8. CLEFT IN MEDITERRANEAN RIDGE, IONIAN SEA – SITE 126

The Shipboard Scientific Party[1]

SITE DATA

Occupied: September 4-5, 1970

Position: Near the axis of a deep cleft in the Mediterrean Ridge, Ionian Basin.
Latitude: 35° 09.72′N
Longitude: 21° 25.63′E

Holes Drilled: Two holes (126 and 126A).

Water Depth: 3730 and 3733 meters respectively.

Cores Taken: Six and one respectively.

Total Penetration: 129.4 and 66 meters respectively.

Deepest Unit Recovered: Laminated pyritic shale of Middle Miocene age.

MAIN RESULTS

After penetrating a hundred-meter-thick sequence of partly resedimented Quaternary basin fill, the drill string entered massive grayish green shale of Middle Miocene (Serravallian) age. The planktonic fauna indicates an open marine basin of more or less normal salinity prior to the Upper Miocene period of evaporite formation. However, the absence of any kind of benthic life, an abundance of iron sulfide, and occasional fine laminations in this unit indicate anoxic conditions near the sediment-water interface at the time of deposition. Two holes were drilled, and both were terminated in the shale unit when penetration rates in the hard waxy formation dropped to less than one meter per hour.

BACKGROUND

The identification on board of a "sabkha-like" (supratidal) facies for certain levels of the evaporites was not only unexpected, but led us to ask many questions. One particularly important query dealt with a plausible mechanism for sedimentation on a sunlit sea floor across vast areas of the Mediterranean that are now submerged beneath several thousand meters of water. Two basic hypotheses were entertained, based on the assumption that the "sabkha-like" facies had been properly diagnosed. The first proposed the existence of an ancient shallow floor of lagoons and tidal flats with restricted communication to and from the Atlantic Ocean (shallow water–shallow basin) which, subsequent to the salinity crisis in the Mediterranean, had foundered to its present depth. The alternate supposition was that pre-existing deep basins had desiccated following closure of a passageway to the open ocean (shallow water–deep basin).[2]

It was reasoned that if the first idea were correct we should expect to encounter terrestrial sediments and possibly even continental bedrock beneath the evaporites. However, if we were to discover deep sea deposits not appreciably older than the late Miocene evaporites, this would mitigate against crustal subsidence[3] as an exclusive mechanism, and would make the dessication model at least worth very careful attention. The ideal place to make such a test seemed to be the center of one of the basins (Figure 1).

With the direct approach of cutting through the M-Reflectors having failed at three sites (122, 124 and 125) because of technical difficulties in drilling evaporite lithologies, it seemed appropriate at this point to take a short cut route into a deep subcrop of pre-M-Reflector strata.

Objectives

The single *raison d'etre* for selecting Site 126 was to explore the pre-evaporite history of the eastern Mediterranean and hopefully to establish the paleoenvironment which preceded the Late Miocene salinity crisis. The type of location needed was one which would allow bypassing Reflector M. However, a simple outcrop of subjacent strata was not sufficient since drilling practice calls for a cover of superficial sediment for spudding in.

An attractive target had been picked by the Mediterranean Advisory Panel with careful forethought to the problem of encountering strong reflectors which might cause drilling problems (for example, the occurrence of chert layers in the Atlantic and Pacific). This site was in a deep cleft in the Mediterranean Ridge in the central Ionian Sea–a cleft that cuts more than 250 meters below the level of Horizon M and at the same time is floored by flat-lying sediments (Figure 2). The fill was particularly promising because it could be used not only to stabilize the bottom hole assembly, but because it might also contain components derived from outcropping strata, thus providing clues as to the lithology and age of bypassed horizons.

Reconnaissance tracks of the research vessels *Vema* (1956, 1958) and *Robert D. Conrad* (1965) of the

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[2]For a discussion of these two models of evaporite deposition, the reader is referred to Chapter 43 of this volume.

[3]The origin of the present Mediterranean basins through subsidence has been entertained by many geologists–e.g., Klemme, 1958; Bourcart, 1960; Aubouin, 1965; Hersey, 1965; Glangeaud *et al.*, 1966; Maxwell, 1969; Van Bemmelen, 1969; Morelli, 1970; Heezen *et al.*, 1971; Auzende *et al.*, 1971; and Selli and Fabbri, 1971.

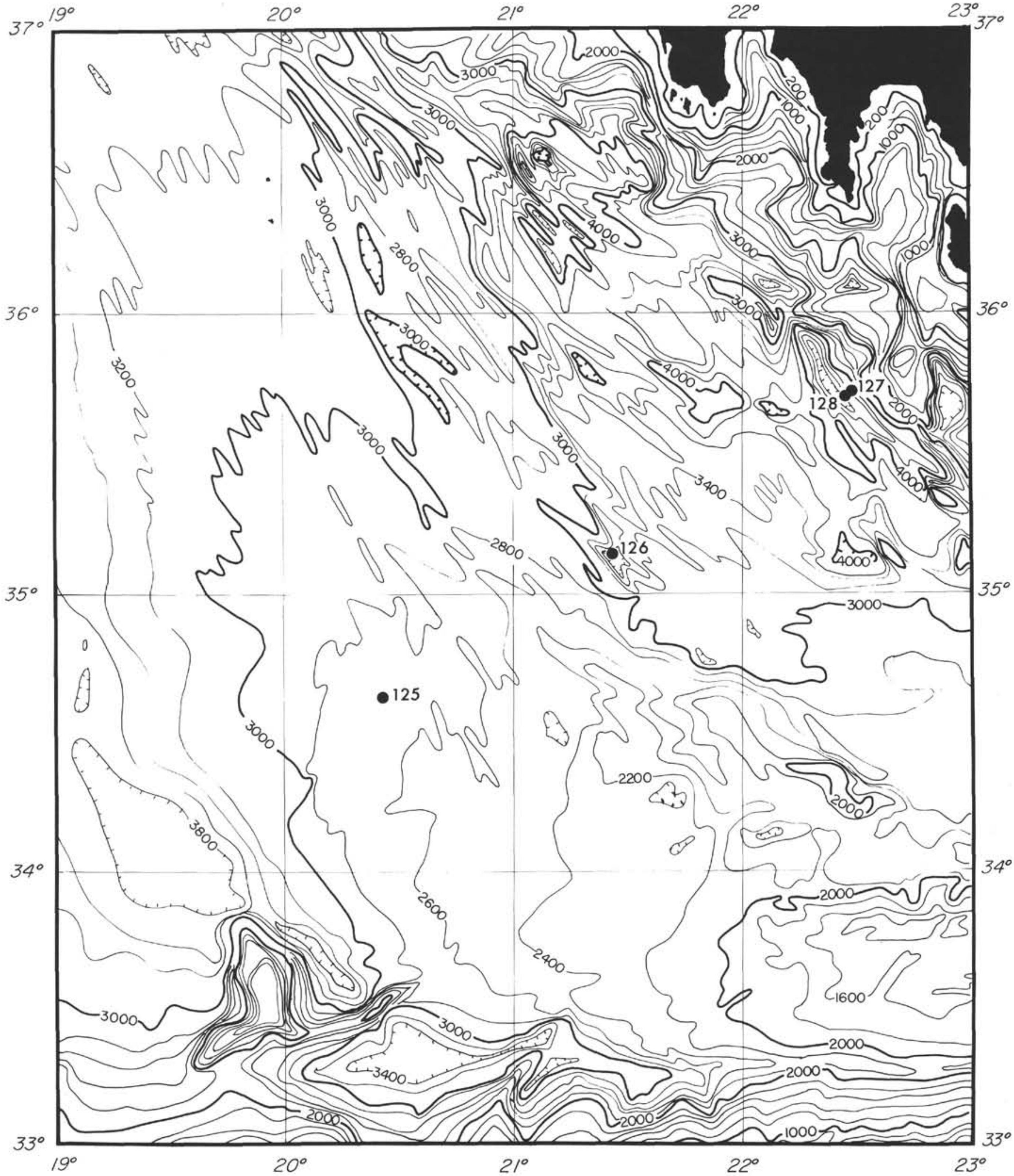

Figure 1. *Environs of Site 126 in Cleft in Mediterranean Ridge. Contours in meters, adapted from Chart 310 Defense Mapping Agency Hydrographic Center.*

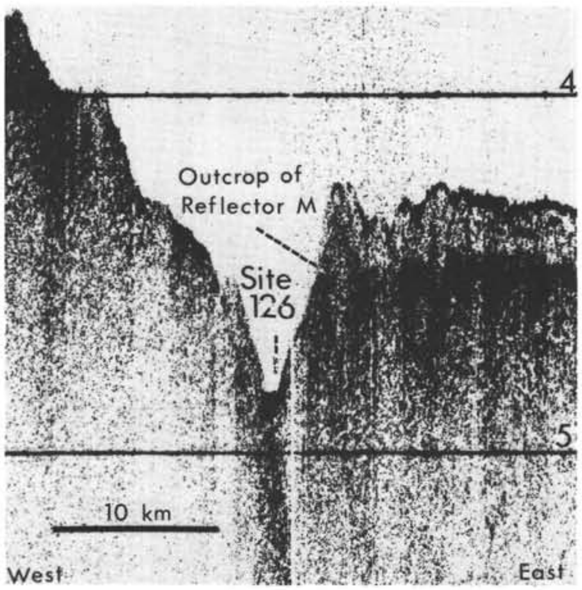

Figure 2. *The cleft in the Mediterranean Ridge, Ionian Basin. This airgun reflection profile made in 1965 by the* Robert D. Conrad *of the Lamont-Doherty Geological Observatory of Columbia University shows an outcrop of Reflector M in the eastern wall of the cleft. Site 126 was located in the narrow sediment-filled floor. Vertical exaggeration is approximately 33:1.*

Lamont-Doherty Geological Observatory of Columbia University, and *Chain* (1959, 1961, 1964 and 1966) of the Woods Hole Oceanographic Institution had disclosed local areas of "sediment ponding" in the Mediterranean Ridge (Hersey, 1965a and b). The ponds occupy the axes of small cracks, crevasses, and holes within hummocky areas (regions of the so-called "cobblestone relief" of Emery *et al.*, 1966). Where detailed surveys have been undertaken, most of the areas of ponded sediments appear as isolated sediment pockets rather than interconnected features belonging to a complex drainage system, such as meandering channels or interfingering abyssal plains. The occurrence of tiny individual pockets scattered across a sedimentary cover is different from anything yet reported from sedimentary provinces of the open ocean[4] (Heezen *et al.*, 1959; Heezen and Laughton, 1963; Menard, 1964; Vogt *et al.*, 1969) and thus was of a priority interest. It was suspected that the flat-floored component of the Mediterranean Ridge topography has probably resulted from some process of sediment redistribution in purely pelagic environments.

A secondary objective of the cleft site-selection was to ascertain what kind of sediment makes up the horizontal fill (Figure 3) and hopefully to determine some details of the history and mechanics of the depression-filling process.

[4]The Mediterranean morphology of depressions in a **sedimentary** layer is not to be confused with the well-known intermontane basins of the Mid-Oceanic Ridge where ponding occurs in **basement** depressions.

Strategy

The orientation of the cleft first recognized on a *Robert D. Conrad* reflection profile (Figure 2) was not known. Examination of the seismic records suggested that Horizon M crops out at 4.5 seconds on the northeastern wall, and that the drill string might encounter a subcrop of this wall anywhere up to 400 meters below this level.

Challenger Site Approach

Streaming her magnetometer and seismic hydrophone array, the *Glomar Challenger* approached the cleft on a course of 53 degrees at 10 knots (Figure 4). At 1000 hours on September 4th, the bottom started to rapidly slip away into the deep depression. At 1036 hours a sharp echo from the narrow floor was recognized (Figure 5). When this echo suddenly disappeared at the foot of the northeastern wall at 1043 hours a free floating marker buoy was launched, and the vessel was slowed to 5 knots to retrieve the towed gear. With everything secured at 1057 hours, she swung hard to the right on a return course. The cleft floor reappeared at 1114 hours and the command was given to heave to. The vessel came to a stop at 1117 hours.

However, by this time the side echoes from the northeast wall had disappeared. Consequently, the ship was turned back once again onto course 053 degrees and brought to a speed of 1 knot. Upon reappearance of the side echoes, she once again hove to. This was followed by the dropping of the acoustical positioning beacon at 1140 hours. As shown in Figure 6, the side-echo trace while station keeping, when matched to the original cleft crossing, indicates that the final target was between 600 and 700 meters from the base of the northeastern wall (i.e., last echo from the floor). An average of 12 satellite fixes while drilling placed the vessel location less than 500 meters north of the original *Conrad* profile.

OPERATIONS

The *Challenger* stayed on site for almost two days (between 1130 hours September 4th and 0445 hours September 6th). Two holes were drilled and the maximum penetration was 129.4 meters (Table 1), some 20 meters into pre-evaporite marl and shales subcropping beneath valley fill of Quaternary age. A button bit (Smith 3 Cone, Type 9-C) was used. The drill string penetrated rapidly through the Quaternary section. The first change in lithology was noticed immediately after encountering the bottom. Upon commencing the initial washing in (to bury and stabilize the bottom hole assembly), a remarkably resistant thin crust was encountered. With more than 1000 pounds of bit weight, it took over a minute of high-pressure pumping to break through into more typical, soft, near-surface sediments.

A few levels of resistance were again noted at 25 meters below bottom. Core 1 was cut from 34 to 43 meters in fairly stiff sediment. Cores 2 and 3 followed at more or less evenly spaced intervals, exploring the nature of the valley fill. However, having not yet reached the wall at 106 meters below bottom while still cutting Core 3, and being anxious to have the fill to wall contact, we chose as a precaution to pull this core right then, and replace the core catcher with one designed for better recovery of hard rock formations.

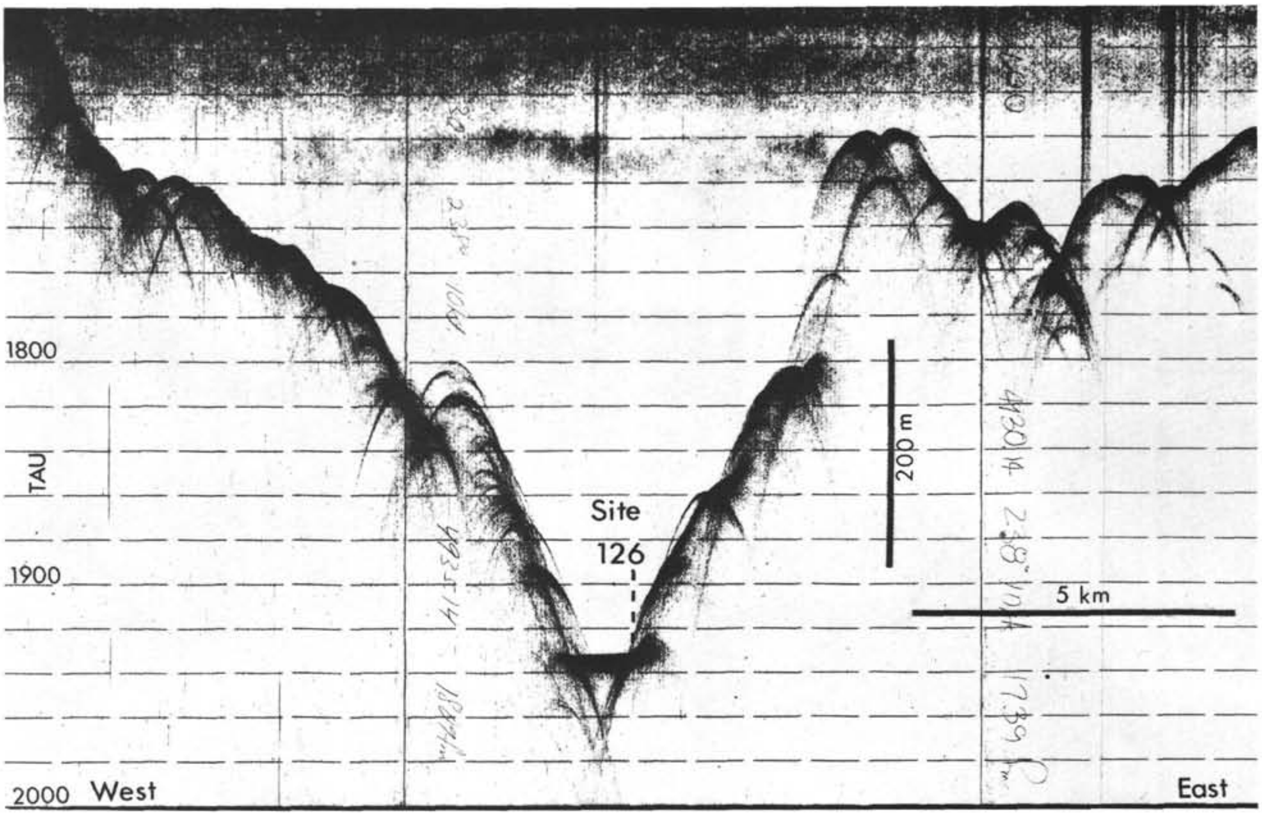

Figure 3. *Precision 12 kHz fathogram of the* Robert D. Conrad *across the small sediment pond on the floor of the cleft, illustrating the nature of the flat-lying sediment fill. Vertical scale in uncorrected units: 1 tau = 1/400th second. Vertical exaggeration ≃17:1.*

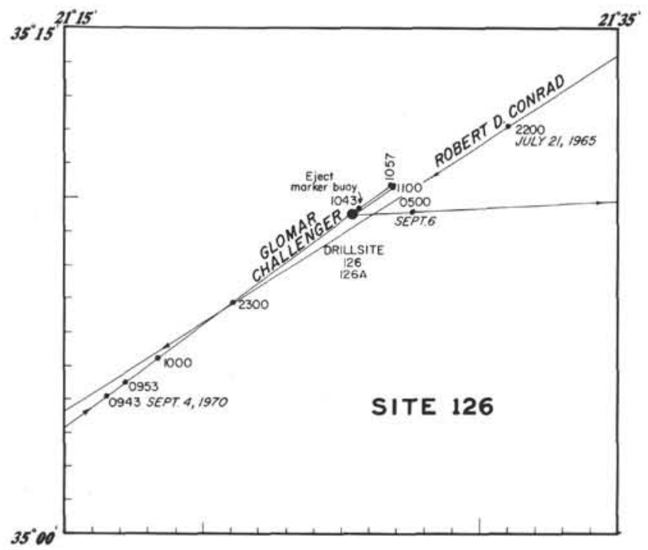

Figure 4. *Details of the* Challenger's *survey track in the vicinity of Site 126. Heavy line shows segment of the track illustrated in Figure 7.*

This proved wise, because while cutting Core 4, back to back with Core 3, we had only made two meters when the bit apparently encountered the wall. This contact was noticed first by abrupt variation, and then rapid fluctuations in the drill string torque. The change was not simply one of cutting slightly firmer sediments, because the entire assembly proceeded to bounce on the formation and grab at it as if we were in solid bedrock.

After drilling for over an hour and a half, and penetrating possibly only a fraction of a meter in the last forty-five minutes, the bit abruptly broke through into something that did not grab or torque. Core 4 was then pulled in order to check on the condition of the core catcher and to determine the type of rock we had drilled. However, the core barrel was absolutely empty. Nevertheless, it was decided that there probably was no question but that we were now in older strata and that the best line of action would be to drill deeper. In order to achieve penetration in the subcropping strata, we chose to drill ahead for two pipe lengths (≈20 m) without coring and with a centerbit insert and heavy circulation. Drilling the two lengths took six hours. Knowledge of what was slowing us up came with the recovery in Core 5 of 20 cm of waxy, marly shale. The roller cone button bit designed primarily to be effective in brittle sedimentary rocks, such as limestone and chert, was only spinning in its tracks on the shale.

Thus, while cutting Core 6 we made plans to drill a second hole closer to the axis of the cleft. Here, it was reasoned, a greater overburden of sediment fill would allow the bit to reach lower levels of the subcrop in much less time than could be accomplished by continuing drilling in

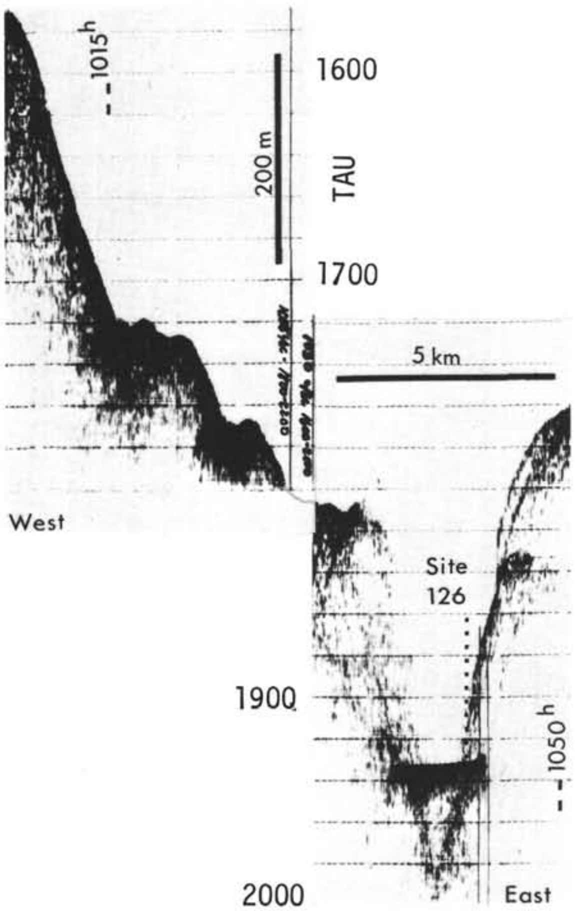

Figure 5. *Fathogram of the* Glomar Challenger *showing the initial crossing of the small sediment pond in the axis of the cleft. Note the abruptness of the first appearance and termination of the coherent echo sequence from the valley floor. Vertical exaggeration ≃24:1.*

the first hole. Since it would take only a few hours to pull pipe to the mud line, offset the drilling vessel, and repenetrate the basin fill, valuable time could be gained even if the drill string were to spud in only some ten meters deeper.

Hole 126A was located 1500 feet southwest of the original hole. It had been estimated, on the basis of interpreting the seismic profiling record of this site approach, that the basin fill here might be up to 200 meters thick (Figure 7), as compared to 100 meters for the original hole. However, the subcropping marl was encountered at only 65 meters below bottom. Again, less than 1 meter was cut in five hours of drilling. When Core 126A/1 was hauled on deck, it was found to contain virtually the same Middle Miocene shale as Core 126/5.

This Middle Miocene formation may be several hundred meters thick if a correlation with the marl of the same age in western Greece is made. It was thus concluded that drilling at the slow prevailing rate of less than one meter per hour might not yield significant new results even if we should stay another week on location. Furthermore, the primary objective of sampling the pre-evaporite sediments had been attained. The decision was therefore made to

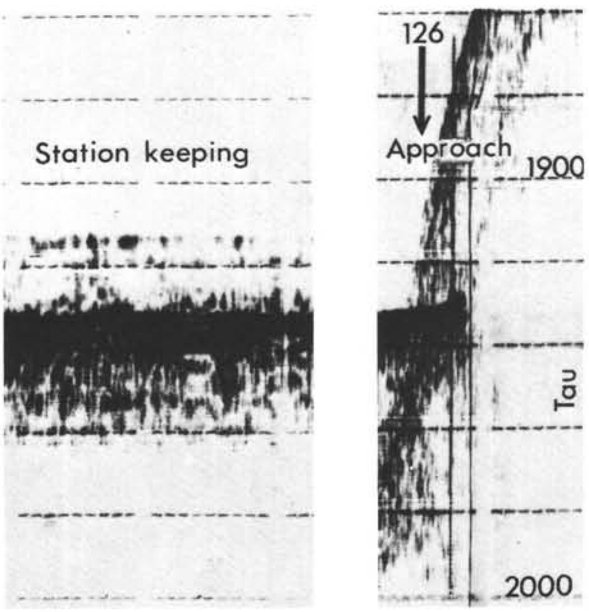

Figure 6. *A comparison of the echo sequences while station keeping with those obtained while approaching the eastern wall of the cleft. The side-echo characteristics indicate a position of the drill site between 600 and 700 meters before the termination of the flat-floor echo return at the eastern margin of the small sediment pond. Vertical scale in uncorrected units: 1 tau = 1/400th second.*

leave this site. We still hoped to sample older sediments at some more opportune location.

BIOSTRATIGRAPHY

Seven cores, one of which was empty, were recovered from the two holes at Site 126, located in a cleft valley on the Mediterranean Ridge.

Quaternary Valley Fill (M.B.C.)

Cores 1 to 3 from Site 126 recovered Quaternary biogenic calcareous oozes very rich in nannoplankton and planktonic foraminifera. The presence of sand layers, in which the coarse fraction is comprised almost entirely of foraminiferal tests and authigenic minerals, indicates that pelagic sedimentation here was now and then interrupted by redeposition and reworking in near-bottom current regimes. Graded layers suggest the local initiation of turbidity currents from slopes on the ridge or within the cleft, followed by settling from suspension currents travelling across the cleft floor. Thin "foraminiferal pavements" may possibly reflect winnowing of the cleft floor by currents passing through it. An important observation is that all the material components in the resedimented layer are themselves products of former pelagic deposition, and no terrigenous clastics were discovered that indicate the cleft belonged to a distribution system of clastic sediment derived from the continents.

All the washed residues investigated yielded a marked amount of crystals of pyrite and tubular concretions. Minute crystals of pyrite were also found adhering to the foraminiferal tests, while other tests were entirely pyritized, or preserved as internal molds (of microgranular pyrite).

TABLE 1
Core Inventory – Site 126

Core	No. Sections	Date	Time	Cored[a] Interval (m)	Cored (m)	Recovered (m)	Subbottom Penetration (m) Top	Bottom	Lithology	Age
Hole 126										
1	6	9/4	1917	3774-3783	9.0	8.2	34	43.0	Nanno oozes, Foram oozes, Sapropels	Quaternary
2	5	9/4	2043	3811-3820	9.0	7.6	71	80.0	Nanno ooze	Quaternary
3	2	9/4	2215	3839-3846	7.0	1.4	99	106.0	Nanno ooze	Quaternary
4	0	9/5	0100	3846-3849.1	3.1	0.0	106	109.0	–	–
5	1	9/5	1100	3867-3868	1.0	0.2	127	128.0	Marly shale	M. Miocene
6	1	9/5	1315	3868-3869.4	1.4	0.7	128	129.4	Marly shale	M. Miocene
Total					30.5	18.0		129.4		
% Recovered						59%				
Hole 126A										
1	1	9/5	2138	3808-3808.9	0.9	0.5	65	65.9	Marly shale	M. Miocene

[a]Drill pipe measurements from derrick floor to sea floor: 3740 m.

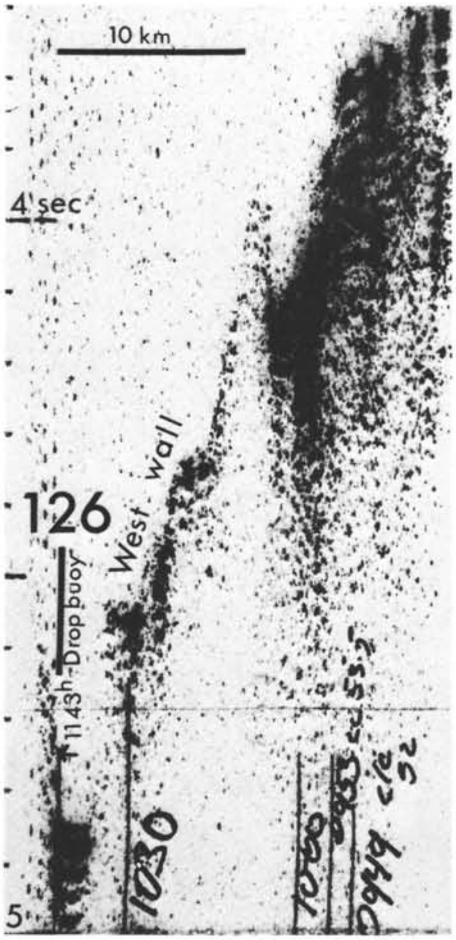

Figure 7. *Details of the sediment layering in the axis of the cleft illustrated in an airgun reflection profile made by the* Glomar Challenger *during her initial site approach. Vertical scale in seconds. Vertical exaggeration ≈50:1.*

Sapropelitic layers were encountered in Core 1, indicating periods of stagnation. In contrast to those at Site 125, they are associated with redeposited sediments (turbidites) and consequently are much thicker and have a gradual upper transition, instead of a sharp boundary. This sapropelitic interval belongs to the *Gephyrocapsa oceanica* nannofossil zone and can be correlated with the upper sapropelitic interval cored at Site 125 to the west and Sites 127 and 128 to the east in the Hellenic Trench.

The Subcropping Miocene Strata (M.B.C.)

Cores 5 and 6 from Hole 126 (126 meters and 129.4 meters below bottom, respectively) and Core 1 from Hole 126A (65.9 meters below bottom) yielded indurated grayish blue pyritic marls and brownish gray shales containing abundant and well-preserved calcareous nannofossils and extremely rare planktonic foraminifera, both indicating a Middle Miocene (Serravallian) age.

Unfortunately, the contact between the two stratigraphic units was not recovered, with the return of an empty core barrel for Core 4. Without question, however, the Pleistocene valley fill unconformably overlies the Serravallian indurated marls and shales. The evaporitic sediments underlying Reflector M have been entirely removed by erosion in the cleft valley.

The finding of Serravallian open marine deposits is a very significant result of the drilling at this site, notwithstanding the limited penetration.

The Middle Miocene (Serravallian) sediments recovered at Site 126 are similar in lithology to the succession described by Bizon (1967) from the island of Lefkas, south of Corfu (Ionian Islands). She describes massive bluish gray marls, about 100 meters thick and belonging to the *Globorotalia mayeri* Zone (*sensu* Bolli, 1957), underlying Tortonian sediments overlain by gypsum. The section described belongs to the pre-Apulian Zone (*sensu* Aubouin, 1959), which is external with respect to the Ionian Zone, and probably also continues in the Mediterranean Ridge.

Middle Miocene sediments (the Apostoli Formation) referable to the Serravallian are also known from Crete (Meulenkamp, 1969). They mostly consist of gray to blue marine marls above pre-Neogene rocks.

We point out that the Middle Miocene marls are completely devoid of any kind of benthic life, which suggests unfavorable conditions at the bottom. In this respect, they are similar to those recovered from the Middle Miocene of the Levantine Basin (Site 129, discussed in Chapter 10). For further discussion of the Middle Miocene paleoenvironment, reference is made to point 5 of Part II of Chapter 40.

Rates of Sedimentation (M.B.C.)

The available data are too scanty to allow a reliable estimate to be made at this site.

The Quaternary exceeds 100 meters in thickness in Hole 126, which was located near the eastern wall of the valley. This thickness provides a sedimentation rate exceeding 5 cm/10^3y, which is possibly underestimated since we have no clear evidence that either the Pleistocene succession is complete and continuous at this site or that the drilling site represents the thickest expression of the Pleistocene unit.

Planktonic Foraminifera (M.B.C.)

Quaternary

The abundance of planktonic foraminifera is highly variable in the Quaternary sediments and is dependent upon their occasional transportation in density currents, which may accumulate a great amount of sorted tests in the basal part of graded sand layers.

Differences in the number of foraminiferal tests per gram of sediment are, according to visual estimates, of more than one order of magnitude and in some instances approach two orders of magnitude.

The process of transportation in currents and subsequent redeposition in turbidites results in abnormal distribution of species considered as cold- and warm-water indicators. Cold-water indicators, such as *Globigerina pachyderma, G. quinqueloba,* and *Globorotalia scitula,* are small-sized forms and therefore tend to be accumulated in the finest fractions of a graded layer. On the other hand, most of the warm-water indicators, such as the keeled globorotalids and particularly *G. truncatulinoides, Orbulina universa, Globigerinoides ruber* (tapering forms), *G. conglobatus,* and *Hastigerina* sp., are large species, and are present in abundance in the basal, coarse-grained fraction of the deposits. Thus, one and the same turbiditic sequence, representing a single depositional event, appears to belong to different paleoclimatic zones because of the sorting in foraminiferal shells. This was observed in Core 2, Site 126.

No range charts are given for the Quaternary section, since the distribution of fossils is in part controlled by sedimentary processes. Species recorded include:

Globigerina bulloides d'Orbigny
Globigerina eggeri Rhumbler
Globigerina pachyderma (Ehrenberg)
Globigerina quinqueloba Natland
Globigerinita glutinata (Egger)
Globigerinoides conglobatus (Brady)
Globorotalia acostaensis Blow
Globorotalia crassaformis (Galloway and Wissler)
Globorotalia dutertrei (d'Orbigny)
Globorotalia inflata (d'Orbigny)
Globorotalia oscitans Todd
Globorotalia scitula (Brady)
Globorotalia truncatulinoides (d'Orbigny)
Hastigerina siphonifera (d'Orbigny)
Orbulina universa d'Orbigny

Evidence of colder water conditions is recorded in Core 126-1, CC and of temperate conditions in Core 126-2-4 (130-132 cm).

Globorotalia truncatulinoides occurs with a certain abundance in the coarse fraction of the turbidites cored in Core 2; it is in a phylogenetically advanced stage, fully keeled and large sized.

Miocene

Six samples were examined from the Miocene section penetrated, namely, Core 126-5-CC, 126-5-CC (inner tube), 126-6-1 (130-133 cm), 126-6-CC, 126-A-1 (120-123 cm), 126A-1-CC.

The sand-sized fraction of each sample consists mostly of discrete fragments of indurated marls or shales and of pyrite crystals. The autochtonous fossils are extremely rare in the samples investigated; they show fossilized, internally filled tests, light brown in color, which are not well preserved. One specimen of *Globoquadrina dehiscens* was recorded in Sample 126-6-1 (130-133 cm).

The relatively richest assemblage was found in a sample from the core catcher of Core 5, Site 126, coming from outside the inner tube of the catcher apparatus. The sediment consisted of a dark grayish blue indurated marl and contained a great number of introduced fossils with shells which were empty or filled with pyrite. It also included pteropods, otoliths, fragments of pelecypod shells and so forth. The Miocene faunule consists of a few representatives of *Globigerina* cf. *praebulloides, Globigerinoides trilobus, G. sacculifer, Globoquadrina altispira, G. dehiscens, Globorotalia obesa, G. siakensis, Orbulina suturalis,* and *O. universa.*

This faunule probably derives from a level immediately overlying the shales, which are practically barren. The association of *Orbulina universa* and *Globorotalia siakensis* indicate a stratigraphic interval within the N.14/N.11 foraminiferal zone of Blow's zonal scheme, which is Serravallian in age (see discussion in Cita and Blow, 1969).

The samples also contain introduced fossils (downhole contamination) in various amounts. The contrast among the empty, well-preserved, white, fragile shells of Quaternary foraminifera (also including large-sized specimens of *Globorotalia truncatulinoides* and *G. inflata* in the most contaminated samples) and the blackish sediment, strongly indurated, is striking.

Benthonic Foraminifera (W.M.)

As evidenced on the distribution chart of Table 2, benthonic foraminifera are rare in the Quaternary section and are entirely absent from the Miocene shales.

TABLE 2
Range Chart of Benthonic Foraminifera at Site 126

Age	Depth Below Sea Floor (m)	Cores	*Nodophtalmidium* cf. *tibia* (Jones & Parker)	*Articulina tubulosa* (Seg.)	*Bolivina pseudoplicata* Herr. All. & Earl.	*Bulimina aculeata basispinosa* Ted. & Zanm.	*Pyrgo depressa* (d'Orb.)	*Bolivina* cf. *aenariensis* (Costa)	*Bolivina dilatata* Reuss	*Cibicides lobatulus* (Walk. & Jac.)	*Pleurostomella alternans* Schwager	*Sigmoilina tenuis* (Czjzek)	*Pyrgo* cf. *serrata* (Bailey)	*Lagena gracillima* (Seg.)	*Lagena pseudorbignyana* Buchner	*Pullenia bulloides* (d'Orb.)	*Lagena* cf. *bradyana* Forn.	*Bolivina* cf. *pseudoplicata* Herr. All. & Earl.	*Cassidulina subglobosa* Brady	*Lagena staphyllearia inermis* Buchner	*Bolivina punctata* d'Orb.	*Cassidulinoides bradyi* (Norman)
	Sea Floor 3740 m																					
Pleistocene	34-34	1	I	I	I	I	I	I	I	I	I	I	I	I	I							
Pleistocene	71-80	2	I	I	I	I										I	I	I	I	I	I	
Pleistocene	99-106	3		I																		I
Pleistocene	106-109	4																				
Middle Miocene (Serravallian)	127-128	5																				
Middle Miocene (Serravallian)	128-129.4	6																				

Nannoplankton (H.S.)

Calcareous nannoplankton assemblages were found in every core. *Gephyrocapsa oceanica* and other species common in the middle part of the Quaternary (NN 20) are very abundant in Cores 1 and 2. Core 3 contains *Pseudoemiliania lacunosa*, which is characteristic for the NN 19 nannoplankton zone (lower Quaternary). The dark marls of Cores 5 and 6 contain an assemblage with *Discoaster bollii, D. exilis, D. musicus* and compact *Discoaster* specimens, which are close to *Catinaster coalitus*. The age of this assemblage, which is considered nannoplankton zone NN 8 according to Martini and Worsley (1971) and to Berggren (1971) is Middle Miocene (Serravallian). The core catcher sample, 1-CC of Core 126A, contains a similar nannoplankton assemblage and is apparently of similar age.

The age-diagnostic nannofossil assemblages are shown below.

Quaternary

Samples: 13-121-1-1, 85 cm; 125-1-2, 155 cm; 126-1-3, 188 cm; 126-1-4, 70 cm; 126-1-5, 40 cm; 126-1-6, 15 cm; 126-1, CC:

Braarudosphaera bigelowi
Ceratolithus cristatus
Ceratolithus telesmus
Coccolithus pelagicus
Gephyrocapsa oceanica
Cyclococcolithus leptoporus s.l.
Helicosphaera carteri
Oolithotus antillarum
Pontosphaera scutellum
Rhabdosphaera clavigera
Rhabdosphera stylifera
Scyphosphaera apsteini
Scapholithus fossilis
Syracosphaera pulchra

Samples: 13-126-2-1, 90 cm; 126-2-2, 140 cm; 126-2-3, 10 cm; 126-2-4, 110 cm; 126-2-5, 30 cm; and 126-2, CC:

Braarudosphaera bigelowi
Ceratolithus cristatus
Coccolithus pelagicus
Cyclococcolithus leptoporus s.l.
Gephyrocapsa oceanica
Helicosphaera carteri
Pseudoemilia lacunosa
Rhabdosphaera clavigera
Rhabdosphaera stylifera

Pseudoemiliania lacunosa Zone NN 19

Samples: 13-126-3-1, 140 cm; 126-3-2, 70 cm and 126-3,CC:

Braarudosphaera bigelowi
Ceratolithus cristatus
Coccolithus pelagicus
Cyclococcolithus leptoporus s.l.
Discoaster perplexus
Gephyrocapsa oceanica
Helicosphaera carteri

Oolithothus antillarum
Pontosphaera japonica
Pseudoemilia lacunosa
Rhabdosphaera clavigera
Rhabdosphaera stylifera
Scapholithus fossilis
Scyphosphaera apsteini
Sphenolithus abies
Syracosphaera pulchra
Thoracosphaera imperforata
Pseudoemiliania lacunosa Zone NN 19

Miocene

Samples: 13-126-5-1, 126 cm; 126-5-1, 130 cm; 126-5-1, 135 cm; 126-5, CC; 126-6, CC; 126A-1-1, 140 cm; and 126A-1, CC:

Braarudosphaera bigelowi
Catinaster cf. *coalitus*
Coccolithus cf. *eopelagicus*
Coccolithus pelagicus
Cyclococcolithus neogammation
Discoaster bollii
Discoaster exilis
Discoaster musicus
Discolithina macropora
Lithostromation perdurum
Micrantholithus vesper
Pontosphaera multipora
Reticulofenestra pseudoumbilica
Scyphosphaera intermedia
Catinaster coalithus Zone NN 8

LITHOSTRATIGRAPHY

Two holes, 126 and 126A, were drilled in the cleft of the Mediterranean Ridge, penetrating 129.4 meters of sediments and consolidated rocks. Two lithologic units could be distinguished: (1) marl oozes, graded sands and marl oozes, sand-silt laminae, a few rock fragments, and sapropels; and (2) marls and shales.

TABLE 3
Lithologic Units of Site 126

Unit	Lithology	Age
1	Marl oozes, sands, silts, sapropels and breccias	Quaternary
≈108 m (126) / 57 m (126A)		
2	Marls and shales (pelagic)	Middle Miocene
129.4 m		

Unit 1 – Marl Oozes, Sands, Silts, Sapropels and Breccias

Individual sequences of sands grading to silts and marl oozes, and occasionally with sand-silt laminae were recovered in the first three cores cut between 35 and 106 meters below bottom. They are intercalated in nanno ooze of Quaternary age. In addition, sapropels and rock fragments were encountered in Cores 1 and 2.

The outstanding characteristic of the coarse-grained sediments has already been mentioned in the discussion under biostratigraphy. It is that the sedimentary components include only those materials previously deposited in the basically pelagic environment of the Mediterranean Ridge. The beds are in many cases graded with abrupt basal contacts, contain parallel laminations in the lower sandy interval, and have a thick homogeneous upper interval of marl ooze. They range in thickness from less than ten centimeters to greater than two meters. The marl ooze interval is generally olive gray except for beds involving redeposited sapropelitic muds where the color is much darker, often solid black (Figure 8A). The sandier parts are clearly of a lighter color, reflecting a high degree of sorting of foraminiferal tests (Figure 8B). In the darker layers, the foraminifera are coated with crusts of iron sulfide. Aggregates, as well as individual spherules of pyrite, are a common component in the sand fraction here. Other minerals present include traces of quartz sand and silt, mica, volcanic glass shards, siderite and dolomite in the coarse fraction, and illite, interstratified clays, montmorillonite, kaolinite, and chlorite in the fine fraction.

The graded units have bedding structures typical of the flysch-turbidite facies model (Bouma, 1964). The interval of massive sand at the base of the facies model is very thin or absent, and is overlain by a rather well developed sequence of parallel laminations (Figure 8C). The laminations consist of quite distinct thin horizons of rather clean foraminiferal sand (size-sorted) separated by a few millimeters of fine-grained marl ooze without foraminifera. Of note is the observation that the foraminiferal tests in the sand layer are often extensively filled with coccoliths and clay, whereas the scattered foraminifera in normal pelagic sediments are markedly cleaner. The sharp basal contacts (Figure 9) occasionally have erosional markings suggestive of flutes or grooves.

No crossbedding was observed in the cleft fill and the transition from the laminated interval to the overlying pelitic interval is quite abrupt. Only the uppermost parts of the pelitic interval are burrowed.

In the graded layers with significant amounts of pelitic mud, the color of the pelitic interval invariably lightens towards the top (e.g., Section 3 of Core 1).

The nanno ooze between the graded layers has a carbonate content as high as eighty per cent. The lowest values occur in the redeposited units (e.g., 36% in Core 2, Section 4, 110 cm, rich in clay minerals and dolomitic marl). Very thin layers (≈1 cm thick) of foraminiferal sands are found at several levels interbedded in both nanno ooze (Core 1-6, 42 cm) of the pelagic background sediment and marl ooze of the graded beds (Core 1-4, 50 cm). An example of the latter is illustrated in Figure 10.

These thin layers are sometimes accompanied by hydrotroilite blotches or laminae (Core 1-5, 60 cm). The subjacent strata consists invariably of nanno ooze or marl ooze with scattered tests of foraminifera, whereas the immediately overlying units are noticeably lacking in sand-sized sediment. The origin of the thin sand laminae is not clearly understood at the present time. One cannot exclude the possibility that these thin layers are also deposits from small scale density currents arriving on the floor of the cleft

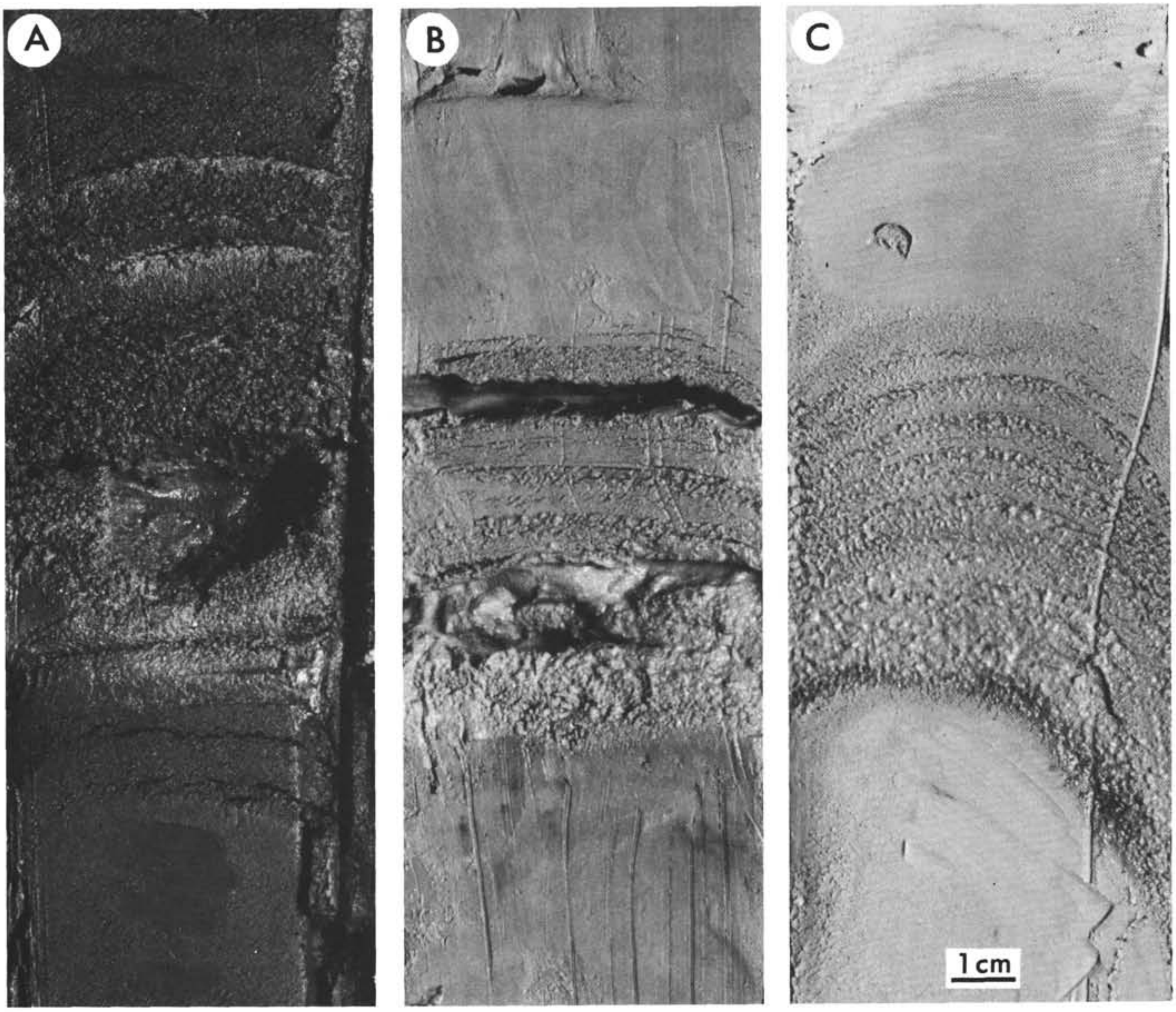

Figure 8. *Illustrations of current bedding (primary structures) from graded sequences of Unit 1. (A) contains resedimented sapropelitic muds (Core 1-1, 115 cm); (B) exemplifies the lower intervals of laminated and graded foraminiferal sands (Core 1-6, 114 cm); and (C) shows a particular development of cyclic laminations (pulses) in a small graded sequence from Core 2-5, 42 cm. Scales shown are in centimeters. These sedimentary deposits are interpreted as turbidites.*

following slumping on the surrounding walls. However, they may also represent lag deposits of winnowed foraminiferal oozes formed during periods of bottom current activity, and they may therefore be unrelated to episodic turbidity currents.

However, if currents near the sea floor have been active in the cleft during Quaternary time, we should point out that no such "foraminiferal pavements" were noticed outside the cleft either in nearby piston cores or in the Quaternary sequences of Site 125 near the crest of the ridge some 105 km to the southwest.

Other interesting components in the Quaternary sediment fill are the erratics of limestone and dolostone abundant in Core 2. One fragment, the size of a cobble (see Figure 11), consists of a piece of indurated breccia. Dark slump balls within this cobble are made up of dolomite mudstone very similar to the dolomitic marl facies of the evaporite series cored at Site 125A (Cores 7 and 9). Other pieces (Core 2-2, 130 cm) consist of slightly magnesian micritic limestone encrusted with manganese and iron oxides. These erratics are perhaps fragments from outcrops in the walls of the cleft.

The top of Core 2 (72.2 m) is a highly deformed marl ooze showing slump structures between 73 and 74.8 meters and containing scattered pieces of massive dolomitic marls.

Three layers of sapropel occur in the cores recovered. Two are graded and are believed to have been redeposited. The third, at 75.30 meters, shows sharp boundaries and could have been deposited *in situ*. In the sapropel beds, pyrite is generally present in amounts of 20 per cent, but

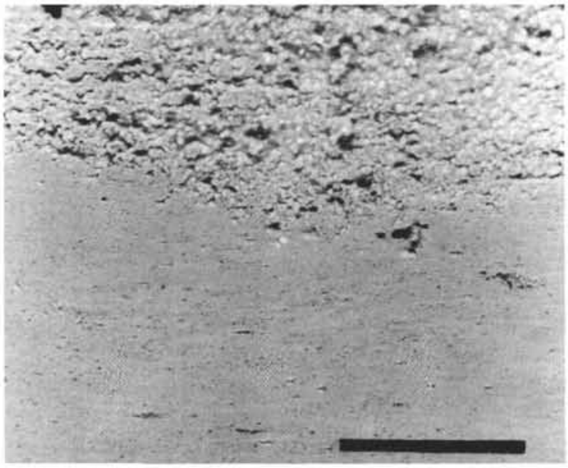

Figure 9. *Details of the basal contact of a graded bed of foraminiferal sand. The small depression is suggestive of flute or scour mark. Note that the maximum grain size is not reached until a few millimeters above the erosional surface. Scale bar represents 1 cm.*

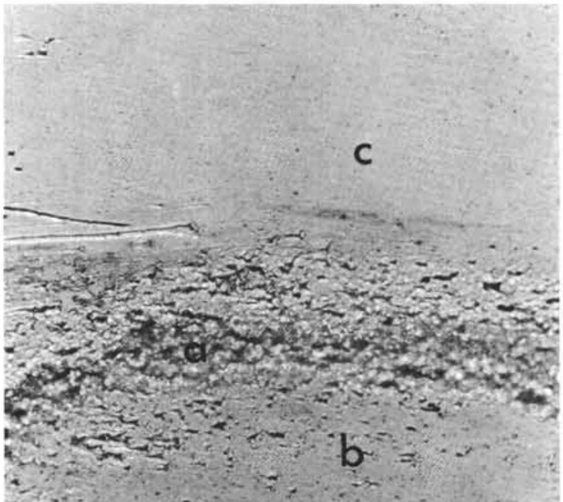

Figure 10. *Thin laminae (a) of well-sorted foraminiferal sand separating two layers of distinctive textures. The lower unit (b) contains scattered tests of foraminifera shown by the tiny holes on the freshly split core surface. The upper unit (c) is devoid of foraminifera. The laminae might be a lag deposit ("foram-pavement") formed by winnowing of previously deposited pelagic sediments. Scale bar represents 1 cm.*

Figure 11. *An erratic cobble of lithified breccia in Section 4 of Core 2. Loose rocks such as this are probably fragments broken loose from the outcropping walls of the cleft and subsequently incorporated in the valley fill. Scale is in centimeters.*

may reach 70 per cent at certain levels. The organic carbon content is also high–about 2 per cent compared with 0.1 per cent in normal oozes.

Unit 2 – Marls and Marly Shale

Consolidated marls, Middle Miocene (Serravalian) in age, were encountered between 106 and 129.4 meters in Hole 126. They unconformably underlie the Quaternary sediments of the cleft. The marls, medium to very dark gray, are lithified into waxy and fissile shales. They are composed of nannoplankton and foraminifera (5 to 13% calcium carbonate), quartz, montmorillonite, and kaolinite. Smear slide observations also reveal the presence of pyrite. No dolomite was found.

In Hole 126A which was drilled more toward the axis of the cleft (500 meters southwest of the original hole), Unit 2 marls were encountered at 65.3 meters below the sea floor.

PHYSICAL PROPERTIES

The recovery from this hole was very poor so that physical parameters were measured only on those cores, in the upper part of the hole, where undisturbed sections were found. Sediments include nanno oozes with intercalated layers of sapropels, sands, and silts.

A large part of Cores 1 to 3 displayed cyclic coloration within marl oozes and also included intercalated graded sands and sapropels. Detailed penetrometer measurements were made in undisturbed sections and the variations from coarse- to fine-grained material were easily distinguishable. For example, in Core 1-5, an increase in grain size is reflected by successive readings of 108.7, 114.0, and 122.7 $\times$ 10^{-1} mm. Color variation in the sediments reflects a difference in plasticity, with induration increasing and penetrometer readings decreasing in the darker oozes. All readings fall within the range 32.0 to 122.7 $\times$ 10^{-1} mm, except for an anomalous high 154.0 $\times$ 10^{-1} mm in a sand in Core 1-6, and a reading of 19.0 $\times$ 10^{-1} mm in an ooze containing dolomite pebbles in Core 2-5.

Bulk density varies between 1.54 and 1.76 gm/cc, with a suggestive trend of decreasing values with depth. Densities determined from section weights bear little relationship to those determined in the laboratory, possibly because of the abundance of voids in this case. Details of methods of density determination are further discussed in Chapter 39. Grain densities are in the range 2.10 to 2.66 gm/cc; the higher values corresponding to greater calcium carbonate content. Water content and porosity decrease only slightly with depth (from 33.1 to 30.3% and 51% to 49.9%, respectively) except in disturbed cores where an increase in values is seen.

Natural gamma readings generally range from 1900 to 3000 counts, with occasional maximum peaks over sapropel beds of up to 3900 counts. These beds have a high organic and pyritic content, and the amount of radioactive material has apparently been increased by absorption and adsorption. Dolomite also produces high count rates, as in Core 2-4 at 79 meters where a nodule is detected by peak counts of 3200 over a background rate of 1900. This may be due to constituent impurities whereby in the dolomitization processes uranium is incorporated into the carbonate lattice structure.

SUMMARY AND CONCLUSIONS

The lower part of the eastern wall of the Mediterranean Ridge cleft contains marine shales of Middle Miocene age (Figure 12). The strata cored at 3860 meters below sea level (Core 6) subcrop approximately 400 meters down the wall from an outcrop of Horizon M.

From previous drilling at Site 125 on the ridge, Horizon M was found to mark the top of an evaporite formation believed to be equatable with Gessoso Solfifera of Sicily (Ogniben, 1956) and time correlatable with the Messinian stage of the Upper Miocene (Selli, 1960).

As yet, no knowledge is available concerning the sedimentary section between the evaporites and the shales,

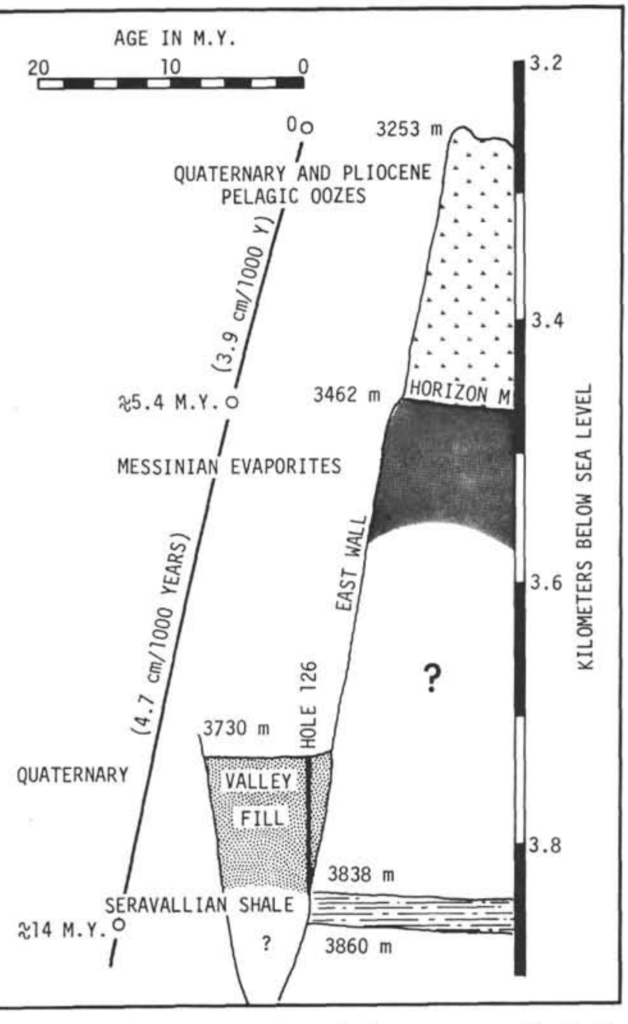

Figure 12. *Schematic section of the eastern wall of the cleft. The top of Reflector M outcrops at 3462 meters. The Serravallian shales were drilled almost 400 meters below this level. Interval sedimentation rates of 3.9 cm/10*^{3}*y have been calculated from the Quaternary-Pliocene section of transparent oozes above Horizon M and 4.7 cm for the interval of Upper and Middle Miocene sediments below.*

though a 270-meter interval of this section lies exposed on the eastern wall of the cleft waiting to be cored or dredged. No rocks older than Middle Miocene were recovered, and the age and nature of the basement beneath the ridge remains unknown.

Assuming a date of approximately 14 my for the Serravallian shales of Cores 5 and 6 (Van Couvering and Miller, 1971) and an age of approximately 5.4 my for the end of the crisis of salinity during which the evaporites were deposited, one can calculate a mean ratio of sediment accumulation of 4.7 cm/10^3y for this region of the ridge during Middle to Late Miocene time. The resulting value is not much greater than that of 3.9 cm/10^3y for the post-Horizon-M sequence at this location. It possibly indicates that the evaporite layer may only comprise a hundred meters or so of the unknown section, provided, of course, that we assume an equal rate for pelagic deposition both before and after the salinity crisis.

Pre-evaporite Environment

Much more significant than the inferred rate of accumulation or thickness of the Serravallian shale is the observation that it was deposited in an open marine environment. The lack of a benthic fauna, fine laminations without burrowing, and a high content of pyrite all point to anoxic conditions in a poorly ventilated deep basin. These characteristics call to mind the periods of intermittent stagnation in the Ionian and Levantine seas during the Quaternary (Olausson, 1961).

We can get some ideas as to the possible depth of the basin from Benson and Sylvester-Bradley (1971) who have reported (1) the discovery by Sissingh of deep-sea psychrospheric ostracods in the Miocene (Gavdos Formation) of Crete just to the east of the drill site, and (2) the presence of ostracods *Paijenborchella* and *Krithe* in the Miocene of Cyprus. These findings are from sediments older than the evaporites and can be interpreted to indicate that parts of the eastern Mediterranean formerly had deep passageways to an open ocean.

As to the nature of the Ionian Basin crust we can only speculate. Gass (1958) has proposed that the Troodos Massif of Cyprus is a piece of Mesozoic "oceanic" crust and upper mantle. Temple and Zimmerman (1969) and Moores and Vine (1971) consider not only the ultramafic complex of Cyprus, but the entire belt of Alpine ophiolite bodies in Turkey and Greece as fragments of a once extensive Tethyan ocean, parts of which are now sheared off and preserved in former subduction zones. If this simatic crust were extended as far south as the foreland of North Africa according to the seismic studies of Payo (1967), the gravity measurements of Rabinowitz and Ryan (1970), and the tectonic models of Dewey and Bird (1970), then one is immediately confronted with the perplexing question of how to get an evaporite pavement across a strip of the earth which we know from the hypsometric curve usually lies three to five kilometers below the ocean surface.

Although this discussion is in large part speculative, awaiting further deep drilling of the eastern Mediterranean basins, it must be acknowledged that Upper Miocene evaporites are found in Cyprus (Turner, 1971; A. G. Fischer, personal communication) in continuity with lower Cenozoic and Mesozoic deep-sea sediments, themselves sitting on pillow lavas. It would not be surprising to find a similar situation at a Mediterranean Ridge drilling site.

The formation of a pyritic facies at Site 126 possibly reflects the initial choking off of former deep passageways between the relic Tethys as we know it today and the Indian Ocean, commencing with the collision of the Arabian shield and Iran along the Zagros crush zone (Stöcklin, 1968; Wells, 1970). Isolation of the Black Sea regions from the eastern Mediterranean is marked by a simultaneous development of brackish faunas in the Pannonian Basin. According to the new radiometric isotope dating of Van Couvering and Miller (1971), the Sarmatian vertebrate faunas immediately predate the arrival of *Hipparion* at $\approx$12.5 my. This places the commencement of the brackish-marine molluscan faunas of the type Pontian Stage of the Crimea well in advance of the crisis of salinity. Apparently, the Ionian and Levantine basins kept their marine character until the Messinian by having open connections to the Atlantic through the western Mediterranean basins (Ruggieri, 1967). When the passage to the Atlantic was cut off, evaporation (being in excess of precipitation and river runoff) caused the southern basins to dry into isolated playas while the northern para-Tethys expanded into a huge interconnected lake.

Nature of the Valley Fill

The upper 106 meters of sediment is Quaternary in age. As discussed in earlier sections of this chapter, the sedimentary strata consist of both primary and redeposited pelagic sediments which were deposited in both stagnant and well-ventilated environments. Furthermore, the slumping and resuspension has incorporated both oxidized and reduced (sapropel) oozes, and sometimes a mixture of the two.

The occurrence here of carbonate turbidites is of interest, because unlike many of those reported in the literature (van Straaten, 1964; Rusnak and Nesteroff, 1964; Schneider and Heezen, 1966; Davies, 1968) the graded sand layers of the Mediterranean Ridge cleft do not contain components of shallow water origin (except for an occasional erratic fragment or two from the exposed evaporite layer beneath the outcrop of Horizon M–see Figure 11). The strongest modern day analogies to this type of sedimentation exist in the carbonate turbidites of intermontane basins of the Mid-Oceanic Ridge provinces (van Andel and Komar, 1969), and ancient counterparts would be the Upper Cretaceous Monte Antola Flysch of the northern Apennines (Scholle, 1971). However, unlike the latter, the Mediterranean Ridge sand layers were found intercalated in calcareous nanno oozes indicating that the site was above the depth of calcite compensation throughout its depositional history.

The evidence for emplacement by turbidity currents of individual layered sequences includes graded bedding, selective size sorting of foraminifera, and the confinement of burrowing to the uppermost part of the pelitic interval.

That sediments once accumulated as a thick blanket across the ridge should subsequently become redeposited is an intriguing question. Perhaps instabilities are triggered by solution-collapse in the underlying evaporite layer. Of particular relevance is the unusual rock fragment illustrated in Figure 11. Considering its past stratigraphic position in the cleft wall, its irregularly shaped clasts consisting of unfossiliferous indurated dolomitic marl, and its deformed matrix of sparry calcite and pulverized dolostone with recalcitized rims (dedolomitized), this rock displays key properties of an evaporite solution-collapse breccia (Blount and Moore, 1969).

Circumstantial evidence is also provided in the findings by Fischer and Garrison (1967), Biscaye *et al.* (1971), and at 130 cm in Section 2 of Core 2, of isolated fragments of lithified pelagic foraminiferal limestone in sampling cleft areas of the ridge. Microscopic examination reveals a fine-textured micritic matrix made up of coccoliths which are not visibly recrystallized. The course of cementation is not known, but is associated with magnesium enrichment, perhaps due to dedolomitization of part of the Messinian evaporite sequence. Research should be encouraged on this unusual variant of *in situ* deep-sea diagenesis. Bruce Heezen (personal communication) has noted "terribly hard crusts" covering sedimentary outcrops on the deep escarpments of the Medina Bank and the Malta Escarpment in the western Ionian Basin which frustrated numerous attempts at dredging there in the summer of 1970.

A synsedimentary morphologic development of the hummocky texture of the Mediterranean Ridge as related both to evaporite solution mechanics and halokinesis is explored further in Chapter 43 of this Volume.

Comments on the Origin of the Cleft

The cleft of Site 126 was drilled primarily to facilitate the recovery of pre-evaporite strata. The method of exploration was not directed toward learning of the particular development of this topographic feature, and the recovered cores add little to the knowledge of its origin. However, the following observations are of interest:

1) The cleft does not appear to align with any linear feature such as a fracture zone or rift zone.

2) There is no associated magnetic anomaly.

3) The cleft marks a displacement of the level of Horizon M between the NE and SW walls of about 600 meters, with the downdropped block descending into the Hellenic Trough. Analogous normal fault displacement on the seaward wall of oceanic trenches has been reported by Ludwig *et al.* (1966) and Bellaiche (1967).

4) Other clefts have been observed in reflection profiles across the Mediterranean Ridge (see, for example, Figures 6 and 16c of Ryan *et al.*, 1971). Although this particular cleft, drilled at Site 126, does not appear to be equidimensional, many of the others are isolated pockets and are reminiscent of sink holes in karst terrains.

5) This particular cleft cuts entirely through the evaporite formation well down into indurated pre-evaporite strata. The contact between the valley fill and the subcropping shale contains a one-meter zone that drilled like solid rock (i.e., no different according to the drillers than the basaltic basement of the Atlantic or Pacific).

6) The cleft is partly filled with ponded Quaternary sediments indicating that it was already in existence in essentially its present configuration some two million years ago.

7) No Pliocene sediments were recovered, though only the upper 106 meters of the fill were examined, and the axis of the valley might contain more than 0.3 second (≈240 meters) of layered strata.

A speculative interpretation of the origin of the cleft is discussed in a context of other collaborative data in Chapter 43. The presented hypothesis relates a deep erosional cutting of an Upper Miocene sea bed with an extensively lowered wave-base in a desiccated evaporite basin. The cleft drilled at Site 126 is inferred to have acted at one time as a breach between a partly dried and isolated Sirte-Messina Basin west of the Mediterranean Ridge and the deeper Hellenic Trough of the eastern half of the Ionian Sea. The mechanics of incision into the late Miocene sea floor are tentatively linked with subareal erosive processes, with the cleft acting as a gorge for the overflow from the western Mediterranean lakes and seas which emptied into deeper eastern Mediterranean depressions.

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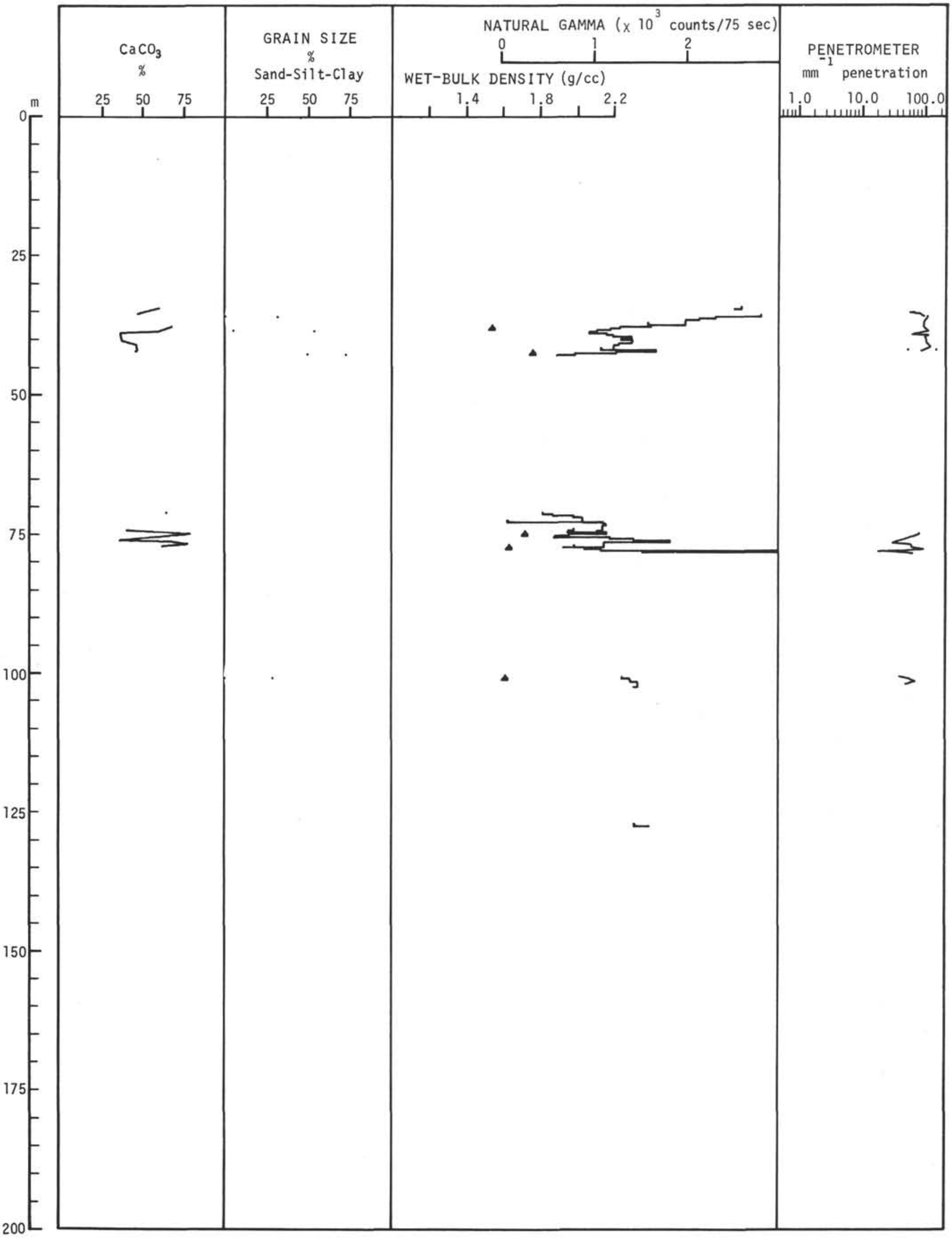
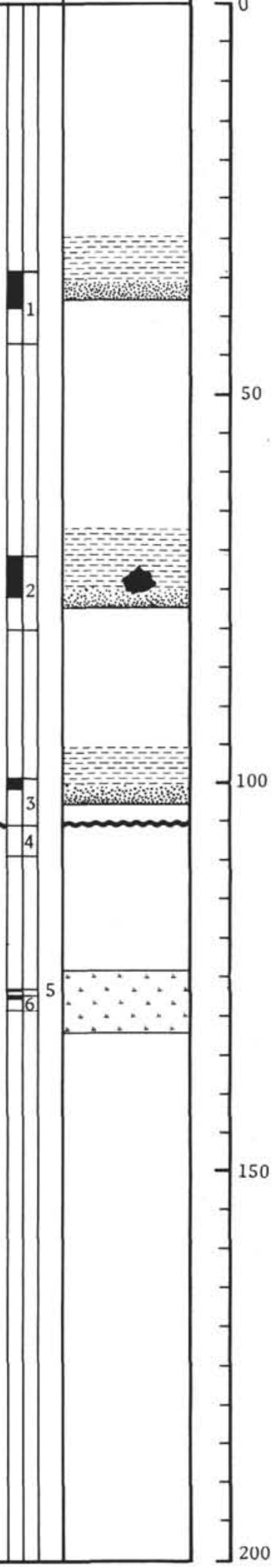
Hole Summary 126



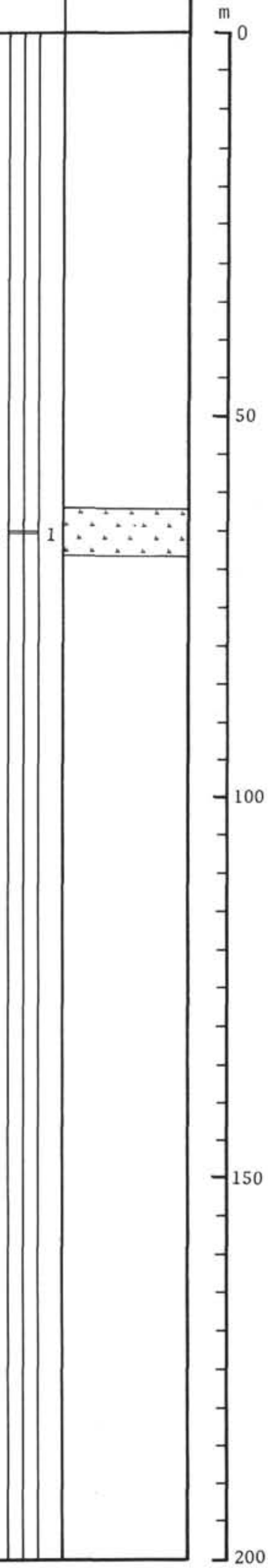
AGE		LITHOLOGY AND BIOSTRATIGRAPHY
PLEISTOCENE	UPPER -?- MIDDLE -?- LOWER	Turbidites: Graded SANDS and MARL OOZES, ROCKS, SAND-SILT laminae, SAPROPELS Sequences of foraminiferal sand grading to marl ooze. Sharp contacts between sequences. Mostly olive gray. Layers of foraminiferal sands interbedded with sharp contacts. Occasional rocks: dolomitic marls. SAPROPELS Black stained graded sequences with high pyrite content in cores 1 and 2 in the *G. oceanica* zone.
		106m
MIDDLE MIOCENE	(SERRAVALLIAN)	MARLS medium gray indurated and brittle quartz, calcite, clays, trace shell fragments, pteropods, pyrite very poor planktonic foraminifera and no benthonics

LITHOLOGY

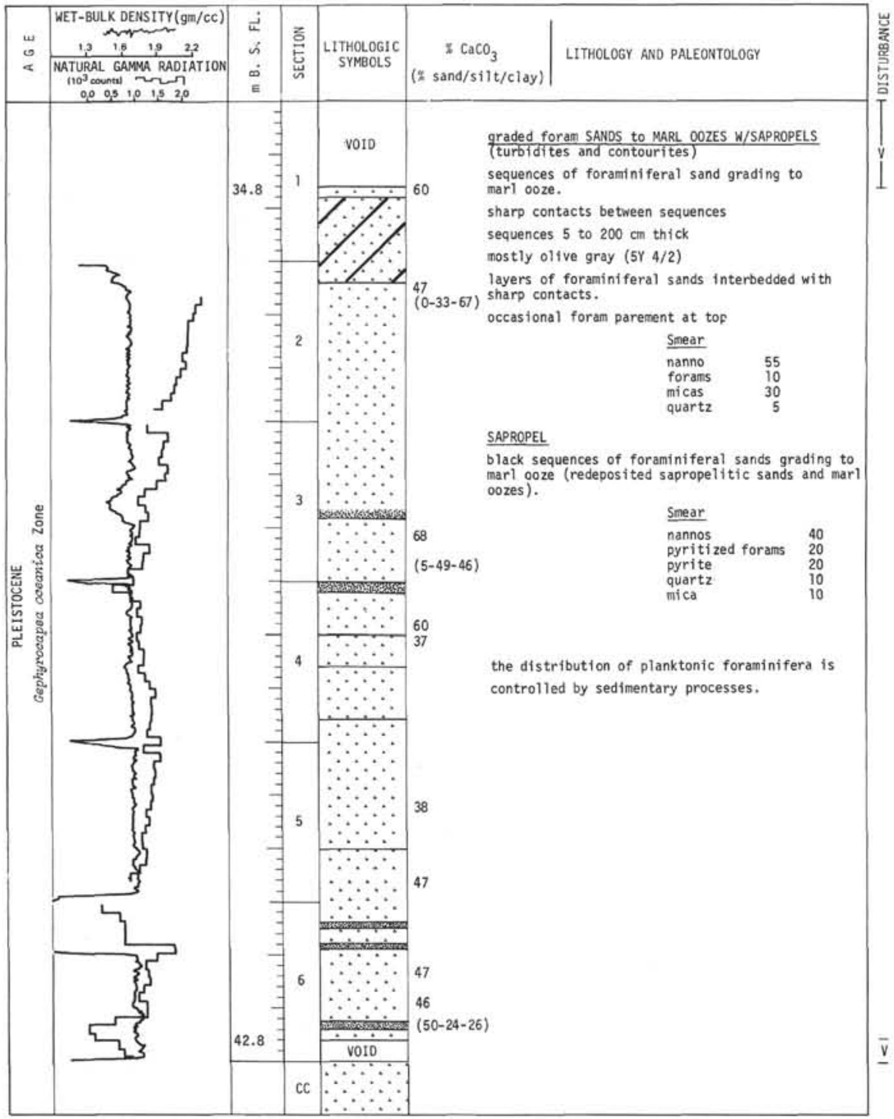


Hole Summary 126A

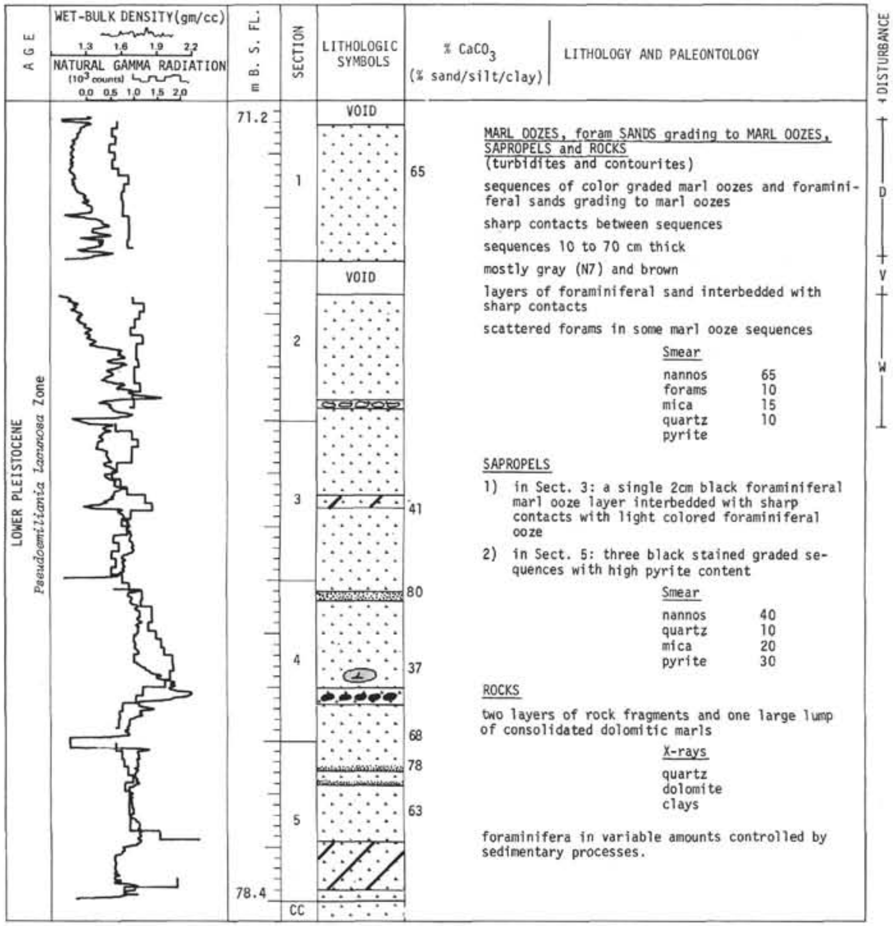
AGE	LITHOLOGY AND BIOSTRATIGRAPHY	LITHOLOGY
MIDDLE MIOCENE (SERRAVALLIAN)	MARL very dark gray indurated and fissile H_2S odor same lithology as 126 cores 5 and 6 65 m 1	



SITE 126 CORE 1 Cored Interval 34-43 m



SITE 126 CORE 2 Cored Interval 71-80 m



SITE 126 CORE 3 Cored Interval 99-106 m

AGE	WET-BULK DENSITY (gm/cc) 1.3 1.6 1.9 2.2 / NATURAL GAMMA RADIATION (10^3 counts) 0.0 0.5 1.0 1.5 2.0	m B. S. FL.	SECTION	LITHOLOGIC SYMBOLS	% $CaCO_3$ (% sand/silt/clay)	LITHOLOGY AND PALEONTOLOGY	DISTURBANCE
LOWER PLEISTOCENE *Pseudoemiliania lacunosa* Zone		100.3 102	1 2 CC	VOID	(0-30-70) 45	MARL OOZE olive gray (5Y 5/2) plastic, homogeneous faint bedding Smear: nannos 45, forams tr., quartz 20, micas 35, pyrite 1	V

Site 126, Core 4: Cored interval, 106-109m; no recovery.

SITE 126 CORE 5 Cored Interval 127-128 m

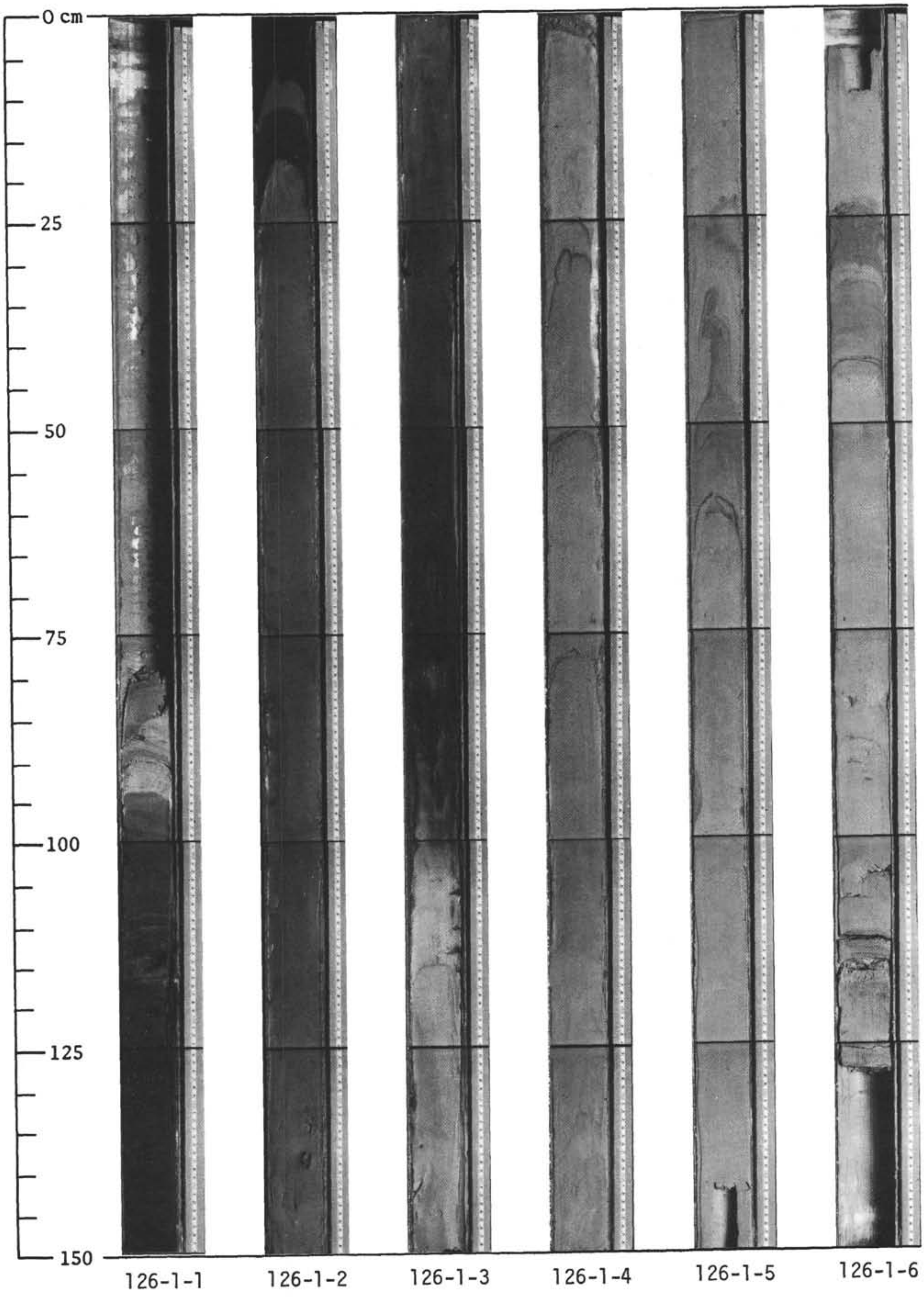
AGE	WET-BULK DENSITY (gm/cc) 1.3 1.6 1.9 2.2 / NATURAL GAMMA RADIATION (10^3 counts) 0.0 0.5 1.0 1.5 2.0	m B. S. FL.	SECTION	LITHOLOGIC SYMBOLS	% $CaCO_3$ (% sand/silt/clay)	LITHOLOGY AND PALEONTOLOGY	DISTURBANCE
MIDDLE MIOCENE Serravallian		127.7 128.2	1 CC	VOID		MARL medium gray (N5) to very dark gray (N#1) indurated brittle and fissile X-ray: quartz, calcite, clays, feldspar Smear: nannos 40, forams 3, quartz 20, mica 35, pyrite 2 rare autochtonous foraminifera including *Globoquadrina dehiscens*, *Globorotalia siakensis*, and *Orbulia universa*. Nannoplankton with *Discoaster bollii*, *D. exilis*, *D. musicus* and discoasters similar to *Catinaster coalitus*. NN8	V

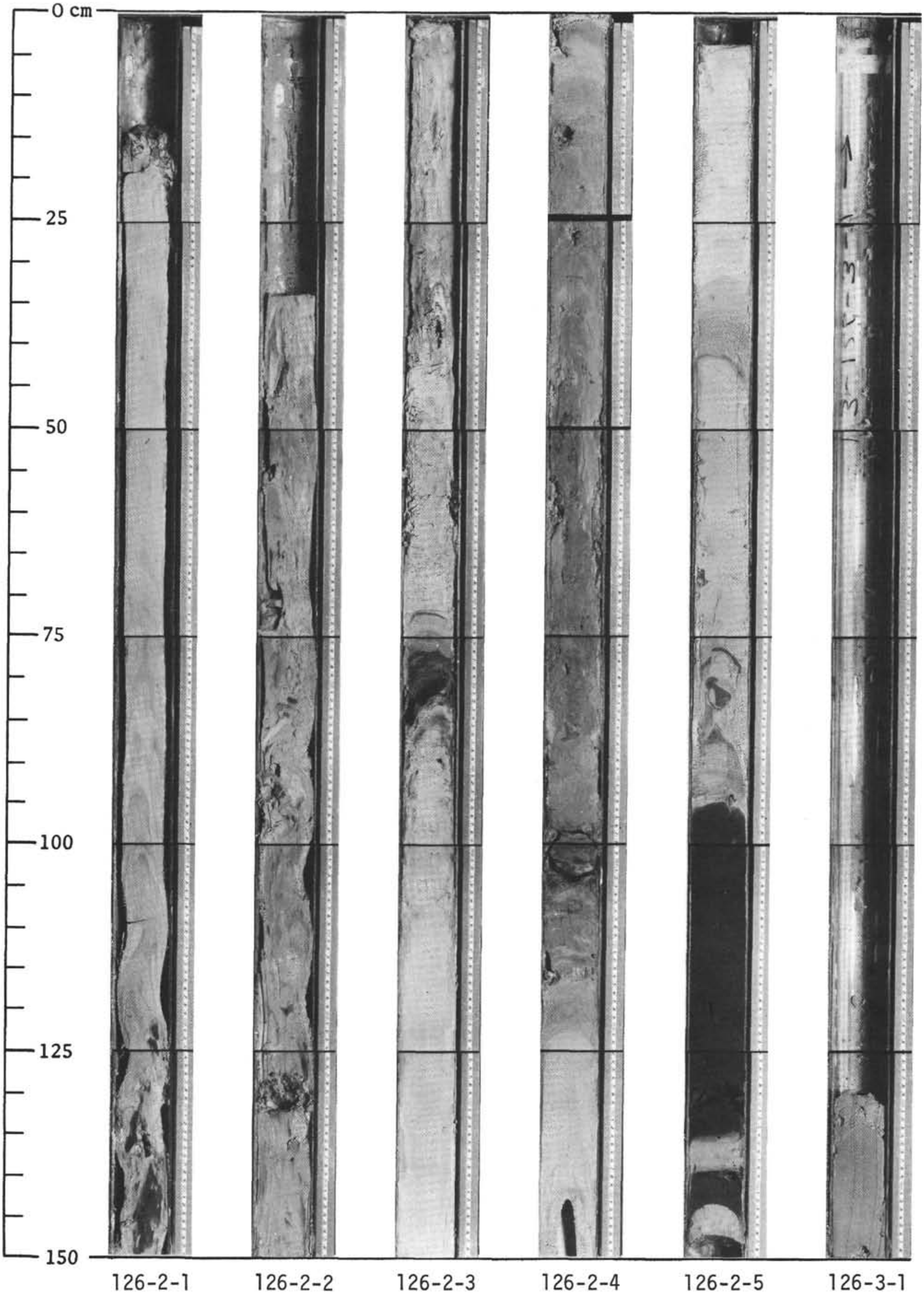
SITE 126 CORE 6 Cored Interval 128-129.4 m

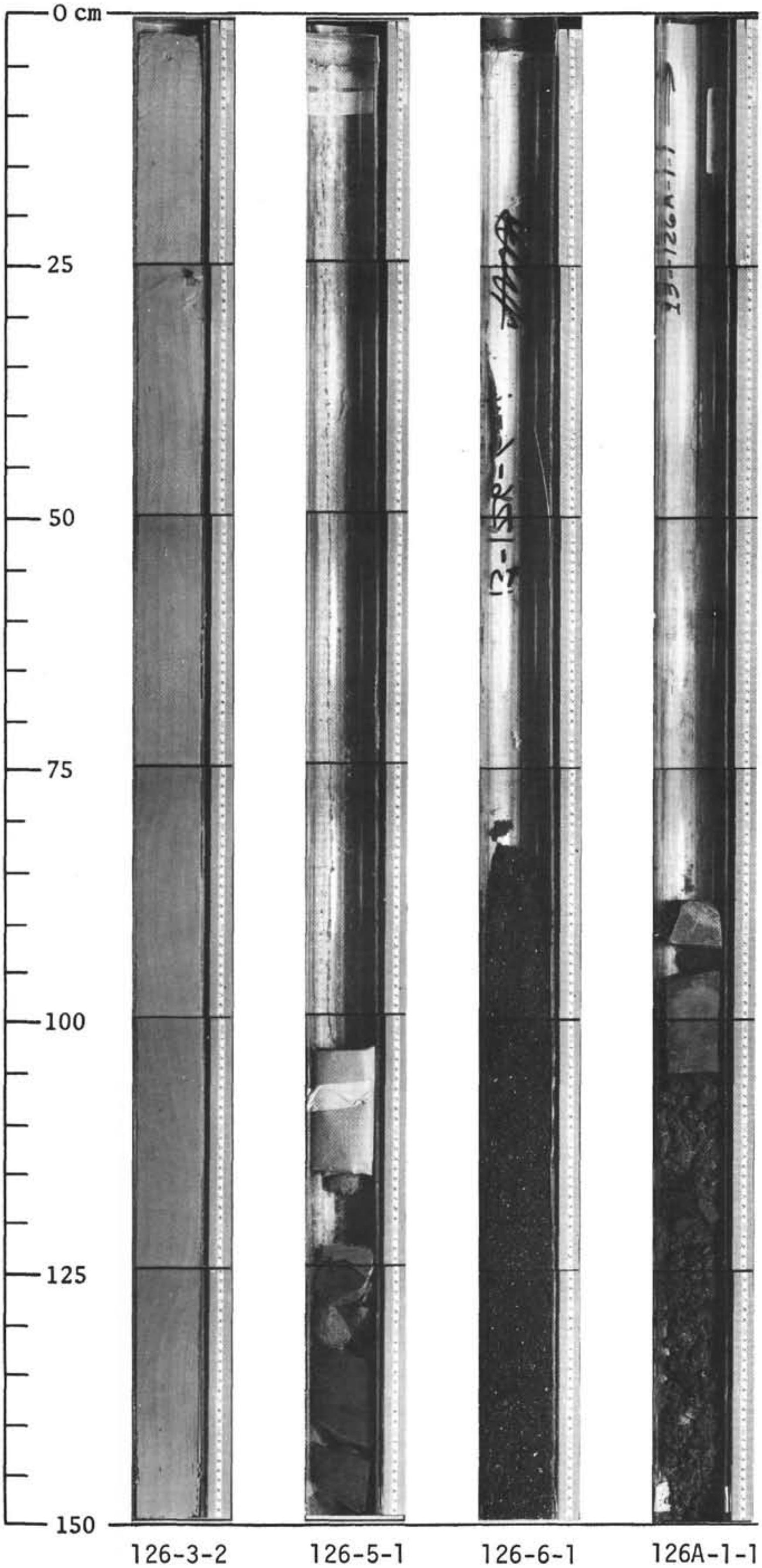
AGE	WET-BULK DENSITY (gm/cc) 1.3 1.6 1.9 2.2 / NATURAL GAMMA RADIATION (10^3 counts) 0.0 0.5 1.0 1.5 2.0	m B. S. FL.	SECTION	LITHOLOGIC SYMBOLS	% $CaCO_3$ (% sand/silt/clay)	LITHOLOGY AND PALEONTOLOGY	DISTURBANCE
MIDDLE MIOCENE Serravallian		128.5 129.4	1 CC	VOID		MARL medium gray (N5) indurated brittle: broken in small pieces by the drilling shell fragments, pteropods, etc. pyrite extremely rare autochtonous foraminifera. Many downhole contaminants no benthonic foraminifera Nannofossil Zone NN8 Total Drilling: 129.4 m in marls.	V

SITE 126A CORE 1A Cored Interval 65-65.9 m

AGE	WET-BULK DENSITY (gm/cc) 1.3 1.6 1.9 2.2 / NATURAL GAMMA RADIATION (10^3 counts) 0.0 0.5 1.0 1.5 2.0	m B. S. FL.	SECTION	LITHOLOGIC SYMBOLS	% $CaCO_3$ (% sand/silt/clay)	LITHOLOGY AND PALEONTOLOGY	DISTURBANCE
MIDDLE MIOCENE Serravallian		65 65.8	1 CC	VOID		MARL very dark gray (N#1) indurated fissile lower part broken in small pieces by the drilling H_2S odor X-rays: quartz, calcite, montmorillonite, kaolinite no autochtonous planktonic foraminifera Nannoplankton Zone NN8 Total drilling: 65.9 m in marls.	V


0 cm
25
50
75
100
125
150
126-1-1
126-1-2
126-1-3
126-1-4
126-1-5
126-1-6


0 cm
25
50
75
100
125
150
126-2-1
126-2-2
126-2-3
126-2-4
126-2-5
126-3-1


0 cm
25
50
75
100
125
150
126-3-2
126-5-1
126-6-1
126A-1-1