8. SITE 170

The Shipboard Scientific Party[1]

SITE DATA

Position:
Latitude: 11°48.0′N;
Longitude: 177°37.0′E.

Geography: In northwest part of central basin.

Water Depth:
5774 meters, by PDR, to derrick floor.
5792 meters, from drill pipe measurement from derrick floor (adopted).

Date Occupied: 12-14 May 71.

Time On Location: 64 hours.

Depth of Maximum Penetration: 196 meters.

Cores Taken: 16.

Total Length of Cored Section: 134 meters.

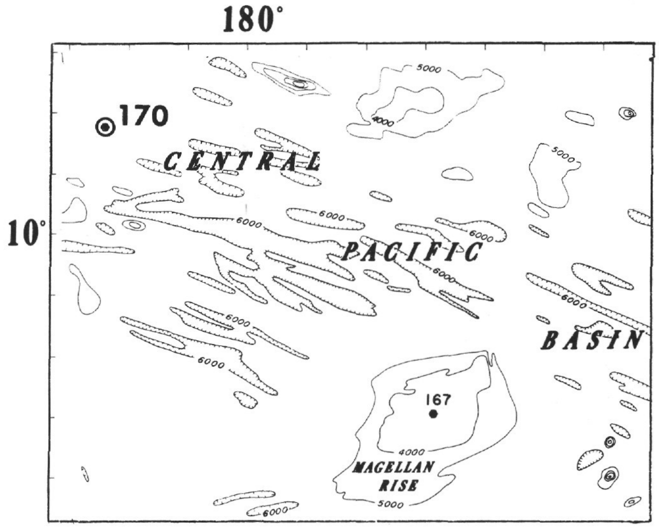
Total Recovery:
Length: 30.7 meters.
Percentage: 22.8.

Percentage of Penetrated Section Cored: 68

Principal Results: At Site 170, the column consists of 20 meters of Oligocene to Quaternary brown radiolarian zeolitic ooze and clay, overlying 172 meters of late Albian to Oligocene cherty ooze, nannofossil ooze, chalk, and limestone resting on basalt. A few centimeters of fractured basalt, in beds of Santonian to Coniacian age, were cored at about 150 meters depth. (See Figure 1.)

BACKGROUND AND OBJECTIVES

After finding sediments no older than 100 m.y. at Site 169, we became increasingly in doubt as to whether the acoustic basement there might correspond to volcanic flows that date the birth of the Marshall Islands, rather than the birth of the crust at a spreading axis. Accordingly, we decided to drill another hole far enough east of the islands that their influence would be unlikely to be felt. It was hoped that another hole would either confirm the suspected effect of the Marshall Islands, or conversely, show that the acoustic basement throughout this part of the basin is younger than has been deduced from extrapolated spreading rates.



The thickness of the sedimentary section in this region is extremely variable, and in only a relatively few places can it be described as consisting of upper transparent, opaque, and lower transparent layers, as is typical of so much of the Western Pacific. The thickest accumulations appear to be ponded in depressions that are typically steep-sided. The section at Site 170 consists of about 0.02 sec of upper transparent and 0.15 sec of combined opaque and lower transparent layers (Figure 2). The site was chosen with strong probability that hard chert layers would be encountered at very shallow depth in the bottom, but the likelihood of finding a thick section of soft sediment was considered to be remote, and the objectives of the hole were deemed to be worth the risk.

OPERATIONS

The site was crossed initially on a course of 045°, reapproached on the reciprocal course, and the beacon was dropped underway (Figure 3). As shown in the profiler record of Figure 2, the site is on a gentle slope on which the sediment cover thickens downhill. A small nonreflective peak interrupts the acoustic layering northeast of the site, a common feature of the region, but the layers and reflectors are quite distinct at the site proper.

The hole was spudded in at 1325 hours on 12 May 71. The sea floor, according to the drill string measurement, was found 18 meters deeper than predicted by corrected echo soundings; the drill string depth of 5792 meters was accepted.

The second core bottomed at a hard layer only 15 meters below sea floor, but sampled only the soft clay and radiolarian ooze above it. The third core barrel was dropped, and the hole was drilled to a depth of 74 meters where it appeared that the hard layers had been penetrated. The sample contained in this barrel was chert chips and a few pieces of moderately hard chalk. From the drilling

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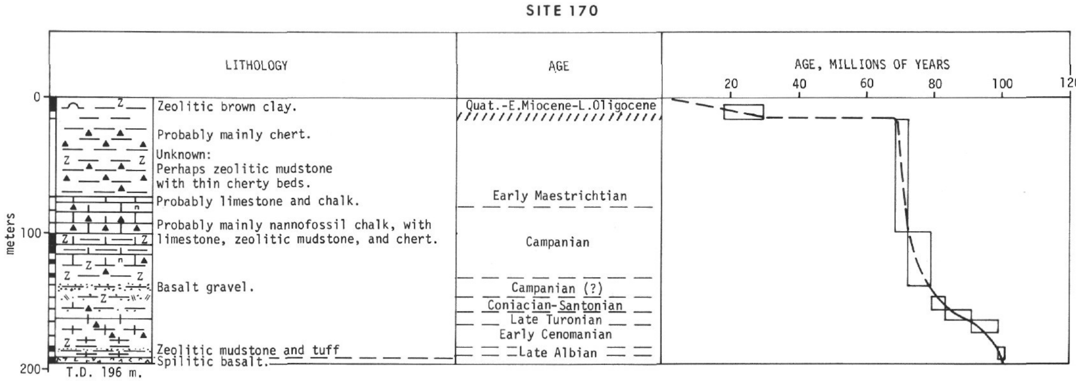


Figure 1. *Graphic log showing lithology, age, and rate of accumulation of sediments at Site 170.*

record we deduced that the chert zone extends from 15 to 69 meters and that the chalk probably came from the interval between 69 and 74 meters. Most of the section below the upper chert zone was penetrated rather easily with the exception of a few cores between 120 and 160 meters which required 2 to 5 minutes per meter to cut. Recovery in four cores of this zone was relatively good, but overall recovery in the hole was very poor.

Pieces of basalt were recovered in Cores 10, 11, and 12 (140-165 m) and possibly came from a thin flow, but more probably from a bed containing fragmented, and possibly displaced, rock. None of the pieces recovered appeared to have been cut by the drill. The lumps of basalt (and of chert) had a strong tendency to wedge themselves in the core catcher and were a big factor in the poor core recovery.

Massive basalt was encountered at 192 meters. As this depth corresponded satisfactorily with the acoustic basement, and as penetration was very slow (only slightly more than 1 m/hr), we decided to abandon the hole after drilling only 4 meters into the layer in order to conserve time for drilling at one more site in the Mid-Pacific Mountains.

BIOSTRATIGRAPHY

At Site 170, the first four cores were drilled and cored through the upper 83 meters of the section. After drilling for 9 meters further, the remainder of the section was cored continuously to basalt basement, however, most of the cores contained only small catcher samples. As at Site 169, sediments overlying basement are of late Albian age.

The small sample in Core 1 contains Quaternary Radiolaria and Quaternary to Cretaceous nannoplankton. This is directly underlain by the highly zeolitic sediments of Core 2 which contain only a few corroded radiolarians of late Oligocene to early Miocene age. Core 3 was taken between 16 and 74 meters below the sea floor and, based on the foraminifera and nannoflora, penetrated most or all of the Maestrichtian. Core 4 may also contain sediment that is of early Maestrichtian age. Cores 5 through 8 contain Campanian calcareous microfossils, with reworked Cenomanian to Albian foraminifera and radiolarians occurring in Core 7. Because of the lack of diagnostic microfossils, Cores 9 and 10 cannot be dated. However, Core 11 contains etched Santonian to Coniacian nannoplankton; thus, Cores 9 and 10 should be of Campanian to Santonian age. Core 12 yields a late Turonian nannoflora. Based on the calcareous flora and fauna, Cores 13 and 14 are early Cenomanian. Core 15 is predominately a volcanic ash but does contain calcareous microfossils of late Albian age. Basalt basement directly underlies this ash.

LITHOLOGIC SUMMARY

Very little sediment was recovered at Site 170, and there was no downhole logging. Consequently, the lithologic column there is not well known. This summary is based on the sediment that was recovered, chiefly as core catcher samples, supplemented by inferences from the drilling record, such as the rate of penetration and the nature of core disturbance.

The most likely reconstruction of the stratigraphic column is as follows:

1) zeolitic brown clay (0-16 m);
2) unknown, probably mainly chert (16-36 m);
3) unknown, perhaps zeolitic mudstone with thin cherty beds (36-39 m);
4) probably limestone and chalk (69-83 m);
5) probably nannofossil chalk and zeolitic mudstone, with limestone near 120 meters, alkali basalt gravel near 140 meters, and thin cherty beds below 148 meters (83-184 m);
6) zeolitic mudstone and tuff (184-192 m);
7) altered tholeiitic basalt (192-196 m).

The uppermost 16 meters is zeolitic brown clay, dominated by phillipsite prisms, commonly twinned, and also containing several percent each of clay minerals, micronodules, and dark glass, as well as some feldspar and palagonite grains and rarer nannofossils, radiolarians, and fish debris. The red brown clay is typical of middle and upper Cenozoic pelagic deposits at similar depths in the Central Pacific.

Only a few kilograms of rock were recovered between 16 and 101 meters depth. The interval between 16 and 36 meters was very hard to drill and undoubtedly is the first main reflector ("upper opaque") on continuous reflection seismic profiles in this region (Figure 2). The inference that it is chert at Site 170 is based on chert fragments in lower cores that probably are cavings, as well as past experience in drilling characteristics and the early Cenozoic age of the unit. Drilling was more rapid between 36 and 69 meters, with a few thin, very hard layers that broke ahead of the bit. That interval may be a soft rock, such as mudstone or ooze, with thin chert stringers.

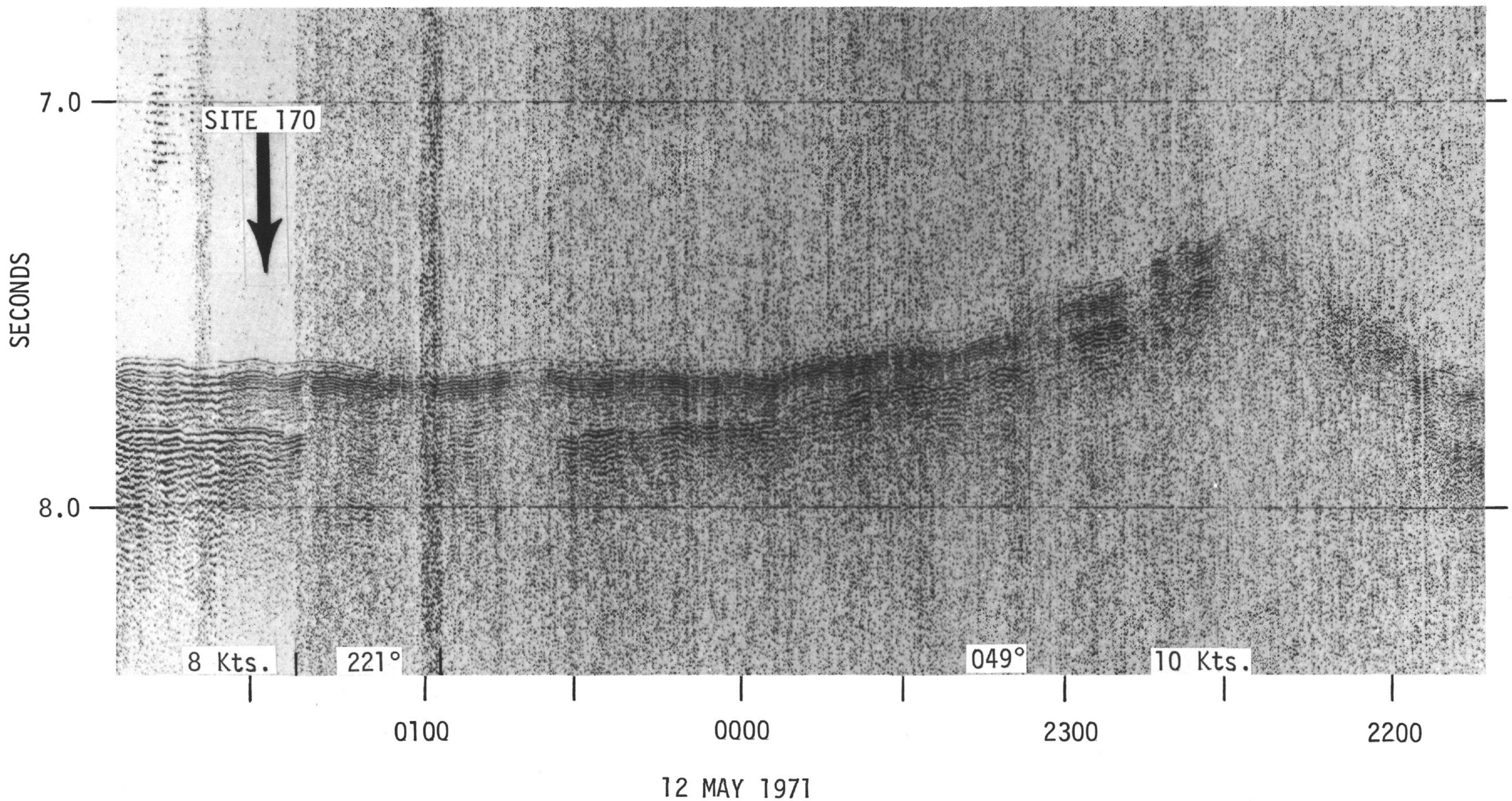


Figure 2. *Seismic profile recorded by* Glomar Challenger *while approaching Site 170.*

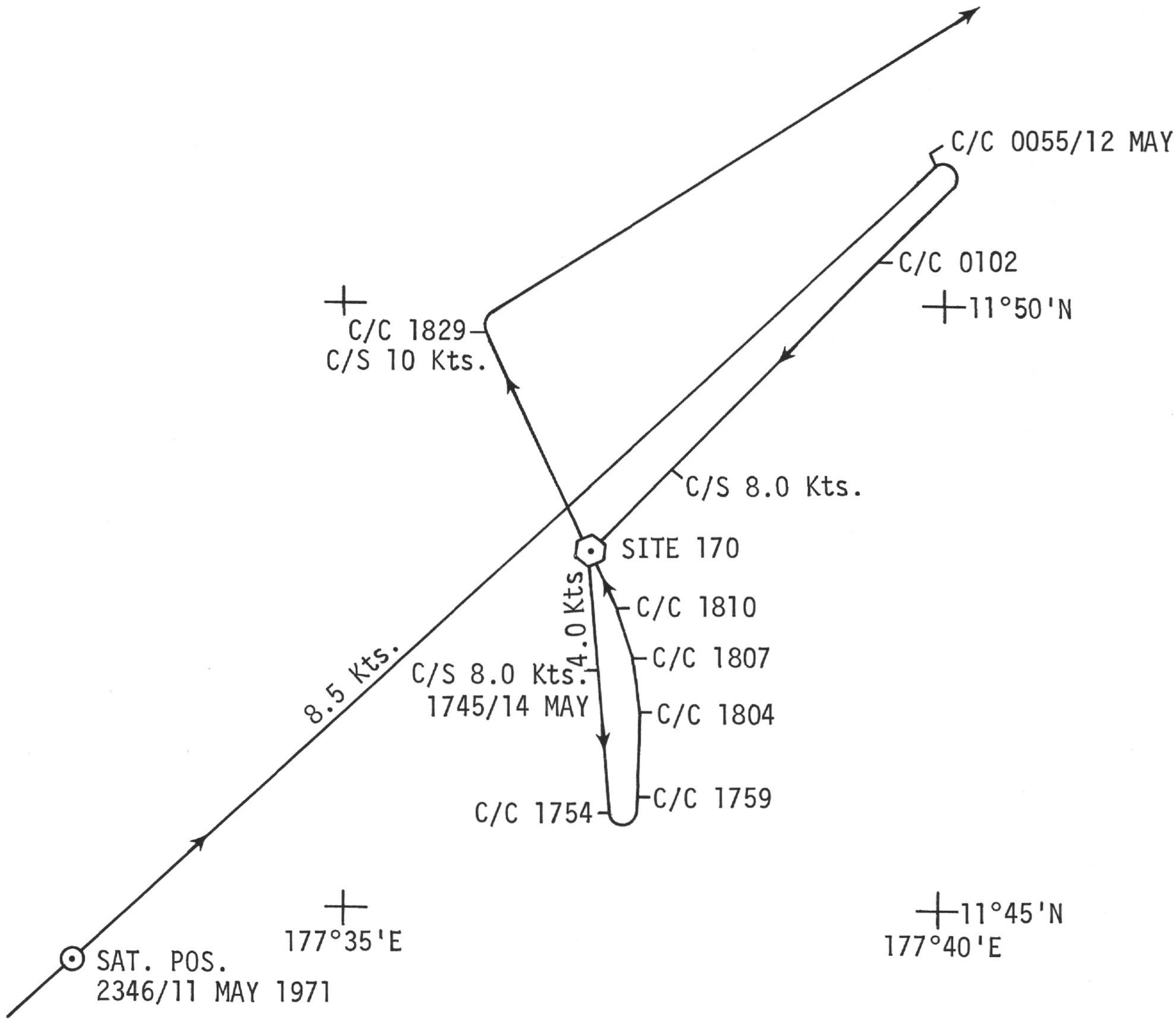


Figure 3. *Track of* Glomar Challenger *in the vicinity of Site 170.*

From 69 to 83 meters depth the drilling rate again was slow. The few samples obtained in the core catchers of Cores 3 and 4 are mainly limestone and firm chalk. The pale orange rocks are aphanitic to very fine grained, composed of nannofossils and microcrystalline inorganic, presumably recrystallized, calcite. A bluish green limestone is partly silicified. Probably this 14-meter thick interval of the uppermost Cretaceous is dominated by similar carbonate rocks.

With the information at hand, it may be best to consider the next 101 meters as one stratigraphic unit. The softer sediments recovered in Cores 5 through 14 range between zeolitic nannofossil chalk or ooze and calcareous zeolitic mudstone or clay. Although the evidence, mainly from Cores 6 and 7, is scanty, apparently the section in place is brown zeolitic mudstone of pelagic origin, interbedded with pink, slightly zeolitic and marly nannofossil chalks of turbidite as well as of pelagic origin. Some of the range of mixtures of calcareous and zeolitic lithologies may have been primary. However, much of that lithologic mixture, and the range in texture from firm lumps to soft homogeneous paste of the samples recovered at this site, is thought to be largely an artifact of the drilling process.

Within this calcareous and zeolitic section a few hard rocks were recovered. Pink limestone was present in Core 8, where there was also a moderate increase in the drilling rate. Two pieces of alkali basalt, each about 6 cm in diameter, were in the core catcher of Core 10. Their internal alteration-banding parallels their outer surfaces, none of which was broken or cut by the bit. Core 10 was cut at a very rapid rate. Almost certainly the basalt was not cored from a flow. Probably it was in a gravel or rubble that had slumped from some nearby eruptive site. Additional limestone pieces were recovered below Core 8 and basalt below Core 10, they may be from other lower beds, but it is more likely they are cavings that could not be circulated out of the hole.

Below 148 meters the drilling rate increased moderately and dusky red and dusky brown chert chips and larger fragments are common in the lower cores, suggesting that there are several thin chert beds or lenses in that part of the zeolitic mudstone and nannofossil chalk unit.

Core 15 recovered volcanogenic sediment. The top of the interval cannot be placed closely because of the minimal recovery in Core 14, and so may be anywhere between 175 and 184 meters. It is placed arbitrarily at the deeper level. The rock grades downward from a light brownish gray zeolitic mudstone characterized by abundant analcime as well as chlorite, magnetite-ilmenite, sparry calcite, and glass, into a bluish gray vitric tuff. Montmorillonite, pyroxene, palagonite, and phillipsite are present throughout. Lamination, and nannofossils, and more than one kind of glass indicate that the deposit is pyroclastic rather than hyaloclastitic, or it may be reworked by bottom currents and slumping from either. Several centimeters of soft pinkish gray nannofossil chalk lie below the tuff.

The lowest unit cored at Site 170 is gray basalt. The top of the basalt probably is at 192 meters, the base of Core 15, as indicated by the considerably slower drilling rate that started there. The few scraps of basalt in the core catcher for Core 15 may have been recovered from the top of the flow, but they resemble the basalt fragments from Core 10 and below, and so may be cavings.

Aside from the uppermost piece of grayish brown chert that probably also caved, Core 16 is wholly basalt. The top 10 cm is aphanitic to fine grained, with the groundmass heavily replaced by celadonite. It has a few subhorizontal calcite veinlets, and calcite and celadonite amygdules. The remainder of the 3 meters cored has less of a greenish shade and is fine grained; maximum length of plagioclase laths is about 1 mm. The rock is mainly celadonite and plagioclase with minor amounts of K-feldspar, montmorillonite, clinopyroxene, maghemite, and pyrite. Amygdules, veinlets, and joints are rare, and neither glassy selvages nor inclusions are present. The rock apparently is a flow rather than a sill because of its fine texture and the seeming lack of alteration of the overlying sediments, but the evidence is poor and not conclusive. On trace element criteria it resembles the tholeiites of oceanic volcanic islands rather than those of spreading ridges.

PHYSICAL PROPERTIES

Densities from the Tertiary brown clay of Core 2 are probably unreliable because of core disturbance; the large discrepancy in densities calculated by different methods may have been caused by some error in measurement procedure. The limestone and mudstones below 100 meters have typical gamma values but somewhat lower densities than usual.

The several different lithologies from the lower part of Site 170 clearly have different physical properties, as shown by Table 1. The zeolitic clay has a much lower GRAPE density and higher gamma count than the nannofossil ooze, as was the case at Site 169. Syringe technique densities of 1.53, 1.50, and 1.54 from the clay are considerably lower than the densities of 1.71, 1.66, 1.73, and 1.78 from the nannofossil ooze. The altered tuff zeolitic mudstone has a similar density to the zeolitic clay, but has a gamma count intermediate between that of the zeolitic clay and nannofossil chalk. The limestone appears to have a lower density and gamma average than the chalk, in contrast to the relationship at other sites. However, because of the small amount of limestone this relationship may be only apparent. Because of the incremental nature of the gamma counting apparatus a 20-cm wide portion of core may be too narrow to give a reliable gamma average. The very low GRAPE density of the limestone may be caused by the small diameter of the limestone pieces.

CORRELATION BETWEEN STRATIGRAPHIC SECTION AND SEISMIC REFLECTION PROFILE

There seems to be no reasonable alternative to the correlation of the shallowest and the deepest reflectors at this site, the former with the uppermost chert and the latter with the basalt at 192 meters (Figure 4). This results in a rather high interval velocity, 2.30 km/sec, for the main layer of the section, but this layer is apparently composed largely of chalks and limestones in which sound velocity measurements on cored samples ranged between 1.8 and 2.8 km/sec.

The upper boundary of the limestone section is not well determined. A drilled interval from 15 to 74 meters (with core barrel in the string) produced a few cobbles of Maestrichtian limestone, and by inference from the drilling record, it appears most likely that these samples came from the lower part of the interval. However, there is no real assurance that they did not come from a shallower level.

The basalt at 150 meters is probably a thin layer, or even an isolated patch of loose cobbles. None of the pieces recovered had been cut by the drill or freshly broken. The dashed line connecting this layer with the seismic section in Figure 4 is, therefore, intended only to indicate its approximate corresponding position in the seismic record. No significant reflector appears at the appropriate depth.

CONCLUSIONS

From the total section of 196 meters drilled at Site 170, only 31 meters were recovered as cores, and more than half of this amount comes from just two cores. We have, therefore, very little material on which to base any conclusions.

The stratigraphic column is made up of three major units:

1) 0 to 19 meters – zeolitic brown clay. This constitutes the acoustically transparent layer seen on the profiler record near the site (Figure 2). The unit is of late Oligocene to early Miocene age at its base, assuming the core catcher sample of Core 2 is from the base of the interval cored. What other ages are represented between this sample and the Quaternary clay sampled at the sea floor is unknown.

The transparent layer is of variable thickness, as seen on the profiler records, and at Site 170 is slightly thinner than it is at a few places about 10 miles southwest of the site.

2) 19 to 69 meters – unknown lithology, but probably cherty in the upper 20 meters and softer claystone below. The top of this unit was marked by an increase in drilling difficulty and is believed to correspond to the top of the first strong reflector in the profiler records. Elsewhere in the region, this is a cherty interval in the upper or middle Eocene.

TABLE 1
Physical Property Variations with Lithology Changes

Core-Section	Interval Sampled	Gamma Average	Grape Density	Interval Sampled	Gamma Average	Grape Density	Interval Sampled	Gamma Average	Grape Density	Interval Sampled	Gamma Average	Grape Density
6-4	72-123	1100	1.44-1.51		200	1.62-1.67	0-18,					
6-5	83-100	900	1.47-1.54	0-83, 100-150	300	1.57-1.72	131-550					
6-6	115-135	950	1.48-1.52	66-115, 135-150	300	1.58-1.75						
7-2				0-150	225	1.60-1.67						
7-3	30-74	1225	1.48-1.56	0-30 74-150	325	1.60-1.70						
8-1	44-131	975	1.38-1.45	18-22, 24-44	225	1.55-1.59	0-18, 131-150	0	1.40-1.52			
15-1										0-150	550	1.40-1.58
15-2				135-150	250	1.72-1.75				16-135	450	1.44-1.48

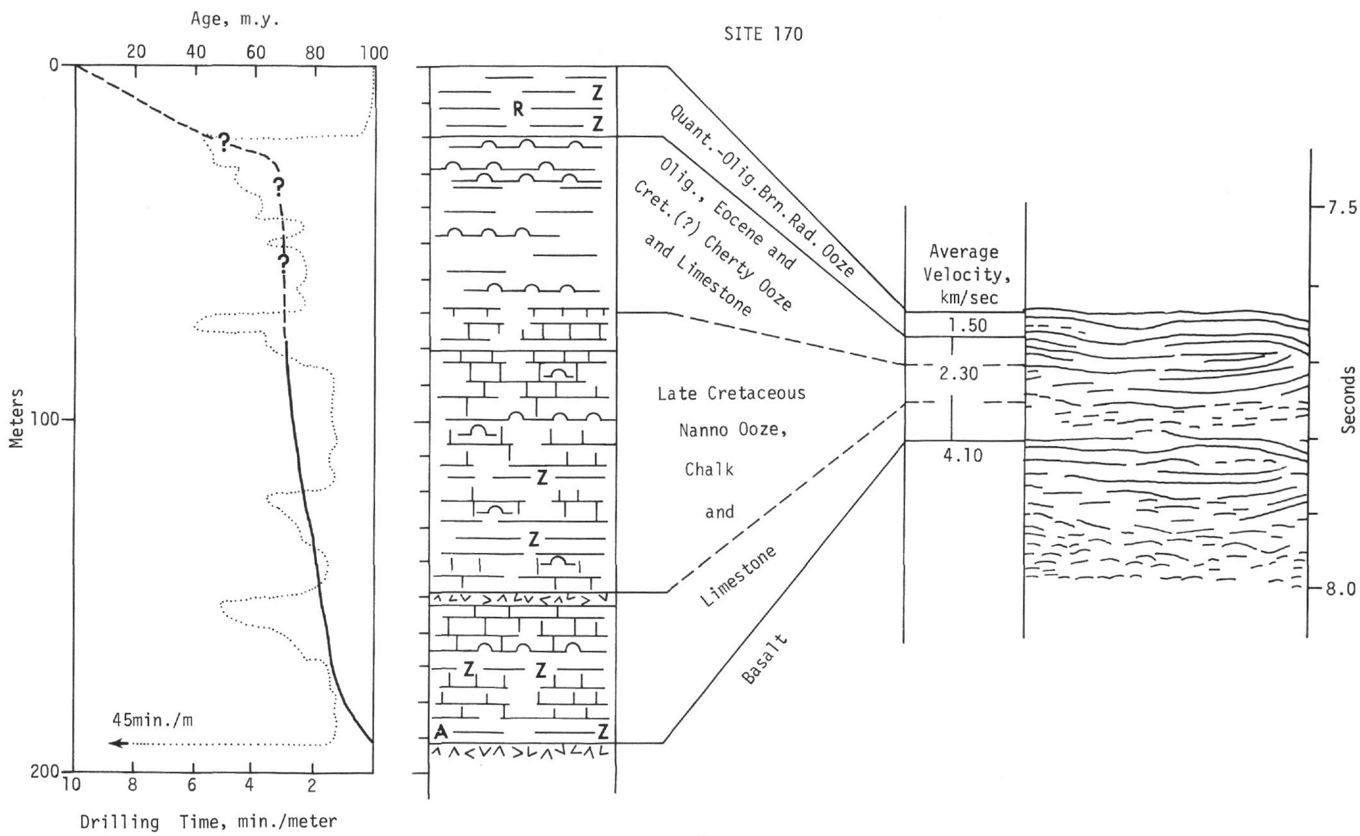


Figure 4. *Correlation of lithology, seismic stratigraphy, drilling rates, and sediment accumulation rates at Site 170.*

3) 69 to 192 meters – cherty chalk and limestone, zeolitic mudstone; with cherty beds below 148 meters, a layer of basalt gravel (?) near 140 meters, and tuffaceous beds in the lowest 8 meters. The unit ranges in age from late Albian to early Maestrichtian. The average velocity of sound through the interval is 2.30 km/sec, and the unit shows mainly as a rather transparent layer between the upper "opaque" layer near the top of unit (2) and the deepest reflector in the profiler records.

The occurrence of carbonate-rich sediments at such a great depth (5800 m) poses the problem of the relative rates of subsidence and changing calcium carbonate compensation depths. Evidence of size sorting and reworking of older foraminifera in Campanian strata suggest that at least some of the calcareous material may be displaced from shallower sites, and this is supported by color and size-graded beds in the same part of the section. Over most of the upper Cretaceous, the amount of material recovered in the cores is too small to see much in the way of sedimentary structures that might indicate the presence of turbidite layers.

The occurrences of foraminifera and nannofossils suggest that the sea floor at Site 170 lay at or just below the compensation depth for calcium carbonate during the early Campanian, but was shallower than this depth at other times during the late Cretaceous and Albian. Whether the site was ever above the lysocline for planktonic foraminifera is moot in view of the possibility of displaced faunas. Nonetheless, the abundance of foraminifera in the Maestrichtian suggests that the sea floor may have been above the lysocline at that time.

It was hoped that Site 170 would clear up the problem about crustal ages that vexed us at Site 169, and some care was expended in locating Site 170 in a "normally" deep region, away from a large chain of seamounts. The only things unusual in the reflection records near Site 170 are the relative smoothness of the deepest reflector as compared to regions east of the Line Islands, and the presence of a peculiar "blank spot" in the seismic record (Figure 3a) about 2 miles northeast of the site, which might represent a buried hill or an intrusive body.

As shown on the regional bathymetric chart (in pocket), Site 170 lies within the region of northwest-trending bathymetric features, in fairly deep water. These trends were not known to the scientific party at the time of the drilling.

The age of the oldest sediments at the site is the same as that obtained at Site 169. The thickness of Cretaceous sediments is about the same at the two sites, and the sediments are notably calcareous at both places, but the sediments at Site 170 are more calcareous. The resemblance between the two sites goes even further: the basalt cobbles at Site 169 occur at about the same place (Santonian-Campanian) as the volcanogenic siltstone (Turonian-Campanian) beneath the diabase sill at Site 169. In short, the story at Site 169 is similar to that at Site 170, and we are no closer to resolving the question of whether the "basement" basalt is new crust, created at a rise crest, or is part of a flood of mid-Cretaceous volcanics that buried parts of the central basin. If Sites 169 and 170 are on new crust, then their near identity of ages and their closely similar history of sedimentation and subsidence should place them nearly along an isochron of any new pattern of sea-floor spreading. A fuller discussion of these problems is found in the chapter on Regional Interpretations.

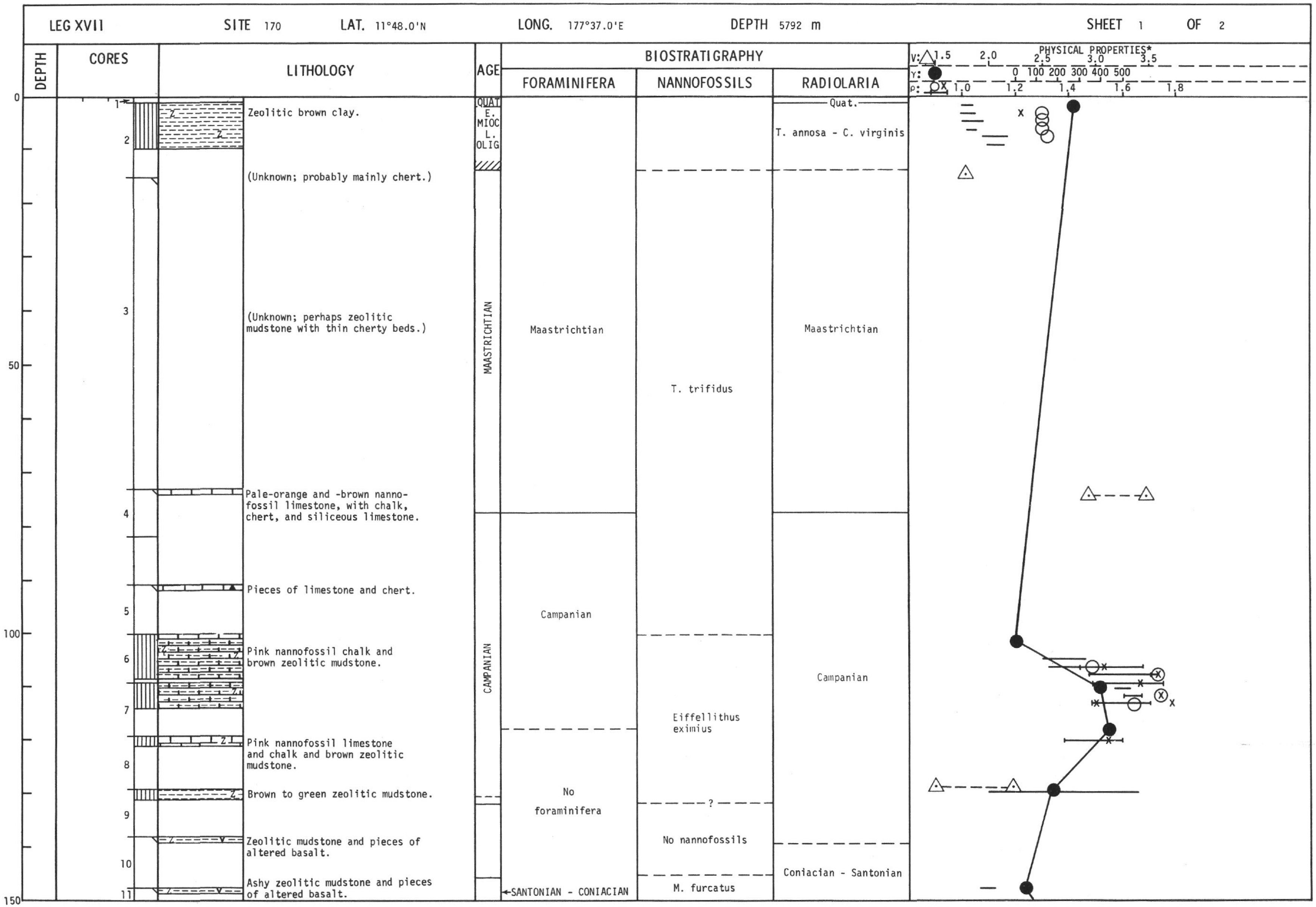
APPENDIX A
Core Inventory – Site 170

Core	Depth Below Sea Floor (m) Top	Depth Below Sea Floor (m) Bottom	Total Depth[a] (m) Top	Total Depth[a] (m) Bottom	Cored (m)	Recovered (m)	Lithology	Age
1	0	1	5792	5793	1	Tr	Zeolitic brown clay	Quaternary
2	1	15	5793	5807	14	9	Zeolitic brown clay	Late Oligocene
3	15	74	5808	5866	[59]	CC	Pale orange and brown nannofossil limestone, with chert and chalk	Early Maastrichtian to Late Campanian
4	74	83	5866	5875	9	CC	Pale orange and brown nannofossil limestone, with chert and chalk	Early Maastrichtian to Late Campanian
5	92	101	5884	5893	9	CC	Limestone and chert	Late Campanian
6	101	110	5893	5902	9	8.2	Pink nannofossil chalk and brown mudstone	Middle to Early Campanian
7	110	120	5902	5912	10	3.9	Pink nannofossil chalk and brown mudstone	Middle to Early Campanian
8	120	129	5912	5921	9	1.5	Pink nannofossil chalk and brown mudstone	Middle to Early Campanian
9	129	138	5921	5930	9	2	Brown to green zeolitic mudstone	?
10	138	148	5930	5940	10	CC	Zeolitic mudstone and altered basalt	Campanian
11	148	157	5940	5949	9	CC	Zeolitic mudstone and altered basalt	Coniacian to Santonian
12	157	165	5949	5957	8	CC	Chalk and clay, with pieces of chert and basalt	Late Turonian
13	165	175	5957	5967	10	CC	Chalk paste with pieces of chert	Cenomanian
14	175	184	5967	5976	9	CC	Chalk paste with pieces of chert	Cenomanian
15	184	192	5976	5984	8	3	Calcareous zeolitic mudstone, vitric tuff, and pink chalk	Late Albian
16	192	196	5984	5988	4	3	Altered basalt	

[a]Measured from the derrick floor.

APPENDIX B
Physical Properties – Site 170

Core Section	Section Weight Wet Bulk Density (g/cc)	GRAPE: Wet Bulk Density Total Range (g/cc)	GRAPE: Wet Bulk Density Undisturbed (g/cc)	GRAPE: Assigned Grain Density (g/cc)	GRAPE: Porosity Total Range (%)	GRAPE: Porosity Undisturbed (%)	Syringe: Interval Sampled (cm)	Syringe: Wet Bulk Density (g/cc)	Syringe: Grain Density (g/cc)	Syringe: Porosity (%)	Natural Gamma Radiation: Total Count	Natural Gamma Radiation: Net	Sonic Velocity: Interval Sampled (cm)	Sonic Velocity: (km/sec)
2-1		1.10-1.14		2.75	93.2-95.5						1825	275		
2-2	1.30	1.10-1.15		2.75	92.6-95.5		11	1.22	1.79	74.5				
2-3	1.30	1.10-1.18		2.75	90.9-95.5									
2-4	1.30	1.12-1.15		2.75	92.6-94.4									
2-5	1.32	1.08-1.17		2.75	91.5-96.7									
2-6		1.10-1.16		2.75	92.1-95.5									
3-CC														1.75-1.82
4-CC														2.94-3.48
6-1											1500	0		
6-3		1.30-1.46		2.71	74.1-83.6									
6-4	1.49	1.32-1.67	1.44-1.67	2.71	61.6-82.4	61.6-75.3	90	1.53	2.65	68.6				
6-5	1.72	1.47-1.72	1.47-1.72	2.71	58.7-73.5	58.7-73.5	107	1.71	2.53	54.2				
6-6		1.48-1.75	1.48-1.75	2.71	56.9-72.9	56.9-72.9	104	1.66	2.41	54.2				
7-1		1.51-1.63		2.71	64.0-67.6									
7-2	1.74	1.60-1.67	1.60-1.67	2.71	61.6-65.8	61.6-65.8	16	1.73	2.62	55.9	1900	400		
7-3	1.64	1.48-1.70	1.48-1.70	2.71	59.9-72.9	59.9-72.9	8	1.78	2.64	53.2				
							42	1.50	2.26	61.5				
8-1		1.38-1.59	1.38-1.59	2.75	67.2-79.3	67.2-79.3	80	1.54	2.29	59.5	2200	425	8	1.87-2.06
													12	2.00-2.22
													40	1.53
													68	1.50
9-1		1.10-1.65		2.75	63.7-95.5						1600	175		
11-1		1.07-1.12		–							1400	50		
15-1		1.40-1.58		2.71	67.0-77.6						1800	450		
15-2		1.44-1.75		2.71	56.9-75.3									
16-1		1.83-1.97	1.83-1.97								1950	675	53	4.07
16-2		1.85-1.96	1.85-1.96										131	4.01-4.22

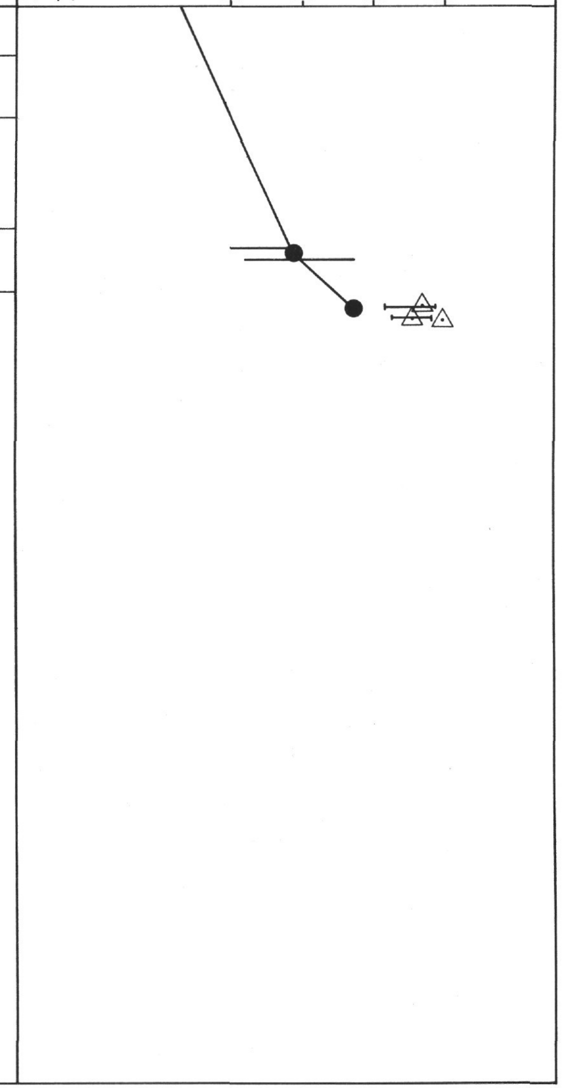


LEG XVII
SITE 170
LAT. 11°48.0'N
LONG. 177°37.0'E
DEPTH 5792 m
SHEET 1 OF 2
DEPTH
CORES
LITHOLOGY
AGE
BIOSTRATIGRAPHY
FORAMINIFERA
NANNOFOSSILS
RADIOLARIA
PHYSICAL PROPERTIES*
V: 1.5 2.0 2.5 3.0 3.5
Y: 0 100 200 300 400 500
ρ: 1.0 1.2 1.4 1.6 1.8
0
50
100
150
1
2
3
4
5
6
7
8
9
10
11
Zeolitic brown clay.
(Unknown; probably mainly chert.)
(Unknown; perhaps zeolitic mudstone with thin cherty beds.)
Pale-orange and -brown nannofossil limestone, with chalk, chert, and siliceous limestone.
Pieces of limestone and chert.
Pink nannofossil chalk and brown zeolitic mudstone.
Pink nannofossil limestone and chalk and brown zeolitic mudstone.
Brown to green zeolitic mudstone.
Zeolitic mudstone and pieces of altered basalt.
Ashy zeolitic mudstone and pieces of altered basalt.
QUAT
E. MIOC
L. OLIG
MAASTRICHTIAN
CAMPANIAN
Maastrichtian
Campanian
No foraminifera
←SANTONIAN - CONIACIAN
T. trifidus
Eiffellithus eximius
?
No nannofossils
M. furcatus
Quat.
T. annosa - C. virginis
Maastrichtian
Campanian
Coniacian - Santonian

LEG XVII SITE 170 LAT. 11°48.0'N LONG. 177°37.0'E DEPTH 5792 m SHEET 2 OF 2

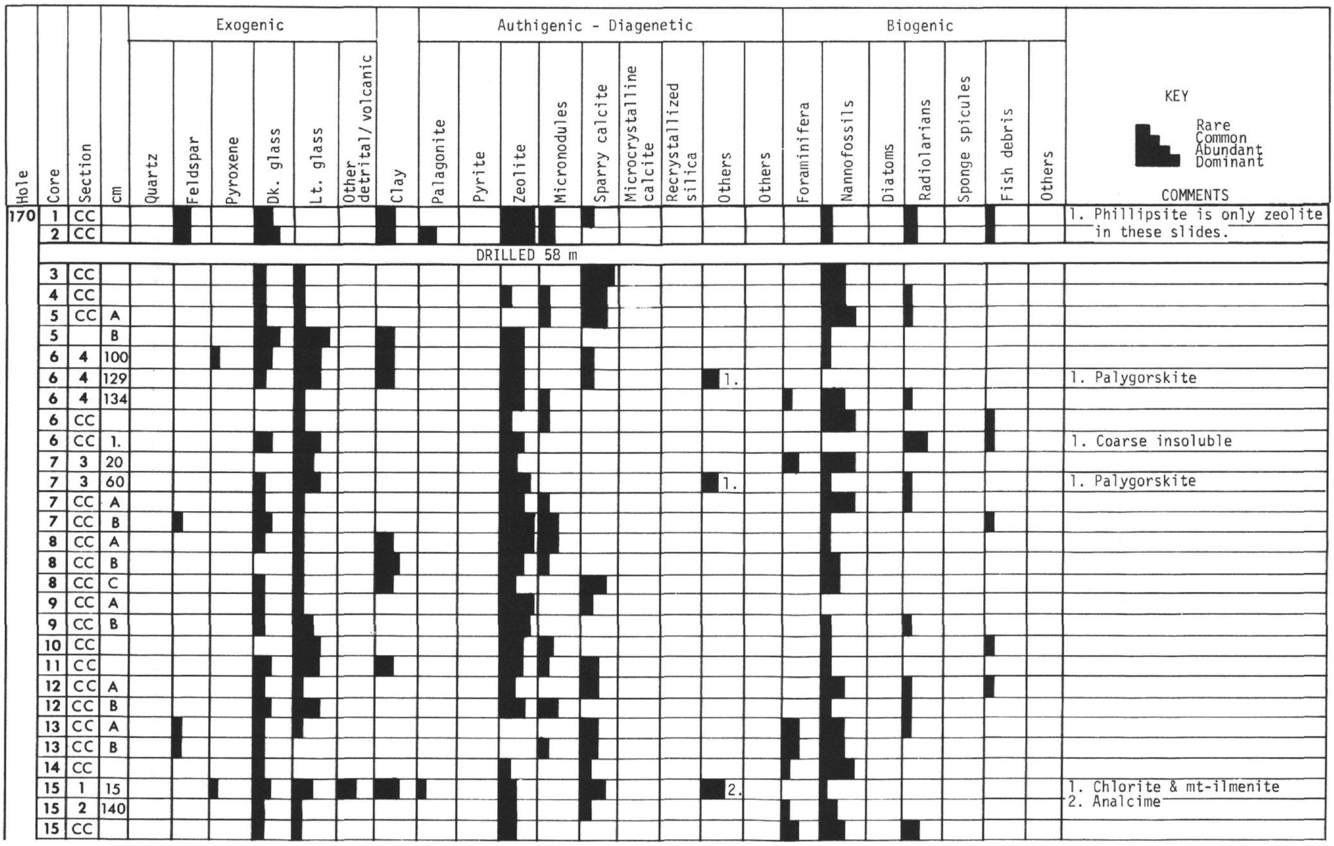
DEPTH	CORES	LITHOLOGY	AGE	FORAMINIFERA	NANNOFOSSILS	RADIOLARIA
150	11		CON. SANT	?	M. furentus	Coniac. - Santon.
	12	Chalk and clay with pieces of chert and basalt.	LATE TURON		M. decussata	Late Turonian
	13	Chalk paste with pieces of chert.	CENOMAN.	?E. CENOMAN.	Lithrapidites alatus	Cenomanian
	14	Chalk paste with pieces of chert.				
	15	Light brown gray calcareous zeolitic mudstone grading down to light blue gray vitric tuff over thin pink chalk.	LATE ALBIAN		E. turriseiffelli	Late Albian
	16	Basalt; few veins and amygdules; strongly altered.				
200	T.D. 196 m					

PHYSICAL PROPERTIES*



SITE 170

SMEAR SLIDE SUMMARY



Site 170 Hole Core 1 Cored Interval: 0 to 1 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
QUATER-NARY		f n r	B R P	 P P	Core Catcher			?	*	Zeolitic Brown Clay

Site 170 Hole Core 2 Cored Interval: 1 to 15 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
LATE OLIGOCENE-EARLY MIOCENE					1	0.5 1.0				Sections 1, 3, 5, and 6 not opened.
		r	B		2					Zeolitic Pelagic Clay: Dark reddish brown (5YR 2.5/2); thoroughly disturbed
					3					
		r	B		4					
					5					
					6					
		f n r	B B R	 P	Core Catcher				*	

Explanatory notes in Chapter 1

Site 170 Hole Core 3 Cored Interval: 15 to 74 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
1	2	f n r	B A R	 M P	Core Catcher				*	Pieces of: Nannofossil Limestone: Pale orange (10YR 7-8/2); and Chert: Brown. Note: Interpretation of drillers' log indicates that these hard lithologies probably were between 69 and 74 m in depth.

[1] MAESTRICHTIAN
[2] Tetralithus trifidus

Site 170 Hole Core 4 Cored Interval: 74 to 83 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
1	T. trifidus	n r	C B	M	Core Catcher				*	Pieces of: Limestone: Pale brown (10YR 7/3); very fine-grained; Cherty Limestone: Pale bluish green (5BG 8/2); and Chert: Brown.

[1] E. MAESTRICHTIAN-L. CAMPANIAN

Site 170 Hole Core 5 Cored Interval: 92 to 101 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
1	T. trifidus	n r	A B	M	Core Catcher				* *	Pieces of: Nannofossil Limestone: Pale brown (10YR 7/2) and greenish white (5GY 9/1); some chips of Chert: Browns (largest, 5 cm diam., is 5YR 3/2); mainly <1cm.

1 LATE CAMPANIAN

Explanatory notes in Chapter 1

Site 170 Hole Core 6 Cored Interval: 101 to 110 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE TO EARLY CAMPANIAN	Eiffellithus eximius				1	0.5, 1.0				Sections 1 and 3 not opened.
					2					Section 2 was watery; when opened nearly all flowed out.
					3					
		n	A	G	4			?	* * *	Top of Section 4 a slurry of clay and chalk lumps. 80 to 136 cm Zeolitic Calcareous Brown Clay Brown (7.5YR 5/4); slightly mottled; to 136 to 150 cm Zeolitic Nannofossil Chalk; Pinkish white (5YR 9/1) to pinks and purplish to greenish whites; a few mottles and distinct contacts toward base. Palygorskite common.
		n	A	G	5			? ? ?		0 to 84 cm Zeolitic Nannofossil Chalk; same as Sect. 4 84 to 120 cm Zeolitic Calcareous Brown Clay; same as Sect. 4 120 to 150 cm Zeolitic Nannofossil Chalk; same as Sect. 4
		n	A	M	6		VOID			70 to 150 cm Zeolitic Nannofossil Chalk; same as Sect. 4 (less zeolitic at base)
		f n r	R B	P	Core Catcher				*	Zeolitic Nannofossil Chalk; same as Sect. 4

Explanatory notes in Chapter 1

Site 170 Hole Core 7 Cored Interval: 110 to 120 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE TO EARLY CAMPANIAN	Eiffellithus eximius				1	0.5, 1.0	VOID			Zeolitic Nannofossil Chalk and Brown Clay: Homogenized in lumps and blotches of pink (7.5YR 8/4) to brown (7.5YR 4/4).
		r n	F A	P M	2					0 to 40 cm same as Sect. 1 40 to 150 cm Nannofossil Chalk: Pinkish-white (5YR 9/1); foraminiferal; in Brown Clay. Possible turbidite bed.
		n	A	M	3				* *	0 to 30 cm Nannofossil Chalk same as Sect. 2 30 to 75 cm Zeolitic Brown Clay: Brown (7.5YR 4/4); no structures. 75 to 150 cm Nannofossil Chalk: Pink (7.5YR 8/4); faintly mottled white and light brown; zeolitic.
		f n r	A R	M P	Core Catcher				* *	Same as Sect. 1.

Site 170 Hole Core 8 Cored Interval: 120 to 129 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
MIDDLE TO EARLY CAMPANIAN	Eiffellithus eximius	n	C	M	1	0.5, 1.0				Limestone and Chalk: Pink (7.5YR 7/4), rare whitish to greenish spots in pieces at top and bottom Section 1, and Pelagic Brown Clay: Brown (7.5YR 4/4); moderately firm.
		f n r	B F R	P P	Core Catcher				* * *	Core catcher has pieces of Nannofossil Chalk: Pale brown; firm, and Zeolitic Mudstone: Brown and pale green; soft

Explanatory notes in Chapter 1

Site 170 Hole Core 9 Cored Interval: 129 to 138 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
M. TO E. CAMPANIAN	Eiffellithus eximius				1	0.5 1.0				Section 1 watery; not opened
		f n	B R	P	Core Catcher				* *	Zeolitic Mudstone: Brown to green

Site 170 Hole Core 10 Cored Interval: 138 to 148 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
CAMPANIAN		f n r	B B C	P	Core Catcher				*	Zeolitic Mudstone: Pink (7.5YR 7/4); thoroughly churned, and containing two pieces of altered basalt, which show no fresh fractures or cuts by drill.

Site 170 Hole Core 11 Cored Interval: 148 to 157 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
SANTONIAN-CONIACIAN	Marthasterites furcatus				1	0.5 1.0				Section 1 watery; not opened.
		f n r	B C F	P P	Core Catcher				*	Zeolitic Mudstone: Pink (7.5YR 7/4); ashy; calcareous (nannofossils); with four pieces (cavings?) of Basalt: Black (N2); vesicular; altered; angular, but no freshly cut or freshly broken surfaces.

Explanatory notes in Chapter 1

Site 170 Hole Core 12 Cored Interval: 157 to 165 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
L. TURONIAN	M. decussata	f n r	B C R	M P	Core Catcher				* *	Churned Zeolitic Nannofossil Chalk and Zeolitic Calcareous Claystone: Generally brown (7.5YR 5/4) for major component, containing pieces of: Basalt: Black (N1 to N2); cavings ?; Chert: Dusky brown (5YR 2/2); glassy and chonchoidally fractured; and Silicified Claystone: Browns to pinks.

Site 170 Hole Core 13 Cored Interval: 165 to 175 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
1	L. alatus	f n r	R A F	M M M	Core Catcher				* *	Foraminiferal Nannofossil Chalk: Churned paste of pinkish white to pale brown; with fragments of Chert: Dusky red (2.5YR 3/2), with red (2.5YR 4/8) and light brownish gray (2.5Y 6/2) bands and streaks.

[1] CENOMANIAN

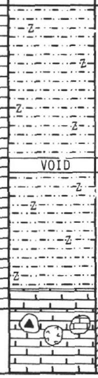
Site 170 Hole Core 14 Cored Interval: 175 to 184 m

AGE	ZONE	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
1	L. alatus	f n r	F A R	P M P	Core Catcher				*	Nannofossil Chalk: Churned paste of white (N9), with several fragments of Chert: Mainly dusky yellowish brown (10YR 2/2).

[1] CENOMANIAN

Explanatory notes in Chapter 1

Site 170 Hole Core 15 Cored Interval: 184 to 192 m

AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
LATE ALBIAN	Eiffellithus turriseiffeli	n r	F B	M	1	0.5 1.0			*
		r n	C A	M M	2		VOID		* *
		n r	A F	M P	Core Catcher				*

LITHOLOGIC DESCRIPTION

Zeolitic Mudstone:
Light brownish gray (5YR 5/1) analcime- and calcite-rich; grading down into:

70 to 150 cm; Zeolitic Mudstone and Vitric Tuff:
Light brownish to bluish gray (5YR 5/1 to 5B 7/1); less zeolitic, and some thin laminations toward base.

15 to 135 cm; Zeolitic Mudstone and Vitric Tuff

135 to 150 cm
Nannofossil Chalk:
Pinkish gray (5YR 8/1) with spots of other tints.

Core Catcher has cavings of Chert, Basalt, and Limestone, in a paste of pink Nannofossil Chalk.

Site 170 Hole Core 16 Cored Interval: 192 to 196 m

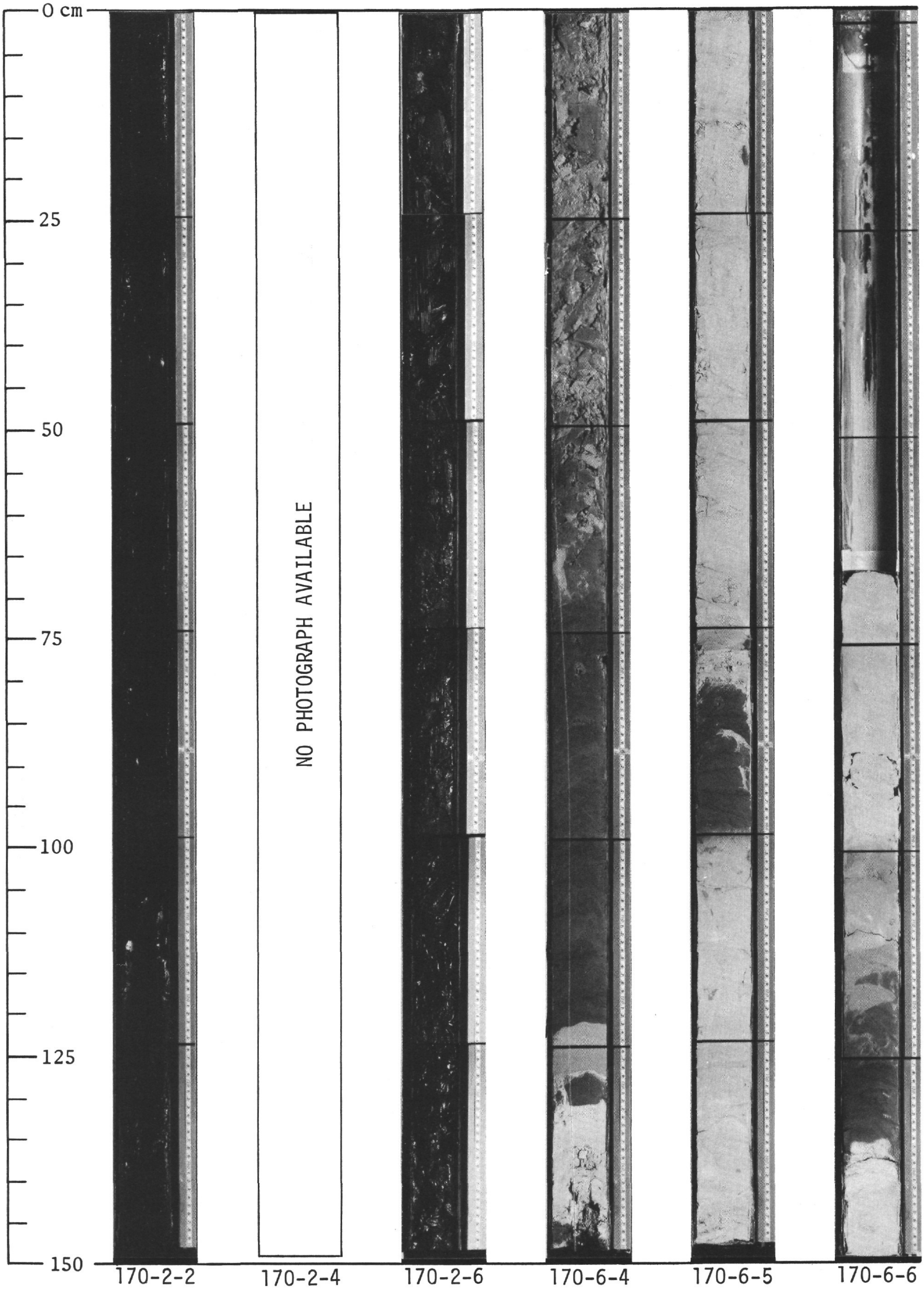
AGE	ZONE	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE
					1	0.5 1.0		?	
					2				
					3				

LITHOLOGIC DESCRIPTION

Piece of Chert:
Grayish brown (5YR 3/2), loose, *on top of*:

Basalt:
Dark gray (N3) to greenish black (5GY 2/1); some calcite and celadonite amygdules in upper part. Strongly altered.

Explanatory notes in Chapter 1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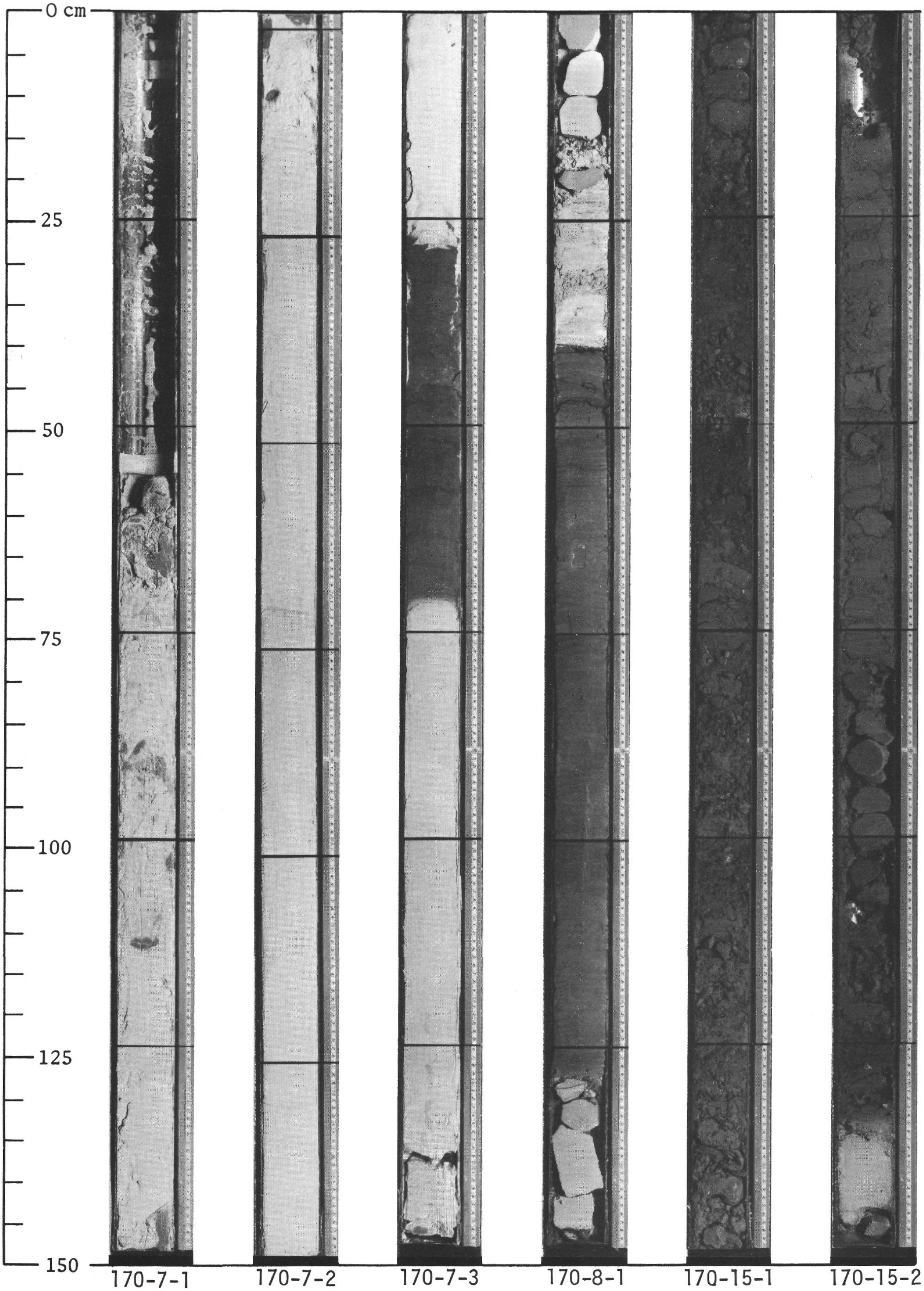
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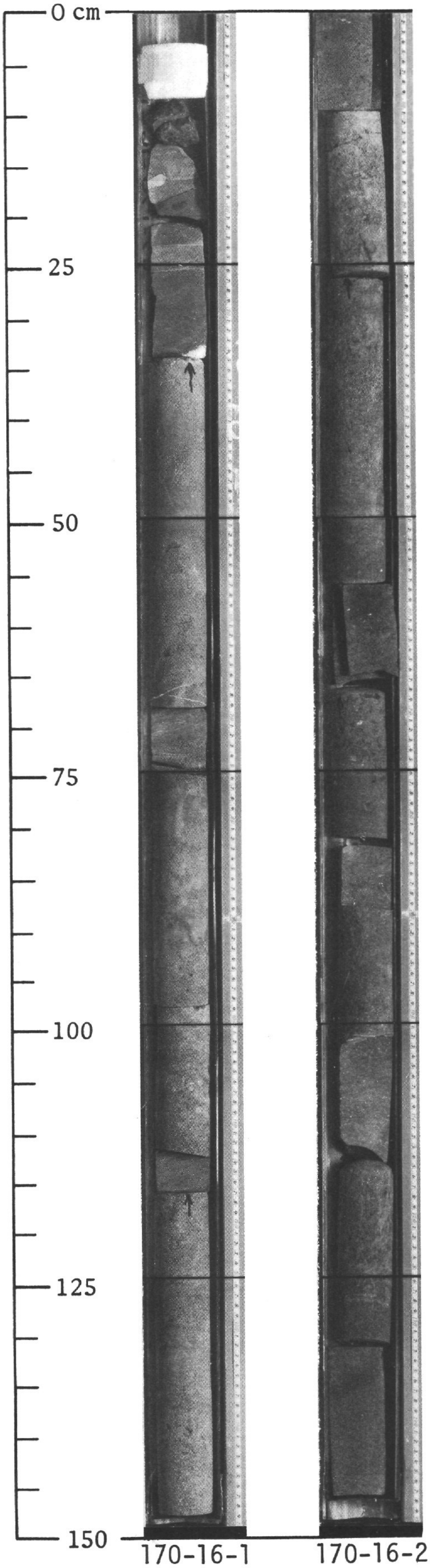
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