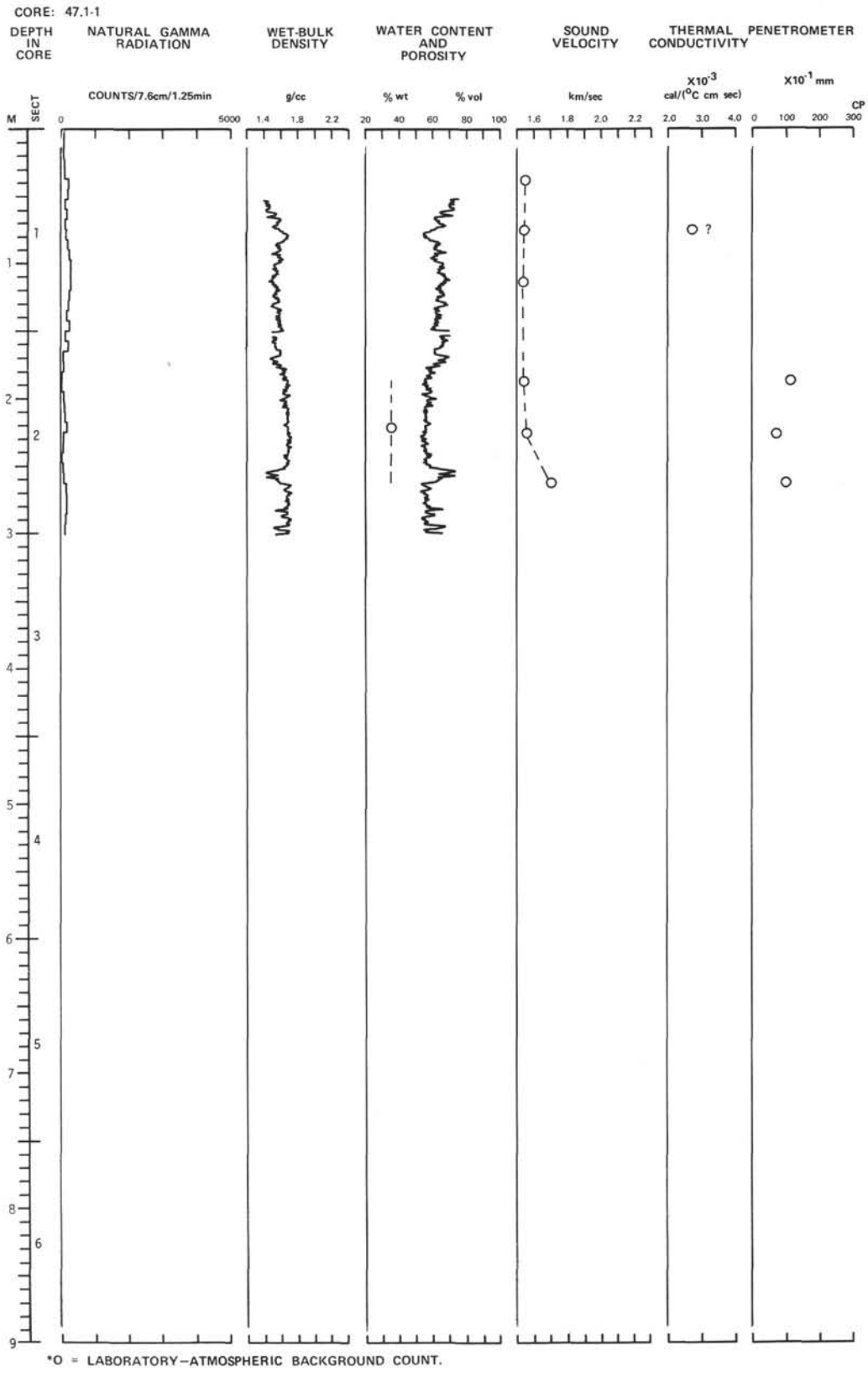


Figure 9. *Summary of physical properties in Hole 47.1 Core 1.*

LEG 6 HOLE 47.1

CORE 1 DEPTH 96.0-105.2 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
This core contains assemblages of planktonic Foraminifera which consist of mixture of Pleistocene, Pliocene and Paleocene (at least, three zones - *Globorotalia velascoensis, G. angulata, Acarinina uncinata)* forms. Small lumps of sediments sometimes include natural associations of foraminifers. *Acarinina uncinata, A. praecursoria, A. multiloculata, A. inconstans* - the *A. uncinata* Zone, 1 - 2 (140 - 142); *Globorotalia velascoensis, G. pseudomenardii, G. apanthesma, G. hispidicidaris, Acarinina mckannai, Globigerina velascoensis* - the *Globorotalia velascoensis* Zone, 1-2 (18 - 19).	Mixed assemblages are present throughout this core. Although the bulk of the species present indicate upper Paleocene there is substantial admixture of upper Miocene and Eocene species probably resulting from drilling technique. Species present include, Paleocene--*Cruciplacolithus tenuis, Discoaster* sp. cf. *D. gemmeus, Fasciculithus tympaniformis, Sphenolithus anarrhopus,* and *Toweius craticulus;* Eocene--*Chiasmolithus grandis, Discoaster barbadiensis,* and *Reticulofenestra umbilica;* Miocene--*Ceratolithus tricornicalatus, Discoaster pentaradiatus, D. qunitatus,* and *D. surculus.*	This core contains the boundary between the Pliocene and Miocene. The species cover the combined ranges of the *Stichocorys peregrina* (upper Miocene) and *Spongaster pentas* (lower Pliocene) zones, above the latest occurrence of *Stichocorys delmontense.* TOP: *Stichocorys peregrina, Eucyrtidium calvertense, Druppatractus acquilonius,* and *Lithopera bacca.* BOTTOM: *Stichocorys peregrina, Eucyrtidium calvertense,* and *Druppatractus acquilonius.*

Figure 10. *Summary of biostratigraphy in Hole 47.1 Core 1.*

NO PHOTOGRAPHS OF HOLE 47-1 CORE 1

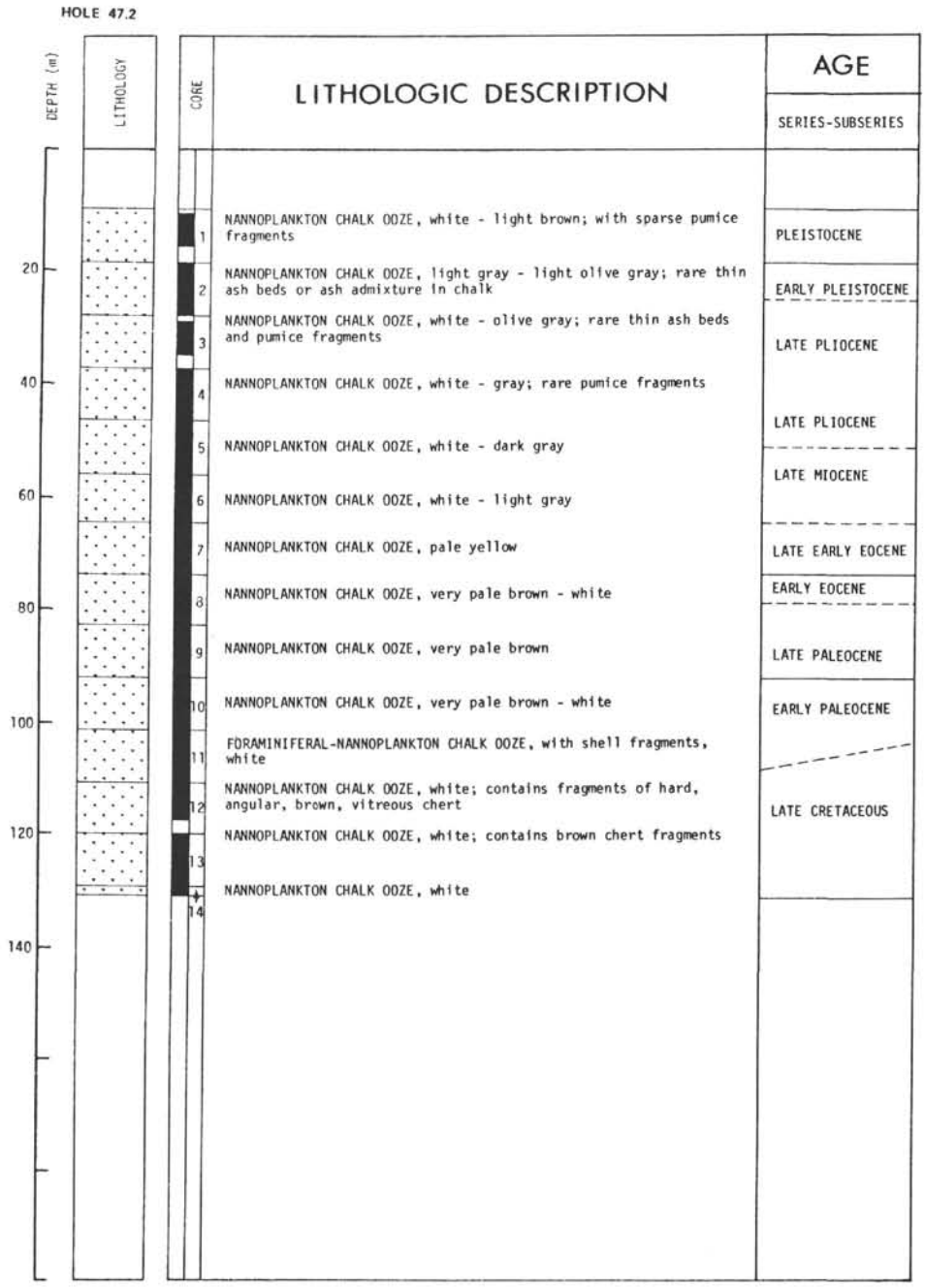


Figure 11. *Summary of lithology in Hole 47.2.*

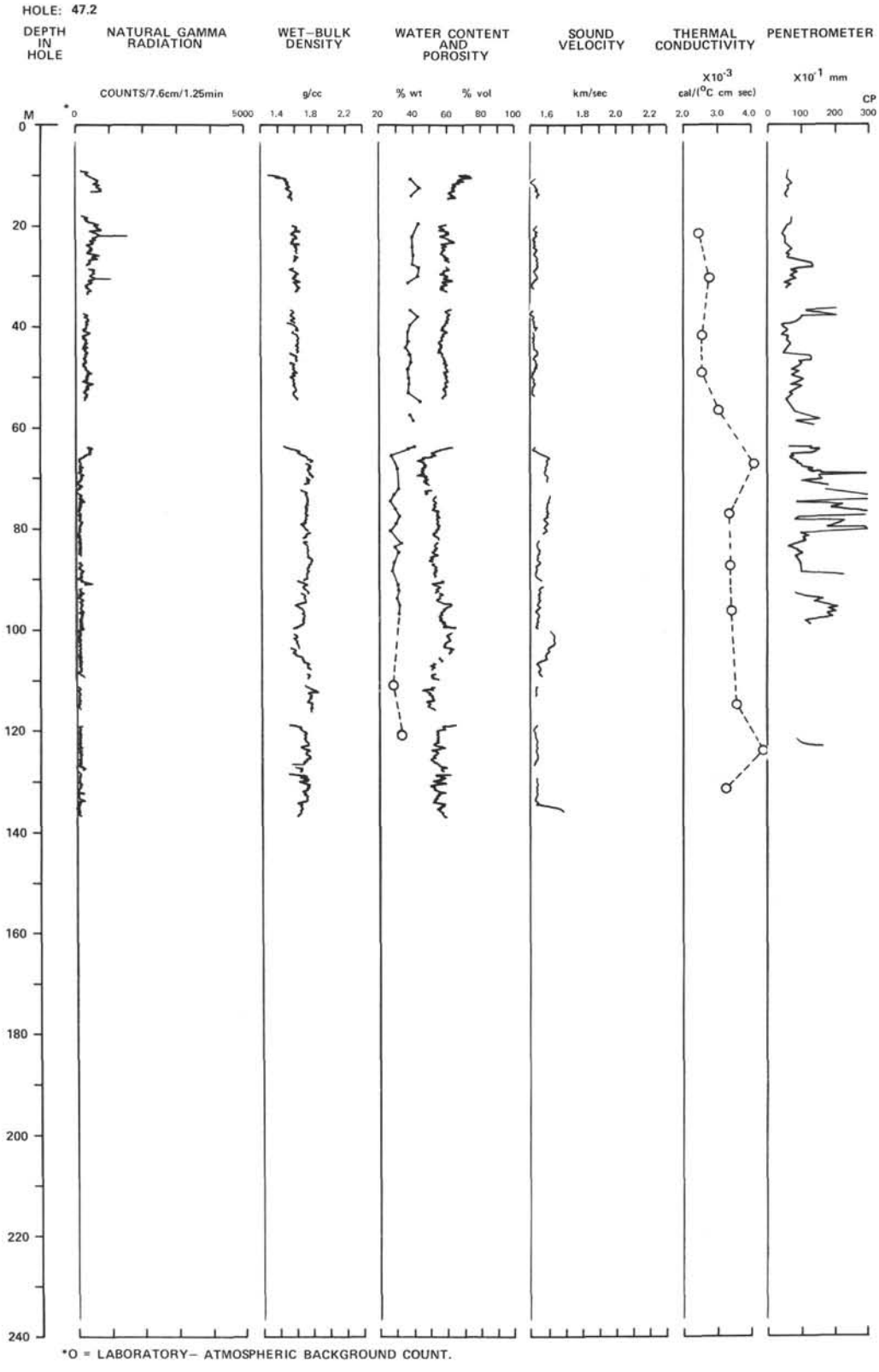


Figure 12. *Summary of physical properties in Hole 47.2.*

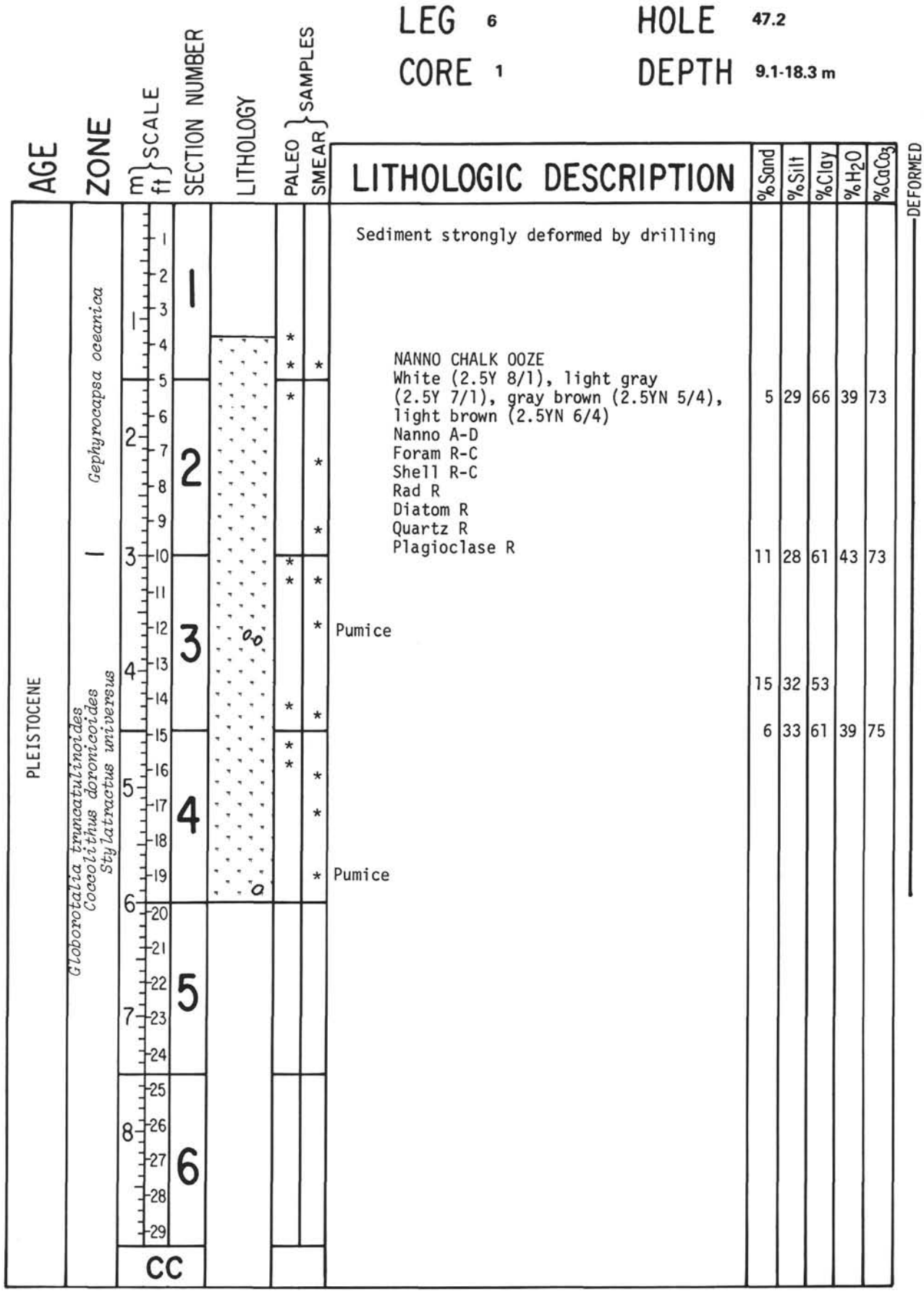


Figure 13. *Summary of lithology in Hole 47.2 Core 1.*

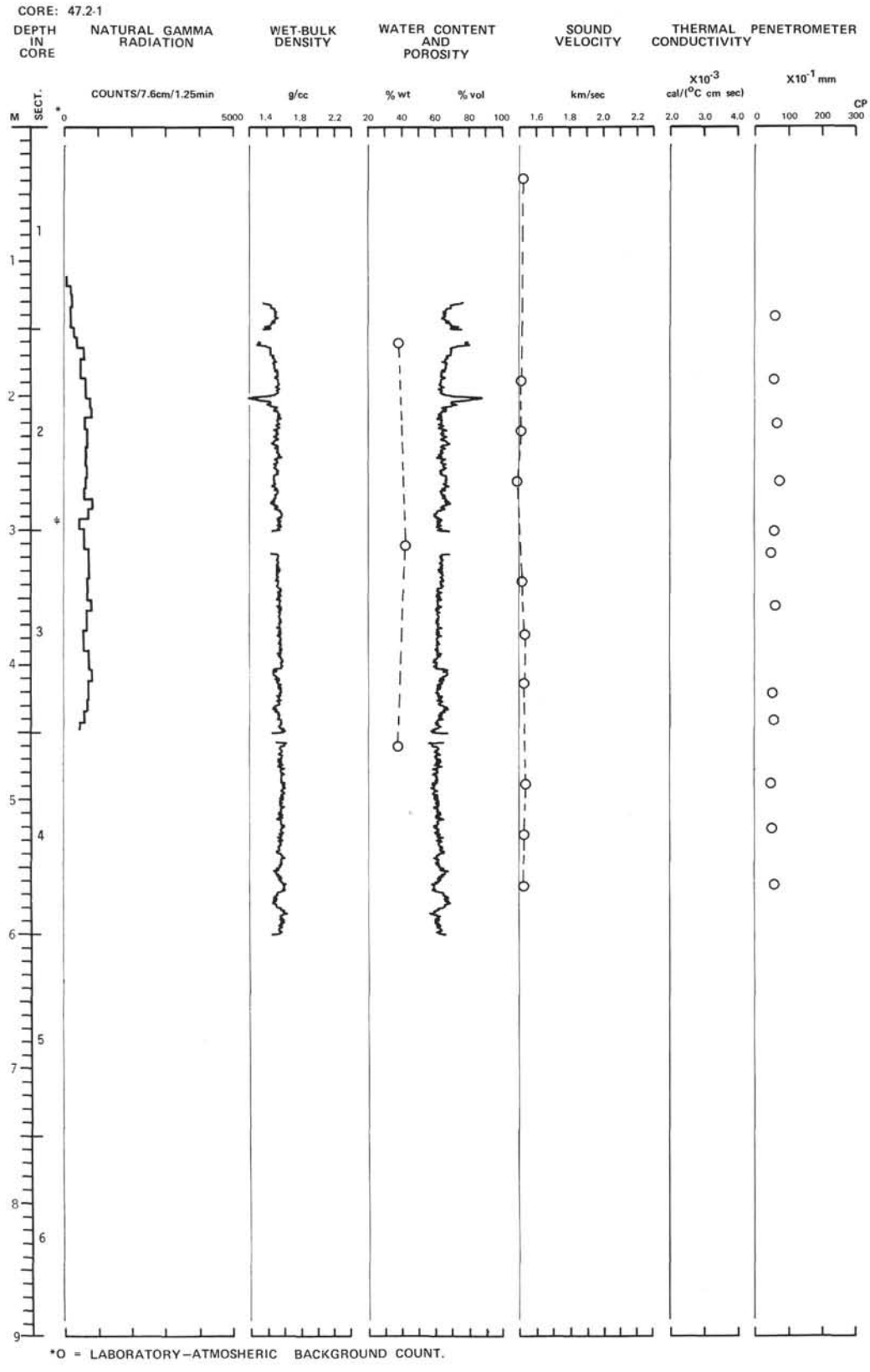


Figure 14. *Summary of physical properties in Hole 47.2 Core 1.*

LEG 6 HOLE 47.2

CORE 1 DEPTH 9.1-18.3 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
All assemblages examined belong to Pleistocene. Among planktonic Foraminifera the most numerous are *Globorotalia inflata, G. puncticulata, G. truncatulinoides, G. crassaformis ronda, G. crassaformis oceanica, Globigerina bulloides, G. quinqueloba, Globigerinita glutinata.* Other species are less frequent and represented by *Globorotalia tumida, G. cultrata, G. hirsuta, G. ungulata, G. crassaformis, Pulleniatina obliquiloculata, Sphaeroidinella dehiscens, Globigerinoides conglobatus, G. ruber, G. sacculifera, Orbulina universa.*	Pleistocene assemblages are present throughout the core. The small number of *Gephyrocapsa oceanica* suggests a middle to lower Pleistocene assignment. Species present include *Ceratolithus cristatus, Coccolithus* sp. cf. *C. doronicoides, Cyclococcolithina leptoporus, Cyclolithella annula, Gephyrocapsa oceanica, Helicopontosphaera kamptneri, Rhabdosphaera clavigera, R. stylifera,* and *Umbilicosphaera mirabilis.*	This entire core falls in the range of the middle Pleistocene *Stylatractus universus* Zone. TOP: *Druppatractus acquilonius, Stylatractus universus, Eucyrtidium calvertense,* and *E. tumidulum.* BOTTOM: same.

Figure 15. *Summary of biostratigraphy in Hole 47.2 Core 1.*

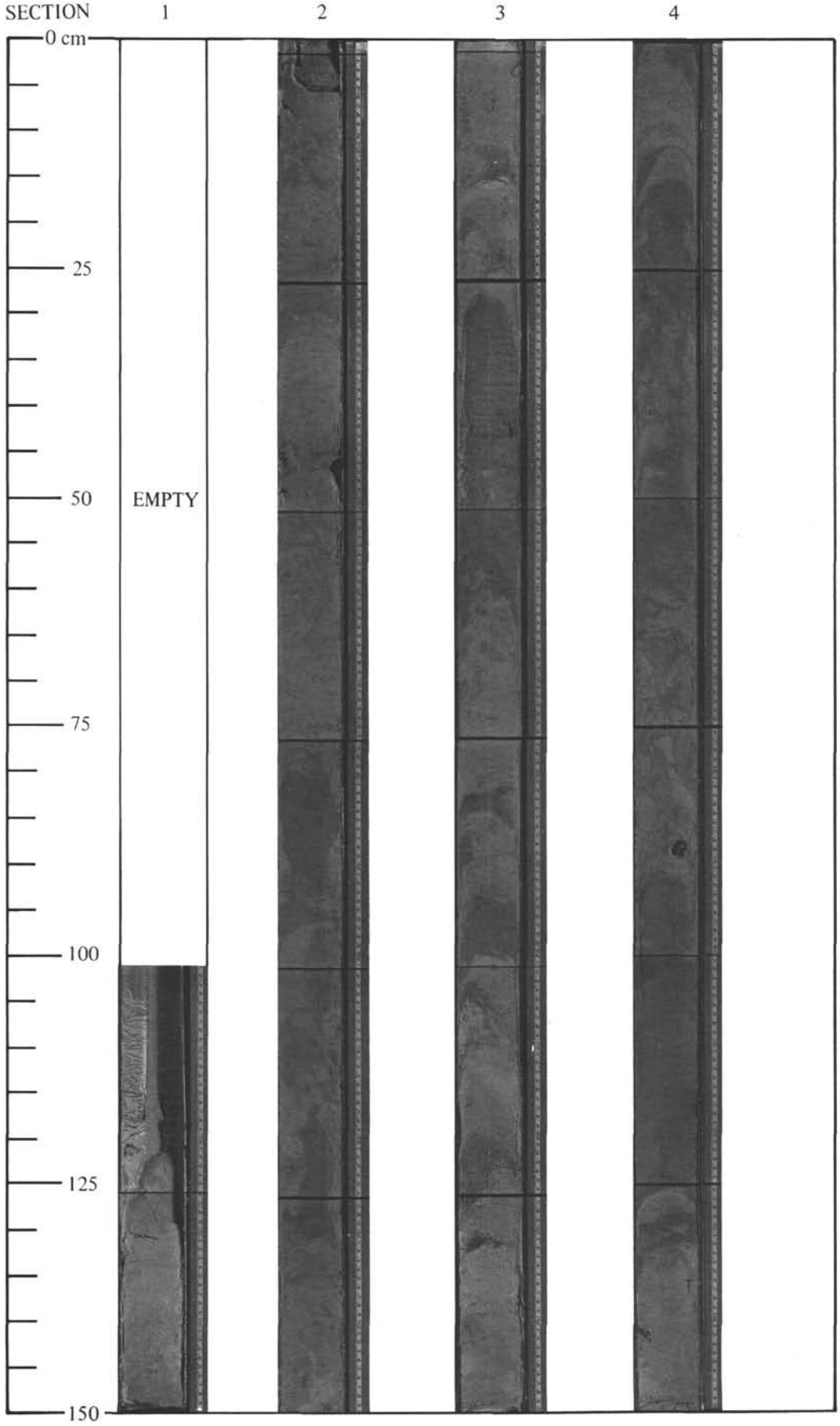


Plate 2. *Photographs Hole 47.2 Core 1.*

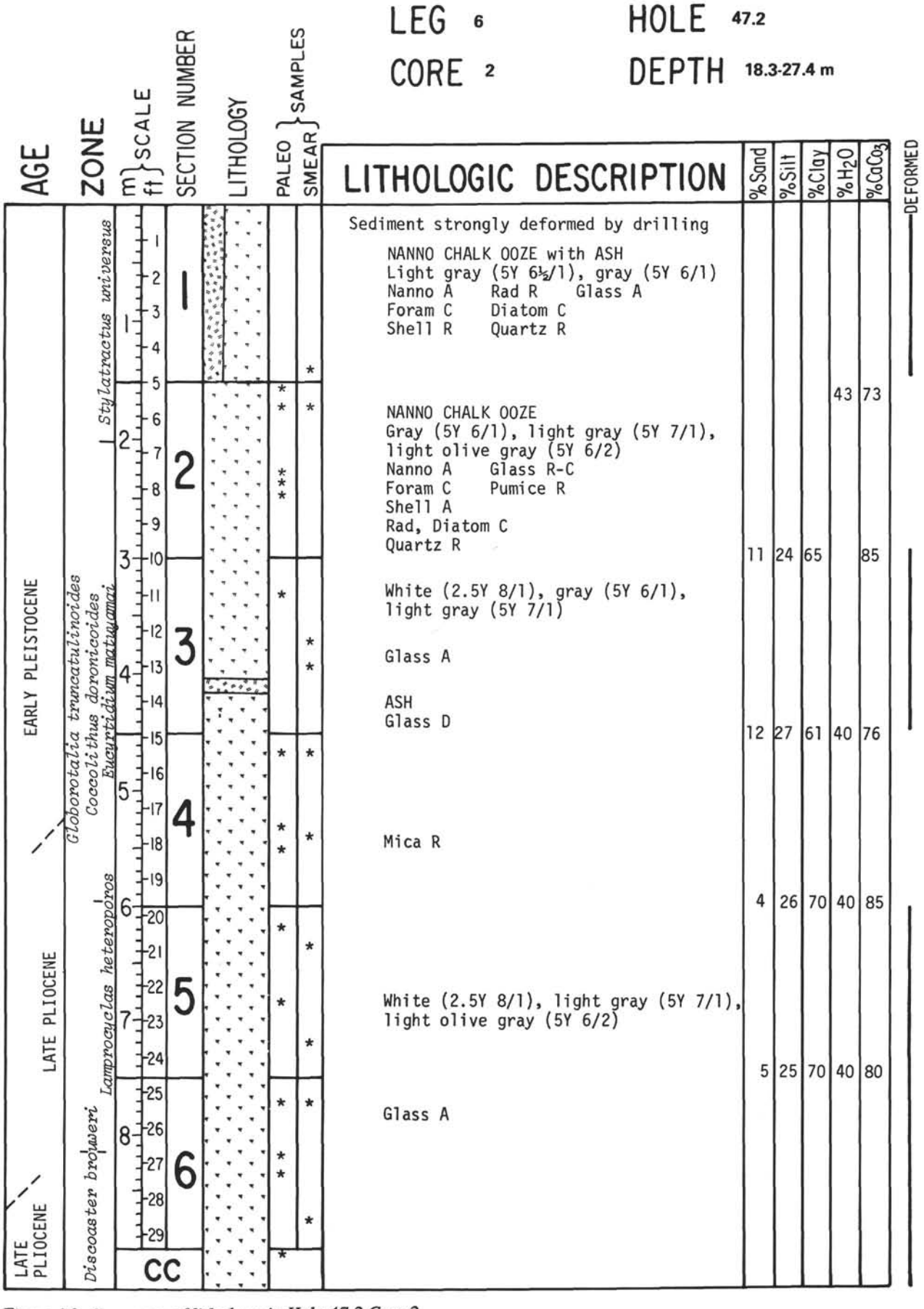


Figure 16. *Summary of lithology in Hole 47.2 Core 2.*

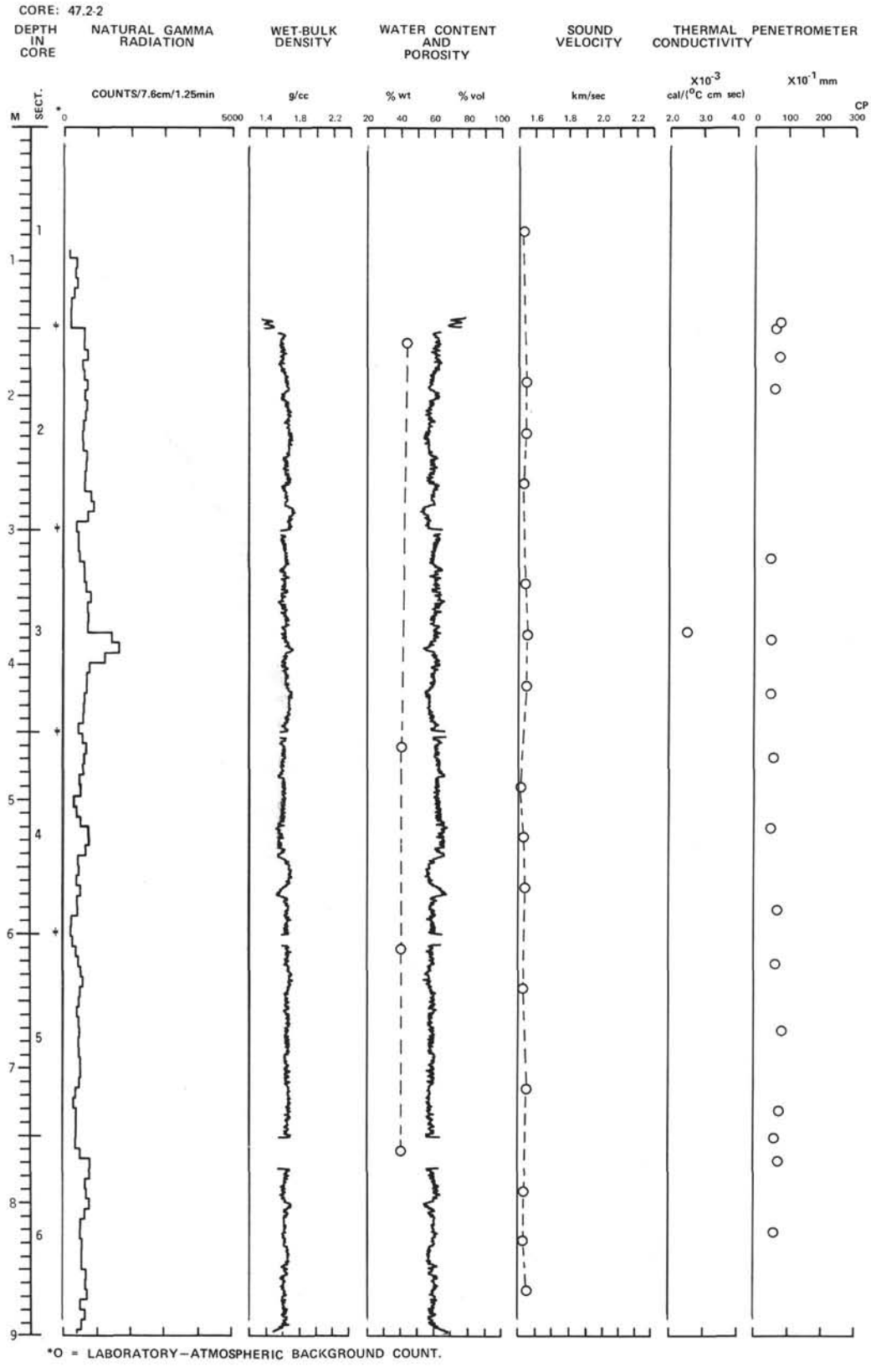


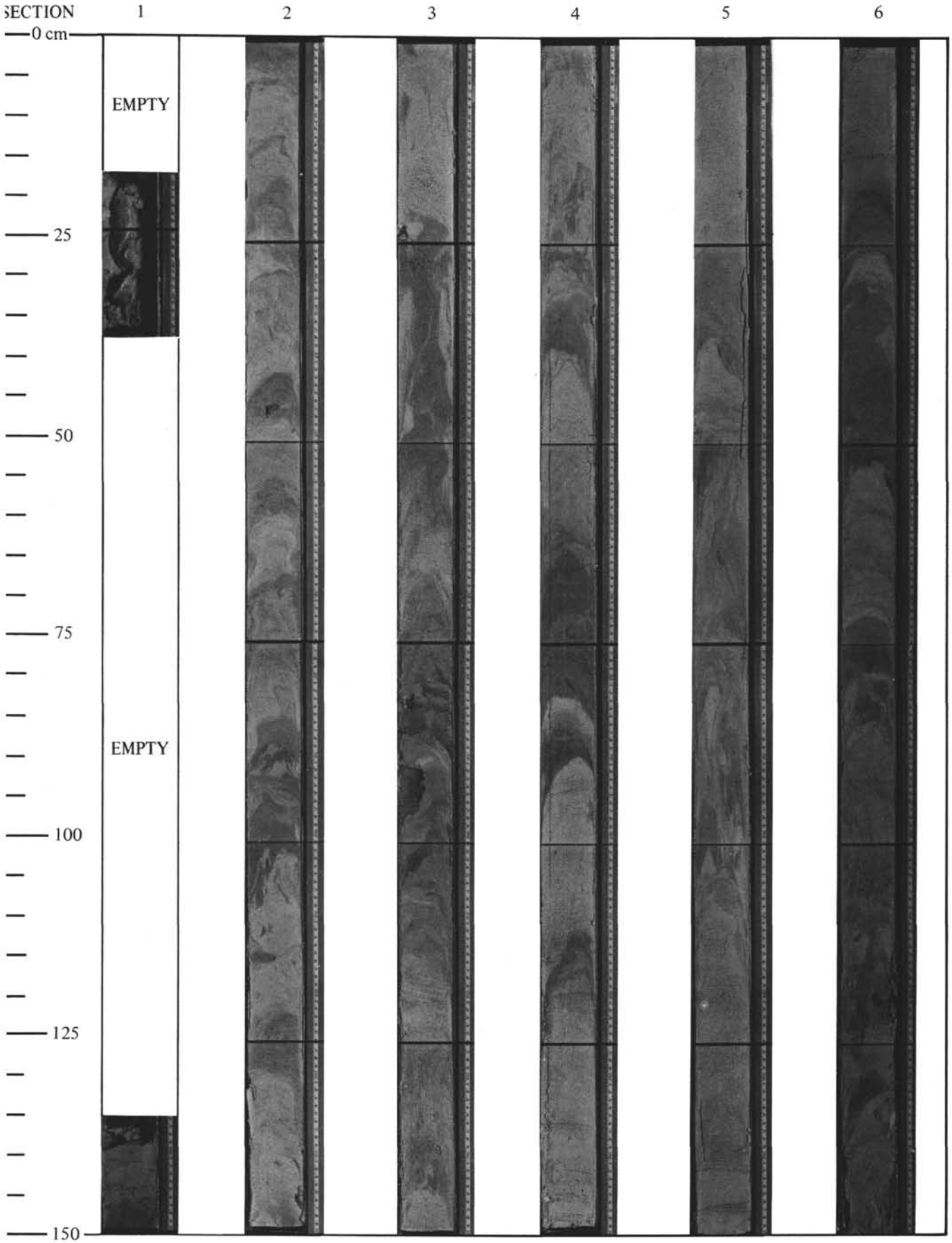
Figure 17. *Summary of physical properties in Hole 47.2 Core 2.*

LEG 6 HOLE 47.2

CORE 2 DEPTH 18.3-27.4 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
(Most of the core (sections 1-5) is characterized by Pleistocene planktonic Foraminifera - abundant *Globorotalia truncatulinoides, G. inflata, G. puncticulata, G. crassaformia oceanica, Globigerina bulloides, G. quinqueloba* and less frequent *Pulleniatina obliquiloculata, Sphaeroidinella dehiscens, Globorotalia tumida tumida, G. crassaformis crassaformis, Globigerinoides conglobatus, G. ruber.* The lower part of this core (section 6 and the core catcher sample) contains common *Globorotalia tosaensis*, rare *G. truncatulinoides* and can be placed seemingly in the top of Pliocene.	Most of the core contains assemblages of the lower Pleistocene *Coccolithus doronicoides* Zone. In the bottom section and core-catcher samples, upper Pliocene assemblages of the *Discoaster brouweri* Zone are present. Species in the upper part of the core include *Coccolithus* sp. cf. *C. doronicoides, Cyclococcolithina leptoporus, Helicopontosphaera kamptneri, H. sellii*, and *Scyphosphaera* sp. cf. *S. apsteinii*. In the lower part of the core *C.* sp. cf. *C. doronicoides, C. leptoporus, C. macintyrei, Discoaster brouweri* [3- and 6-rayed], and *D. sarculus* are present.	The upper part of this core is in the middle Pleistocene *Stylatractus universus* Zone, the middle part in the lower Pleistocene *Eucyrtidium matuyamai* Zone and the lower part in the upper Pliocene *Lamprocyclas heteroporos* Zone. TOP: *Eucyrtidium tumidulum, E. calvertense, Druppatractus acquilonius*, and *Stylatractus universus.* MIDDLE: *Druppatractus acquilonius, Stylatractus universus, Eucyrtidium tumidulum, E. calvertense*, and *E. matuyamai.* BOTTOM: *Eucyrtidium tumidulum, E. calvertense, Druppatractus acquilonius, Stylatractus universus, Lamprocyclas heteroporos*, and *Lithopera bacca.*

Figure 18. *Summary of biostratigraphy in Hole 47.2 Core 2.*



late 3. *Photographs Hole 47.2 Core 2.*

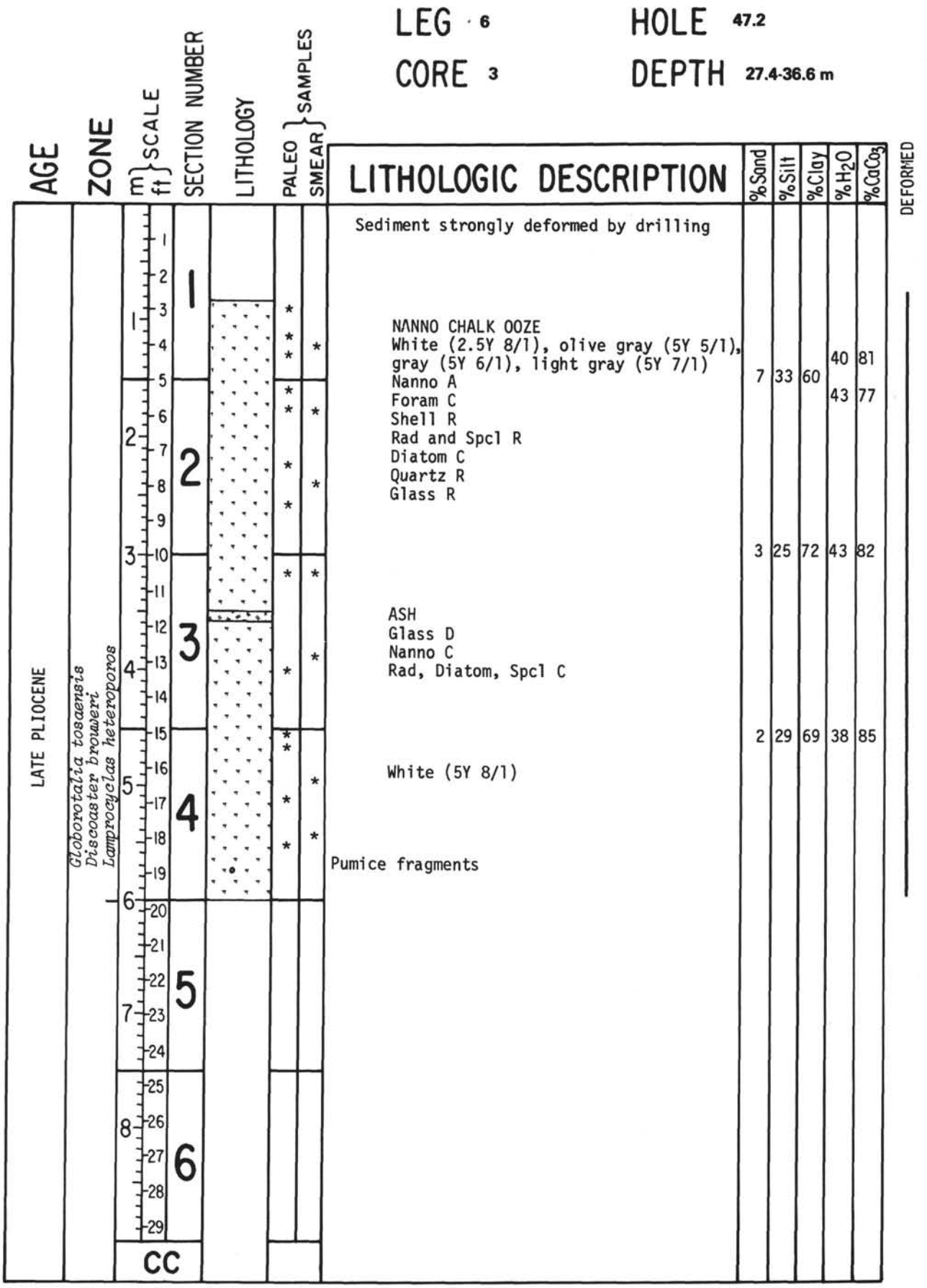


Figure 19. *Summary of lithology in Hole 47.2 Core 3.*

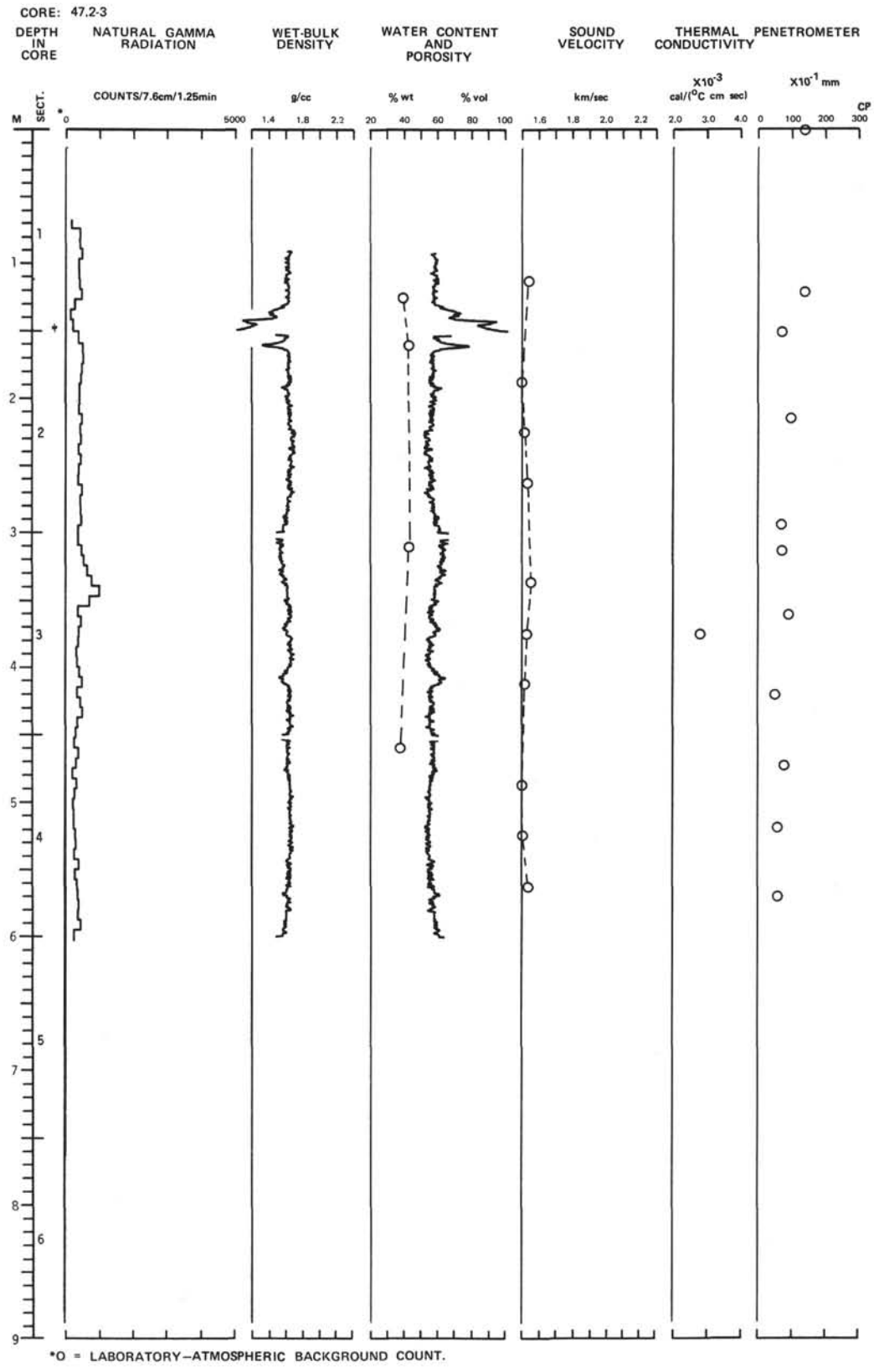


Figure 20. *Summary of physical properties in Hole 47.2 Core 3.*

LEG 6 HOLE 47.2

CORE 3 DEPTH 27.4-36.6 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
All assemblages present indicate the upper part of Pliocene. Among planktonic Foraminifera are numerous *Globorotalia crassaformis oceanica, G. crassaformis ronda, G. crassaformis crassaformis, Globigerina parabulloides, G. bulloides.* Other species are not frequent--*Globorotalia cultrata, G. tumida tumida, G. inflata, G. tosaensis, G. ungulata, Globigerinoides ruber, G. conglobatus, Sphaeroidinella dehiscens, Orbulina universa.*	Upper Pliocene assemblages of the *Discoaster brouweri* Zone are present throughout the core. Species present include *Ceratolithus rugosus, Cyclococcolithina macintyrei, Discoaster brouweri, D. pentaradiatus, D. surculus,* and *Rhabdosphaera stylifera.*	The upper part of this core is in the upper Pliocene *Lamprocyclas heteroporos* Zone. The lower part contains species above the latest occurrence of *Stichocorys delmontense* spanning the combined ranges of the *Spongaster pentas* (lower Pliocene) and *Stichocorys peregrina* (upper Miocene) Zones. TOP: *Druppatractus acquilonius, Eucyrtidium tumidulum, E. calvertense,* and *Stylatractus universus.* BOTTOM: *Stichocorys peregrina, Eucyrtidium tumidulum, E. calvertense, Druppatractus acquilonius, Lamprocyclas heteroporos,* and *Lithopera bacca.*

Figure 21. *Summary of biostratigraphy in Hole 47.2 Core 3.*

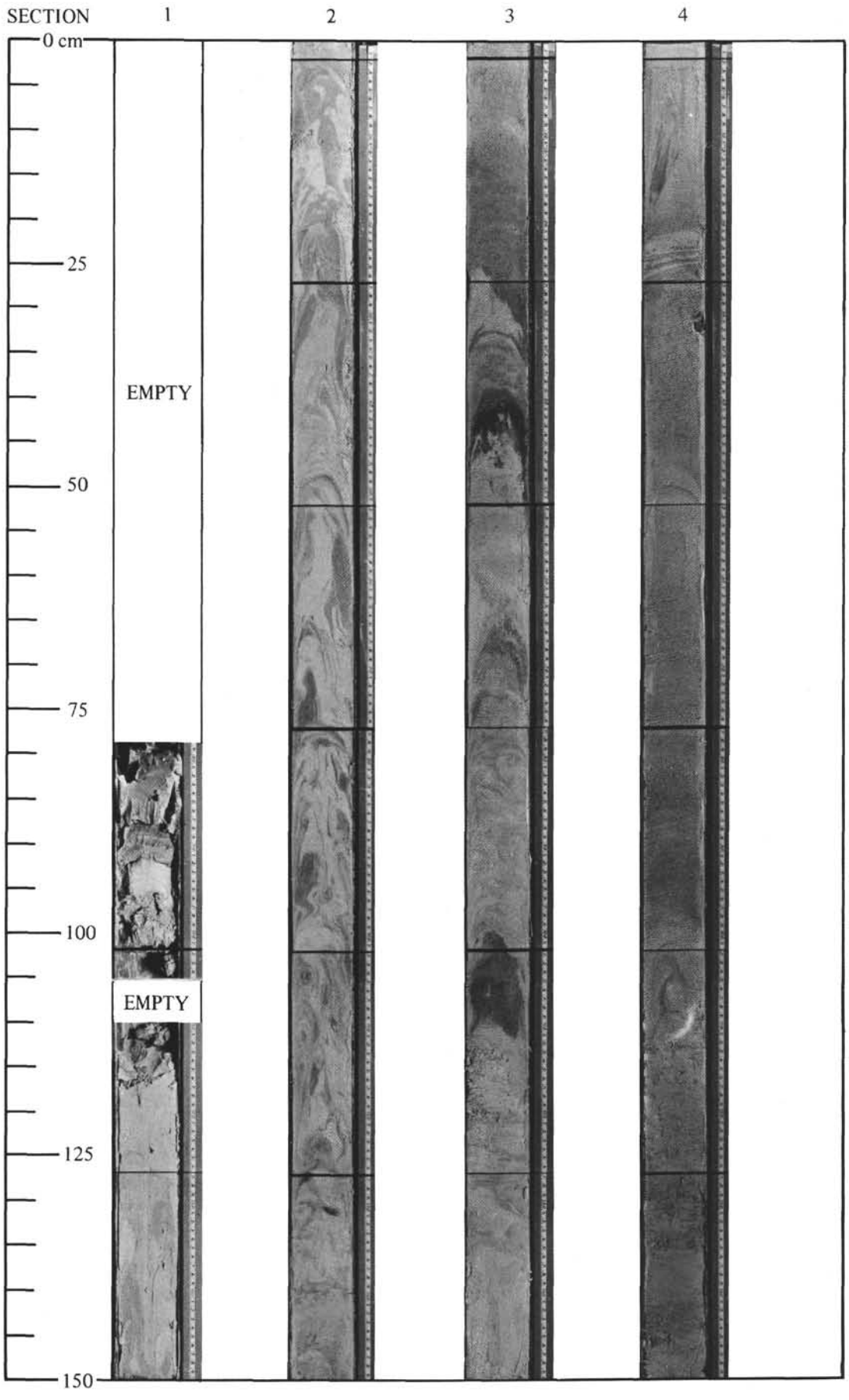


Plate 4. *Photographs Hole 47.2 Core 3.*

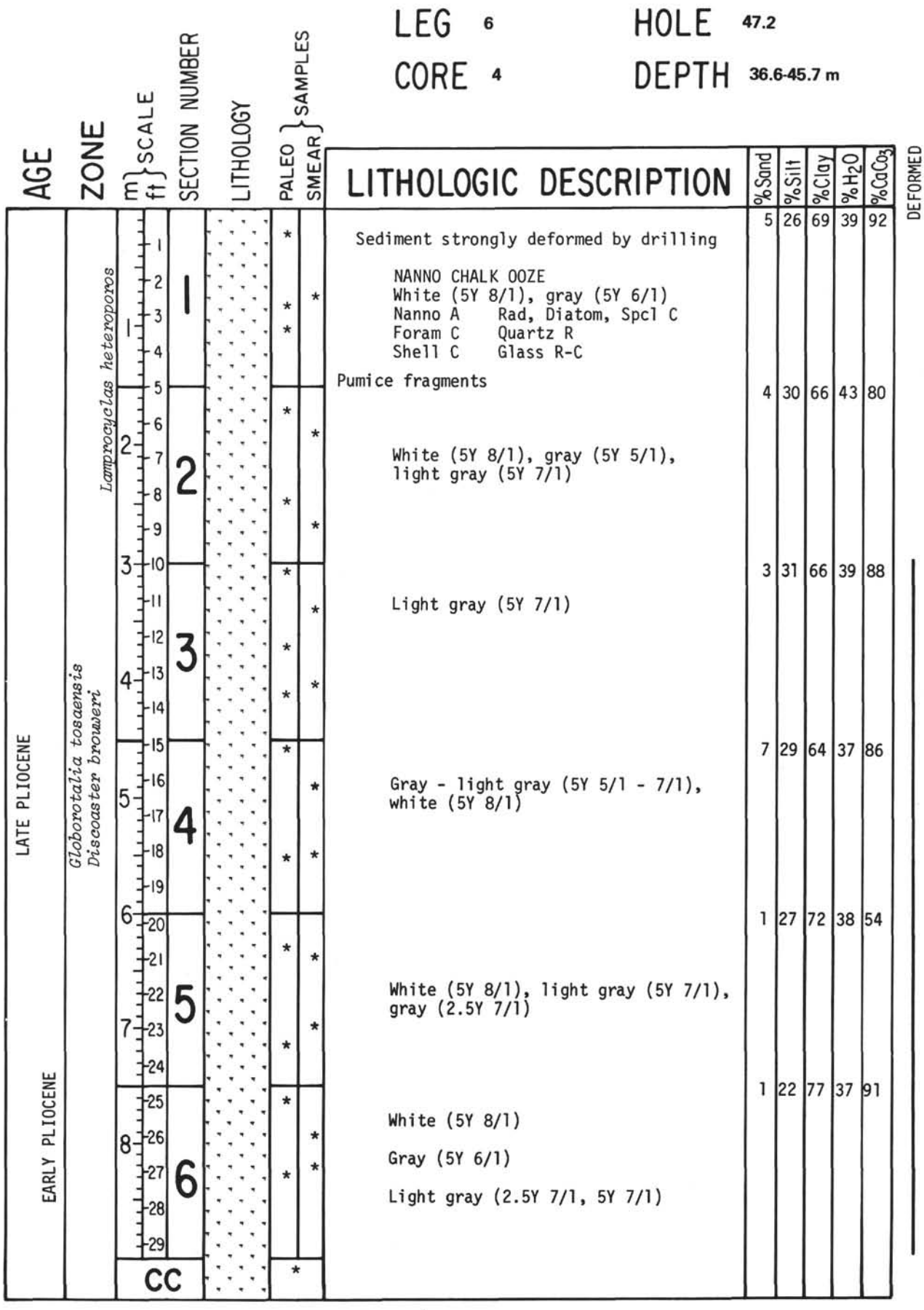


Figure 22. *Summary of lithology in Hole 47.2 Core 4.*

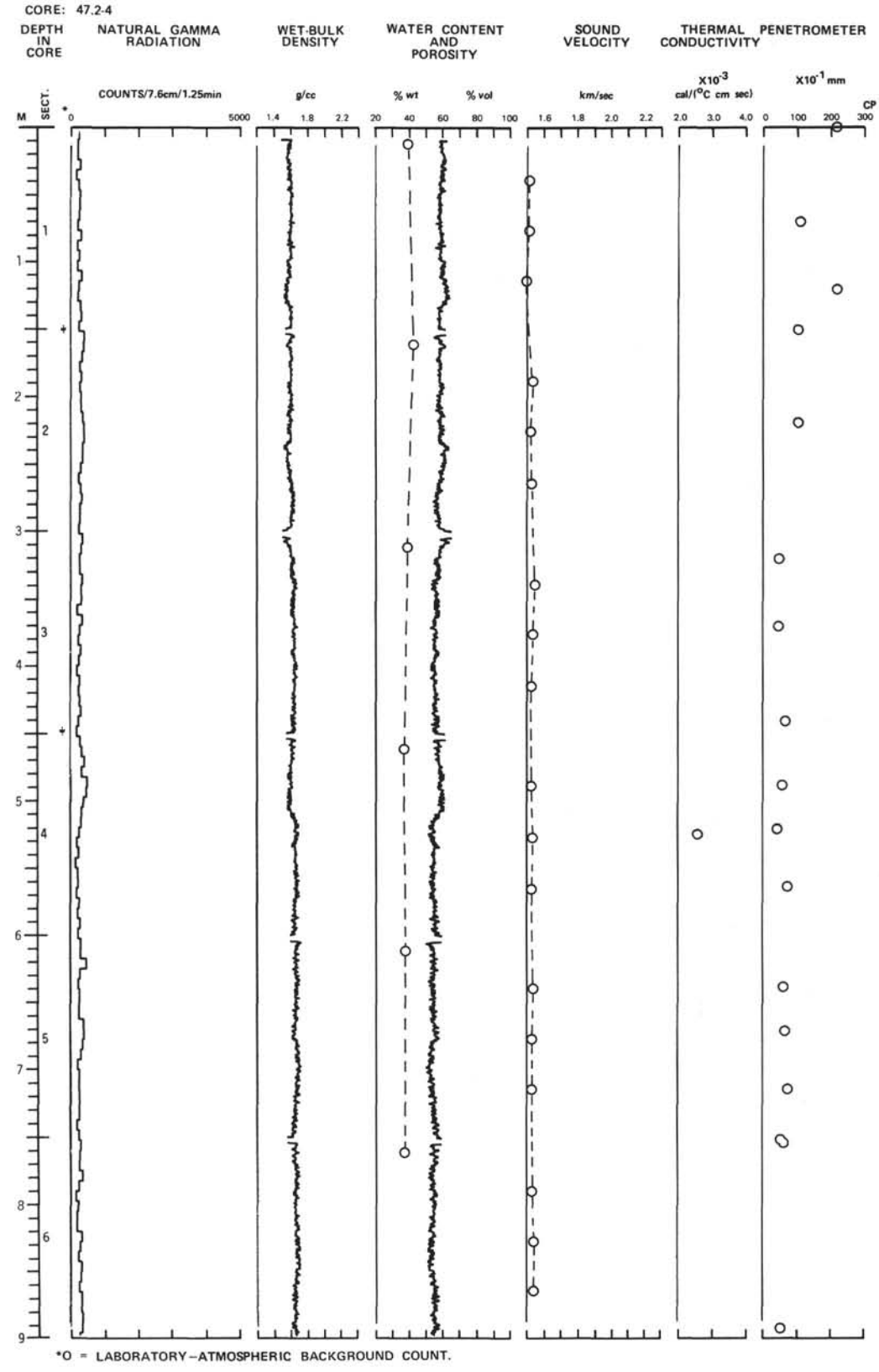


Figure 23. *Summary of physical properties in Hole 47.2 Core 4.*

LEG 6 HOLE 47.2

CORE 4 DEPTH 36.6-45.7 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
Assemblages of the upper part of Pliocene were met throughout the core. They consist of numerous *Globorotalia crassaformis oceanica, G. crassaformis ronda, Globigerina bulloides, G. apertura, G. concinna, Globigerinita clutinata,* common *Globorotalia crassaformis crassaformis, G. tumida tumida, Globigerinoides sacculifera, G. conglobatus, Globigerina eggeri* and rare *Globorotalia tosaensis, G. inflata, G. multicamerata, G. cultrata Sphaeroidinella dehiscens.* The core catcher sample contains very rare specimens of *Globoquadrina altispira.*	Upper Pliocene assemblages of the *Discoaster brouweri* Zone are present throughout the core. Species present include *Ceratolithus rugosus, Cyclococcolithina macintyrei, Discoaster brouweri, D. pentaradiatus,* and *D. surculus.*	The upper two sections of this core are dominated by species of the upper Pliocene *Lamprocyclas heteroporos* Zone suggesting contamination from above. The lower part contains species above the latest occurrence of *Stichocorys delmontense* spanning the combined ranges of the *Spongaster pentas* (lower Pliocene) and *Stichocorys peregrina* (upper Miocene) Zones. TOP: *Eucyrtidium calvertense, E. tumidulum, Druppatractus acquilonius, Lithopera bacca, Lamprocyclas heteroporos,* and rare specimens of *Stichocorys peregrina.* BOTTOM: *Stichocorys peregrina, Druppatractus acquilonius, Lithopera bacca,* and *Eucyrididium calvertense.*

Figure 24. *Summary of biostratigraphy in Hole 47.2 Core 4.*

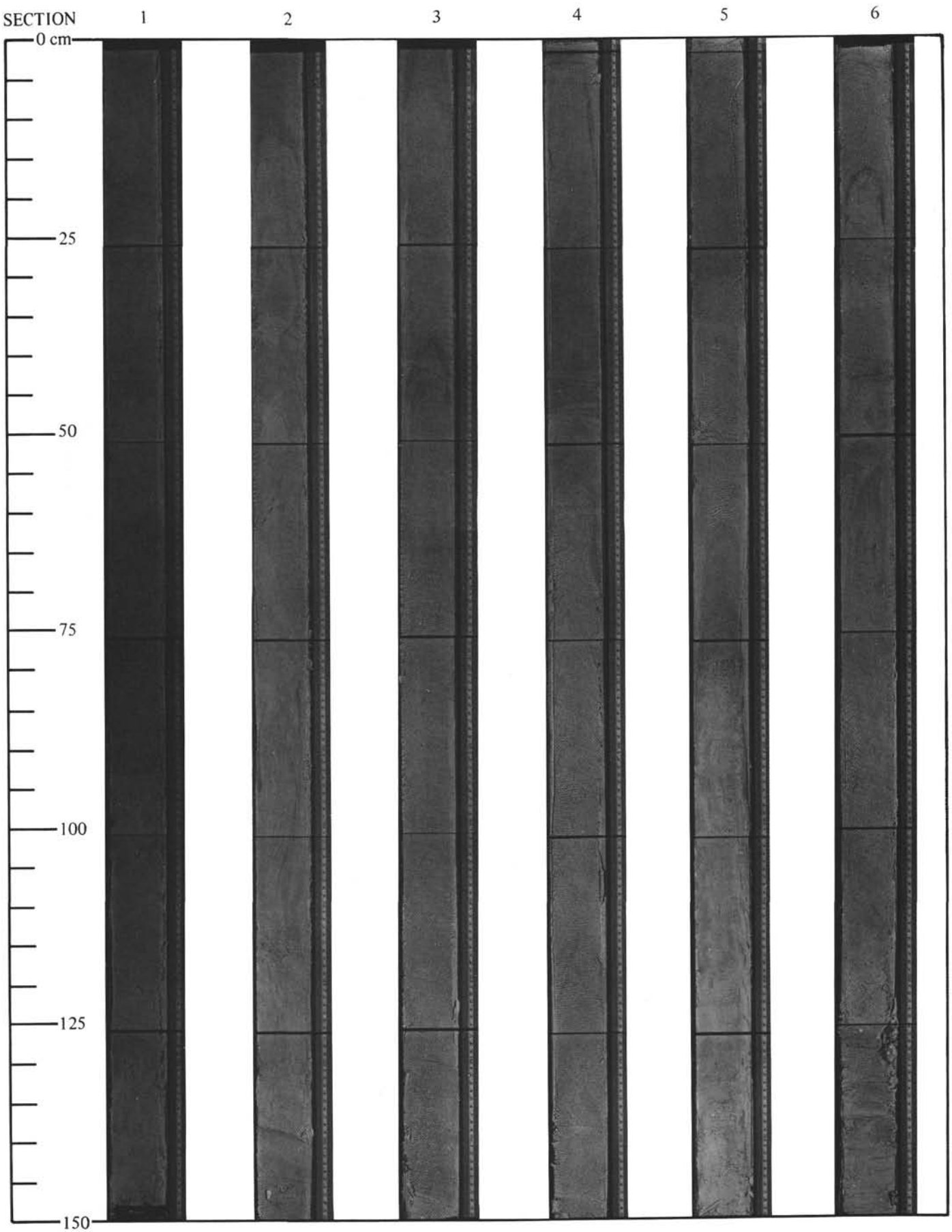


Plate 5. *Photographs Hole 47.2 Core 4.*

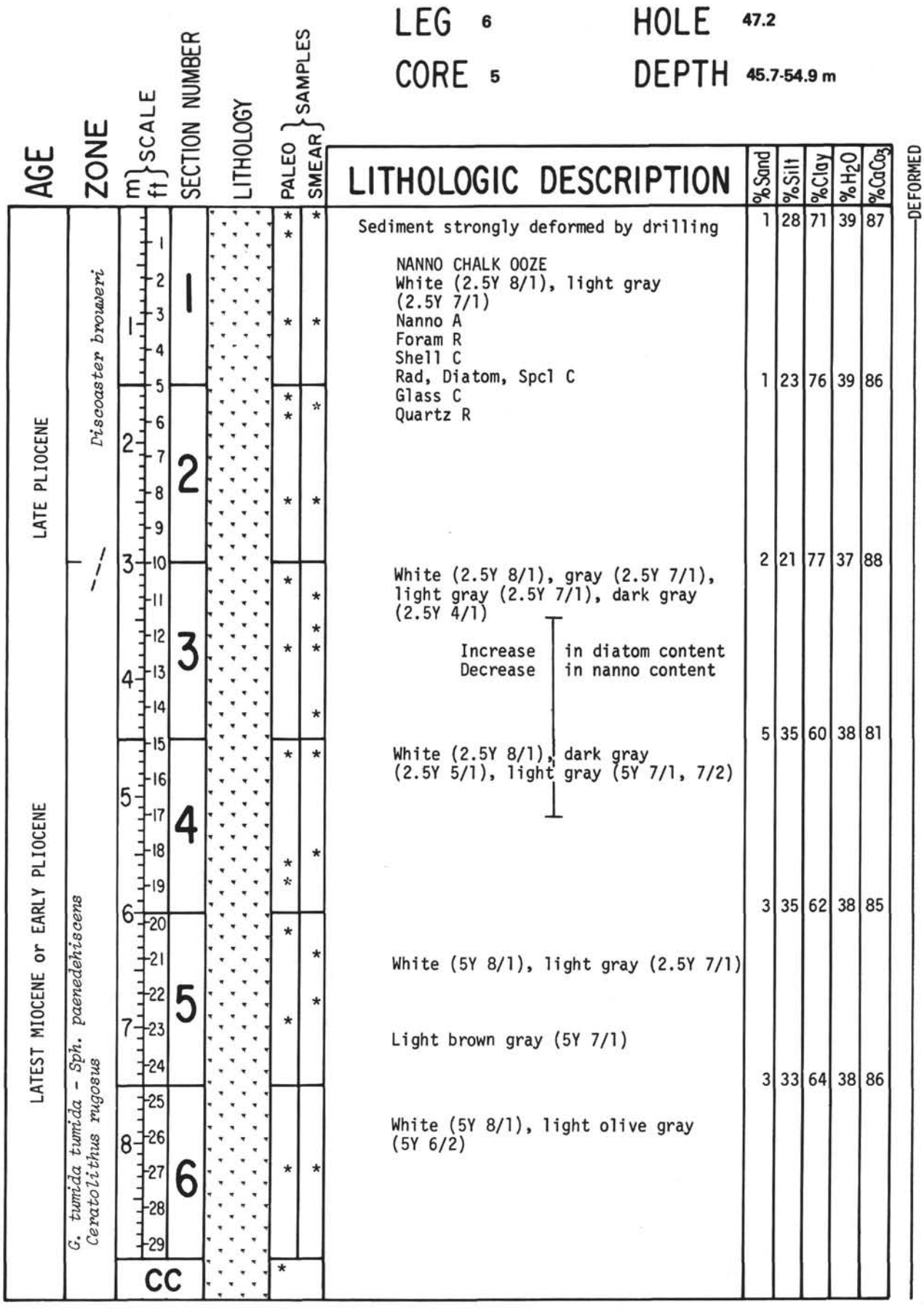


Figure 25. *Summary of lithology in Hole 47.2 Core 5.*

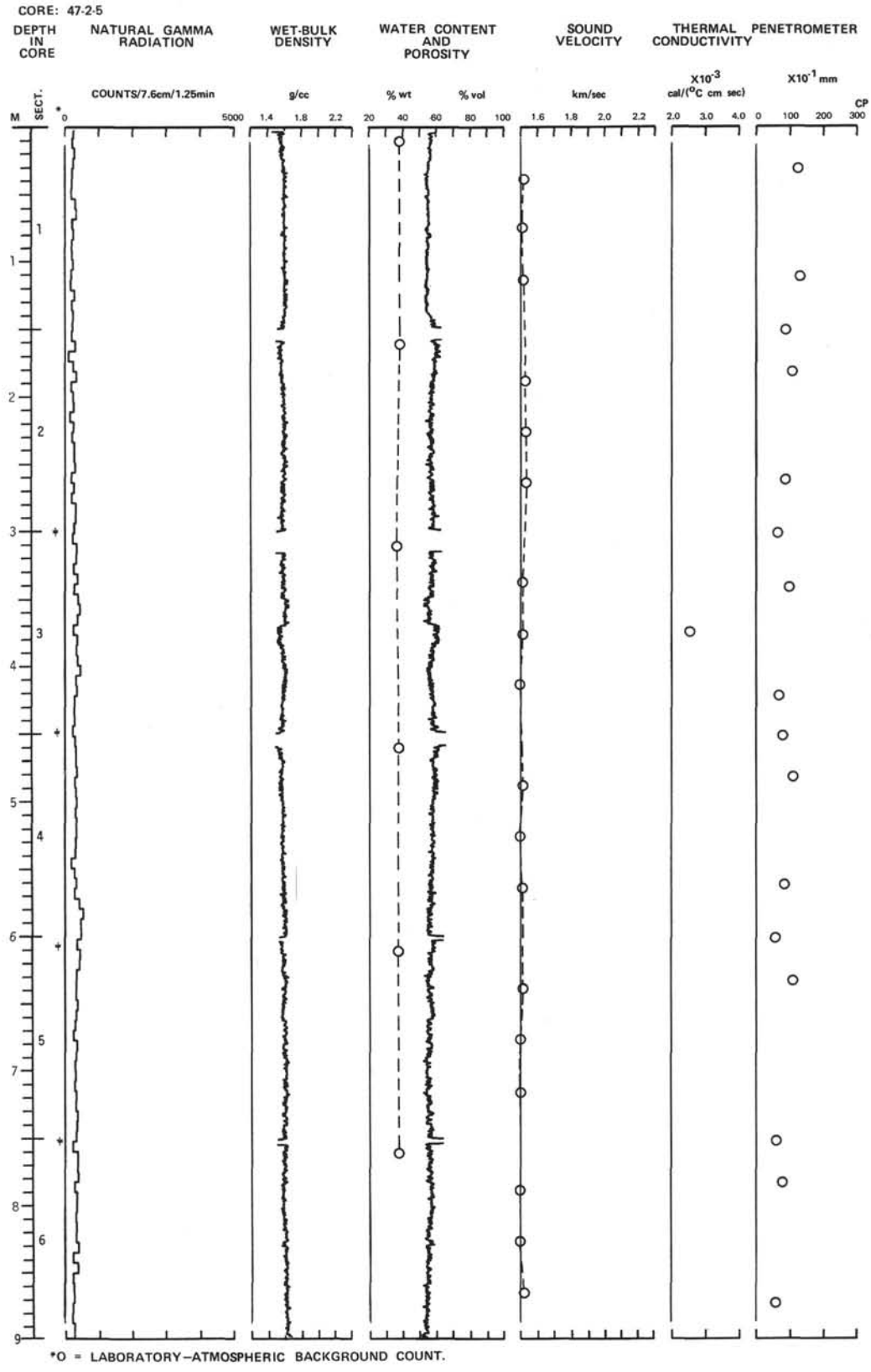


Figure 26. *Summary of physical properties in Hole 47.2 Core 5.*

LEG 6 HOLE 47.2

CORE 5 DEPTH 45.7-54.9 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
Pliocene assemblages present in sections 1-2 (99-101) of this core and abundant planktonic Foraminifera of the *Globorotalia miocenica* Zone (Upper Miocene, Messinian stage) were found in sections 3 (110-112) -6. Pliocene: *Globorotalia crassaformis, G. tumida, G. inflata, G. hirsuta, Sphaeroidinella dehiscens, Pulleniatina obliquiloculata, Globigerinoides ruber.* Upper Miocene: *Globorotalia miozea saphoae, G. tumida tumida, G. margaritae, G. mirbensis, G. miocenica, Sphaeroidinellopsis subdehiscens paenedehiscens, Globigerinoides obliquus extremus, Globigerina nepenthes* (evidently, the *G. tumida tumida - Sph. subdehiscens paenedehiscens* Subzone).	Upper Pliocene *Discoaster browseri* assemblages are present in the two upper core sections and upper Miocene or lower Pliocene assemblages of the *Ceratolithus rugosus* Zone are present in the lower sections. Species in the upper part of the core include *Ceratolithus rugosus, Cyclococcolithina macintyrei, Discoaster browseri,* and *D. surculus.* Species in the lower part of the core include *C. rugosus, C. tricorniculatus, D. surculus,* and *Reticulofenestra pseudoumbilica.*	This core contains species above the latest occurrence of *Stichocorys delmontense* spanning the combined ranges of the *Spongaster pentas* (lower Pliocene) and *Stichocorys peregrina* (upper Miocene) Zones. TOP: *Stichocorys peregrina, Eucyrtidium calvertense, E. tumidulum, Druppatractus acquilonius,* and *Lithopera bacca.* BOTTOM: *Stichocorys peregrina, Eucyrtidium calvertense, Druppatractus acquilonius,* and *Lithopera bacca.*

Figure 27. *Summary of biostratigraphy in Hole 47.2 Core 5.*

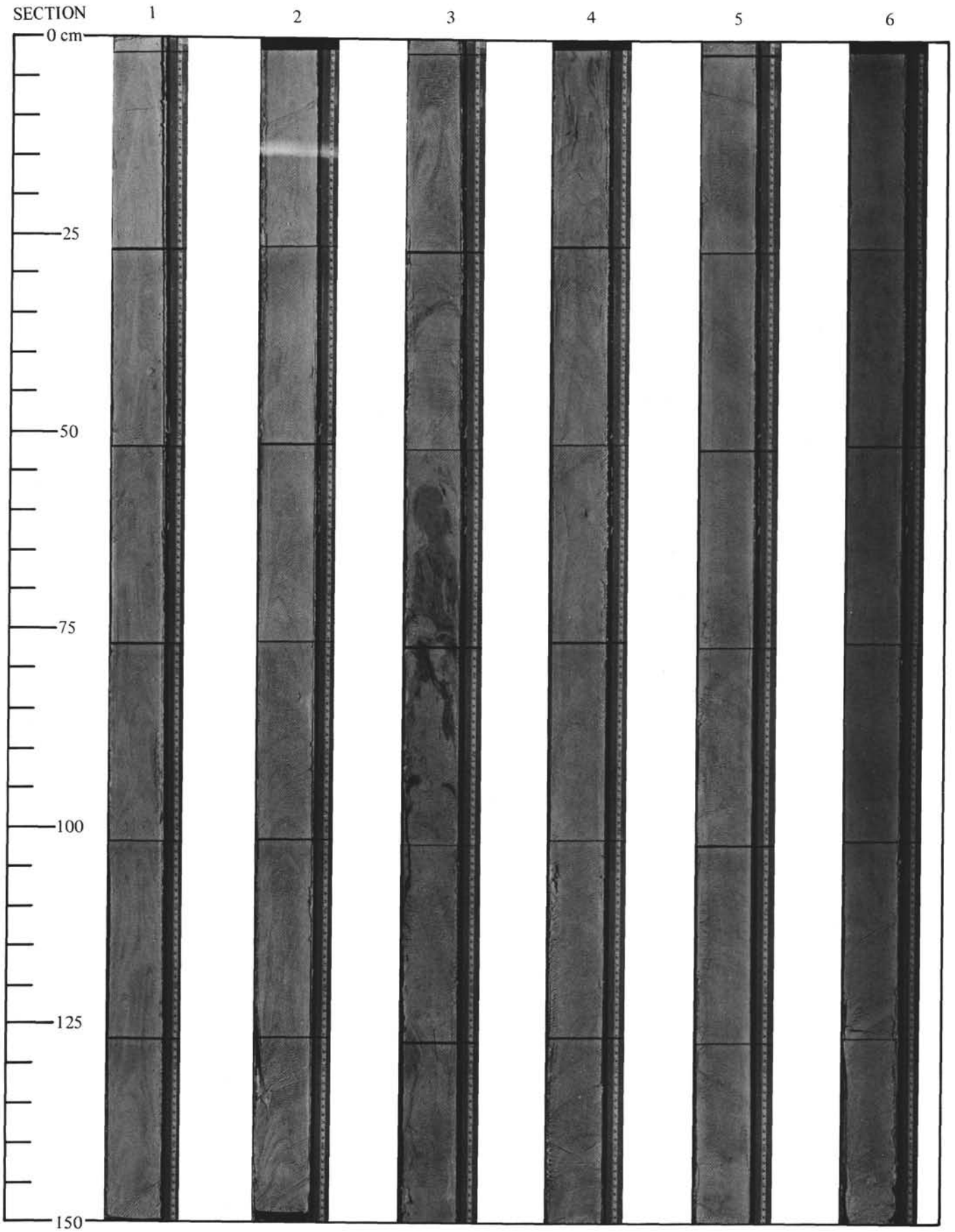


Plate 6. *Photographs Hole 47.2 Core 5.*

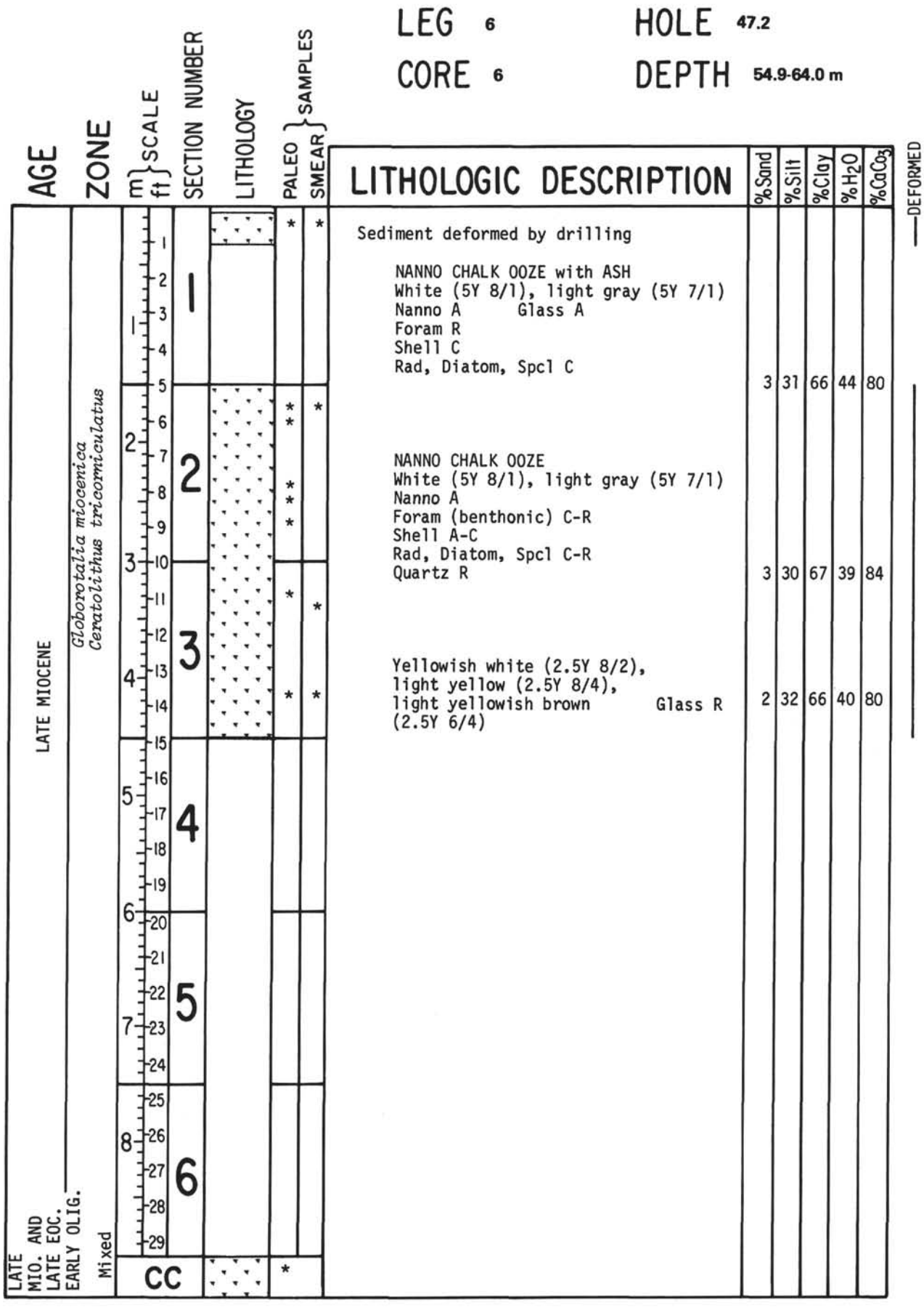


Figure 28. *Summary of lithology in Hole 47.2 Core 6.*

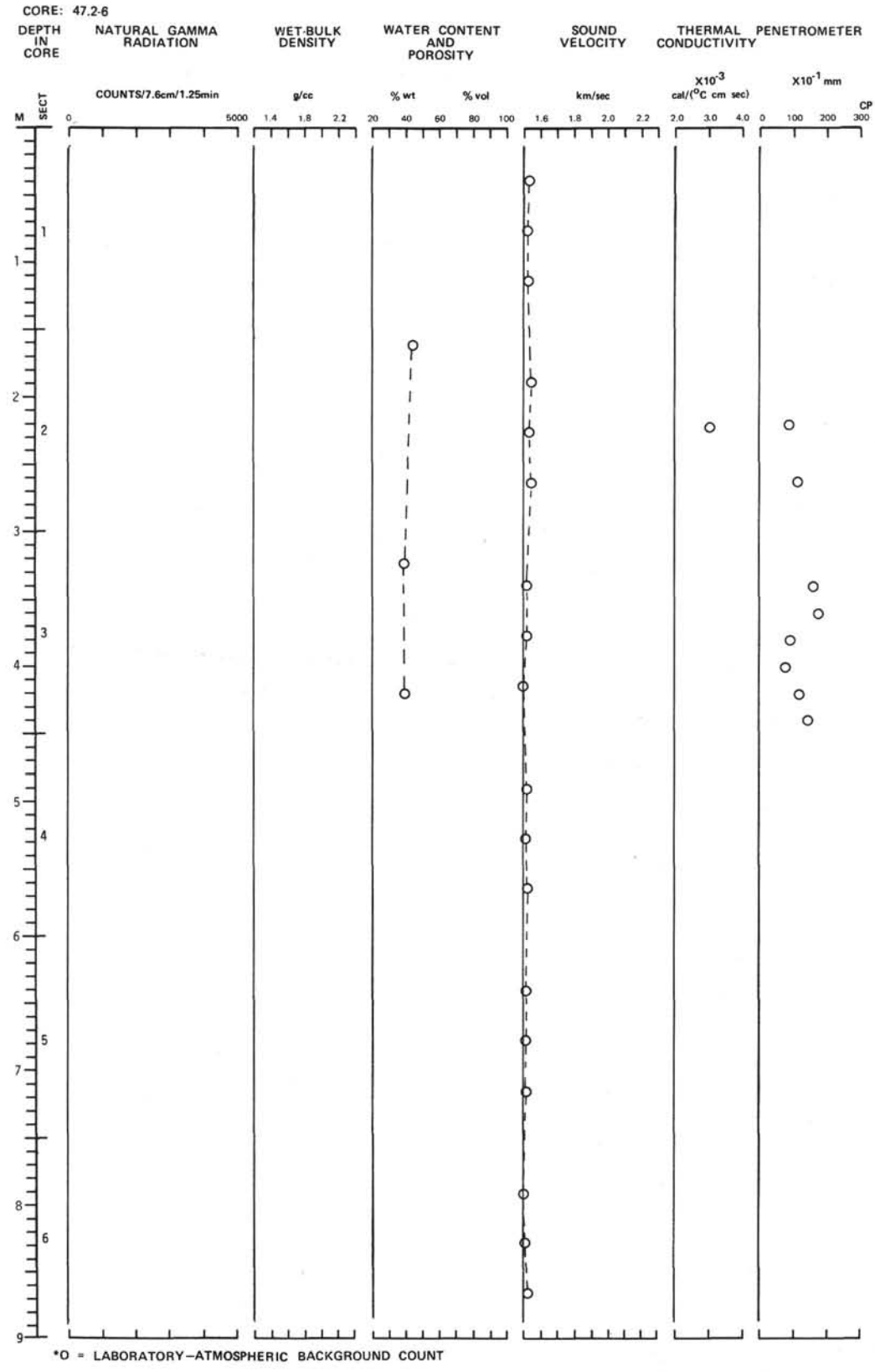


Figure 29. *Summary of physical properties in Hole 47.2 Core 6.*

LEG 6 HOLE 47.2

CORE 6 DEPTH 54.9-64.0 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
All samples of this core contain assemblages of planktonic Foraminifera typical for the *Globorotalia miocaenica* Zone (Upper Miocene, Messinian stage) - *Globorotalia miozea saphoae, G. multicamerata, G. margaritae, G. miocaenica, G. tumida plesiotumida, G. merotumida, Sphaeroidinellopsis subdehiscens, Sph. subdehiscens paenedehiscens, Globigerinoides obliquus, Globigerina nepenthes, G. microstoma, Globigerinita glutinata, Orbulina universa.* Seemingly it is the lower part of this zone (the *Globigerina tumida plesiotumida* Subzone).	Assemblages of the upper Miocene *Ceratolithus tricorniculatus* Zone are present throughout the core, itself. However, the core-catcher sample contains mixed lithologies with discrete assemblages of upper Miocene and upper Eocene to lower Oligocene nannoplankton. Species present through the core include *Ceratolithus tricorniculatus, Discoaster surculus,* and *Reticulofenestra pseudoumbilica.* Species from the core-catcher sample include *Cyclococcolithina neogammation, Discoaster barbadiensis,* and *Isthmolithus recurvus.*	This core contains species above the latest occurrence of *Stichocorys delmontense* spanning the combined ranges of the *Spongaster pentas* (lower Pliocene) and *Stichocorys peregrina* (upper Miocene) Zones. TOP: *Stichocorys peregrina, Eucyrtidium calvertense, Druppatractus acquilonius,* and *Lithopera bacca.* BOTTOM: same.

Figure 30. *Summary of biostratigraphy in Hole 47.2 Core 6.*

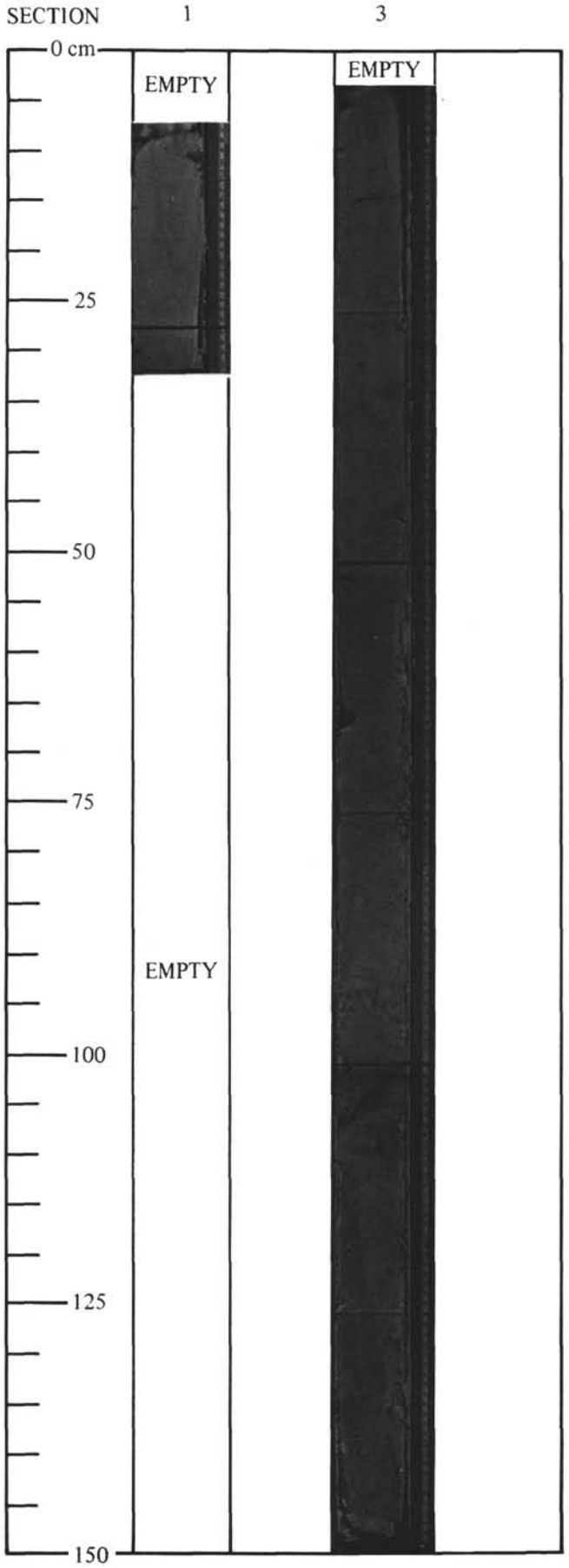


Plate 7. *Photographs Hole 47.2 Core 6.*

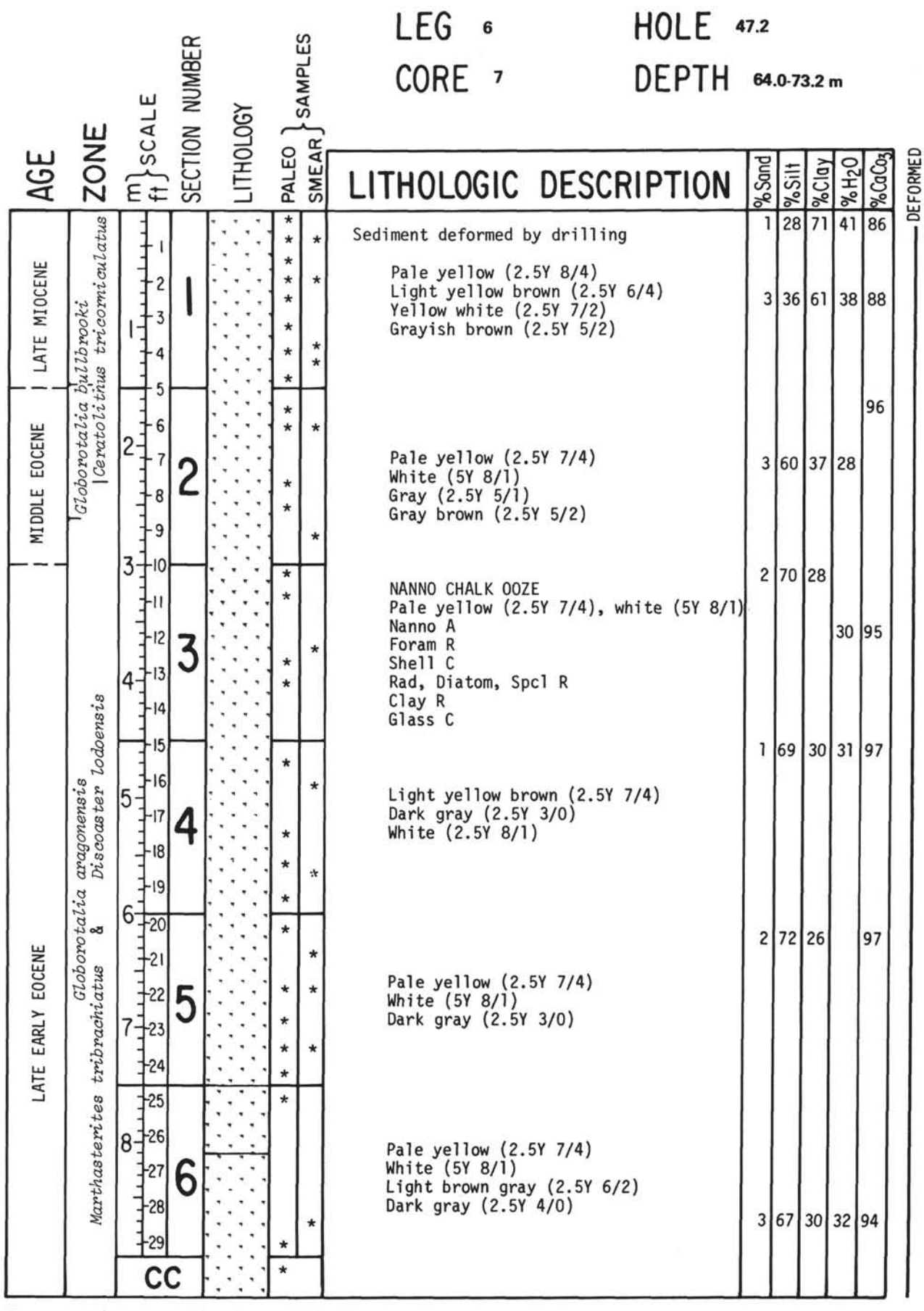


Figure 31. *Summary of lithology in Hole 47.2 Core 7.*

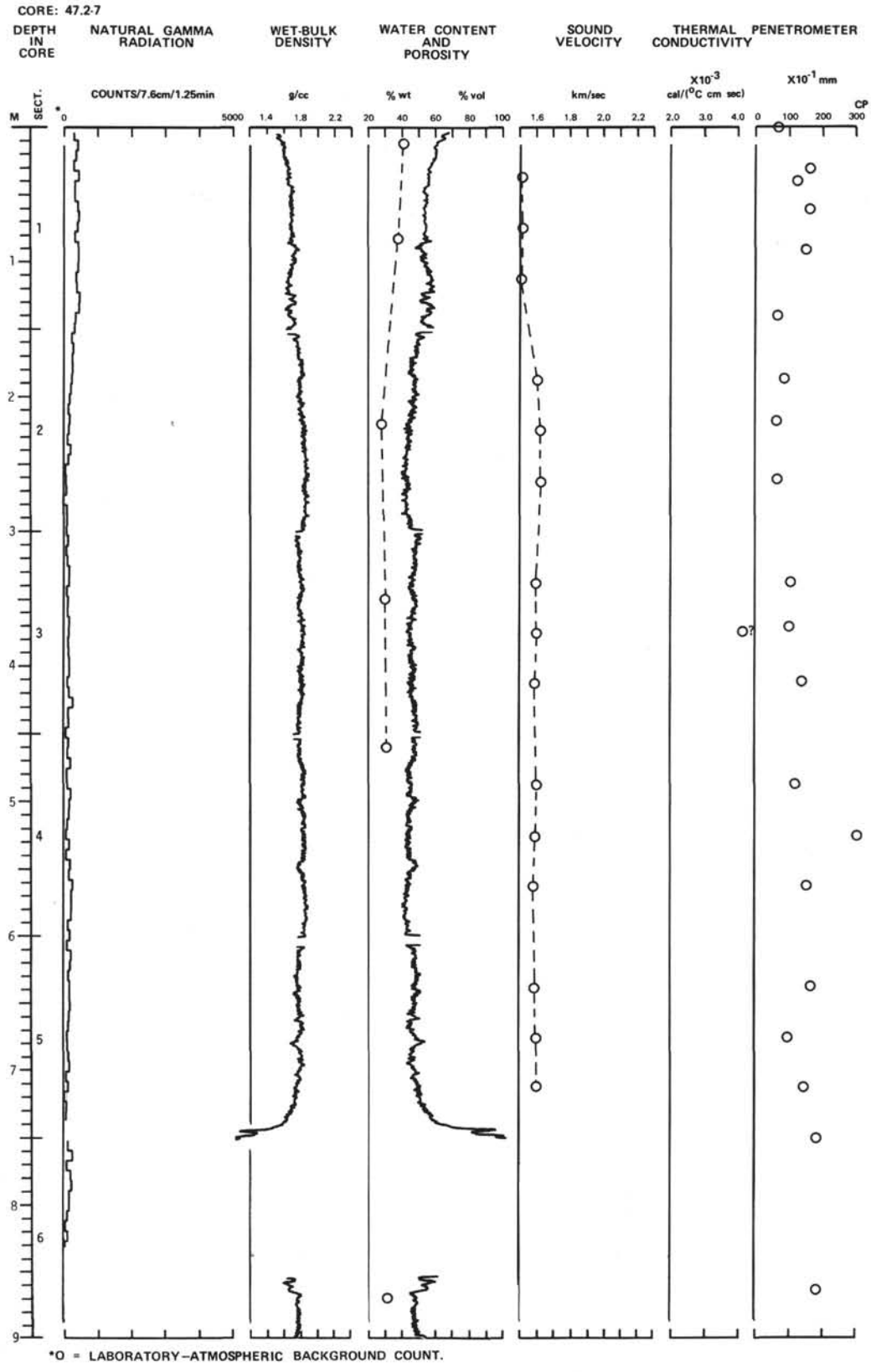


Figure 32. *Summary of physical properties in Hole 47.2 Core 7.*

LEG 6 HOLE 47.2

CORE 7 DEPTH 64.0-73.2 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
Sediments of Upper Miocene, basal layers of Middle Eocene and upper Lower Eocene were established in this core. Microfauna of Upper Miocene (section 1) is presented by *Globorotalia miocenica, G. margaritae, G. gavalae, Sphaeroidinella subdehiscens.* Chalk oozes of section 2 (part) include abundant *Acarinina bullbrooki, A. aspensis* together with infrequent *Globigerapsis index, Globigerinatheca barri, Globorotalia spinulosa, G. renzi* (base of the *A. bullbrooki* Zone of middle Eocene). The *Globorotalia aragonensis* Zone of Lower Eocene (sections 6 - 3 and a part of 2 is characterized by *G. aragonensis, G. caucasica, G. marksi, Acarinina pentacamerata, A. aspensis, A interposita, Globigerina senni, G. prolata.*	The upper core section contains assemblages of the upper Miocene *Ceratolithus tricorniculatus* Zone, possibly as a result of side-wall slumping as core 6 was retrieved. The remainder of the core contains assemblages of the lower Eocene *Discoaster lodoensis* Zone and *Marthasterites tribrachiatus* Zone. Species present in the lower five core sections include *Chiasmolithus grandis, D. lodoensis, Marthasterites tribrachiatus,* and *Sphenolithus radians.*	Radiolaria are rare in the upper part of this core, absent from the lower part. Section 1 contains species spanning the combined ranges of the *Spongaster pentas* (lower Pliocene) and *Stichocorys peregrina* (upper Miocene) Zones. Section 2 contains *Stichocorys delmontense* indicating a middle late Miocene age (probably in the *Ommatartus penultimus* Zone). TOP: *Stichocorys peregrina, Druppatractus acquilonius,* and *Lithopera bacca.* BOTTOM: *Stichocorys delmontense* and *Lithopera bacca.*

Figure 33. *Summary of biostratigraphy in Hole 47.2 Core 7.*

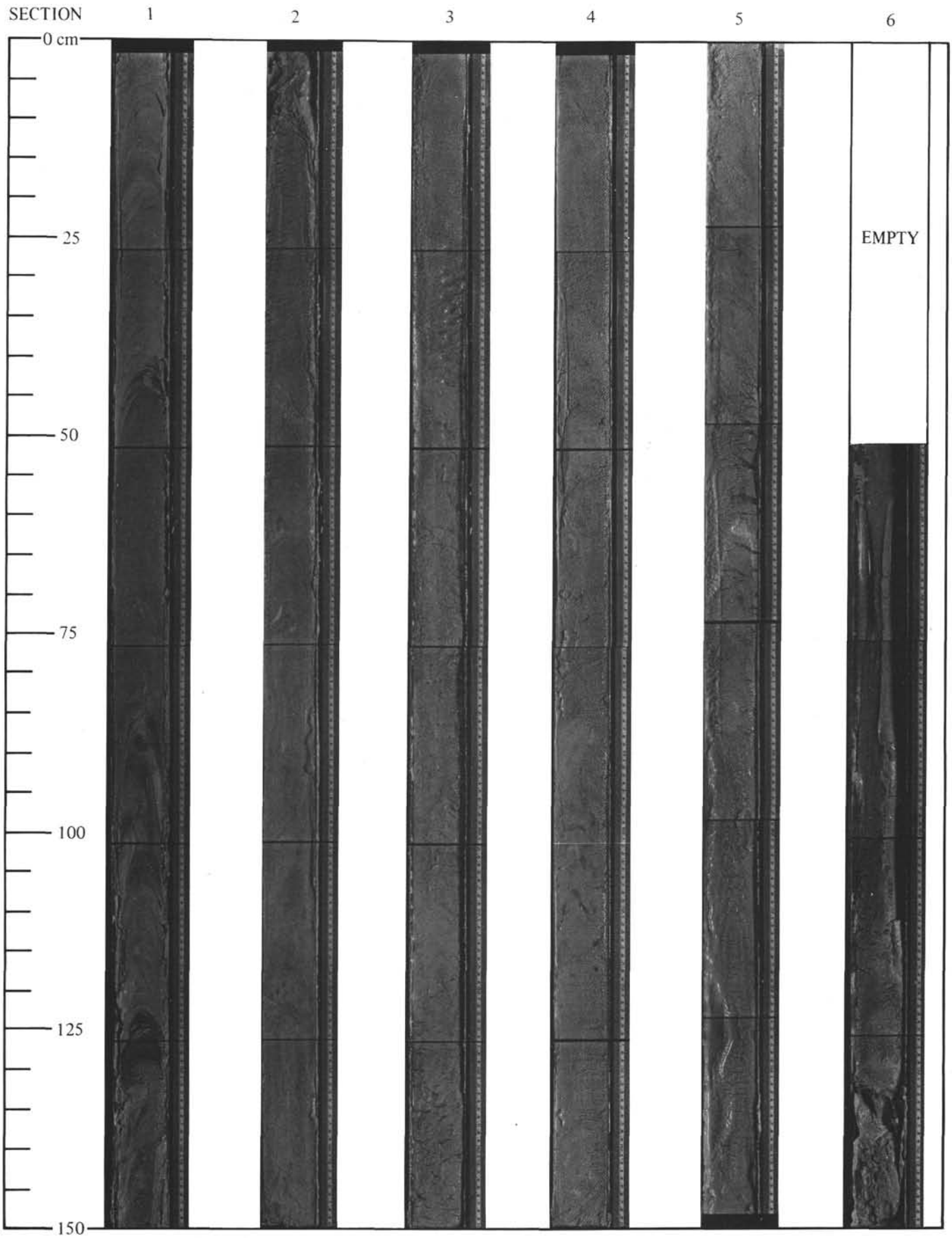


Plate 8. *Photographs Hole 47.2 Core 7.*

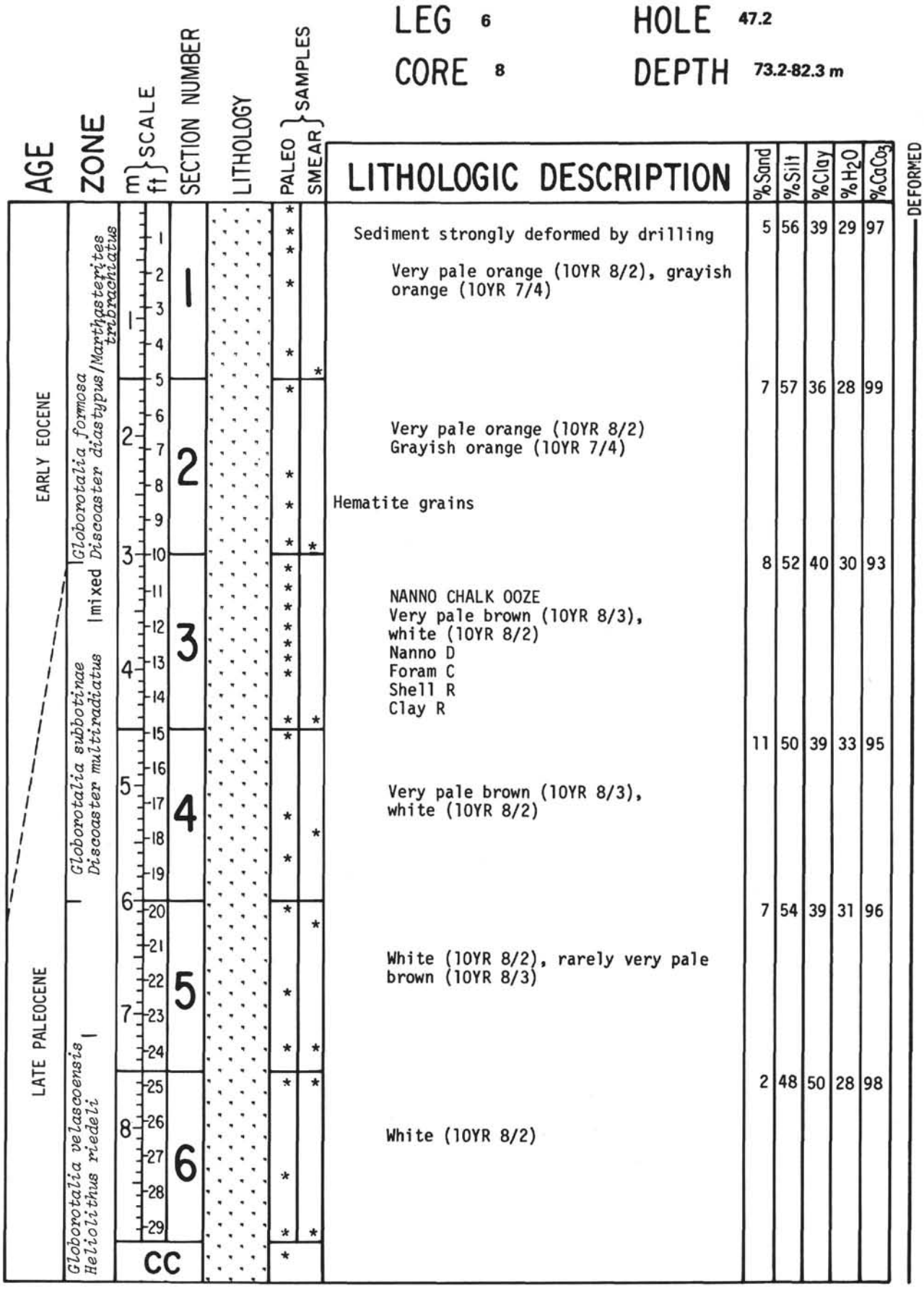


Figure 34. *Summary of lithology in Hole 47.2 Core 8.*

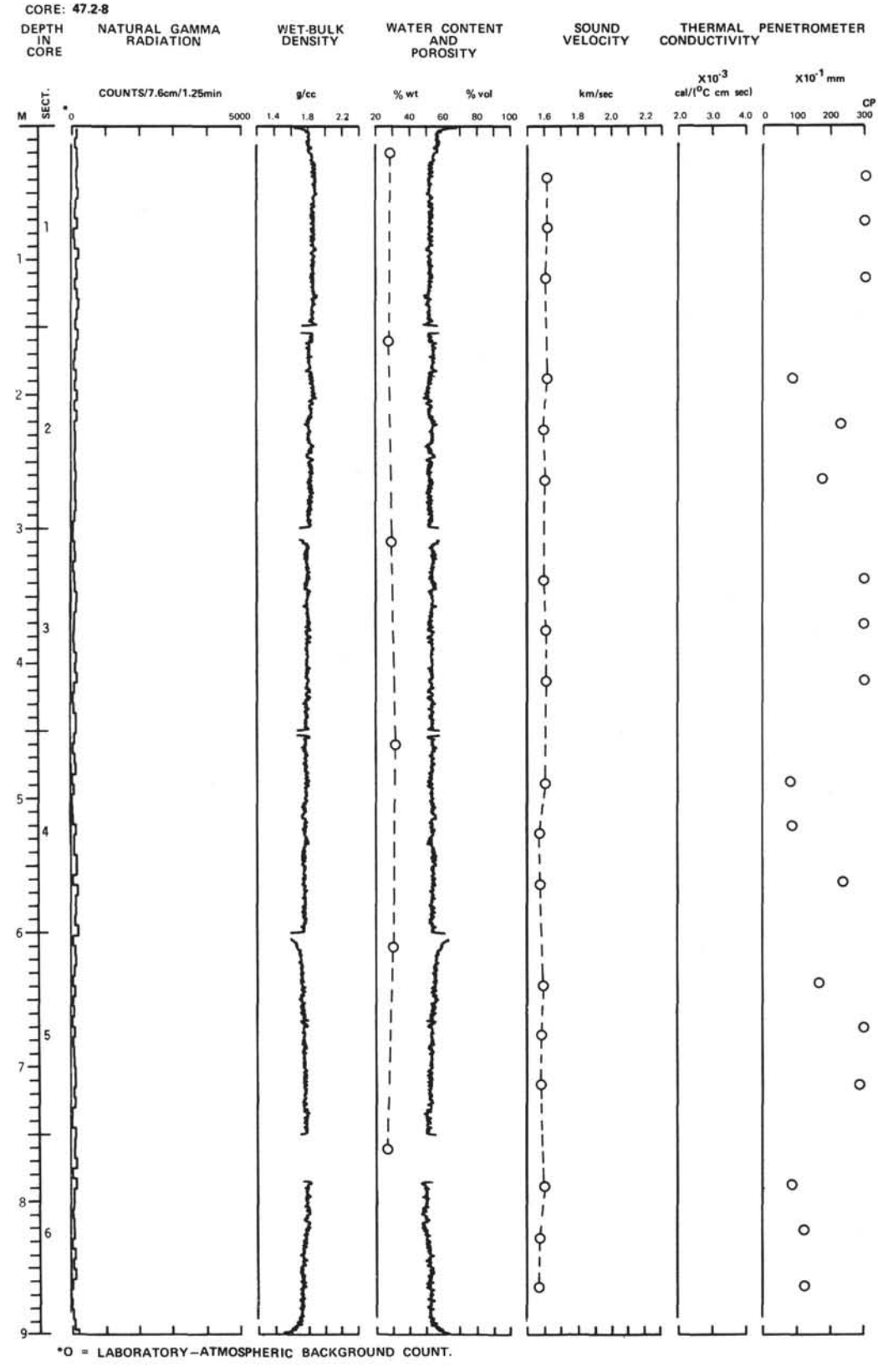


Figure 35. *Summary of physical properties in Hole 47.2 Core 8.*

LEG 6 HOLE 47.2

CORE 8 DEPTH 73.2-82.3 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
Assemblages of planktonic Foraminifers determine the age of sediments as the uppermost Upper Paleocene and lower Lower Eocene. Microfauna of sections 6 and 5 is rich in *Globorotalia velascoensis, G. acuta, G. pasionensis, G. aequa, Acarinina soldadoensis, A. esnaensis* (the *G. velascoensis* Zone and Subzone of Upper Paleocene). In section 4 and 3 predominate *Globorotalia subbotinae, G. wilcoxensis, G. aequa, Acarinina pseudotopilensis, A. soldadoensis, A. gravelli* (the *G. subbotinae* Zone of Lower Eocene). Sections 2 and 1 are characterized by *Globorotalia marginodentata, G. formosa, G. quetra, G. naussi, Acarinina triplex, A. gravelli* (the *G. marginodentata* Zone of Lower Eocene).	This core contains assemblages of the lower Eocene *Marthasterites tribrachiatus* Zone and *Discoaster diastypus* Zone in the upper two core sections. In the lower four core sections upper Paleocene assemblages of the *Discoaster multiradiatus* Zone and *Heliolithus riedeli* Zone are present. Species from the lower Eocene assemblages include *Discoaster barbadiensis, D. diastypus,* and *Marthasterites* sp. cf. *M. tribrachiatus.* Species from the upper Paleocene assemblages include *Discoaster multiradiatus, D.* sp. cf. *D. gemmeus, Heliolithus riedeli,* and *Sphenolithus anarrhopus.*	No Radiolaria.

Figure 36. *Summary of biostratigraphy in Hole 47.2 Core 8.*

Plate 9. *Photographs Hole 47.2 Core 8.*

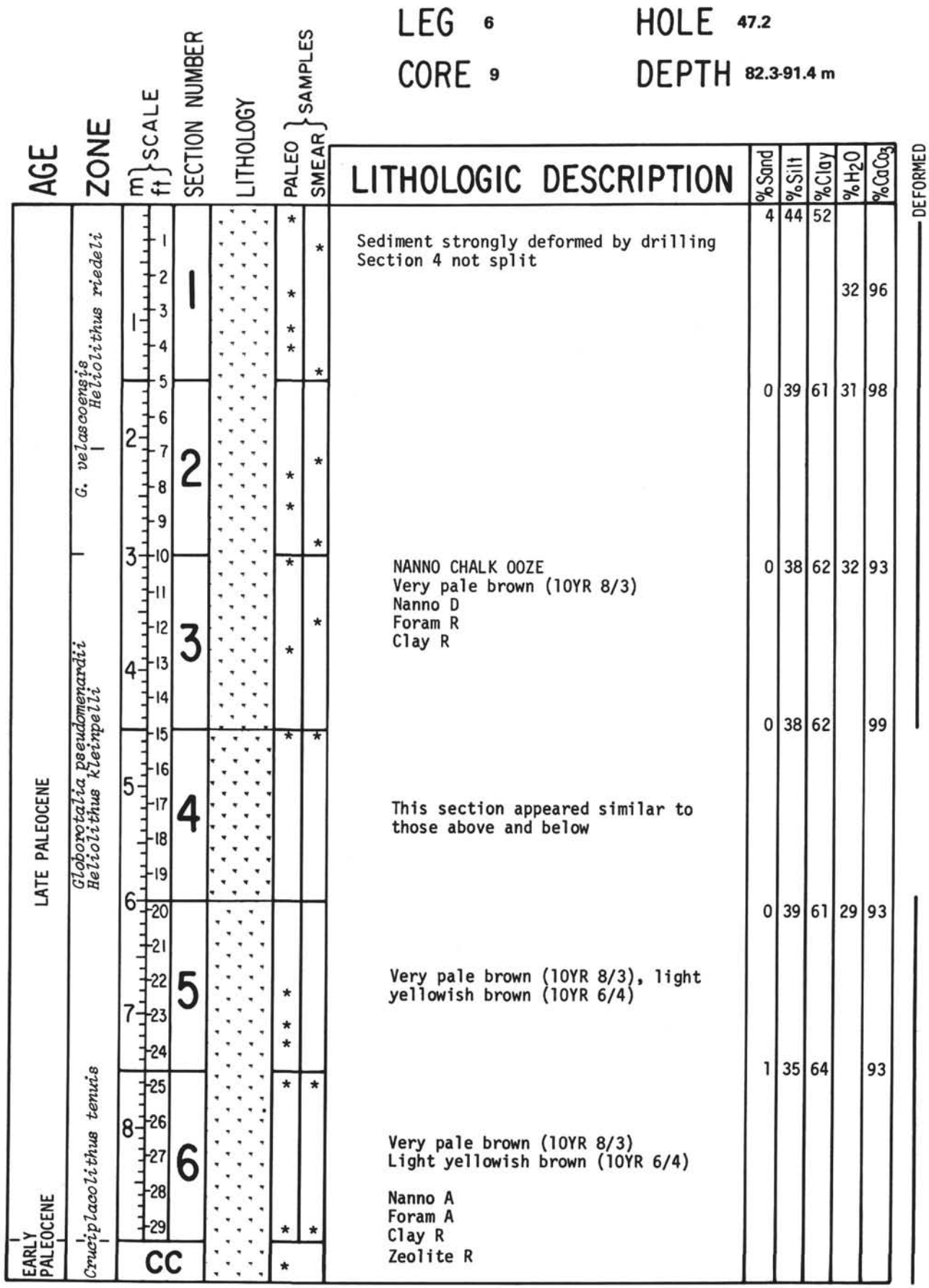


Figure 37. *Summary of lithology in Hole 47.2 Core 9.*

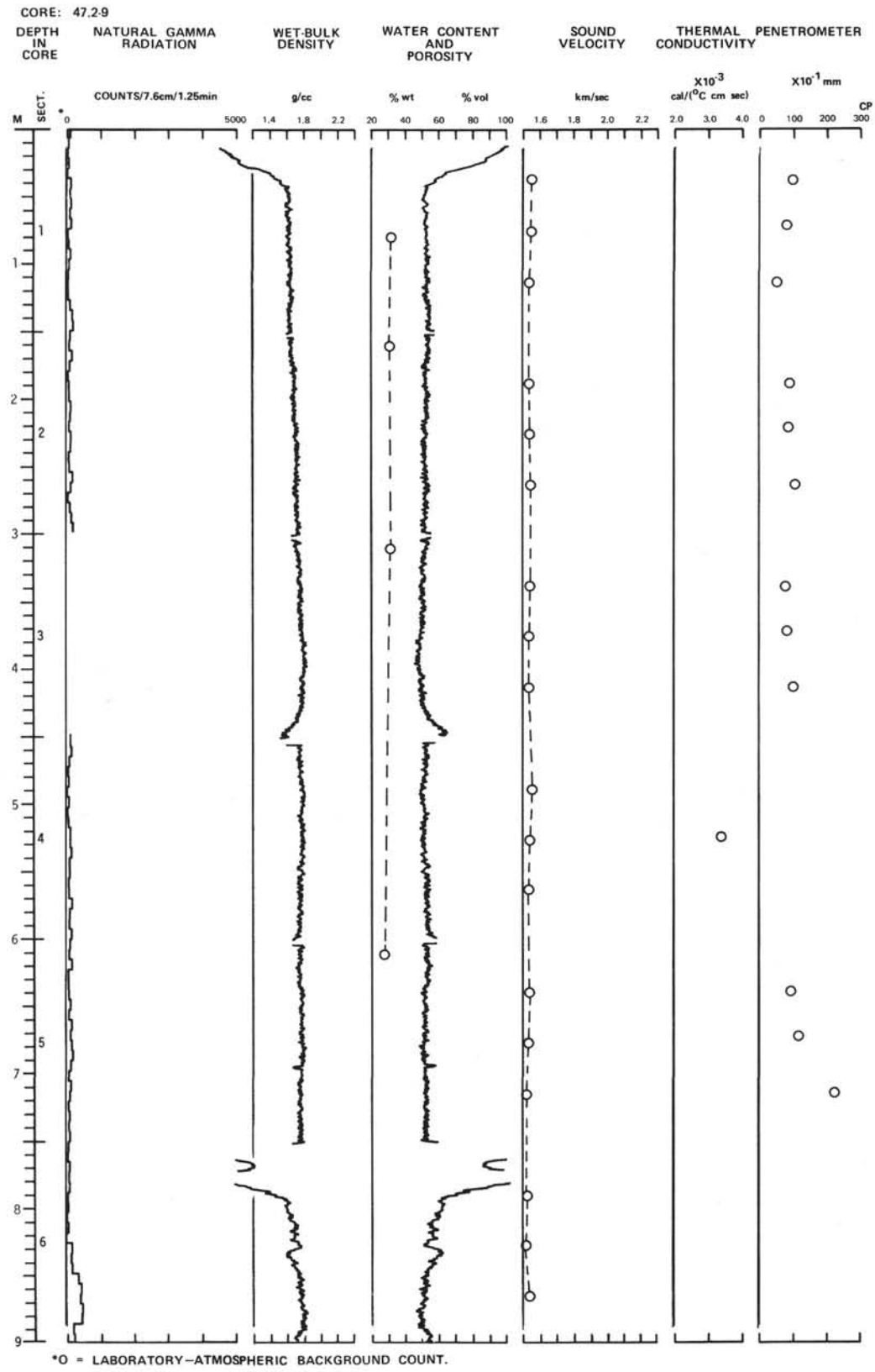


Figure 38. *Summary of physical properties in Hole 47.2 Core 9.*

LEG 6 HOLE 47.2

CORE 9 DEPTH 82.3-91.4 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
Upper Paleocene assemblages of the *Globorotalia velascoensis* Zone were recognized throughout the core: *Globorotalia velascoensis, G. pseudomenardii, G. pasionensis, G. hispidicidaris, G. apanthesma, G. convexa, G. imitata, G. Occlusa, G. trichotrocha, Acarinina acarinata, A. mckannai, A. intermedia, A. primitiva, Globigerina velascoensis, G. nana, G. bacuana, G. chascanona,* Four lower sections with *Globorotalia laevigata* and *G. tortiva* belong to the *G. pseudomenardii* Subzone; two upper sections with *Globorotalia acuta, G. aequa, Acarinina soldadoensis* correspond to the *Globorotalia velascoensis* Subzone (section 2 contains microfauna of a transitional character).	Upper Paleocene assemblages of the *Heliolithus riedeli* Zone are present in the upper core section. The upper Paleocene *Heliolithus kleinpelli* Zone is represented in the lower five core sections. Species from the upper Zone include *Chiasmolithus consuetus, Heliolithus riedeli, Sphenolithus anarrhopus,* and *Toweius craticulus.* Species from the lower zone include *Heliolithus kleinpelli, S. anarrhopus,* and *T. craticulus.*	No Radiolaria.

Figure 39. *Summary of biostratigraphy in Hole 47.2 Core 9.*

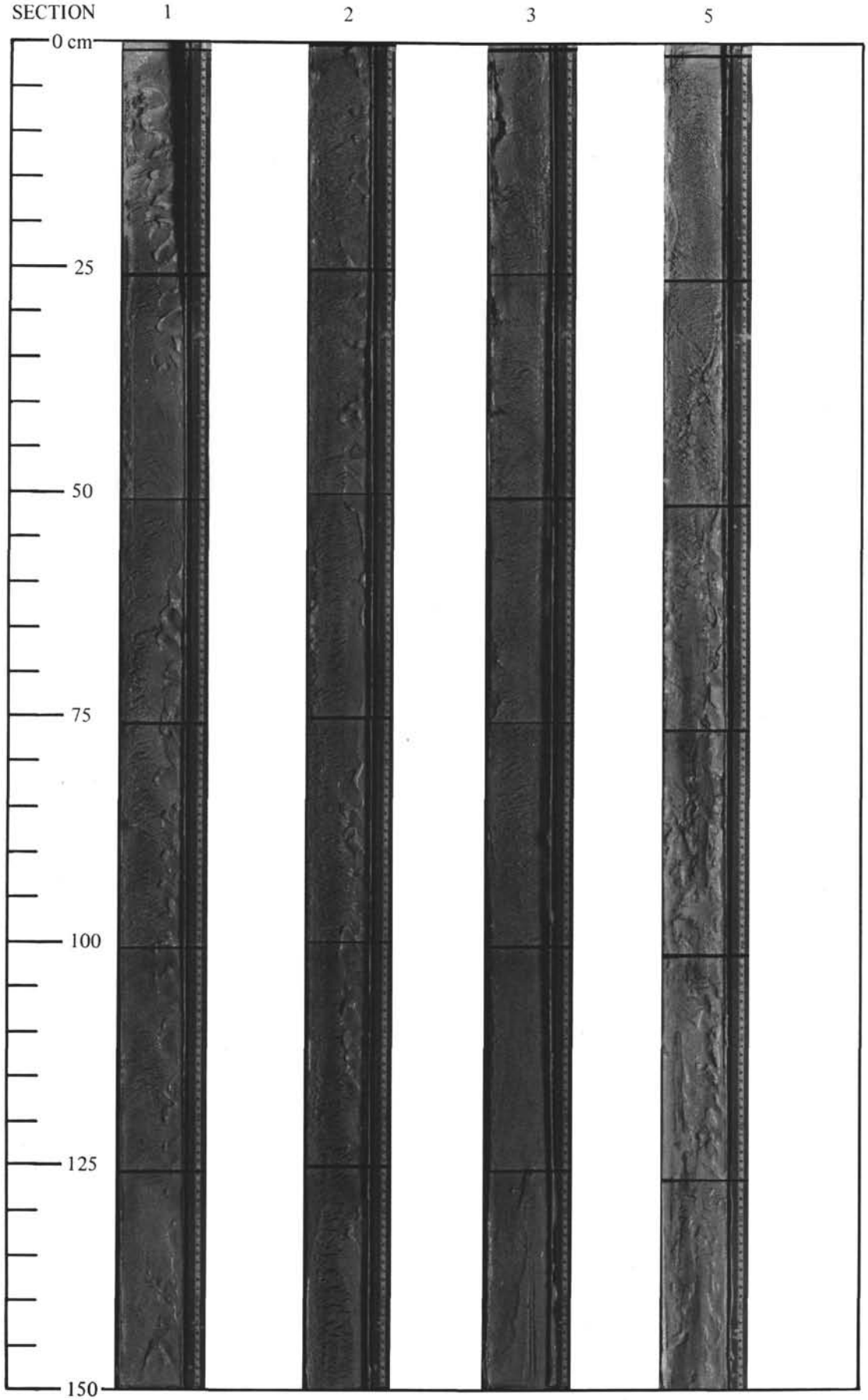


Plate 10. *Photographs Hole 47.2 Core 9.*

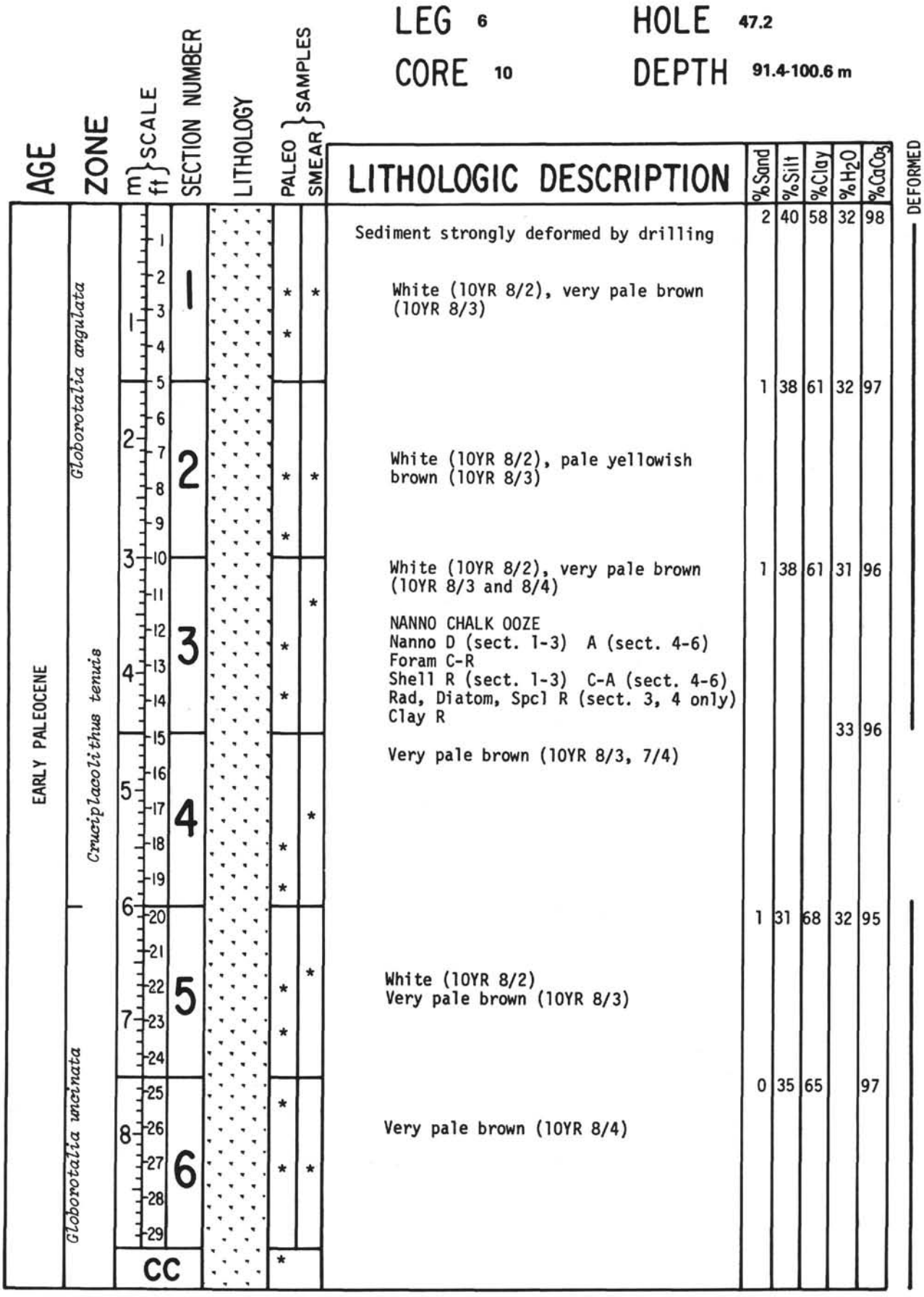


Figure 40. *Summary of lithology in Hole 47.2 Core 10.*

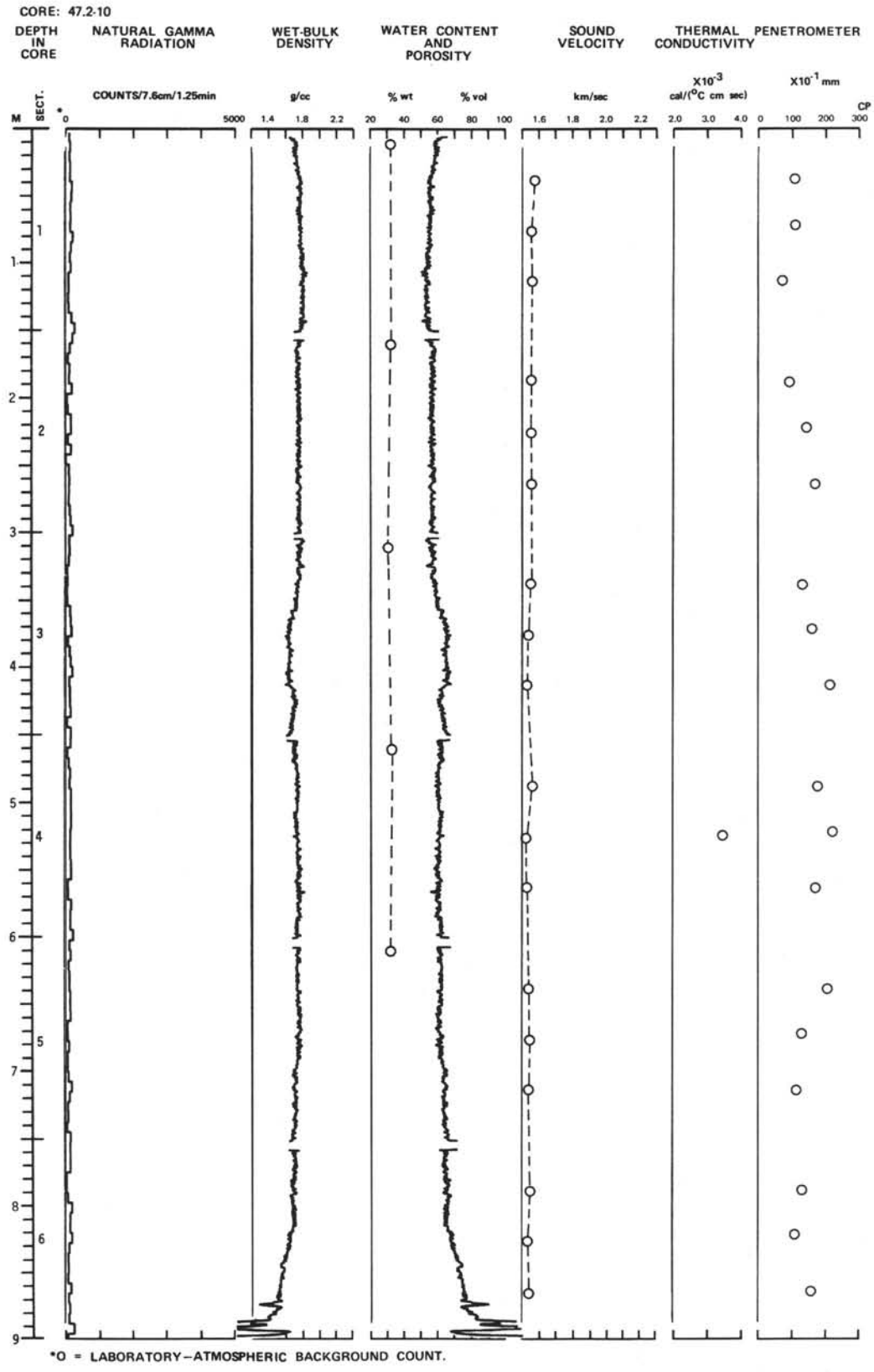


Figure 41. *Summary of physical properties in Hole 47.2 Core 10.*

LEG 6 HOLE 47.2

CORE 10 DEPTH 91.4-100.6 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
Rich assemblages of planktonic Foraminifera determine two zones of the upper Lower Paleocene. The *Acarinina uncinata* Zone (sections 5 - 6) is characterized by *A. uncinata, A. indolensis, A. praecursoria, A. inconstans, A. schachdagica, A. spiralis, Globorotalia compressa, G. quadrata.* Foraminifera of the *Globorotalia angulata* Zone (sections 4 - 1) are represented by *G. angulata, G. conicotruncata, G. pusilla, G. ehrenbergi, G. simulatilis, G. tadjikistanensis, Acarinina multiloculata* (section 4 contains transitional microfauna of these Zones).	Lower Paleocene assemblages of the *Cruciplacolithus tenuis* Zone are present throughout the core. Species present include *Cruciplacolithus tenuis, Fasciculithus* sp. [large], and *Zygodiscus sigmoides.*	No Radiolaria.

Figure 42. *Summary of biostratigraphy in Hole 47.2 Core 10.*

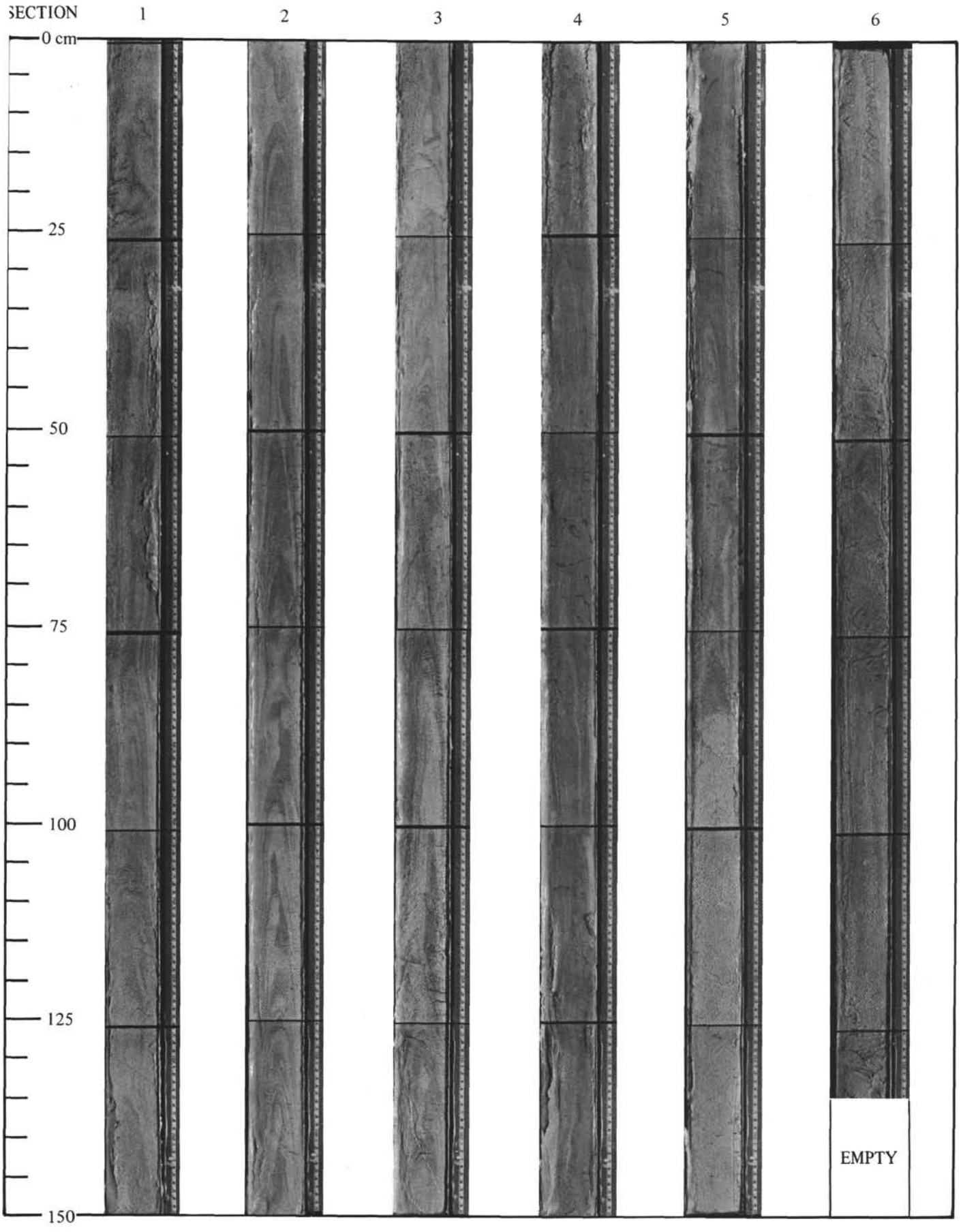


Plate 11. *Photographs Hole 47.2 Core 10.*

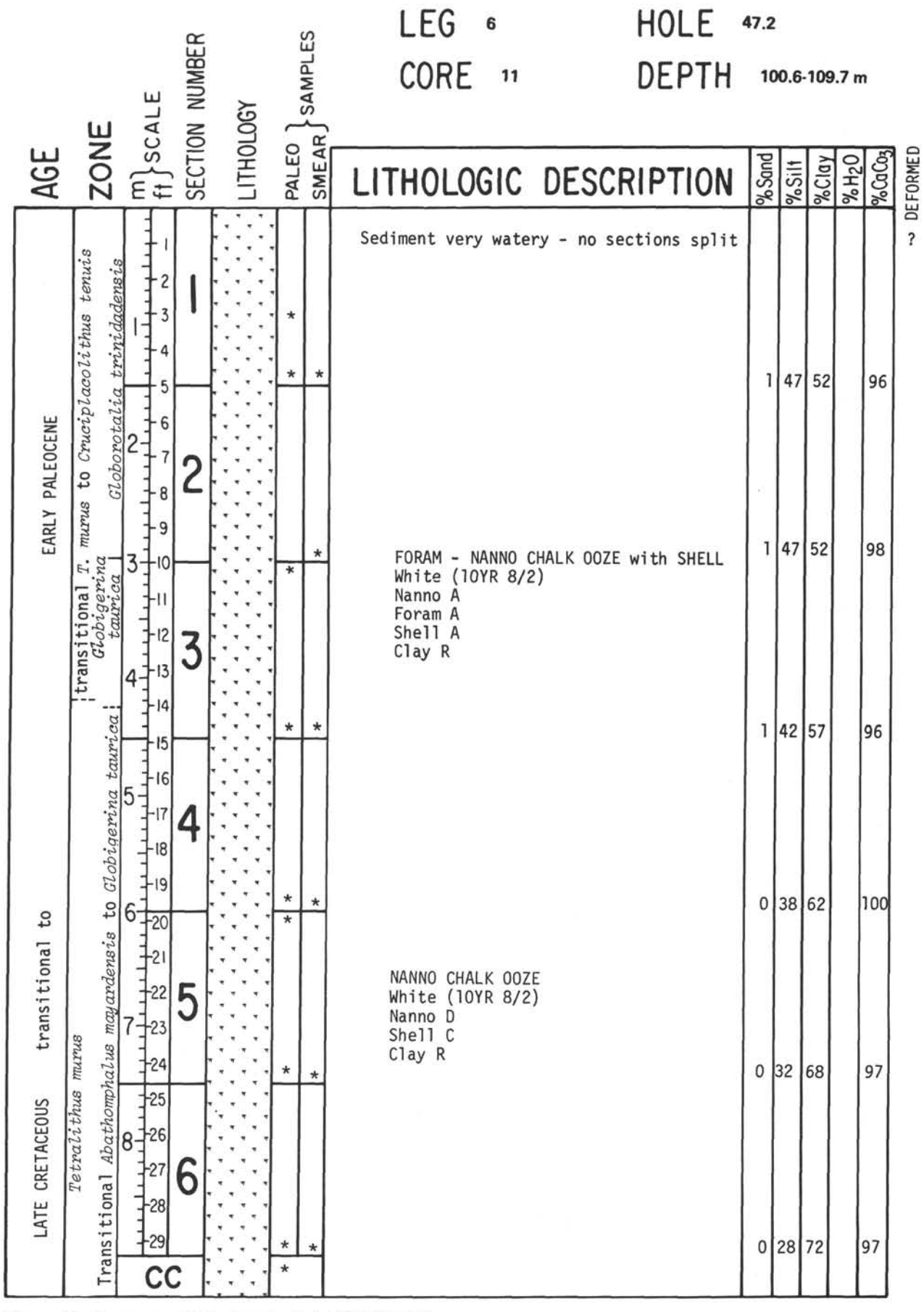


Figure 43. *Summary of lithology in Hole 47.2 Core 11.*

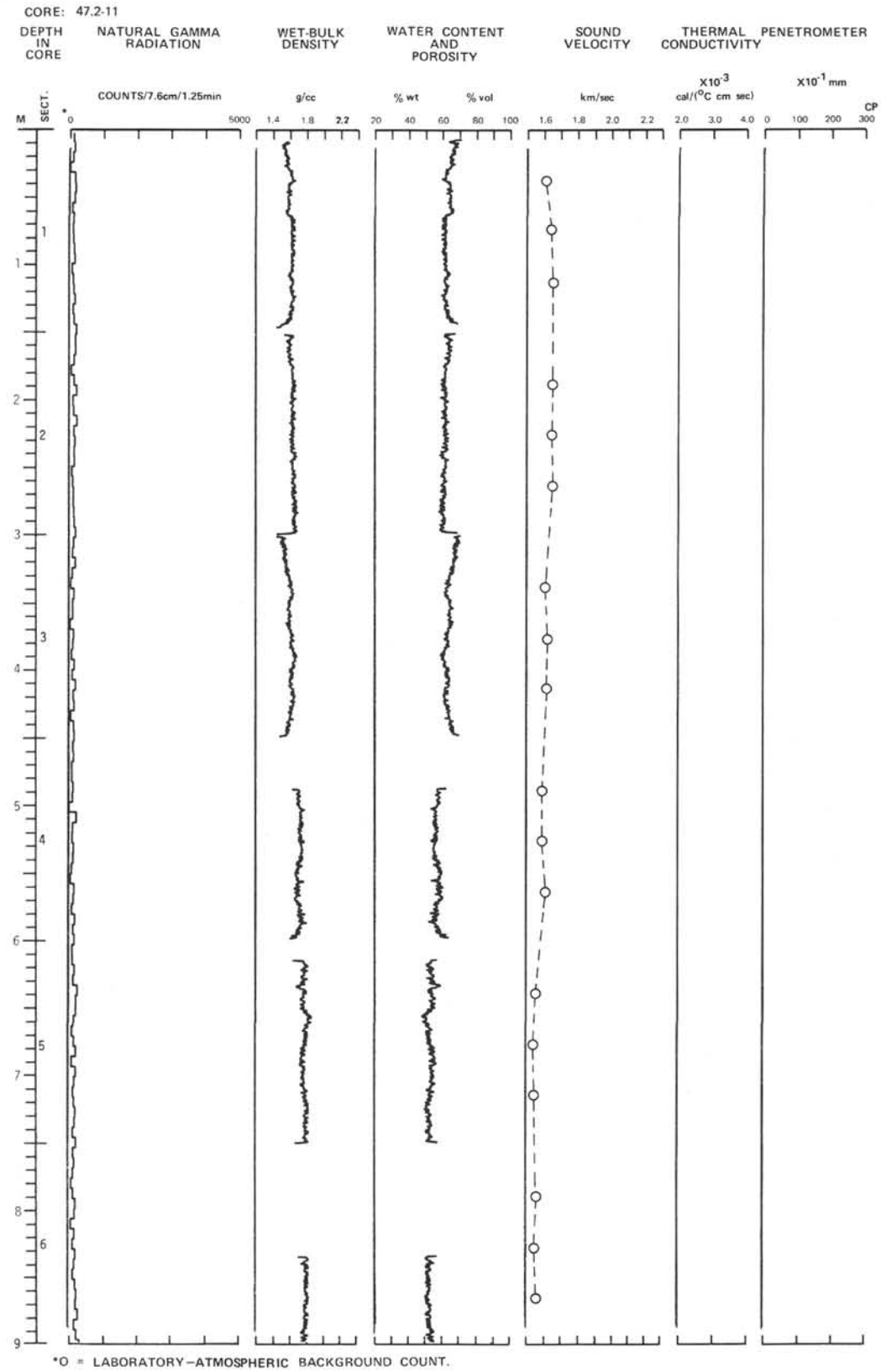


Figure 44. *Summary of physical properties in Hole 47.2 Core 11.*

LEG 6 HOLE 47.2

CORE 11 DEPTH 100.6-109.7 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
The Cretaceous-Tertiary boundary, based on planktonic Foraminifera, occurs in the lower half of this core. Foraminifera from the core are identified as follows: sections 1, 2 and 3 (part) *Globorotalia trinidadensis* Zone; section 3 (part) *Globigerina taurica* Zone (both zones - lower lower Paleocene, Danian stage); sections 4, 5 and 6 contain mixed assemblages of Paleocene, Danian and Maesritichtian species. The Cretaceous species belong to the *Abathomphalus mayaroensis* Zone. TOP: *Globorotalia trinidadensis, G. pseudobulloides, Globigerina triloculinoides, G. varianta, G. trivialis.* MIDDLE: *Globigerina eobulloides, G. tetragona, G. pentagona, G. daubjergensis, G. taurica, G. sabina.* BOTTOM: *Abathomphalus mayaroensis, Globotruncana contusa, G. stuarti, G. trinidadensis, G. aegyptiaca.*	The upper two core sections contain a mixture of lower Paleocene, *Cruciplacolithus tenuis* Zone and upper Maestrichtian *Tetralithus murus* Zone nannoplankton. The lower four core sections contain uncontaminated *Tetralithus murus* Zone nannoplankton.	No Radiolaria.

Figure 45. *Summary of biostratigraphy in Hole 47.2 Core 11.*

NO PHOTOGRAPHS OF HOLE 47.2 CORE 11

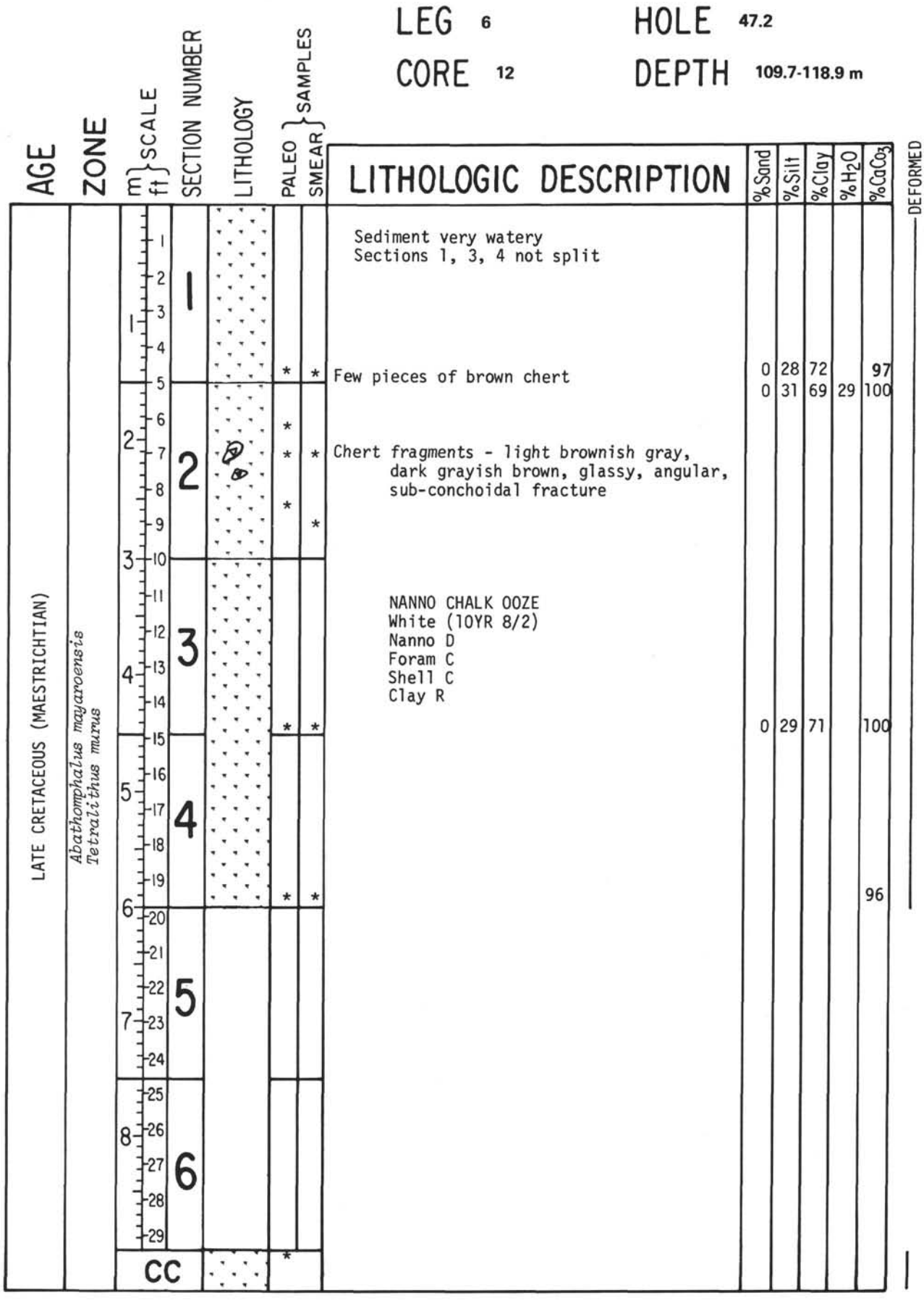


Figure 46. *Summary of lithology in Hole 47.2 Core 12.*

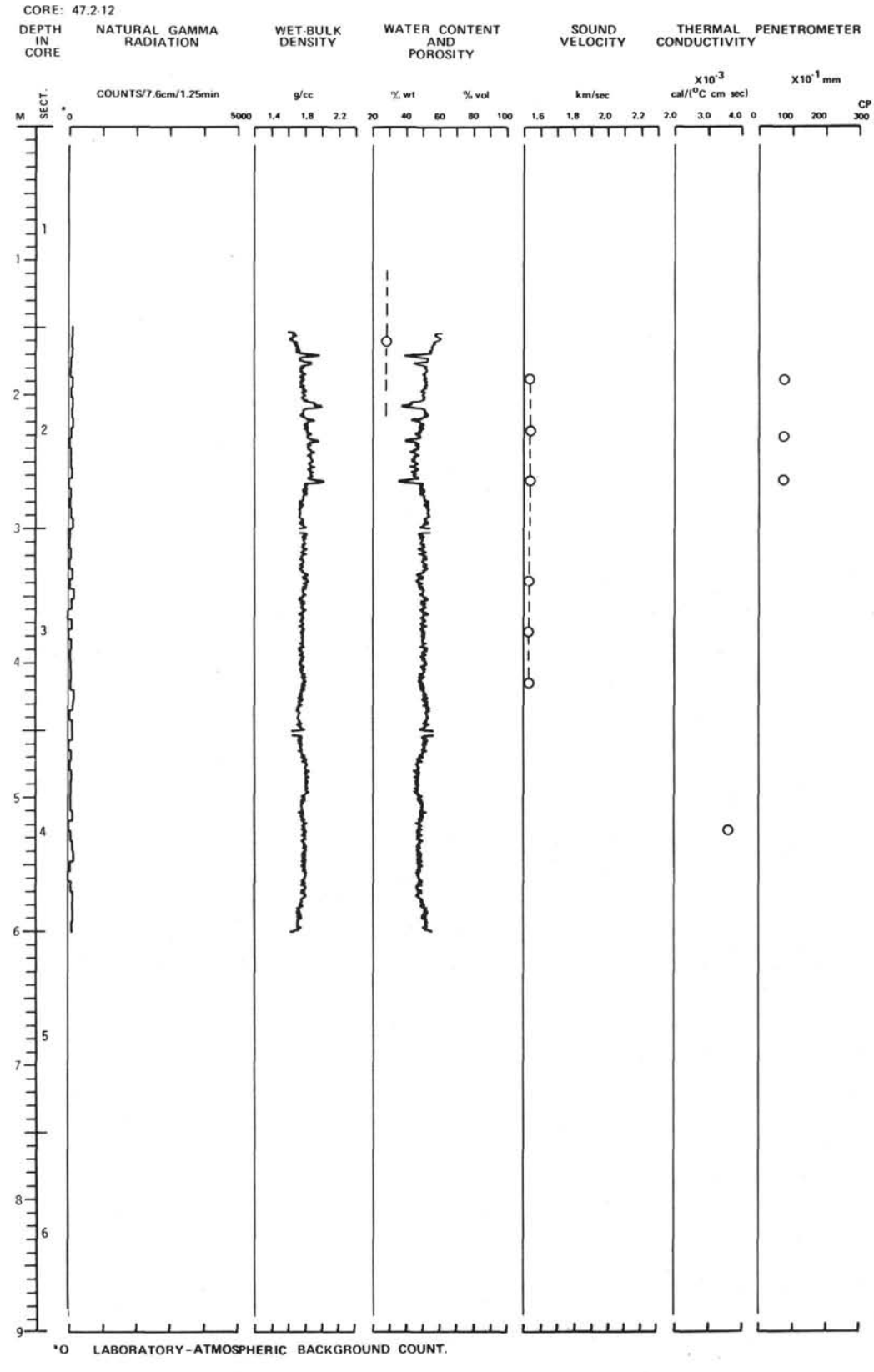


Figure 47. *Summary of physical properties in Hole 47.2 Core 12.*

LEG 6 HOLE 47.2

CORE 12 DEPTH 109.7-118.9 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
Rare occurrences of Tertiary species are mixed with assemblages belonging to the *Abathomphalus mayaroensis* Zone, late upper Maestrichtian. Most specimens are chalky in appearance, contain holes or are broken. *Abathomphalus mayaroensis, A. intermedia, Globotruncanella havanensis, Globotruncana contusa, G. stuarti, G. conica, G. aegyptiaca, Racemiguembelina fructicosa, Pseudotextularia deformis, Pseudoguembelina excolata, Gublerina cuvillieri, Bolivinoides drace,* plus about 25 benthonic species and a few ostracod species.	Upper Maestrichtian *Tetralithus murus* Zone assemblages are present throughout the core. Species present include *Cretarhabdus crenulatus, Prediscosphaera cretacea lata,* and *Tetralithus murus.*	No Radiolaria.

Figure 48. *Summary of biostratigraphy in Hole 47.2 Core 12.*

NO PHOTOGRAPHS OF HOLE 47.2 CORE 2

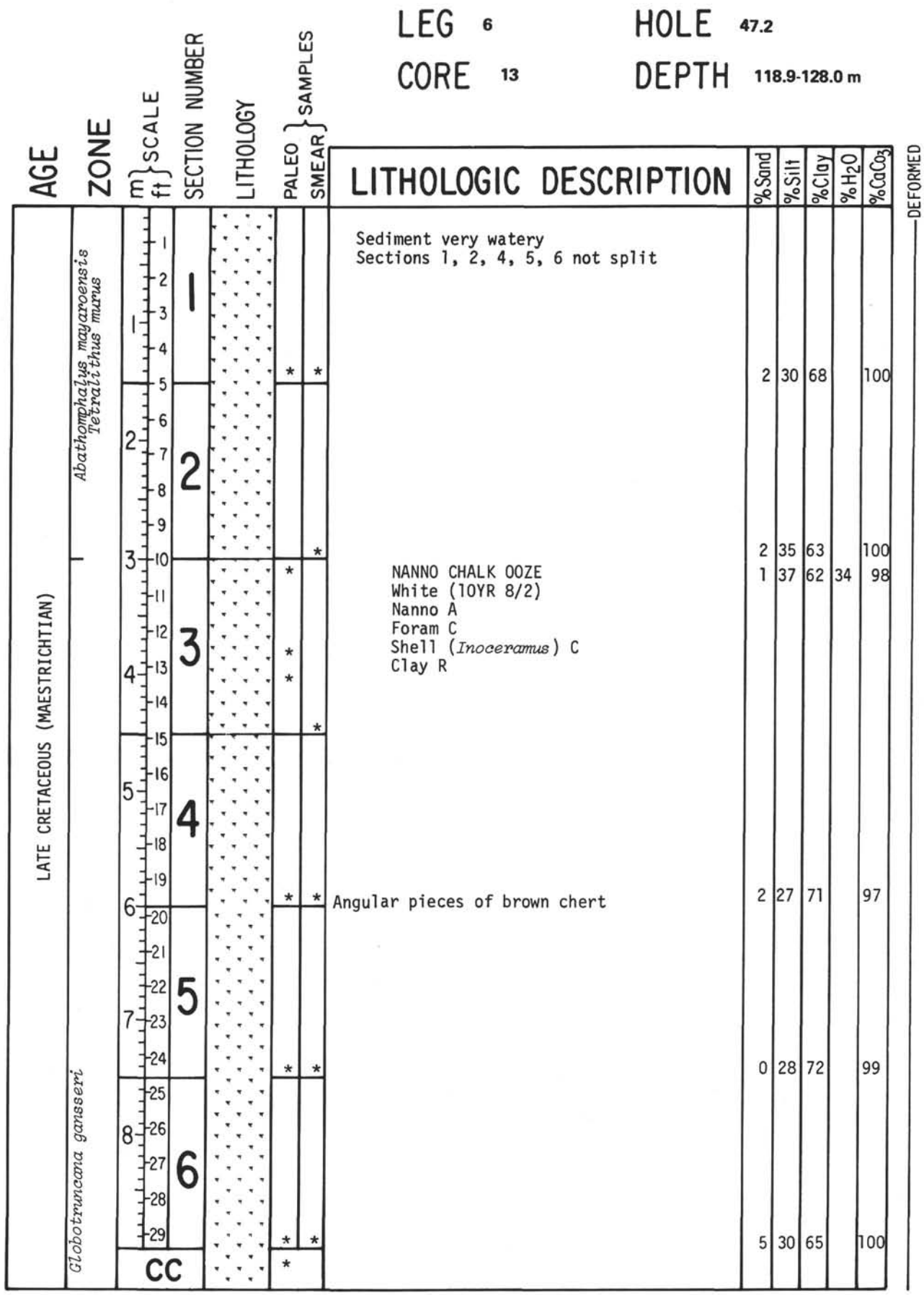


Figure 49. *Summary of lithology in Hole 47.2 Core 13.*

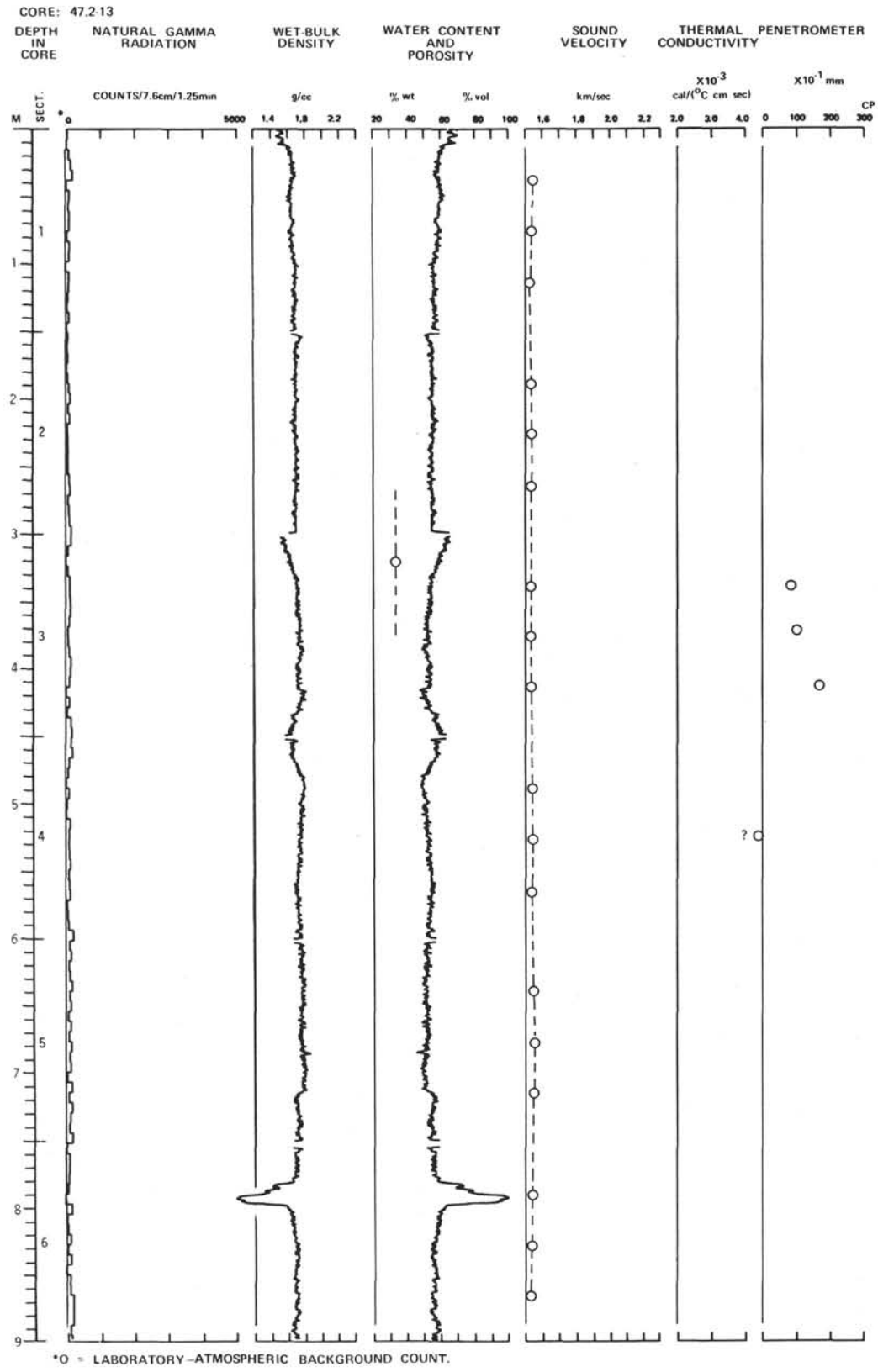


Figure 50. *Summary of physical properties in Hole 47.2 Core 13.*

LEG 6 HOLE 47.2

CORE 13 DEPTH 118.9-128.0 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
The boundary between the *Abathomphalus mayaroensis* Zone and the *Globotruncana gansseri* Zone occurs in the lower half of the core. The age of the assemblages are middle upper Maestrichtian. Benthonic species are very rare. TOP: *Abathomphalus mayaroensis, A. intermedia, Globotruncanella havenensis, G. contusa, G. stuarti, G. conica, Racemiguembelina fructicosa.* BOTTOM: *Abathomphalus intermedia, Globotruncana contusa, G. gansseri, G. aegyptiaca, G. stuartiformis, Trinitella scotti, Rugoglobigerina hexacumerata, Pseudotextularia intermedia.*	Upper Maestrichtian, lower *Tetralithus murus* Zone assemblages are present throughout the core. Species present include *Arkhangelskiella cymbiformis, Microrhabdulus decoratus,* and *Tetralithus* sp. cf. *T. murus.*	No Radiolaria.

Figure 51. *Summary of biostratigraphy in Hole 47.2 Core 13.*

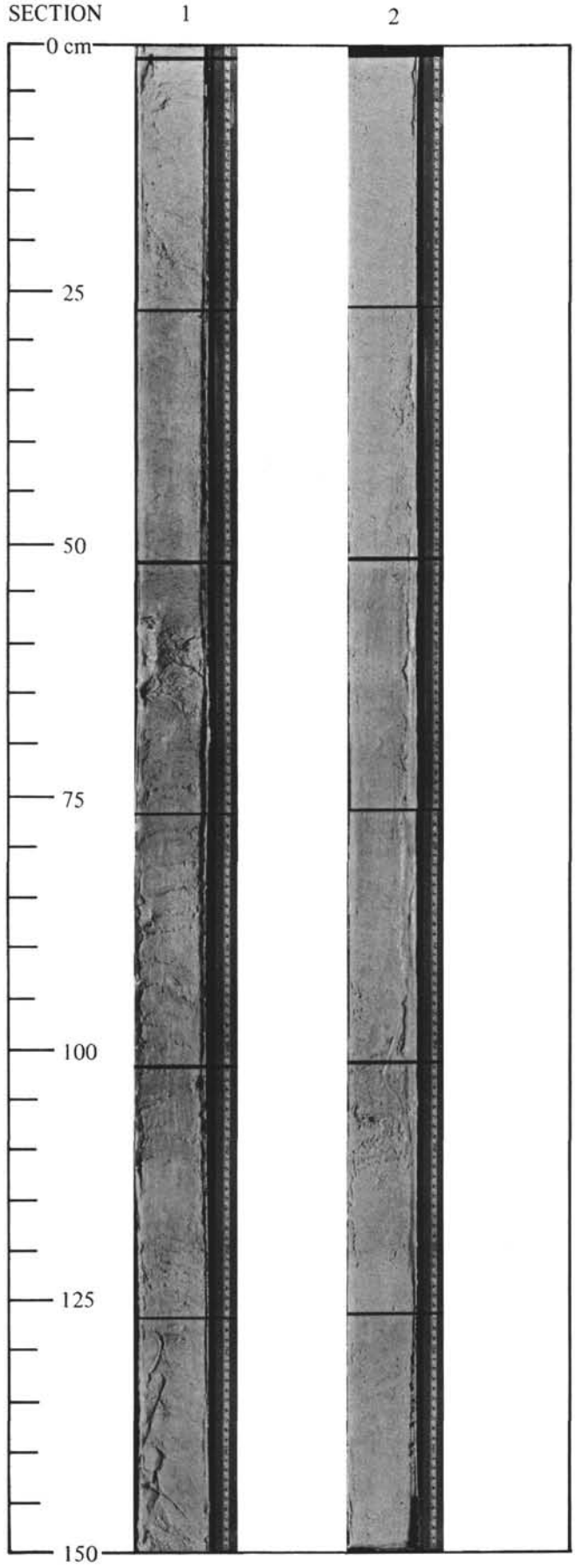


Plate 12. *Photographs Hole 47.2 Core 12 and 13.*

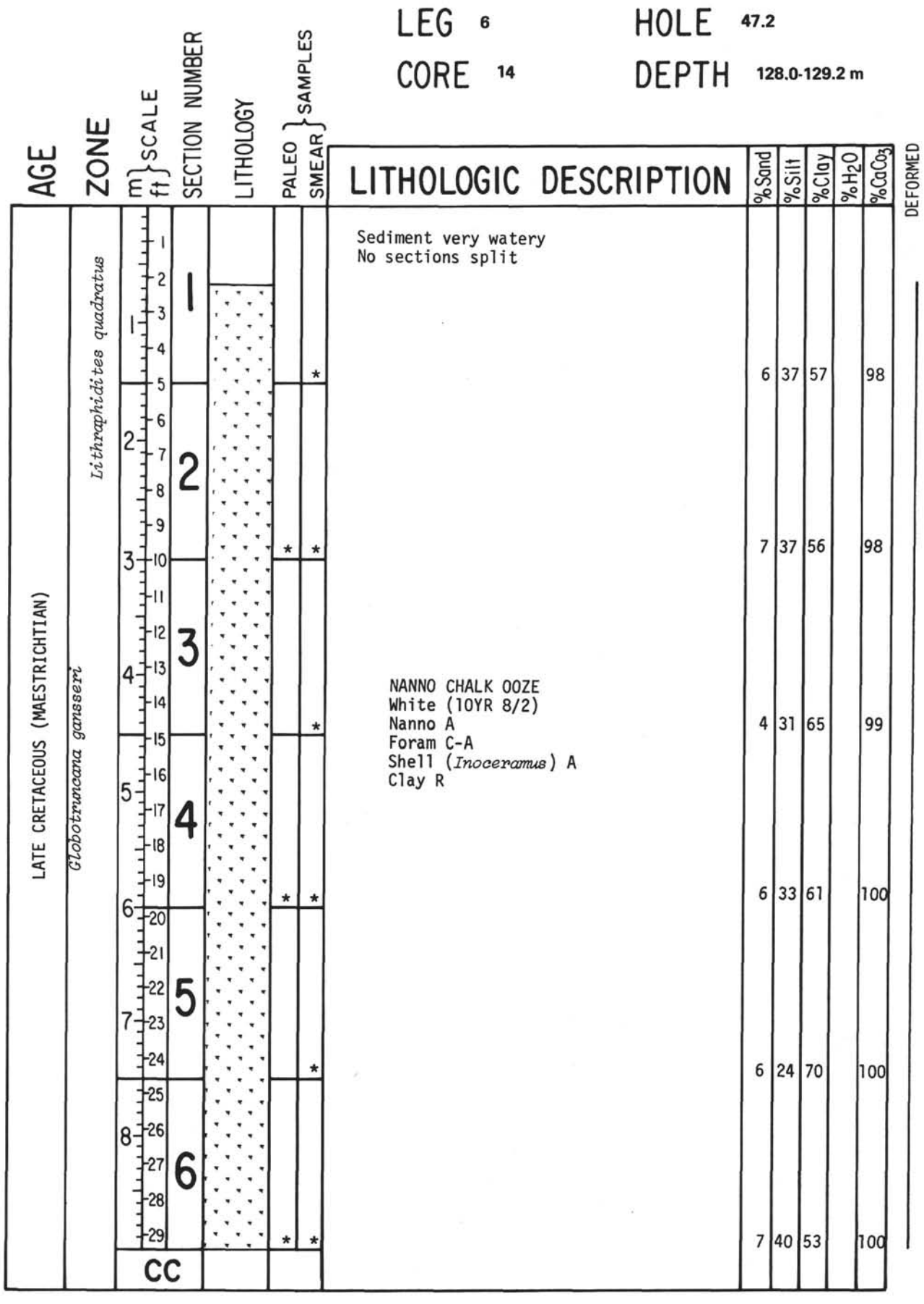


Figure 52. *Summary of lithology in Hole 47.2 Core 14.*

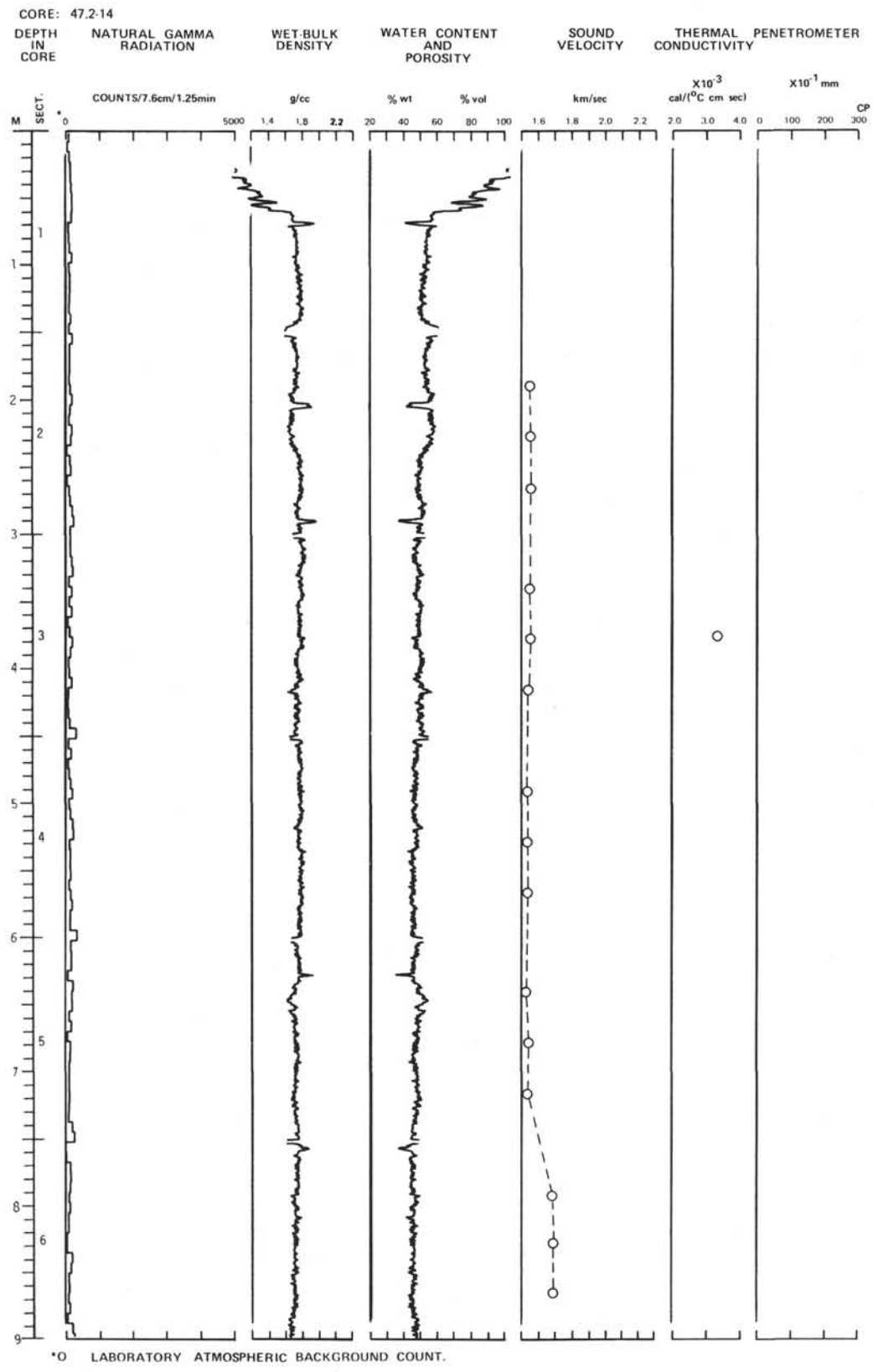


Figure 53. *Summary of physical properties in Hole 47.2 Core 14.*

LEG 6 HOLE 47.2

CORE 14 DEPTH 128.0-129.2 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
A full core was recovered although only 4 feet of hole was cored. The fauna contains assemblages from the *Globotruncana gansseri* Zone (lower upper Maestrichtian). *Globotruncana gansseri, G. fornicata, G. arca, G. stuartiformia, G.* cf. *contusa, G. rosetta, G. elevata, G. subcircumnodifer, Abathomphalus intermedia, Globotruncanella havanensis, Rugoglobigerina hexacamerata, Trinitella scotti.*	Middle Maestrichtian, *Lithraphidites quadratus* Zone assemblages are present throughout the core. Species present include *Arkhangelskiella cymbiformis, Cylindralithus gallicus,* and *Tetralithus pyramidus.*	No Radiolaria.

Figure 54. *Summary of biostratigraphy in Hole 47.2 Core 14.*

NO PHOTOGRAPHS OF HOLE 47.2 CORE 14