6. SITE 48

Shipboard Scientific Party[1]

SITE DATA

Occupied: June 30-July 1, 1969.

Position: Crest of Shatsky Plateau:
Latitude 32° 24.5′N.
Longitude 158° 01.3′E.

Water Depth: 2619 meters.

Hole 48.0: One core, total depth 84 meters in Maestrichtian cherty chalk.

Hole 48.1: One core, total depth 49 meters in Maestrichtian cherty chalk.

Hole 48.2: Three cores, total depth 72 meters in Maestrichtian cherty chalk.

MAIN RESULTS

The Upper Miocene here rests unconformably on Middle Maestrichtian.

This is the first record of Middle Maestrichtian in pelagic carbonate facies from the Northwest Pacific and surrounding lands, a matter of paleontologic-biostratigraphic importance.

BACKGROUND

Having been stopped by chert in the Maestrichtian at Site 47, a site was looked for which would give an adequate Cenozoic thickness for satisfactory spudding-in, yet promised to lead from this into an older part of the section. Such a site, with a much-thinned sedimentary sequence, appeared only some 18 miles to the east along the *Argo* line (Chapter 5, Figure 1) and along the *Glomar Challenger's* own track. The location of Site 48 is shown in Figure 1. Soundings in the area of Site 48 are shown in Figure 2.

The holes at Site 48 were drilled in the moat surrounding a knoll lying off to the side of the *Argo* and the *Glomar Challenger* tracks, but visible as a side echo in the latters' profiles (see Chapter 21). Moated knolls (Heezen and Johnson, 1963, 1969) have been recognized in various areas, and their origin has been attributed to the acceleration of bottom currents around the obstructing knoll. The profiler record shows a marked thinning of the Upper Cretaceous-Cenozoic sequence under this moat, suggesting that the knoll and moat have been in existence throughout this time. Above all, the upper part of the Upper Cretaceous—which had stopped us at Site 47—appeared to have been truncated here and drilling with the hope that the lower parts of the Upper Cretaceous might be less cherty and that they might, therefore, penetrate much more deeply into the sedimentary sequence, drilling commenced.

OPERATIONS

Site 48 was occupied at 2000 hours on June 30, 1969. Hole 48.0 was spudded at 0200 hours July 1, and was drilled to 84 meters, at which depth chert was encountered. A core was cut but not recovered.

A new hole (Hole 48.1) was spudded at 0530 hours, and met chert at 49 meters, where a core was cut in cherty Maestrichtian chalk, and progress was halted.

A third attempt (Hole 48.2) was spudded at 0730 hours. Three cores were cut to a total depth of 72 meters in cherty Maestrichtian chalk.

Stopped by chert, the site was abandoned at 1600 hours, July 14.

NATURE OF THE SEDIMENTS

Hole 48.0

A single core attempted in this hole recovered only a small amount of fluid outwash containing scattered nannofossils.

Hole 48.1

A single core from this hole recovered about 39 centimeters of white to pale brown nannoplankton chalk ooze in which nannofossils are abundant and clay minerals common. Also present are small amounts of planktonic foraminifera, radiolarian tests, sponge spicules, unidentified calcareous shell fragments, and clear shards of volcanic glass. A dark, friable manganese-iron oxide nodule occurs at the top of the core.

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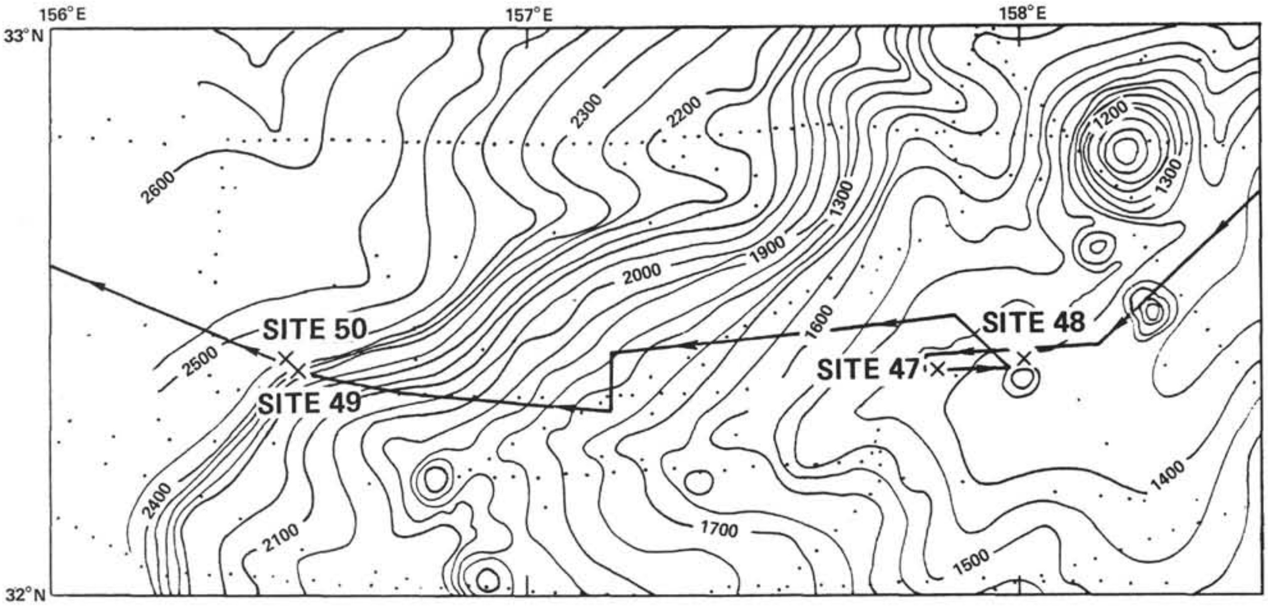

Figure 1. *Bathymetric contour map of Shatsky Rise showing Sites 47, 48, 49, and 50.*

TABLE 1
Summary of Coring at Site 48

	Interval Cored (Below Mudline)		Recovery	
Core No.	(ft)	(m)	(ft)	(m)
48.0-1	274	83.5	0	0.0
48.1-1	159-161	48.5-49.1	2	0.6
48.2-1	167-197	50.9-60.0	30	9.1
48.2-2	197-227	60.0-69.2	30	9.1
48.2-3	227-236	69.2-71.9	9	2.7

Water depth: 2619 meters (8593 feet).

Hole 48.2

The three cores recovered in this hole between 51 and 72 meters subbottom depth contain 23.80 meters of nannoplankton chalk ooze that was highly disturbed during coring.

The upper part of Core 1 (Sections 1 through the middle of Section 6) consists of highly mottled (due to drilling disturbance) white to pale brown to light yellowish-brown nannoplankton chalk ooze with abundant nannofossils and common to abundant clay minerals; among the nannofossils, large and well-preserved discoasters are particularly abundant. Radiolarian tests, well-preserved diatom frustules, sponge spicules, and planktonic foraminifera are common to rare in this part of the core. Fragments of fresh and altered volcanic glass fragments usually occur in small amounts but are locally abundant, as are silt-size grains of prismatic calcite, probably mollusk shell fragments. Large, twinned, euhedral phillipsite crystals are a rare component.

Below about the middle of Section 6, Core 1, the sediment changes to a white nannoplankton chalk ooze (Chapter 38) composed of abundant nannofossils, common planktonic foraminifera, and rare to abundant fragments of mollusk shells. All of Cores 2 and 3 are composed of this ooze which differs from that above in the following respects: (1) there are no siliceous microfossils, and little if any volcanic material; (2) discoasters, common in the sediment above, are very rare and the nannofossils are dominantly coccoliths. This change occurs at about the position of the unconformity between Upper Miocene and Upper Cretaceous sediments.

Large pieces of *Inoceramus* shells occur in Sections 4, 5, and 6 of Core 2, and angular fragments of vitreous brown chert are present near the middle of Section 4, Core 2.

PHYSICAL PROPERTIES

These physical properties do not precisely represent true conditions within the sea floor as the sediment samples were disturbed during coring operations.

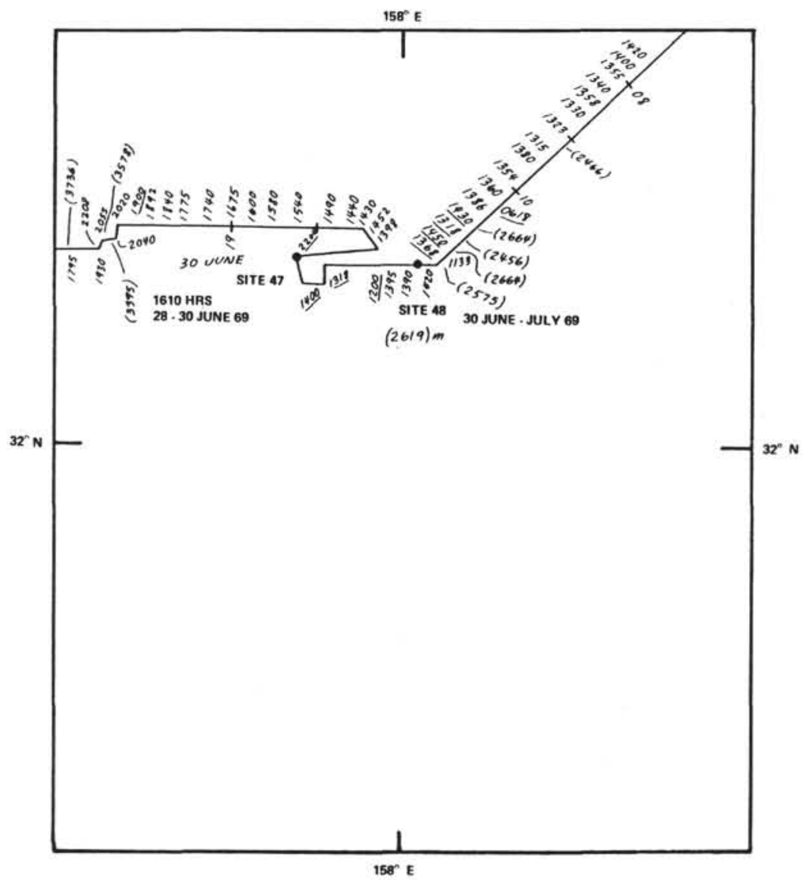

Figure 2. *Bottom soundings in area of Site 47 and 48.*

Natural Gamma Radiation

Upper Tertiary and Cretaceous white to pale brown nannoplankton chalk oozes were recovered from Hole 48.2 from a depth of 51 to 69 meters. Natural gamma emissions ranged from zero to 600 counts/7.6-cm core segment/1.25 minutes and averaged 200. The higher gamma counts (300) were from Pliocene-Miocene marly oozes with the lower counts (100) from the Cretaceous chalk oozes (see hole and core plots). This higher count is apparently related to the greater amount of clay minerals in the Tertiary sediment. Therefore, the unconformable contact between the Upper Tertiary and Cretaceous is marked by a fairly abrupt radiation change. Gamma radiation versus depth usually varies directly with the variations of porosity, and indirectly with wet-bulk density, sound velocity, thermal conductivity, and needle penetration.

Porosity, Wet-Bulk Density and Water Content

Porosities, wet-bulk densities, and water contents of the Teritary-Cretaceous pale brown to white nannoplankton ooze, retrieved from 51 to 69 meters at Hole 48.2, ranged from 50 to 90 per cent(?), 1.15(?) to 1.80 g/cc, and 31 to 48 per cent, respectively, with averages of 63 per cent, 1.40 g/cc, and 41 per cent. The greater porosities averaged 67 per cent (1.38 g/cc) and occurred in the Pliocene-Miocene marly oozes (see hole and core plots). The Cretaceous nannoplankton oozes had lower porosity averages of 61 per cent (1.45 g/cc). A low porosity spike of 35 per cent was recorded where *Inoceramus* fragments occurred.

In general, the Upper Tertiary-Cretaceous unconformity was marked by an apparent porosity decrease, which appears to be a function of particle size. The Cretaceous sediments are coarser with more foraminiferal and shell debris, while the Tertiary are composed of finer-grained clayey sediments, which typically have higher porosities as unconsolidated marine sediments. Porosity, in general, varied inversely with sound velocity, heat conductivity, and the penetrometer values, and of course directly to wet-bulk density.

Sound Velocity

Upper Tertiary and Cretaceous nannoplankton oozes were cored at 51 to 69 meters from Hole 48.2. Sound velocities through these sediments ranged from 1.48 to 1.65 km/sec and averaged 1.53 km/sec. Sediment sound velocities were less in the Tertiary marly oozes, with an average of 1.50 km/sec, and greater in the Cretaceous nannoplankton oozes with an average of 1.57 km/sec (see hole and core plots). This velocity change appears to be a combined function of porosity-density and grain size distribution.

Sound velocity appeared to vary inversely to the penetrometer and porosity values and directly with heat conductivity and wet-bulk density values. All of these properties abruptly changed at the Upper Tertiary-Cretaceous unconformity.

Heat Conductivity

Two heat conductivity values of 2.71 and 2.94×10^{-3} cal-$^{\circ}C^{-1}$ $cm^{-1} sec^{-1}$ were recorded in Upper Tertiary marly ooze and Cretaceous nannoplankton ooze, respectively. When these values are plotted versus depth they exhibit a similar direct variation to wet-bulk density, sound velocity and needle penetration, and a similar inverse variation to porosity and the gamma radiation.

Penetrometer

At Hole 48.2, penetration measurements in Upper Tertiary and Cretaceous nannoplankton chalk oozes from 51 to 7 meters in Hole 48.2 ranged from -4×10^{-1} millimeters to complete penetration to the core liner. Penetrability, in general, was less in the Tertiary marly nannoplankton oozes (see hole and core plots). This may be the result of greater plasticity of the clayey fraction in these marly chalk oozes compared to the finer Cretaceous chalk oozes. The two penetrometer values plotted versus depth of recovery in the hole exhibit an indirect similarity to porosity and gamma radiation, and a direct similarity to wet-bulk density, sound velocity, and heat conductivity.

CONCLUSIONS

At Site 48, the Upper Miocene rests directly on Middle Maestrichtian; the unconformity noted at the base of the Upper Miocene at Site 47 thus cuts deeper into the section at Site 48, having truncated the Eocene, Paleocene and Upper Maestrichtian.

The variable depth at which cherts were encountered at Site 48 confirms the conclusion reached at Site 47, that the cherts in these chalk oozes do not form beds of continuous thickness, but lense in and out over short lateral distances. Specimens recovered in the cores show a highly angular surface, and a differentiation into a vitreous core and a chalky rind. These cherts are thus much like the flints in the chalk of Europe.

The excellent faunas and floras of the Middle Maestrichtian, slightly older than those penetrated at Site 47, add significant paleontologic information. Traces of *Inoceramus* are abundant.

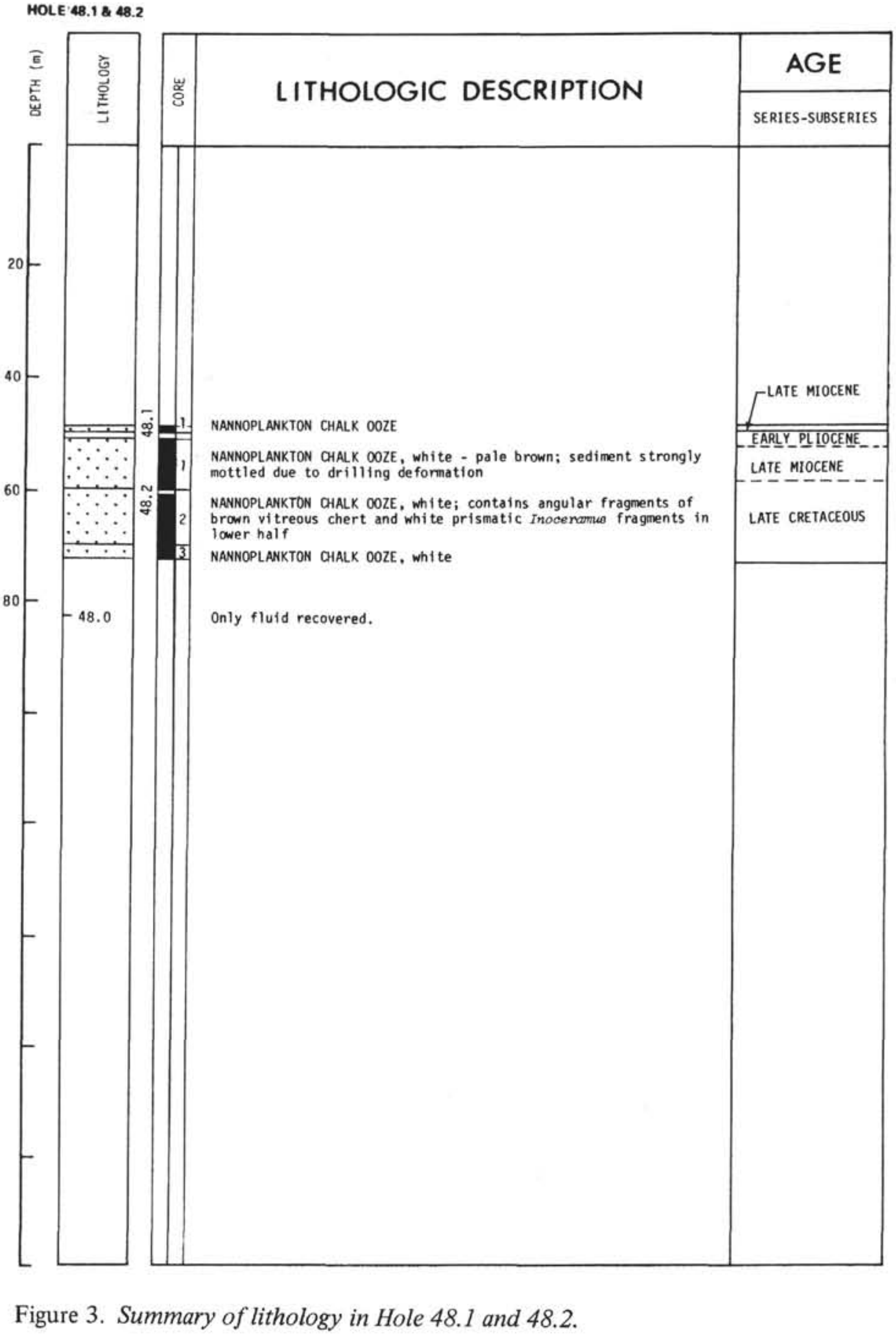

Figure 3. *Summary of lithology in Hole 48.1 and 48.2.*

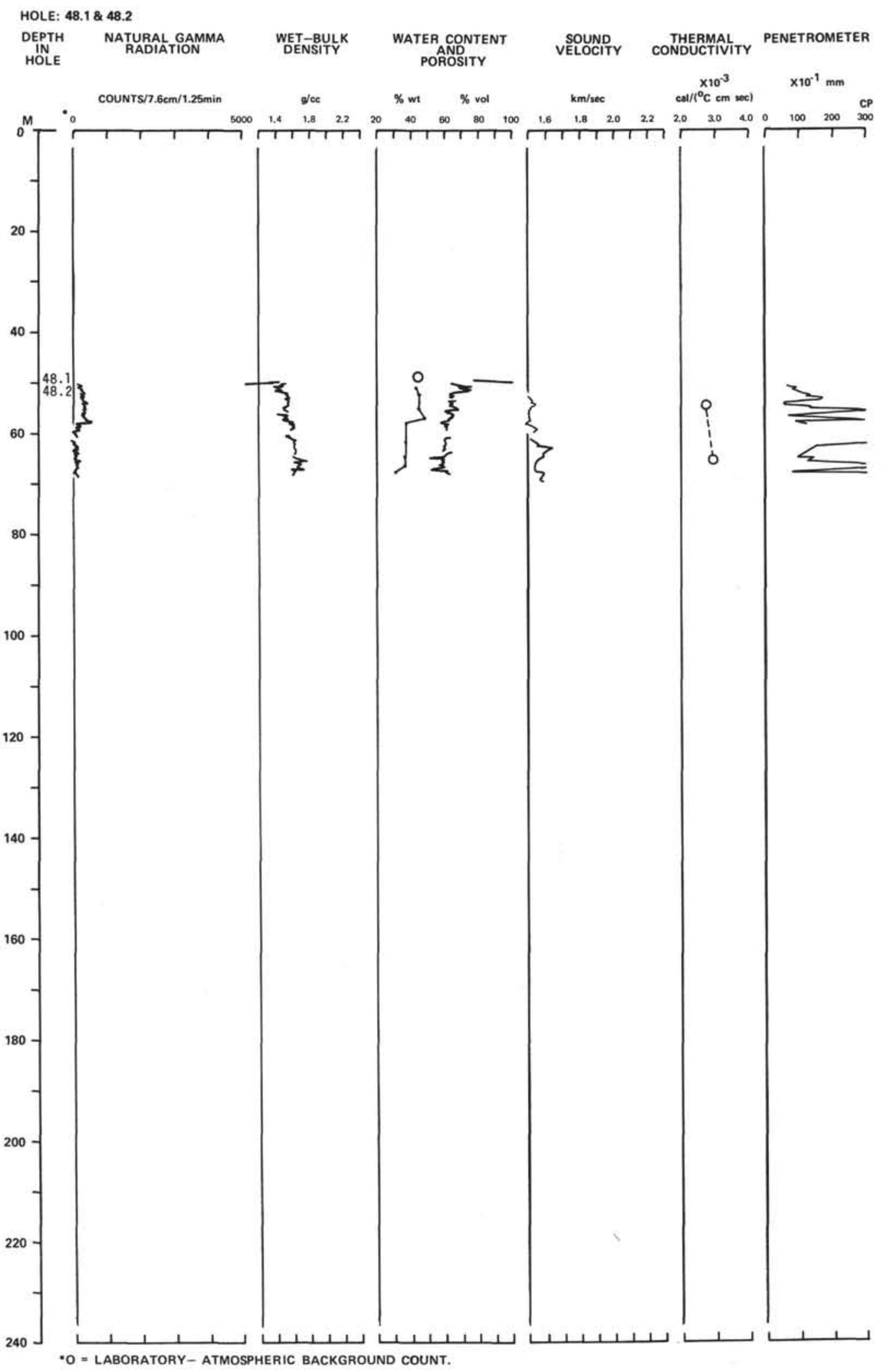

Figure 4. *Summary of physical properties in Hole 48.1 and 48.2.*

LEG 6 HOLE 48.0

CORE 1 DEPTH 83.5

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
None.	Only a fluid outwash containing nannoplankton was recovered from the core. An assemblage of mixed upper Tertiary and Maestrichtian species is present. The upper Tertiary group includes *Cyclococcolithina leptoporus*, *Discoaster brouweri*, and *Helicopontosphaera kamptneri*. The Maestrichtian species include *Apertapetra gronosa*, *Cylindralithus gallicus*, *Prediscosphaera cretacea*, and *Tetralithus murus*.	None.

Figure 5. *Summary of biostratigraphy in Hole 48.0 Core 1.*

NO PHOTOGRAPHS OF HOLE 48.0 CORE 1

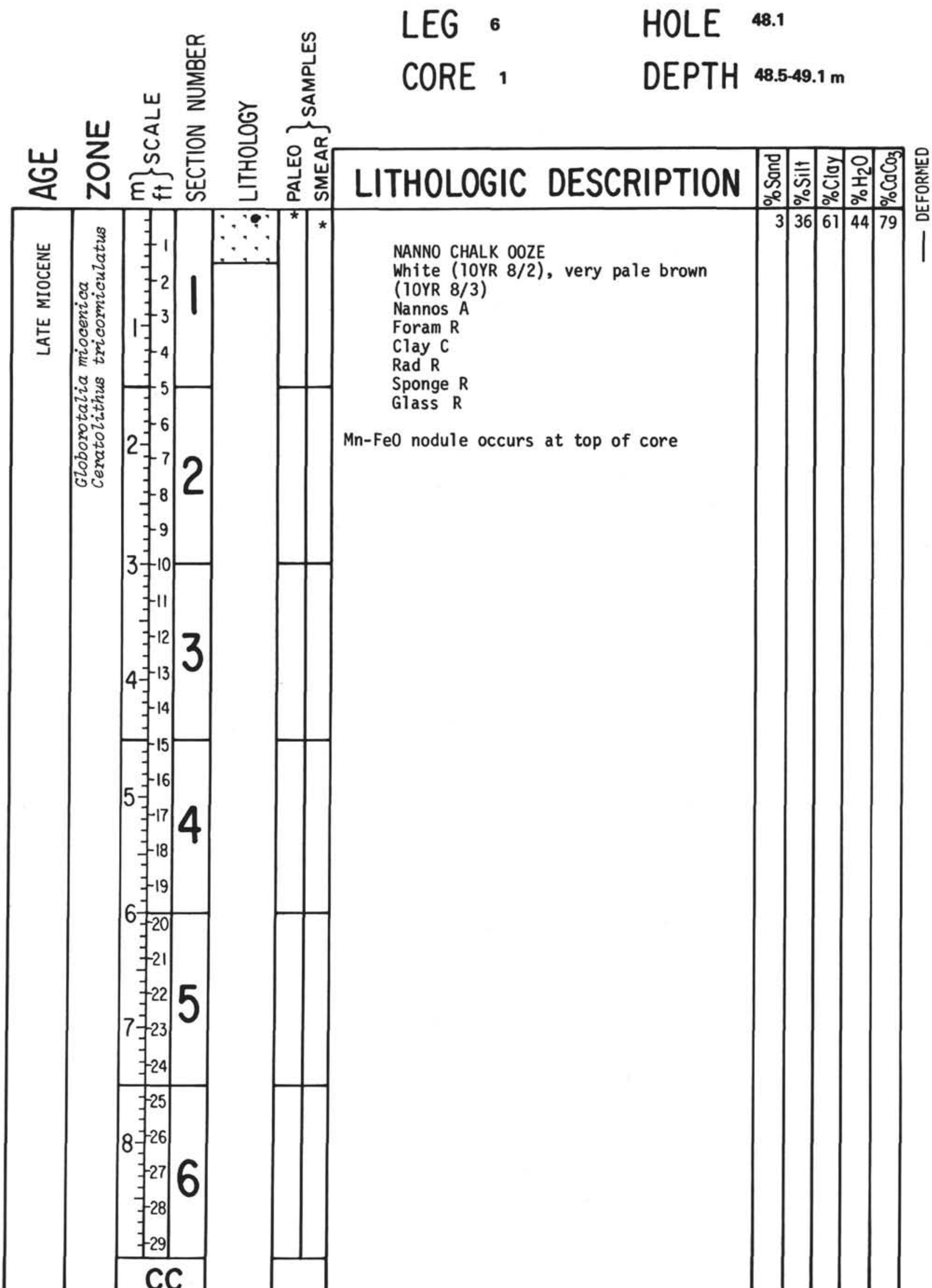

Figure 6. *Summary of lithology in Hole 48.1 Core 1.*

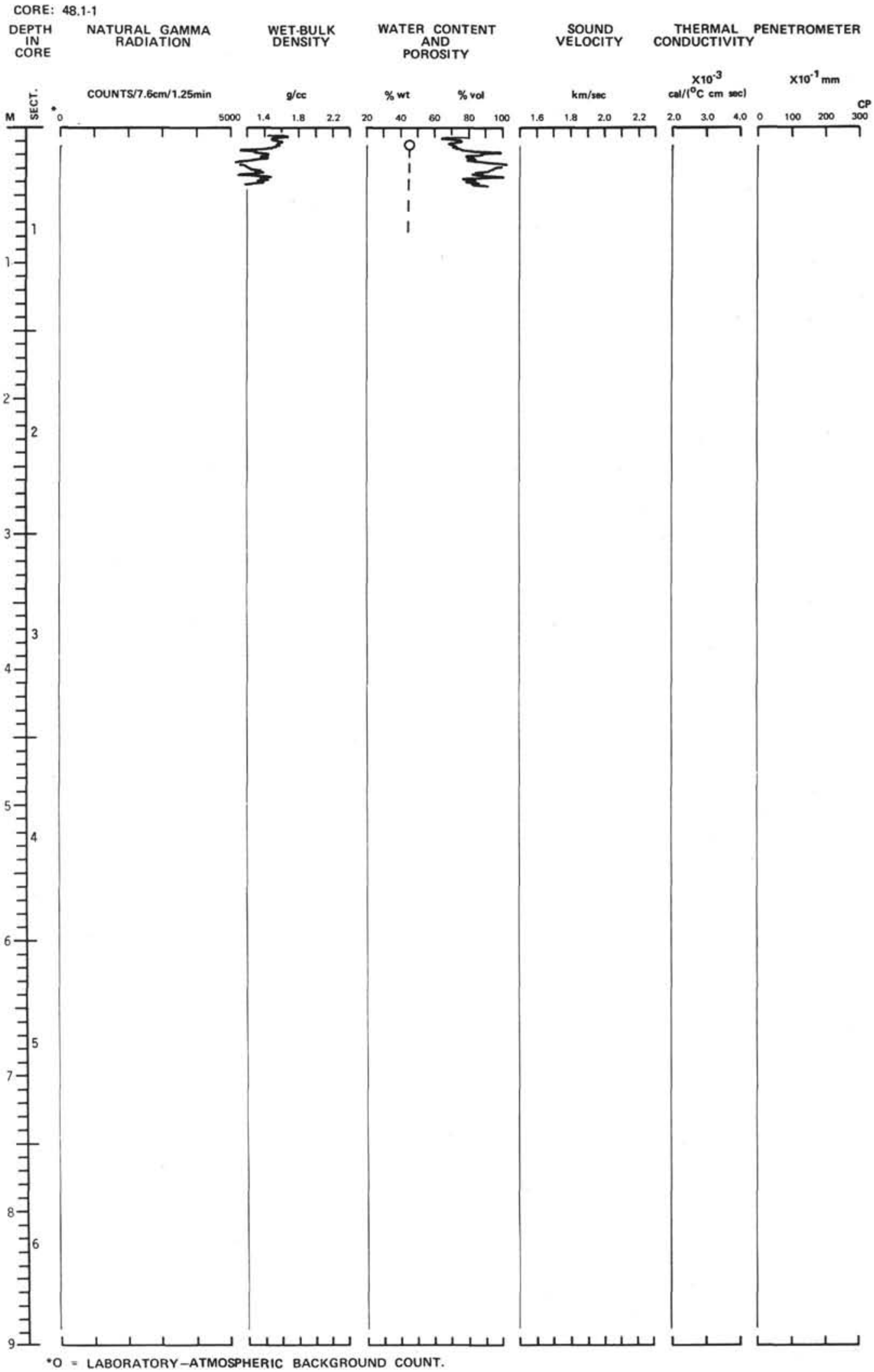

Figure 7. *Summary of physical properties in Hole 48.1 Core 1.*

LEG 6 HOLE 48.1

CORE 1 DEPTH 48.5-49.1 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
This core contains planktonic Foraminifera of the *Globorotalia miocaenica* Zone (Upper Miocene, Messinian stage) - *Globorotalia margaritae, G. tumida plesiotumida, G. tumida gumida, G. acostaensis, Globigerina nepenthes, G. bulloides, G. apertura, Sphaeroidinellopsis subdehiscens paenedehiscens, Globigerinoides obliquus extremus.* Apparently it is the top of Upper Miocene because rare specimens of *Globorotalia crassaformia* and *G. inflata* were found.	A small amount of ooze from the upper upper Miocene *Ceratolithus tricorniculatus* Zone is present in this core. Species present include *Ceratolithus tricorniculatus, Cyclococcolithina leptoporus, Discoaster challengeri, D. quintatus, D. surculus, Reticulofenestra pseudoumbilica,* and *Triquetrorhabdulus rugosus.*	This core contains species representing the combined ranges of the *Spongaster pentas* (lower Pliocene) and *Stichocorys peregrina* (upper Miocene) Zones. Radiolaria are rare. TOP: not examined. BOTTOM: *Stichocorys peregrina* and *Druppatractus acquilonius.*

Figure 8. *Summary of biostratigraphy in Hole 48.1 Core 1.*

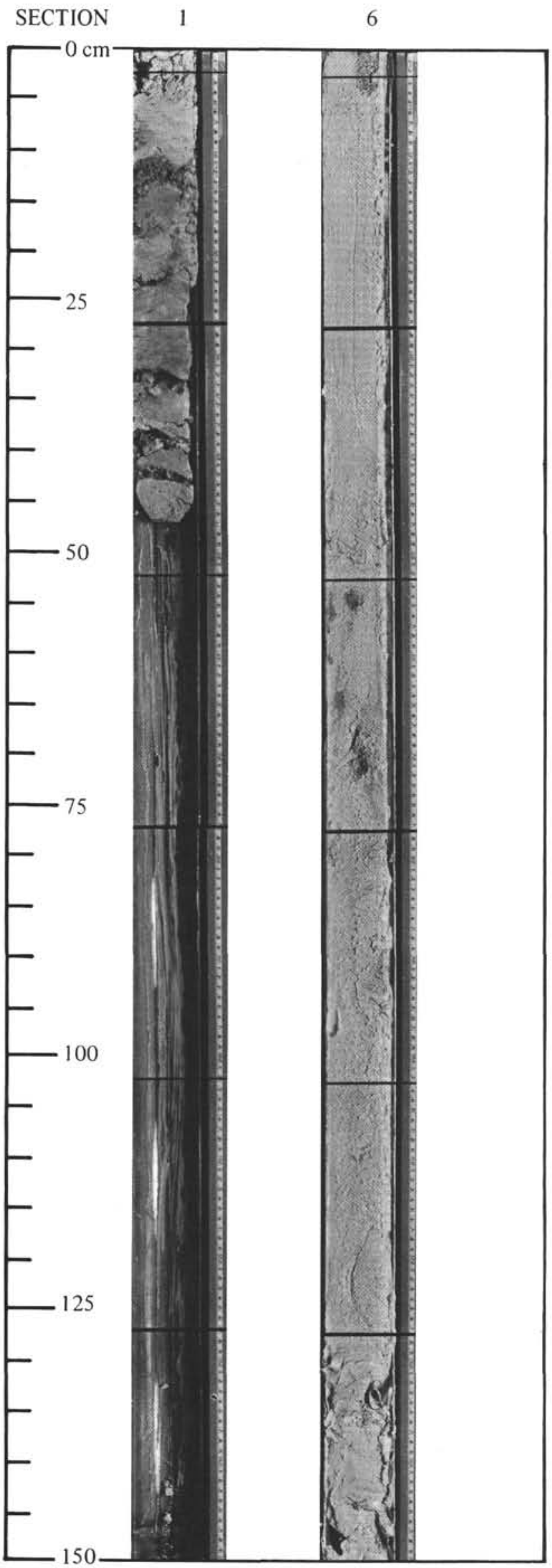

Plate 1. *Photographs of Hole 48.1 Core 1.*

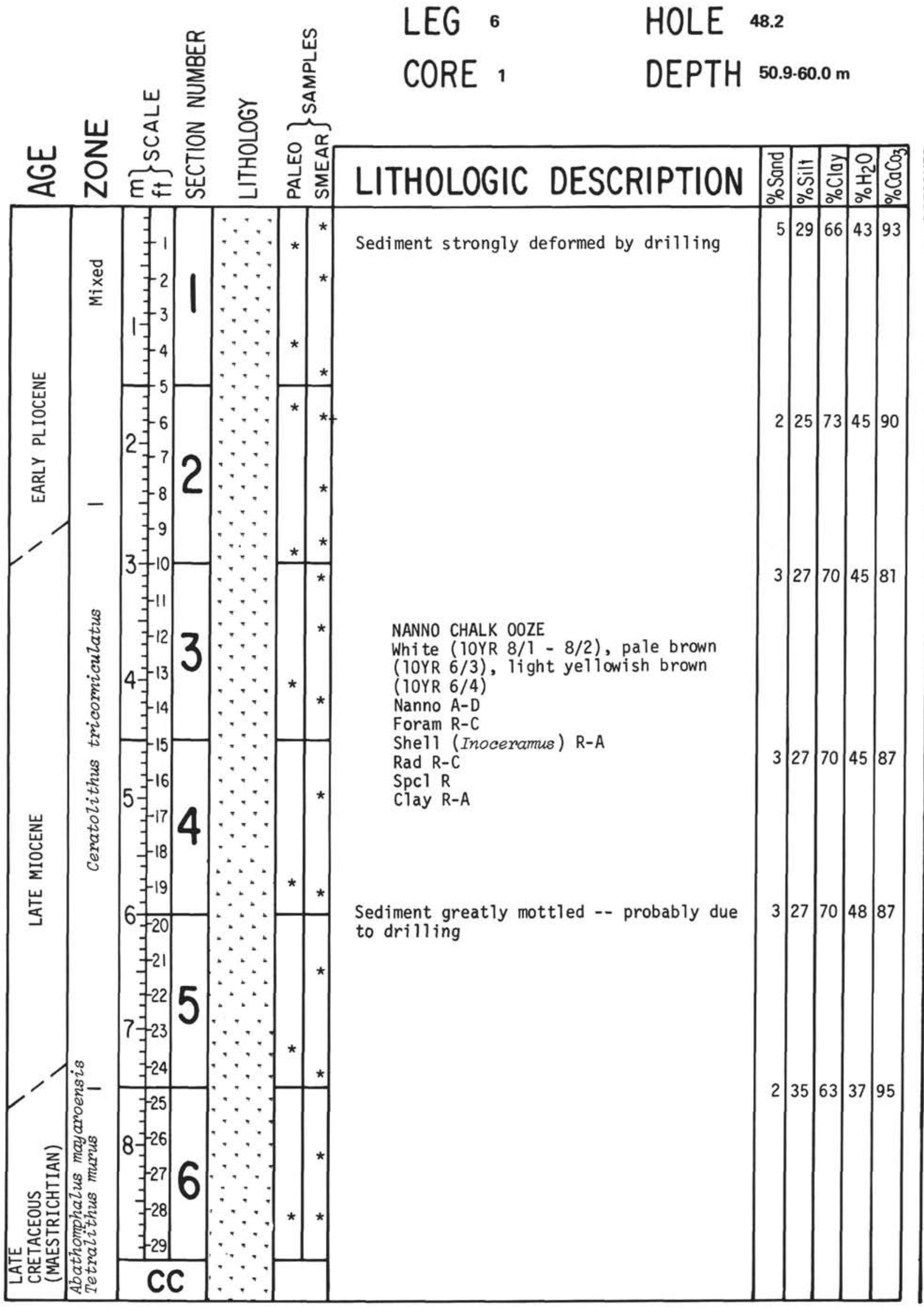

Figure 9. *Summary of lithology in Hole 48.2 Core 1.*

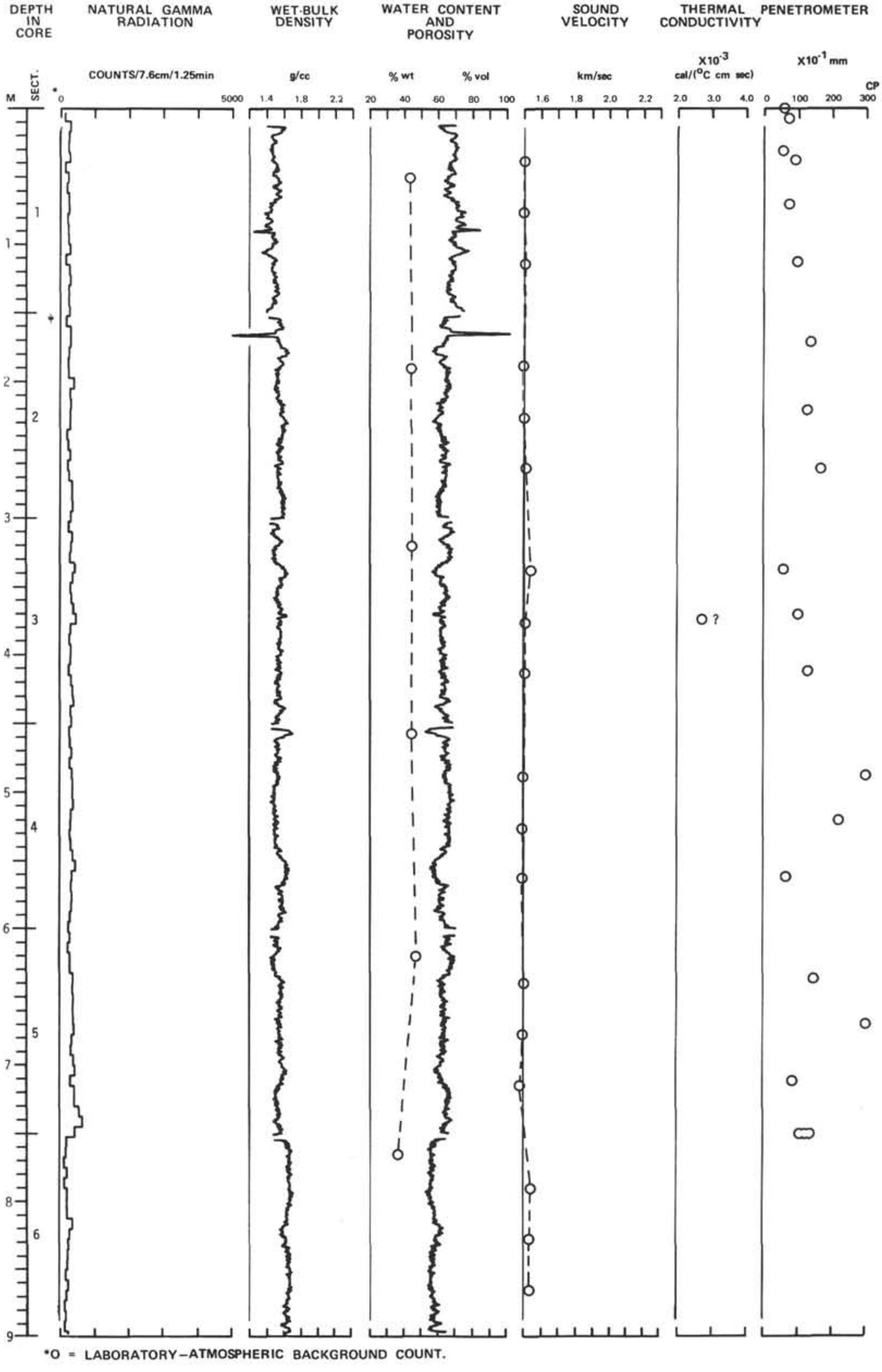

Figure 10. *Summary of physical properties in Hole 48.2 Core 1.*

LEG 6 HOLE 48.2

CORE 1 DEPTH 50.9-60.0 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
The assemblage recovered in the section 6 is characteristic of the lower part of the *Abathomphalus mayaroensis* Zone. Among species present are *Globotruncana stuarti, G. aegyptiaca, G. contusa, G. stuartiformis, Abathomphalus intermedia, Trinitella scotti, Racemigumbelina fructicosa, Pseudotextularia intermedia.* Planktonic Foraminifera of sections 5-2 (107-109) belong to the Upper Miocene (Messinian) - *Globorotalia miozae saphoae, G. margaritae, G. miocaenica, G. multicamerata, G. tumida plesiotumida, G. tumida tumida, Globigerinoides obliquus extremus, Globigerina nepenthes, Sphaeroidinellopsis subdehiscens.* Samples from sections 2(5-7)-1 contain Pliocene microfauna: *Globorotalia crassaformis, G. hirsuta, Sphaeroidinella dehiscens, Globigerinoides conglobatus.*	None.	None.

Figure 11. *Summary of biostratigraphy in Hole 48.2 Core 1.*

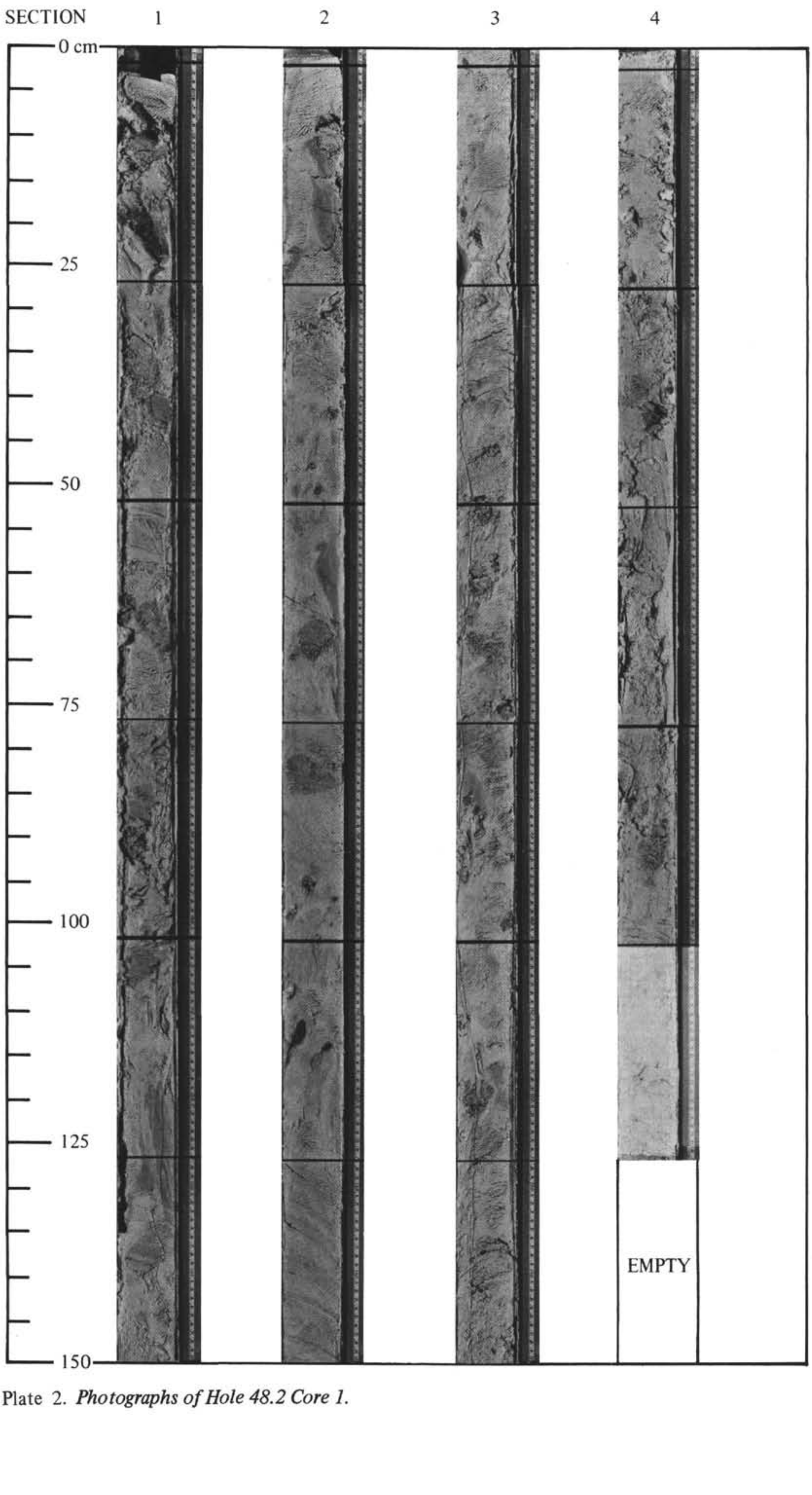

Plate 2. *Photographs of Hole 48.2 Core 1.*

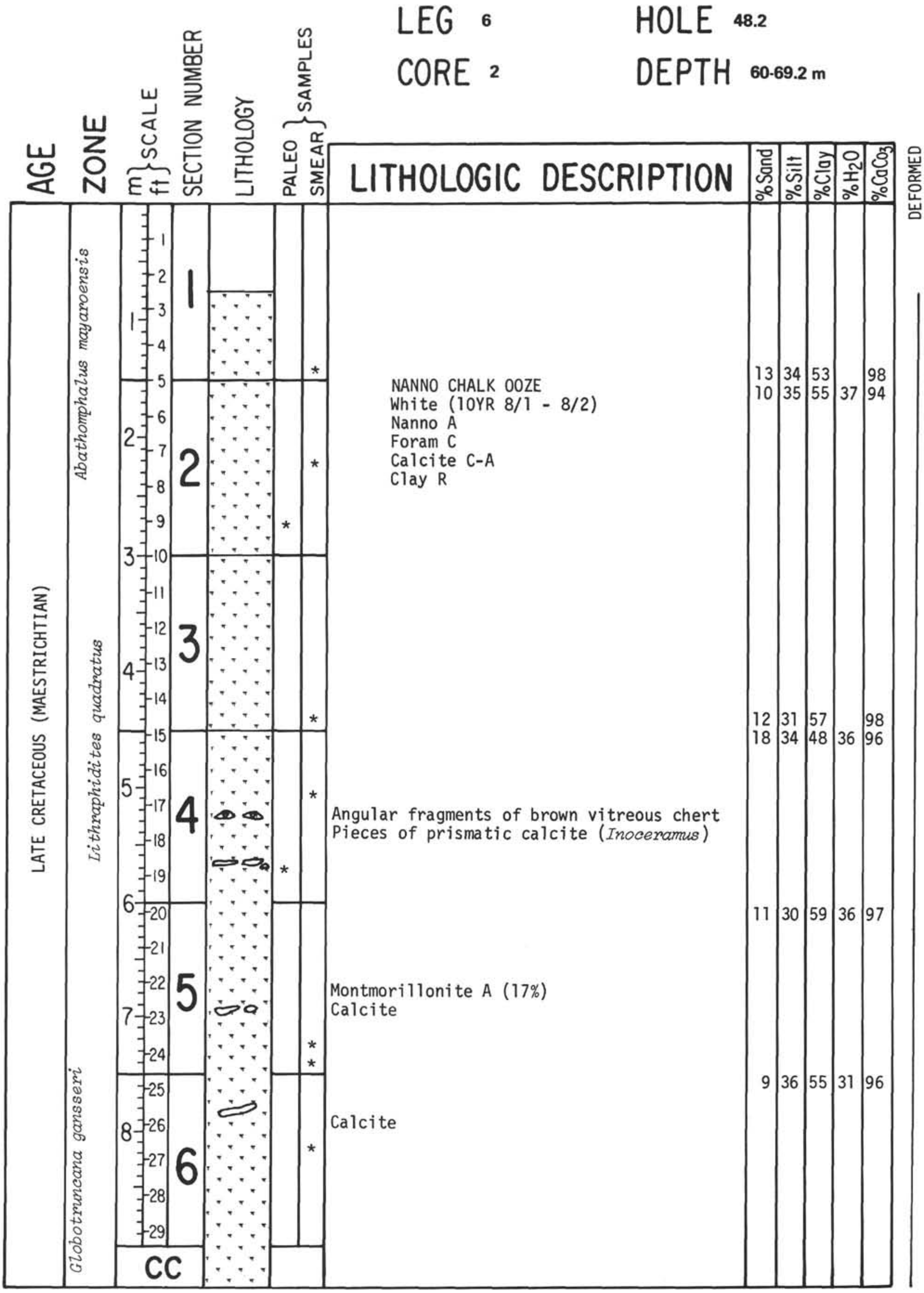

Figure 12. *Summary of lithology in Hole 48.2 Core 2.*

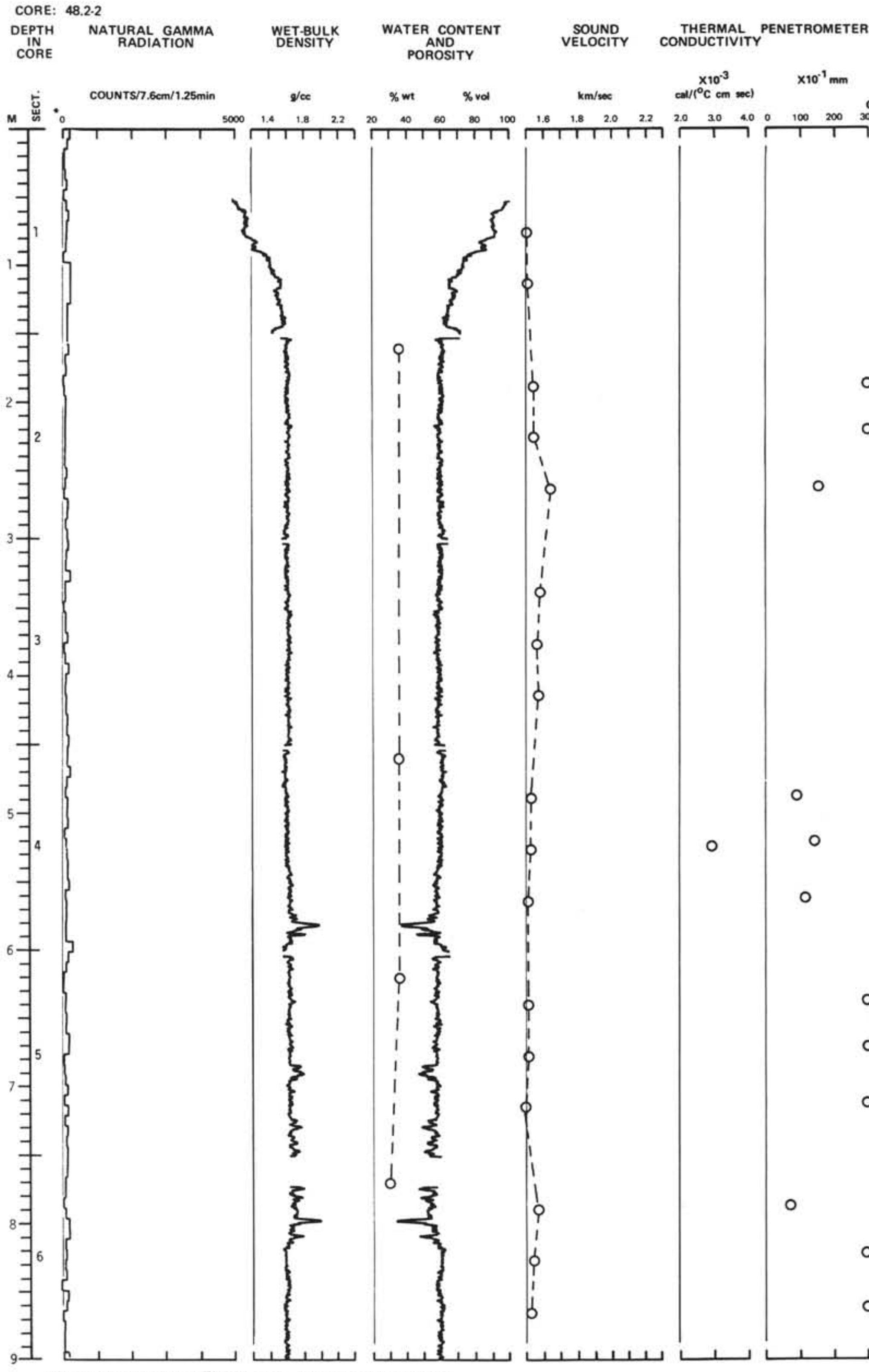

Figure 13. *Summary of physical properties in Hole 48.2 Core 2.*

LEG 6 HOLE 48.2
CORE 2 DEPTH 60.0-69.2 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
Globotruncana gansseri Zone, lower upper Maestrichtian. Preservation fair to good. *Globotruncana gansseri, G.* cf. *contusa, G. stuartiformis, G. fornicata, Globotruncanella havanensis, Abathomphalus intermedia, Trinitella scotti, Rugoglobigerina hexacamerata, Pseudotextularia intermedia.*	Lower or middle Maestrichtian assemblages of the *Lithraphidites quadratus* Zone are present throughout this core. Species present include *Apertapetra gronosa, Arkhangelskiella cymbiformis, Cretarhabdus? anthophorus, C. conicus, C. crenulatus, Cylindralithus gallicus, Eiffellithus turriseiffeli, Microrhabdulus decoratus, Micula decussata, Parhabdolithus angustus, Prediscosphaera cretacea lata,* and *Watznaueria barnesae.*	None.

Figure 14. *Summary of biostratigraphy in Hole 48.2 Core 2.*

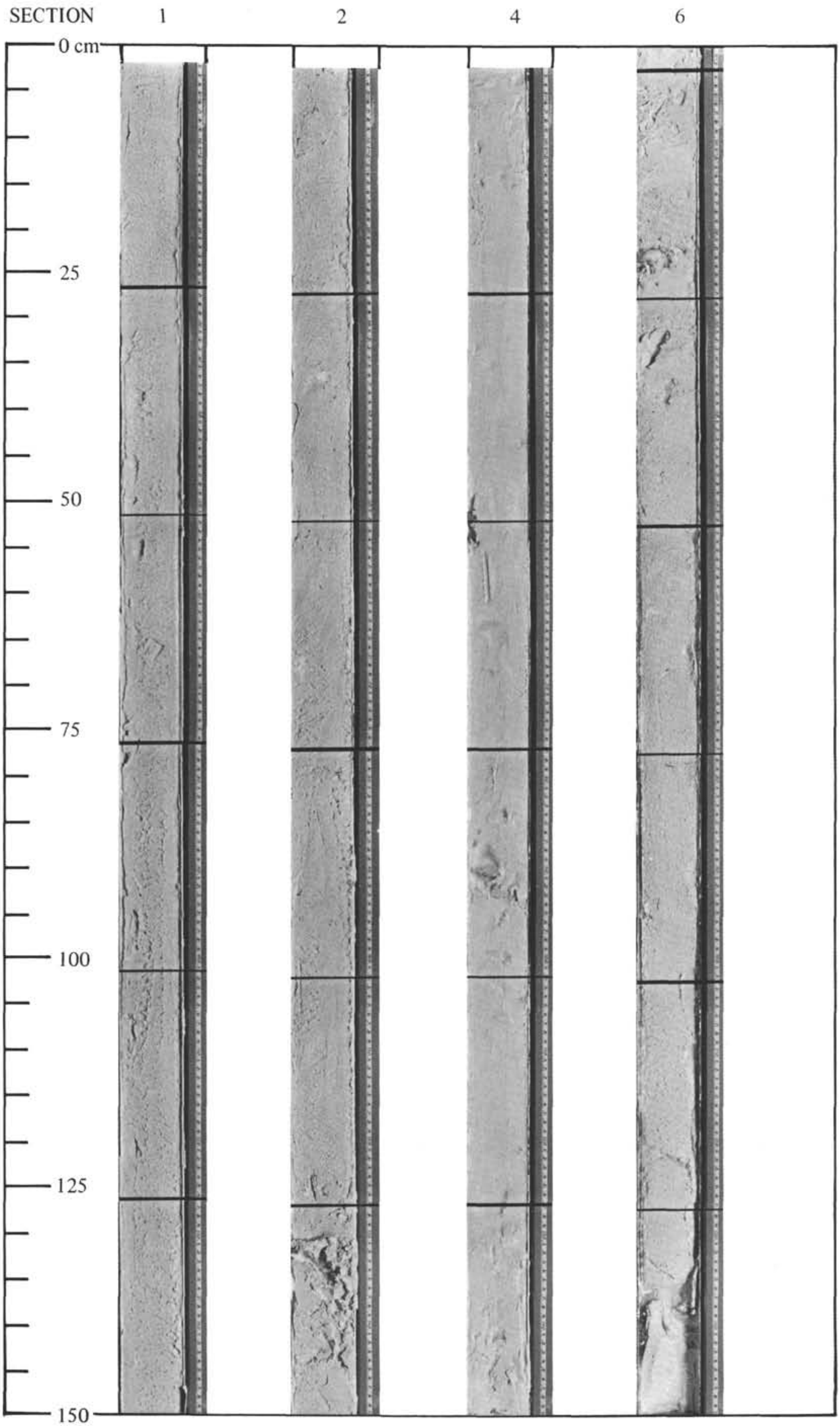

Plate 3. *Photographs of Hole 48.2 Core 2.*

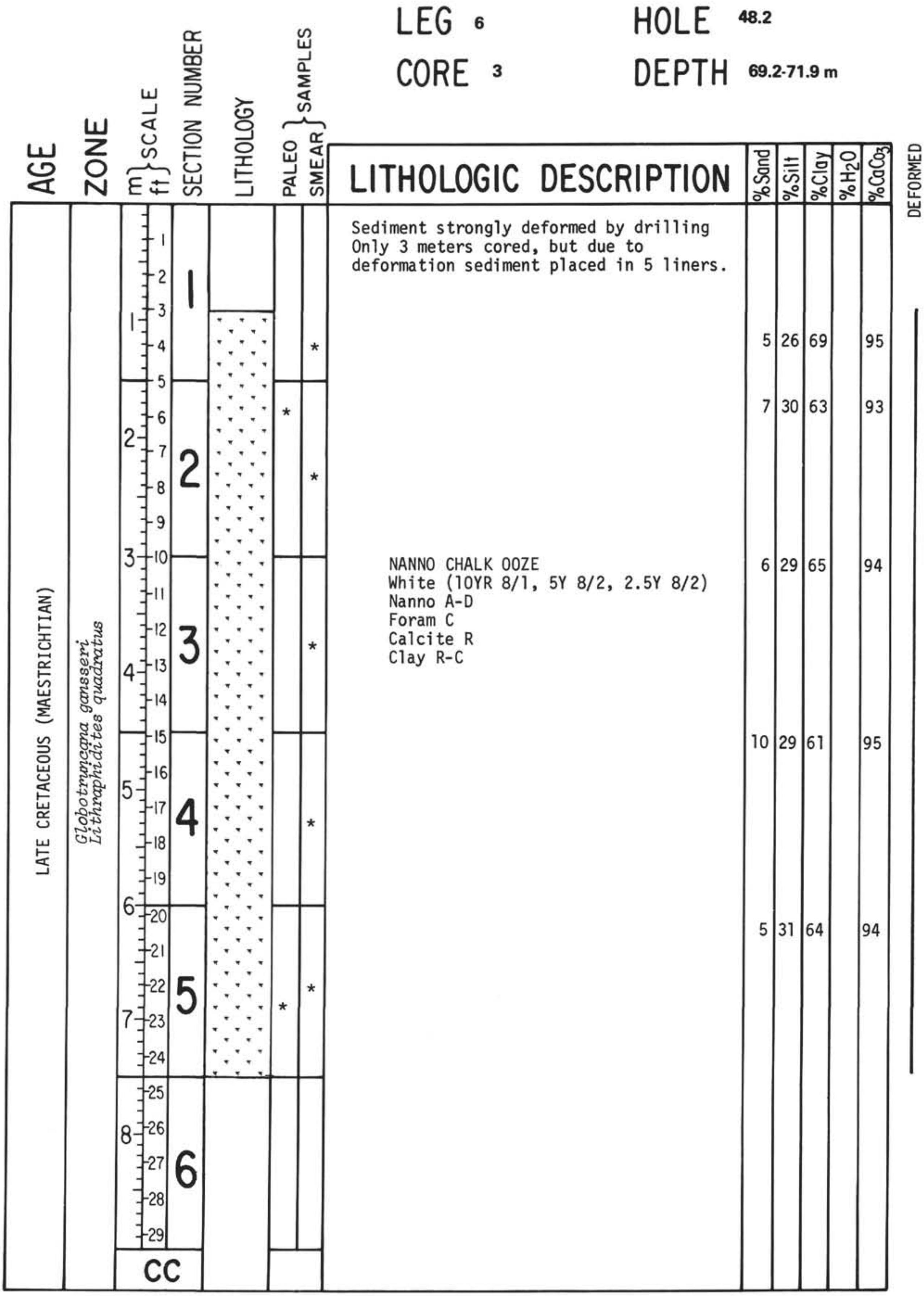

Figure 15. *Summary of lithology in Hole 48.2 Core 3.*

NO PHYSICAL PROPERTIES DATA FOR HOLE 48.2 CORE 3

LEG 6 HOLE 48.2

CORE 3 DEPTH 69.2-71.9 m

FORAMINIFERA	NANNOPLANKTON	RADIOLARIA
Globotruncana gansseri Zone, lower upper Maestrichtian. Preservation good to excellent. *Abathomphalus intermedia, Globotruncana gansseri, G. aegyptiaca, G. elevata, G. stuartiformis, G. fornicata, G. linneiana, G. rosetta, G. subcircummodifier Rugoglobigerina rugosa, R. hexacamerata, Schackoina multispinata, Pseudotextularia elegans.*	Lower or middle Maestrichtian assemblages of the *Lithraphidites quadratus* Zone are present throughout this core. Species present include *Apertapetra gronosa, Arkhangeleskiella cymbiformis, Cretarhabdus? anthophorus, C. conicus, C. crenulatus, Cylindralithus gallicus. Eiffellithus turriseiffeli, Microrhabdulus decoratus, Micula decussata, Parhabdolithus angustus, Prediscosphaera cretacea lata,* and *Watznaueria barnesae.*	None.

Figure 16. *Summary of biostratigraphy in Hole 48.2 Core 3.*

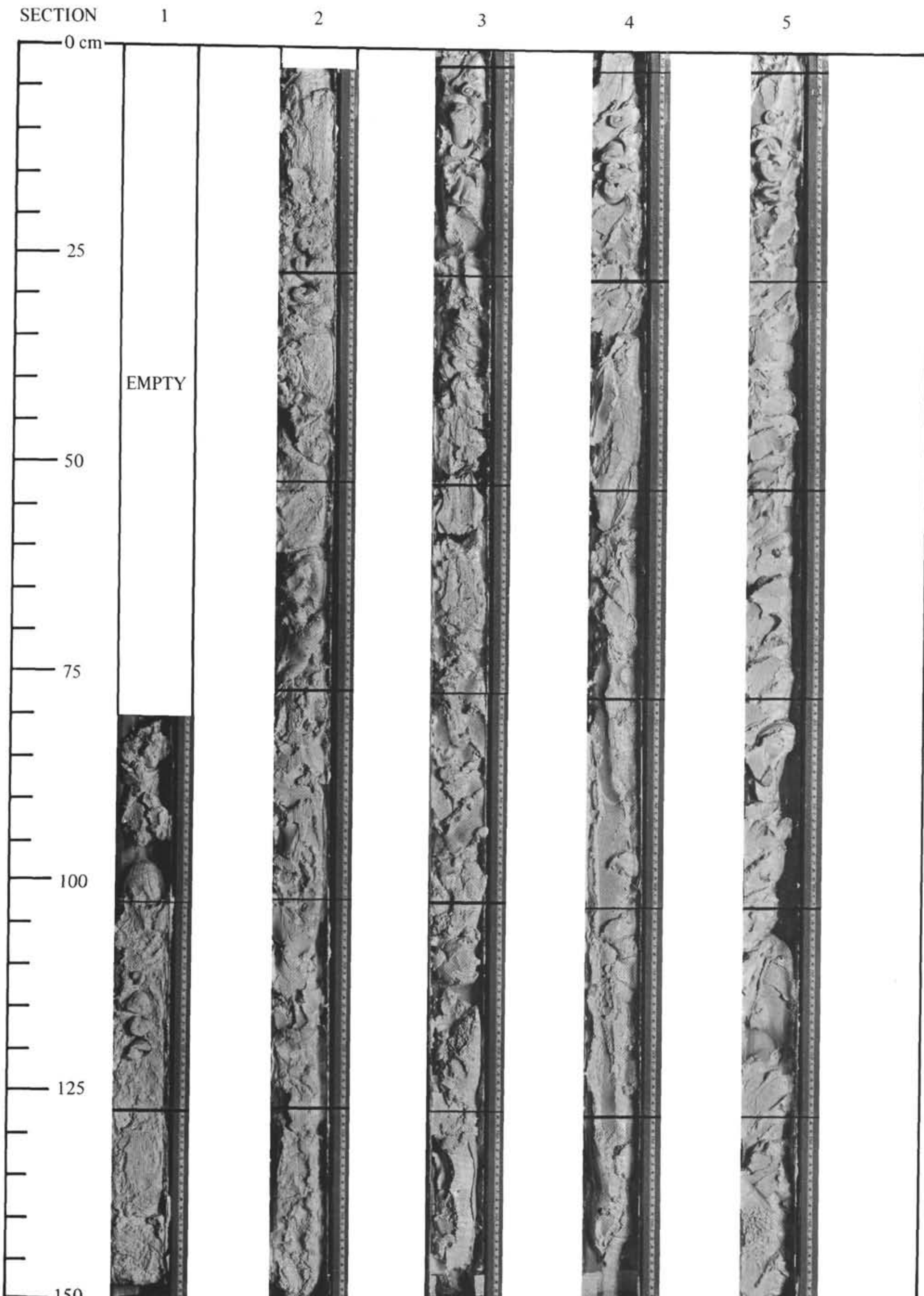

Plate 4. *Photographs of Hole 48.2 Core 3.*