7. SITE 169

The Shipboard Scientific Party[1]

SITE DATA

Position:
Latitude: 10°40.2′N
Longitude: 173°33.0′E.

Geography: At west edge of central basin, about 300 km E of Mejit Island in the Marshall Island Chain. About 7 km SW of Site 168.

Water Depth:
PDR, to derrick floor: 5391 meters
Adopted: 5407 meters.

Date Occupied: 8-10 May 71.

Time On Location: 65 hours, 30 minutes.

Depth of Maximum Penetration: 246 meters.

Cores Taken: 12.

Total Length of Cored Section: 96 meters.

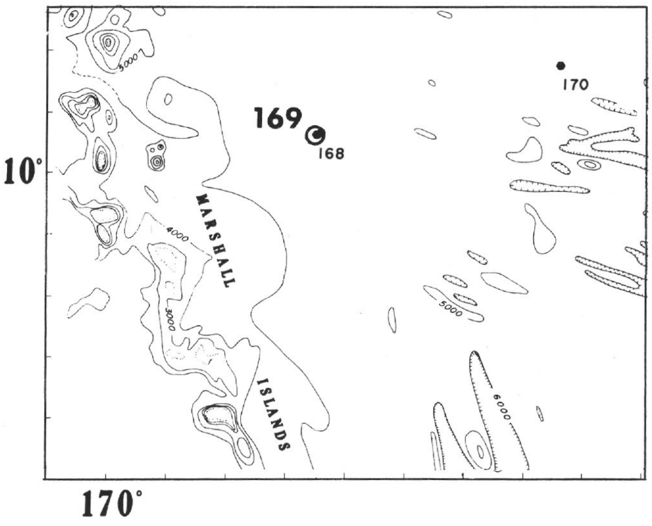
Total Recovery:
Length: 12.4 meters
Percentage: 12.9.

Percentage of Penetrated Section Cored: 39.

Principal Results: At Site 169 the section begun at Site 168 was completed. The upper unit of the column (unsampled at 169), probably all of Tertiary age, consists of 79 meters of brown zeolitic clay, interbedded in its lower half with chert layers. This overlies a unit comprising 122 meters of zeolitic claystone and chert, ashy near the base, and intruded by a 10-meter-thick sill of diabase a few meters above the base. This unit ranges in age from Cenomanian or Turonian to at least middle Maestrichtian. Next below is 36 meters of late Albian to Cenomanian or Turonian cherty nannofossil chalk resting on extrusive basalt. (See Figure 1.)

BACKGROUND AND OBJECTIVES

Site 169, thought at the time of drilling to be located in the Clarion-Molokai block, just east of the Marshall Islands, was judged to offer the best opportunity of the entire leg to sample pre-Cretaceous sediment. Based primarily on extrapolation of the age gradient, determined by the Cenozoic magnetic anomaly pattern in the eastern basin and the age of the deepest sediment at Site 164, an age of early to middle Jurassic was predicted.



Seismic profiles recorded by R/V *Vema* of LDGO and by R/V *Argo* of SIO indicate a sedimentary section 300 to 400 meters thick, overlying a smooth, eastward-dipping acoustic basement. In fact, the basement is so smooth and dips so uniformly away from the Marshall Island chain, there was more than a little hesitation in selecting the site for fear that the sediment above the acoustic basement might record the age of the islands rather than the age of the crust. However, a close examination of all the data at our disposal showed no alternate location in the general area that offered a sufficient thickness of soft sediment for spudding in. Furthermore, the deeper section (opaque layer) at the site (Figure 2) has the same thickness as is found in the least disturbed parts of the rougher region toward the east, so presumably it is characteristic of this part of the central basin.

OPERATIONS

Spudding in at Site 169 (Figure 3) was accomplished at 1500 hrs on 8 May 71. The seismic record was essentially the same as that for Site 168, with the exception of a very slightly thinner upper transparent layer, about 0.09 sec thick, and a somewhat less distinct basement reflector, in part due to the intensification of a reflection in the lower part of the opaque layer (Figure 2). The hole was drilled to 103 meters before the first core was taken, because it was considered essential to penetrate the cherty section with very light weight on the bit and considerable pump pressure, practices which are almost sure to give zero core recovery.

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[1] Edward L. Winterer, Scripps Institution of Oceanography, La Jolla, California; John I. Ewing, Lamont-Doherty Geological Observatory of Columbia University, Palisades, New York; Robert G. Douglas, Case Western Reserve University, Cleveland, Ohio; Richard D. Jarrard, Scripps Institution of Oceanography, La Jolla, California; Yves Lancelot, Universite de Paris, Paris, France; Ralph M. Moberly, University of Hawaii, Honolulu, Hawaii; T. C. Moore, Jr., Oregon State University, Corvallis, Oregon; Peter H. Roth, Scripps Institution of Oceanography, La Jolla, California; Seymour O. Schlanger, University of California at Riverside, Riverside, California.

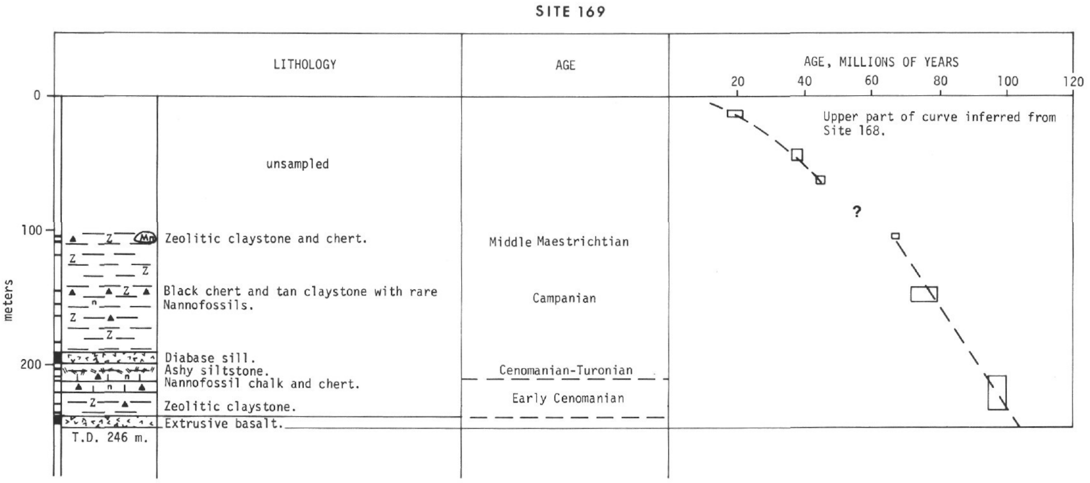


Figure 1. *Graphic log showing lithology, age, and rate of accumulation of sediments at Site 169.*

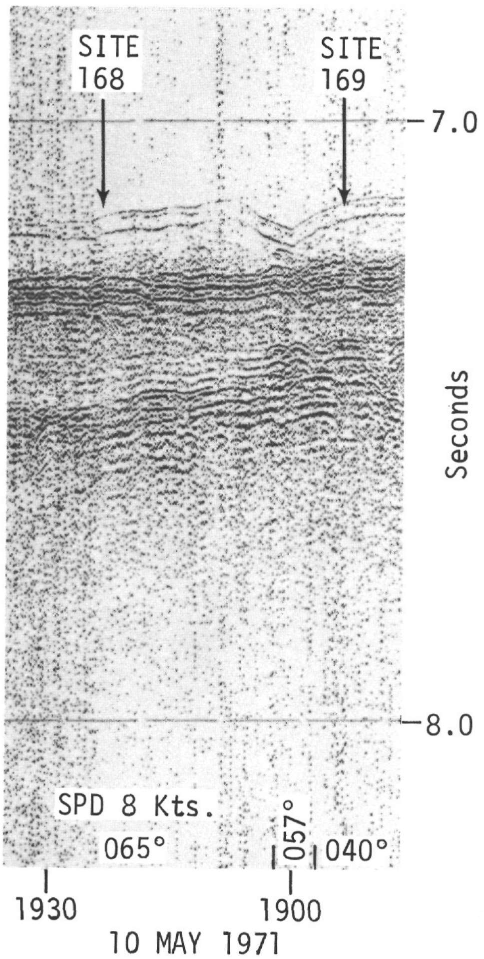


Figure 2. *Seismic profile recorded by* Glomar Challenger *along a course between Sites 168 and 169. See Figure 3 for track.*

The hole was spot-cored to a depth of 186 meters, where a 10 to 12-meter thick diabase sill was encountered. This corresponds to the reflector mentioned above, which is a much more pronounced seismic event at this site than at Site 168. The diabase was penetrated without difficulty, and the sedimentary section below it was continuously cored to acoustic basement, which proved to be extrusive basalt. A sample within 10 meters of the basalt contained fossils of Late Cenomanian age. The hole was abandoned after 10 meters of drilling into the basalt with no evidence of additional sedimentary material.

BIOSTRATIGRAPHIC SUMMARY

Site 169 is located 7 km SW of Site 168, and the section drilled at the two locations can be correlated on the basis of acoustic reflectors. Coring was initiated at 103 meters depth, below the stratigraphic level at which drilling was terminated at Site 168, and cored nearly continuously to the bottom of the hole. Recovery was poor, and the majority of the recovered material consists of a diabasic sill.

Core 1 at 103 to 107 meters, recovered only middle Maestrichtian nannoplankton and badly preserved radiolarians. Cores 2 and 4 are barren of diagnostic microfossils, but Core 3, overlying the diabasic sill, contains nannoplankton. The sill was sampled in Cores 5 and 6. Below the sill and above the basalt basement, four incomplete cores were recovered, covering the Turonian-Cenomanian (Core 7), Cenomanian (Cores 8 and 9), and late Albian (Core 10). All of the cores contained poorly preserved nannoplankton, Core 9 contained foraminifera, and Cores 8, 9, and 10 contained Radiolaria.

The average rate of sediment accumulation at the site is 4 m/m.y. The average rate of sediment accumulation is about 6 m/m.y. for the Maestrichtian through Turonian and 2 m/m.y. for the Cenomanian and late Albian.

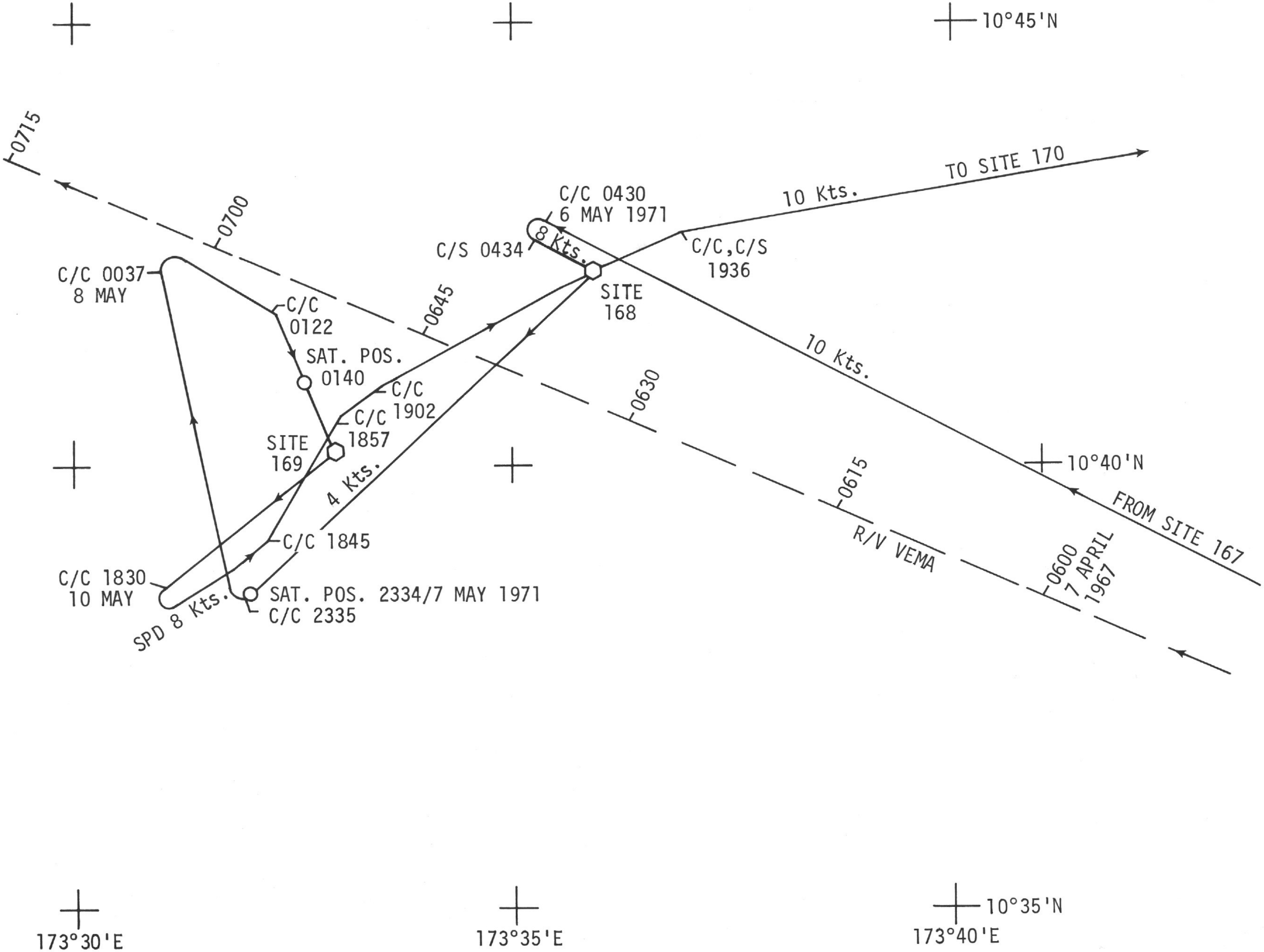


Figure 3. *Tracks of* Glomar Challenger *and* Vema *in the vicinity of Sites 168 and 169.*

LITHOLOGIC SUMMARY

No cores were taken above 103 meters. However, the subbottom profiles of both Sites 168 and 169 show that the sedimentary sections are essentially identical. The drilling record at Site 169 indicates that alternating hard and soft layers were drilled from 46 to 79 meters. This interval is probably lithologically equivalent to the chert and zeolite-rich clays drilled at Site 168 between 41 and 85 meters.

The 12 cores cut between 103 meters and the total depth of 246 meters are interpreted as representing three main lithologic units:

1) Zeolitic claystone and chert containing a diabase sill (103 to 201 m).
2) Nannofossil micritic chalk and chert (201 to 233 m).
3) Basalt (233 to 246 m).

Core recovery at this site, as at Site 168, was very poor. Of the total of approximately 12 meters of rock recovered, approximately 10 meters were from the diabase and the basalt basement.

Zeolitic Claystone and Chert

This unit consists of light tan, brown, light brown, and grayish black phillipsite-rich, stiff claystones. Brownish-black knobby to mammiferous manganese nodules 2 to 2.5 cm in diameter were noted in Core 1. X-ray analyses (A. C. Pimm, personal communication) show that clinoptilolite is abundant in Cores 1 and 2. The claystones are variegated in color and show faint laminations. Smear slides show the presence of rare to locally abundant coccoliths in the upper cores. Above the diabase, volcanic material is sparsely present as angular fragments of silt-size light and dark glass, orange palagonite, and angular plagioclase. In Core 3, rare subhedral crystals of rutile(?) are present. These are blood red in color and show very high relief. Very small irregular grains of Fe-oxide minerals are also abundant in some smear slides as are micronodules of manganese. The diabase drilled from 186 to 194 meters is dark gray, dense, and coarse-grained, consisting of plagioclase and pyroxene. The rocks recovered lack vesicles and glassy selvages characteristic of the extrusive basalts in the region. The texture of the diabase suggests that the rock was intruded as a sill rather than extruded as a flow. Also the subbottom profiles in this region reveal discontinuous reflectors that can be interpreted as having sill-like geometries. The sediments directly below the sill, represented by a few pieces of rock in Core 6, are laminated, gray silty mudstones. The silty laminae are plagioclase and glass-rich; rare pyroxene was also noted. These sediments can be considered as ashy.

The cherts are porcellanitic showing waxy and subvitreous luster. These were recovered only as angular, light brown, dusky brown, and black fragments. In Core 7 the contact between Units 1 and 2 was cored. From 31 to 121 cm of Section 1 the sediment is dark brown to grayish black nannofossil-bearing phillipsite-rich stiff clay with abundant manganese micronodules. From 121 to 135 cm the sediment becomes lighter in color, very pale brown, and the carbonate content in the form of nannofossils increases. From 135 to 150 cm, the sediment is pure nannofossil micritic chalk, light gray to very pale blue green in color.

Neither contact between the presumed sill and the adjacent sediments was cored. The presence of ashy material just below the sill suggests a volcanic event of a surficial nature just prior to the emplacement of the sills in the area.

Nannofossil Chalk and Chert

This unit was established on the basis of the above described contact in Core 7 and core catcher samples 8 and 9. In these pink to bluish white, nannofossil-rich firm chalks are present along with chert. Abundant micrite in the form of angular, anhedral pieces of calcite up to 20 microns long were noted in smear slides, possibly disaggregated, recrystallized nannofossils. A few tests of biserial and coiled small planktonic foraminifera were also seen in the smear slides. The cherts are dark reddish brown and faintly laminated. By Core 10, between 227 and 233 meters, the sediments are light brown nannofossil-bearing zeolite-rich claystone and chert. In Core 11, a piece of brown phillipsite-rich claystone was found in the same core barrel as the uppermost basalt, but no contact was noted.

Basalt

The basalt is dark gray and shot through by numerous veins of white calcite with dark grayish green and greenish black films within the calcite. A number of greenish black and black glassy selvages separate parts of the core. These suggest that the basalt was extrusive.

PHYSICAL PROPERTIES

Section 1 of Core 7 has horizontally bedded, nannofossil zeolitic clay from 30 to 120 cm, with a fairly constant density of 1.47 to 1.55. From 120 to 150 cm the sediment is clayey nannofossil chalk to nannofossil chalk, with a density of 1.67 to 1.72. This difference in densities of zeolitic clays and nannofossil chalks is more thoroughly exhibited at Site 170 and discussed in that chapter. The densities of the two lithologies in this section are very close to the densities of the same lithologies at Site 170.

In the same section the net gamma count ranges from 125 to 725, with the maximum occurring near the middle of the section, where zeolitic clay beds are apparently quite enriched in manganese micronodules.

It is important to notice that, because of the very high sound velocities measured at this site, the scale for sound velocity measurements in the site summary figure is different than in the site summary figures for other sites.

CORRELATION BETWEEN STRATIGRAPHIC SECTION AND SEISMIC REFLECTION PROFILE

In view of some uncertainty about the correct water depth and the small amount of sample that was recovered from the upper part of these holes, it is difficult to judge what part of the section is responsible for the first prominent reflector at approximately 0.08 sec below bottom. If our adopted water depth (corrected PDR depth plus 14 m) is correct, a faint reflecting zone at about 0.06 sec below bottom correlates with the top of shallow chert beds (Figure 4). These beds are clearly recorded by 3.5 kHz echo sounders (Figure 5) and definitely lie above the most

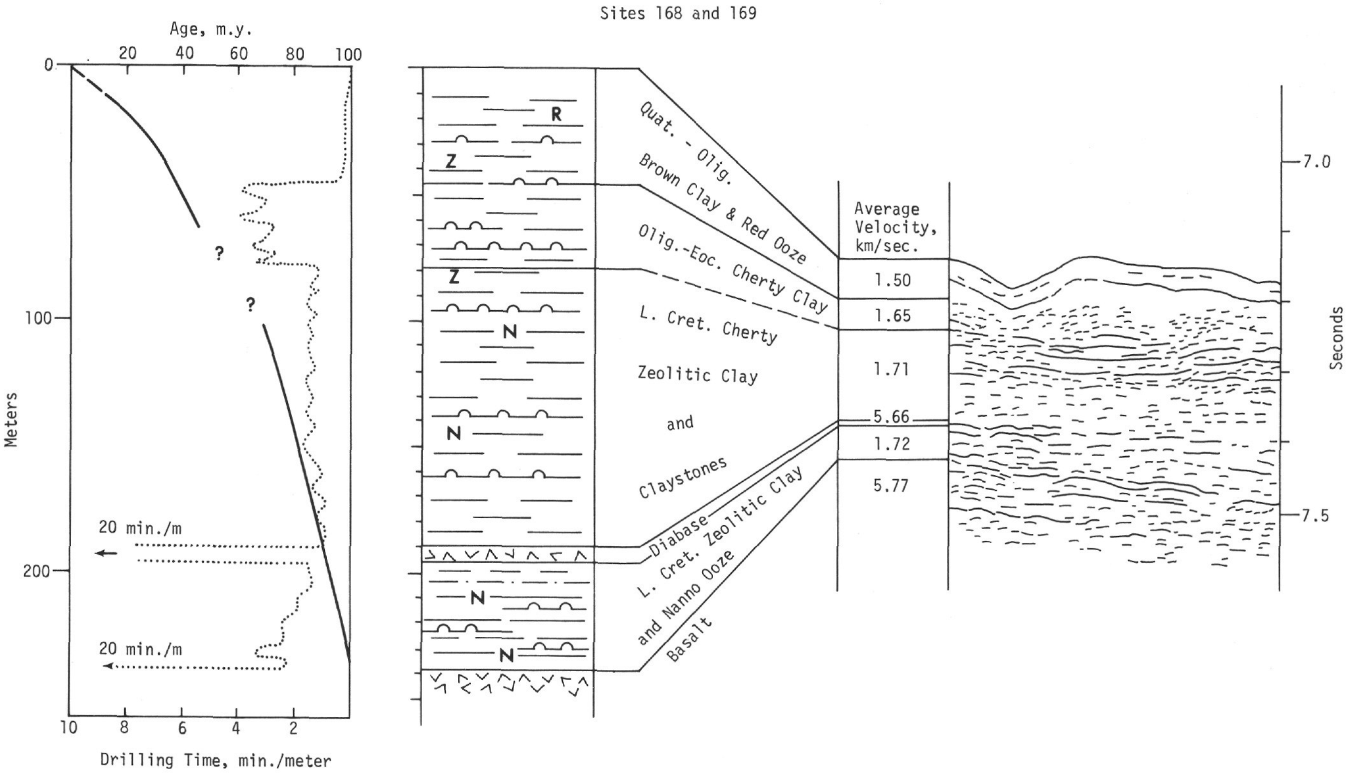


Figure 4. *Correlation of lithology, seismic stratigraphy, drilling rates, and sediment accumulation rates at Sites 168 and 169.*

prominent shallow reflector (A′), which appears at about 0.10 sec depth in the seismic profiler record. The available samples are insufficient to show whether or not there is a significant lithologic change in this part of the section that might account for reflector A′, but we assume that either closely spaced, hard cherts or a hiatus is responsible.

The next deeper reflector, at about 0.23 sec, correlates with the diabase sill at 186 meters. The sill, which is about 8 meters thick, was penetrated in about 4 hours, and a predominantly carbonate section was found underneath it. This layer, in turn, rests on extrusive basalt at 237 meters below sea floor, which is apparently the interface responsible for the deepest identified reflector.

Laboratory sound velocity measurements on the diabase and basalt gave values of 5.66 km/sec and 5.77 km/sec respectively.

CONCLUSIONS

The results from both Sites 168 and 169 are considered together here. At Site 168, drilling ceased at a depth of only 85 meters, and the last core recovered came from between 57 and 66 meters below the sea floor. At Site 169, just 7 km to the southwest (Figure 3), we attempted to continue the stratigraphic column begun at Site 168 by starting to core at a depth of 103 meters. The risk of another accident with the drill string while trying to obtain cores before the bottom-hole assembly was nearly fully supported by the walls of the hole ruled out any attempts to resample the upper layers that were so poorly cored at Site 168.

The reflection profiles at the two sites (Figure 2) are not identical. Specifically, the strong intermediate reflector at about 0.23 sec beneath the sea floor at Site 169 does not appear on the record over Site 168. This reflector is most logically associated with a diabase sill drilled at Site 169. Judging from the intermittent occurrence of this intermediate reflector in the reflection profiles taken in this vicinity by R/V *Glomar Challenger* and R/V *Robert D. Conrad,* the diabase sill has a patchy distribution.

The upper acoustically transparent layer seen on reflection profiles (Figure 2) near Sites 168 and 169 is shown by the drilling to be mainly middle and early Tertiary in age. The topmost sample, possibly right at the sea floor, contains badly dissolved fragments of Quaternary foraminifera, along with grains of feldspar and barite, but the very next sample contains Radiolaria of early Miocene age. The reflection profile shows a very irregular thickness of the upper transparent unit, as if it had been partly eroded away in some places. Sites 168 and 169 were located in places where the transparent layer is relatively thick (about 0.1 sec), but still thicker places—up to about 0.12 sec—can be seen on the profiler records (Figure 2). This extra thickness could allow sediments of late Tertiary age to be present beneath the erosional surface. On the other hand, if the rate of accumulation shown for the Late Eocene to early Miocene on the rate graph (Figure 1) is projected upward for another 20 meters, to account for the possibly eroded section, the top of the column would project to an age of

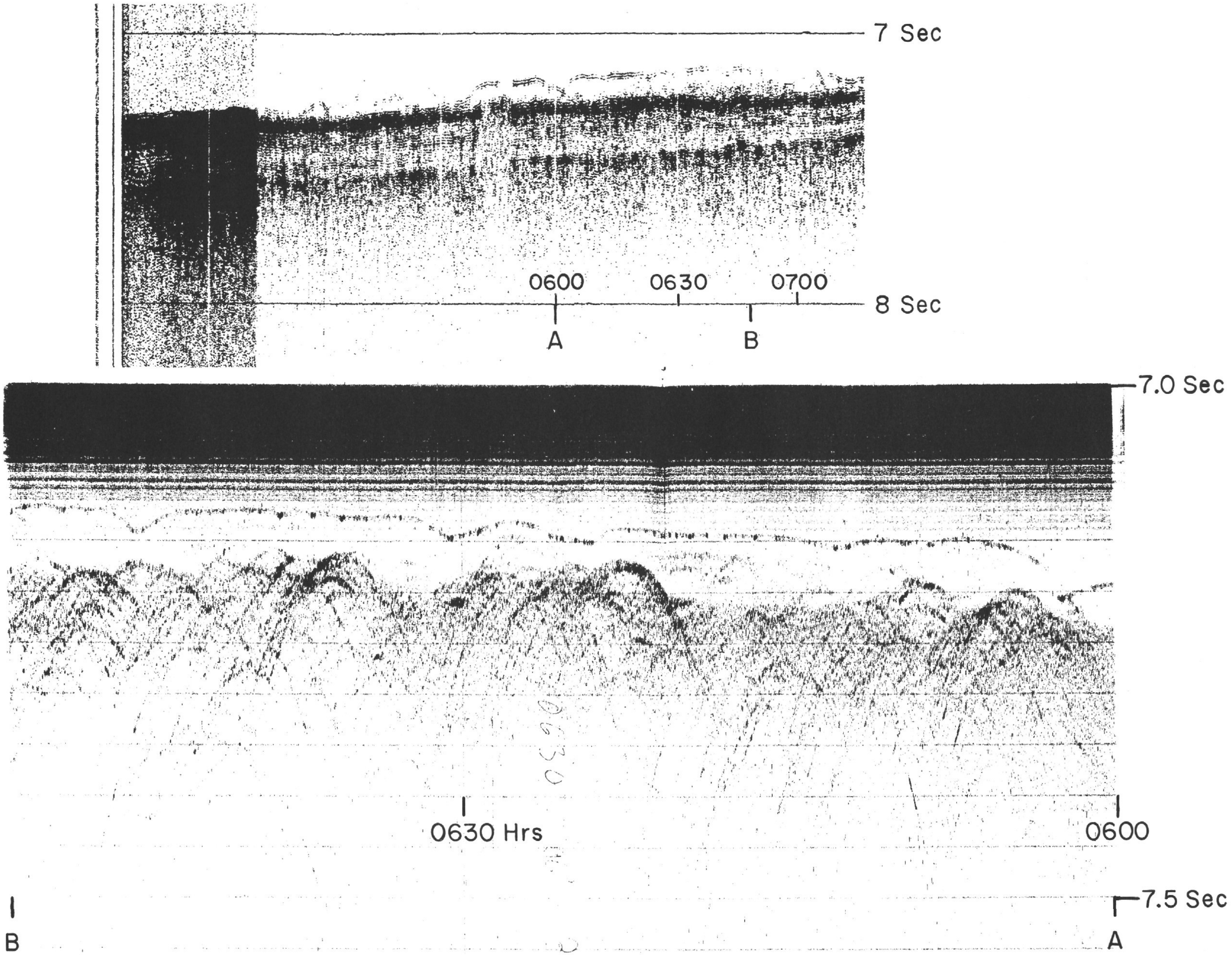


Figure 5. *Seismic profiler (upper) and 3.5 kHz (lower) records from R/V* Vema *near Sites 168 and 169. Note that the "hyperbolic" reflection pattern in the 3.5 kHz record corresponds to the faint pattern above Reflector A′ in the seismic profiler record.*

about 10 m.y. In any event, it seems reasonable to infer that accumulation rates during the latest part of the Cenozoic were very slow, or even negative.

The first cherty beds appear within the transparent layer at a depth of only about 41 meters, in beds of late Eocene age, where some faint and impersistent reflectors appear on the profile records.

Beneath the transparent layer is a prominent seismic reflector at a depth about 0.1 sec on the profiler records. No samples were obtained in the interval between 64 and 103 meters, and it appears likely that the top of this reflector lies somewhere in that unsampled interval. Between 103 and 107 meters, middle Maestrichtian nannofossil ooze was cored. Thus, the reflector is at least as young as the latest Cretaceous and is as old as the late Eocene.

From 103 meters to the base of the section, the strata consist mainly of nannofossil-bearing claystone and minor chalk, ranging in age from late Albian to middle Maestrichtian, except for one interval from 186 to 194 meters, where the section is interrupted by a 8-meter thick diabase sill, underlain by at least 2 meters of volcanogenic siltstone and claystone. Sediments a few meters below the sill are Turonian or Cenomanian, and sediments 20 meters above the sill are Campanian in age.

The presence of nannofossil chalks in sediments now 5600 meters deep suggests either a late Cretaceous lowering of the compensation depth for calcium carbonate, or post-depositional subsidence of the sea floor. In view of the scarcity of calcareous fossils at Site 164, at nearly the same depth and within 3 degrees of latitude of Site 169, it seems reasonable to invoke subsidence at Site 169.

Although only zeolitic claystone was recovered from immediately above the basalt at the bottom of the hole at Site 169, nannofossil chalk occurs within 10 meters above the base of the section, and planktonic foraminifera occur only about 5 meters higher up. The present-day depth of these chalks (~5600 m) is well below the compensation depth for calcium carbonate, which raises the question of the relative importance at this site of subsidence and of secular changes in the depths of carbonate dissolution. Subsidence amounting to about 1500 meters is inferred for the nearby Marshall Islands guyots, some of which are at least as old as middle Eocene in age, and a closely similar amount of subsidence has been demonstrated for mid-Cretaceous guyots (Barremian or Aptian, according to studies made by the late E. C. Allison, personal communication) in the mid-Pacific Mountains. Whether this amount of subsidence applies also to Site 169 is moot. If, on the other hand, we use the age-depth curves for crust formed at ocean ridges (Sclater, et al., 1971), a subsidence of about 3000 meters would be expected. That regional variations in the compensation depth also existed in middle and late Cretaceous times is suggested by comparisons of Site 169 with Site 164, some 3°N and 25°E of 169. At Site 164, the Cretaceous is mainly zeolitic clays, with only very rare calcareous nannofossils in a few samples, yet the present depth at Site 164 is only about 100 meters greater than at Site 169. The set of problems posed by these differences is taken up in more detail in the regional synthesis chapter of this report.

The extrusive basalt at the base of the sedimentary column at Site 169 is at least as old as late Albian – say about 100 to 105 m.y. This age is very much younger than any age obtained from extrapolation westward of spreading rates deduced from magnetic anomaly patterns and drilling results farther to the east, or from northward extrapolation of the spreading rate deduced from Sites 166 and 167.

Two major hypotheses must be tested: (1) the crustal age patterns documented for the eastern and central Pacific do not persist into the region about Site 168 because some other pattern is present there, and (2) one of these patterns includes Site 169, but the old crust has been buried by younger volcanic rocks. Evidence from Site 169 that supports the first hypothesis is that the site is in deep water, of "normal" oceanic depth, and the reflection profiler records show a sedimentary section of "normal" thickness for this general region. Evidence in favor of the second hypothesis is that the acoustic basement is relatively smooth, as compared to the basement in the eastern Pacific (cf., Site 164). The basement slopes gradually upward toward the Marshall Islands. The band of northwest-trending bathymetric features so clearly marked out in the topography of the central Pacific basin farther east are not easily discernible in the vicinity of Site 169, on the apron east of the Marshall Chain (see chart in pocket). The sill and volcanogenic sediments furnish evidence in themselves of volcanic activity at least 20 m.y. after the extrusion of the basalts of the acoustic basement.

The calcareous sediments are consistent with either hypothesis. If formed at a rise crest, the crust would doubtless be relatively shallow (~2500 m) and would subside about 1000 meters in the first 10 m.y. and another 1000 meters in the next 25 m.y. If formed by post-crust volcanism, the region may have been reelevated to within reach of carbonate accumulation.

REFERENCE

Sclater, J. G., Anderson, R. N. and Bell, M. L., 1971. The elevation of ridges and the evolution of the central eastern Pacific. J. Geophys. Res. **76**, 7888.

APPENDIX A
Core Inventory – Site 169

Core	Depth Below Sea Floor (m)		Total Depth[a] (m)		Cored (m)	Recovered (m)	Lithology	Age
	Top	Bottom	Top	Bottom				
1	103	107	5510	5514	4	0.7	Brown zeolitic claystone and chert	Middle Maastrichtian
2	107	116	5514	5523	9	CC	Brown zeolitic mudstone and chert	Campanian
3	144	153	5551	5560	9	CC	Chert and zeolitic mudstone	Early to Middle Campanian
4	153	162	5560	5569	9	0.3	Tan claystone	?
5	181	190	5588	5597	9	0.5	Diabase	?
6	190	200	5597	5607	10	6	Diabase and volcanic-rich claystone and siltstone	?
7	200	209	5607	5616	9	1.2	Claystone and nannofossil chalk	?
8	209	218	5616	5625	9	CC	Nannofossil chalk and chert	Early Cenomanian
9	218	227	5625	5634	9	CC	Nannofossil chalk and chert	Early Cenomanian
10	227	233	5634	5640	6	CC	Zeolitic claystone and chert	Late Albian
11	233	238	5640	5645	5	1.0	Claystone on basalt	
12	238	246	5645	5653	8	2	Basalt	

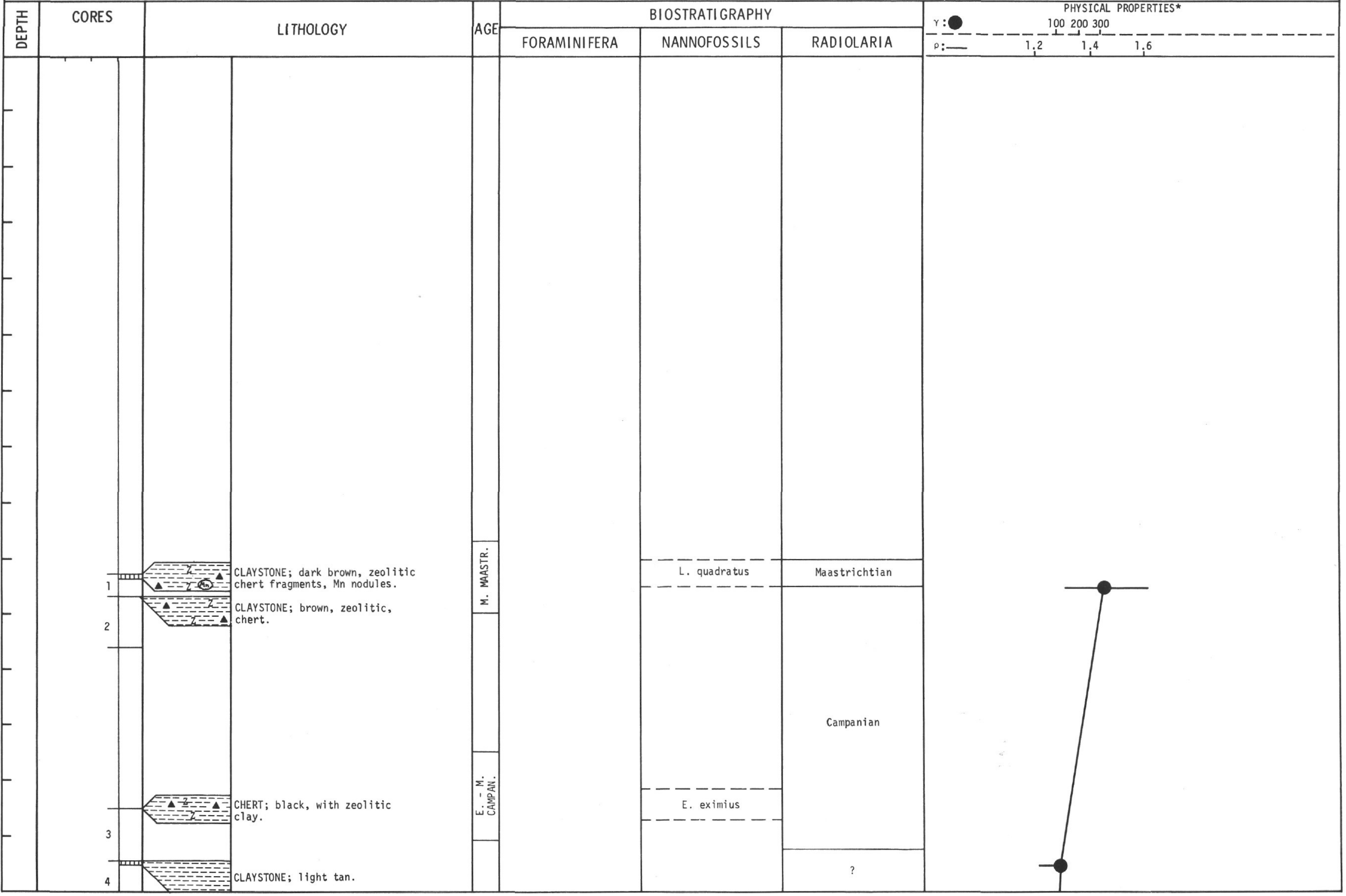
[a] Measured from the derrick floor.

APPENDIX B
Physical Properties – Site 169

		GRAPE					Syringe[a]				Natural Gamma Radiation		Sonic Velocity	
		Wet Bulk Density			Porosity									
Core Section	Section Weight Wet Bulk Density (g/cc)	Total Range (g/cc)	Undisturbed (g/cc)	Assigned Grain Density (g/cc)	Total Range (%)	Undisturbed (%)	Interval Sampled (cm)	Wet Bulk Density (g/cc)	Grain Density (g/cc)	Porosity (%)	Total Count	Net	Interval Sampled (cm)	(km/sec)
1-1		1.30-1.60		2.71	65.8-83.6						1850	300		
4-1		1.20-1.28		2.75	85.1-89.8						1450	100		
6-2		2.15-2.28	2.15-2.28	–							1475	75		
6-3													135	5.75
6-4													78	5.57-5.81
													133	5.56
7-1		1.47-1.72	1.47-1.72	2.75	59.6-74.1						2250	475		
12-1													57	5.60-5.99

[a] Not measured.

LEG XVII SITE 169 LAT. 10°40.2'N LONG. 173°33.0'E DEPTH 5407 m SHEET 1 OF 2

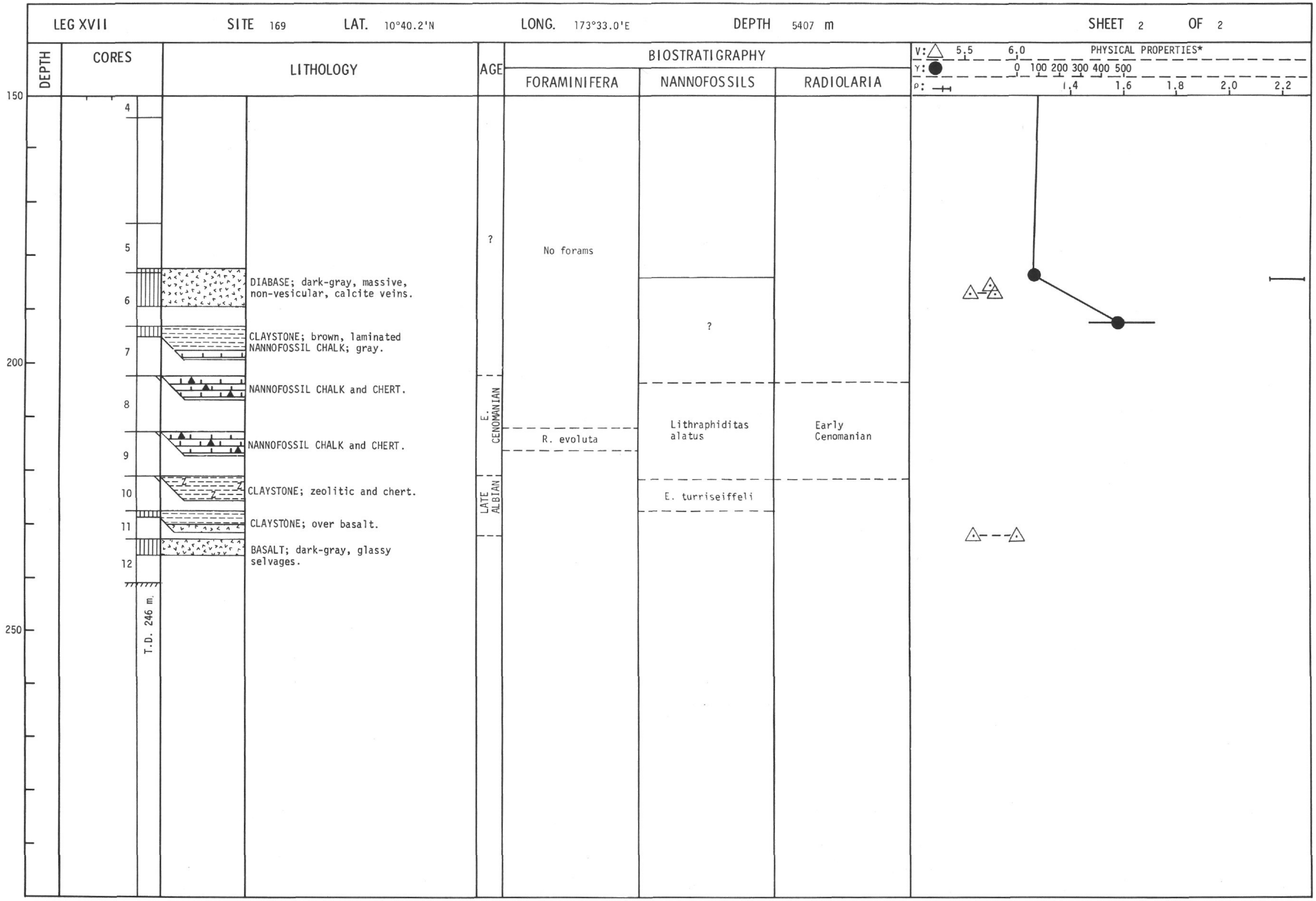


CLAYSTONE; dark brown, zeolitic chert fragments, Mn nodules.

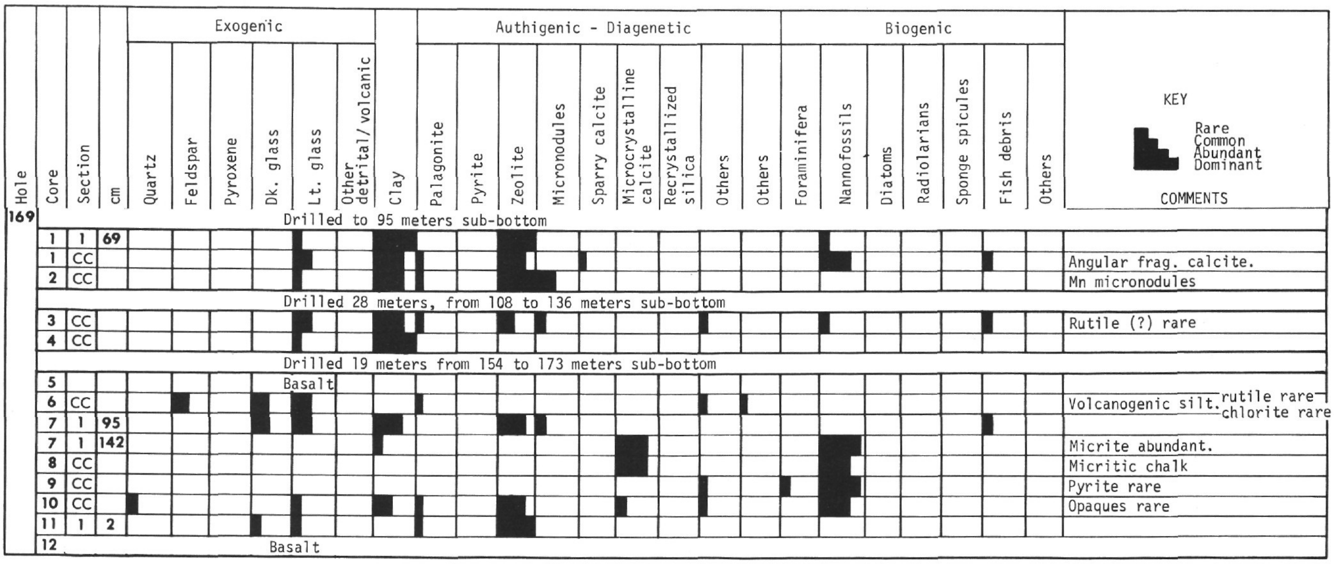
CLAYSTONE; brown, zeolitic, chert.

CHERT; black, with zeolitic clay.

CLAYSTONE; light tan.


LEG XVII
SITE 169
LAT. 10°40.2'N
LONG. 173°33.0'E
DEPTH 5407 m
SHEET 2 OF 2
DEPTH
CORES
LITHOLOGY
AGE
BIOSTRATIGRAPHY
FORAMINIFERA
NANNOFOSSILS
RADIOLARIA
PHYSICAL PROPERTIES*
V: △ 5.5 6.0
γ: ● 0 100 200 300 400 500
ρ: 1.4 1.6 1.8 2.0 2.2
150
200
250
4
5
6
7
8
9
10
11
12
T.D. 246 m.
DIABASE; dark-gray, massive, non-vesicular, calcite veins.
CLAYSTONE; brown, laminated NANNOFOSSIL CHALK; gray.
NANNOFOSSIL CHALK and CHERT.
NANNOFOSSIL CHALK and CHERT.
CLAYSTONE; zeolitic and chert.
CLAYSTONE; over basalt.
BASALT; dark-gray, glassy selvages.
?
E. CENOMANIAN
LATE ALBIAN
No forams
R. evoluta
?
Lithraphiditas alatus
E. turriseiffeli
Early Cenomanian

SITE 169
SMEAR SLIDE SUMMARY



KEY
Rare
Common
Abundant
Dominant

				Exogenic							Authigenic - Diagenetic									Biogenic							
Hole	Core	Section	cm	Quartz	Feldspar	Pyroxene	Dk. glass	Lt. glass	Other detrital/ volcanic	Clay	Palagonite	Pyrite	Zeolite	Micronodules	Sparry calcite	Microcrystalline calcite	Recrystallized silica	Others	Others	Foraminifera	Nannofossils	Diatoms	Radiolarians	Sponge spicules	Fish debris	Others	COMMENTS
169	Drilled to 95 meters sub-bottom																										
	1	1	69					Rare		Dominant			Dominant								Rare						
	1	CC						Common		Abundant	Rare		Abundant		Rare						Abundant				Rare		Angular frag. calcite.
	2	CC						Rare		Abundant	Rare		Dominant	Common													Mn micronodules
	Drilled 28 meters, from 108 to 136 meters sub-bottom																										
	3	CC						Common		Abundant	Rare		Common	Rare				Rare			Rare				Rare		Rutile (?) rare
	4	CC						Rare		Dominant																	
	Drilled 19 meters from 154 to 173 meters sub-bottom																										
	5							Basalt																			
	6	CC			Common		Common	Common			Rare							Rare	Rare								Volcanogenic silt. rutile rare chlorite rare
	7	1	95				Common	Common		Abundant			Abundant	Rare											Rare		
	7	1	142							Rare						Abundant					Dominant						Micrite abundant.
	8	CC														Abundant					Abundant						Micritic chalk
	9	CC																Rare		Rare	Dominant						Pyrite rare
	10	CC		Rare				Rare		Common	Rare		Abundant			Rare		Rare			Abundant						Opaques rare
	11	1	2				Rare	Rare			Rare		Dominant														
	12						Basalt																				

Site 169 Hole Core 1 Cored Interval: 95 to 99 meters

AGE	ZONE	FOSSIL CHARACTER			SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
		FOSSIL	ABUND.	PRES.						
MIDDLE MAESTRICHTIAN	? Lithapharidites quadratus				1	0.5 1.0			*	Claystone: dark yellowish brown (10YR 4/3), zeolitic. Mn nodules, brownish black (5YR 2/1), knobby to mammiferous, 2-2.5 cm in diameter. Chert fragments, light brown (5YR 5/6) to dusky brown (5YR 2/2), porcelanitic.
		n r	A R	M P	Core Catcher					As in section 1.

Site 169 Hole Core 2 Cored Interval: 99 to 108 meters

AGE	ZONE	FOSSIL CHARACTER			SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
		FOSSIL	ABUND.	PRES.						
CAMPANIAN	UNZONED	r	C	P	Core Catcher				*	Mudstone: moderate to yellow brown (7.5-10YR 5/4), zeolitic, chert fragments, dusky yellow brown (10YR 2/2), porcelanitic.

Site 169 Hole Core 3 Cored Interval:

AGE	ZONE	FOSSIL CHARACTER			SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
		FOSSIL	ABUND.	PRES.						
CAMPANIAN	Eiffellithus eximius	n r	F R	P P	Core Catcher				*	Chert: black (10YR 2.5/1) to very pale brown (10YR 7/4), coated by soft zeolitic mudstone

Site 169 Hole Core 4 Cored Interval: 145 to 154 meters

AGE	ZONE	FOSSIL CHARACTER			SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
		FOSSIL	ABUND.	PRES.						
LATE CRETACEOUS	UNZONED CRETACEOUS				1	0.5				Claystone: light tan (5YR 5/0)
		r	R	P	Core Catcher				*	Claystone: light tan (5YR 5/0).

Explanatory notes in Chapter 1

Site 169 Hole Core 5 Cored Interval: 173 to 182 meters

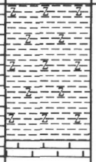
AGE	ZONE	FOSSIL CHARACTER			SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
		FOSSIL	ABUND.	PRES.						
					1	0.5 1.0				Diabase: dark gray (dry)(N3), grayish black (wet)(N2), massive, non-vesicular, cut by thin veins of white calcite.
					Core Catcher					As in section 1.

Site 169 Hole Core 6 Cored Interval: 182 to 192 meters

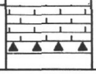
AGE	ZONE	FOSSIL CHARACTER			SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
		FOSSIL	ABUND.	PRES.						
					1	0.5 1.0	VOID			Diabase: dark gray (dry)(N3), grayish black (wet)(N2), dense, non-vesicular, cut by zeolite-bearing calcite veins, light gray (N8) to light greenish gray (5G 8/1).
					2					
					3					
					4					
					5					
		n r	R B	P	Core Catcher				*	Claystone and Siltstone: laminated brown (7.5YR 5/4), pinkish gray (7.5YR 6/2) and yellow brown (10YR 5/4), some laminae rich in plagioclase, burrows abundant.

Explanatory notes in Chapter 1

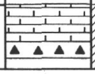
Site 169 Hole Core 7 Cored Interval: 145 to 154 meters

AGE	ZONE	FOSSIL CHARACTER			SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
		FOSSIL	ABUND.	PRES.						
TURONIAN-LATE ALBIAN		n	c	P	1	0.5 1.0		¦	* *	Claystone: variegated and laminated, brown (7.5YR 5/4) to grayish black (N2). Section becomes lighter in color downwards due to increasing carbonate content. At 135 cm there is sharp contact with underlying chalk. 135 to 150 cm. Nannofossil chalk: light gray (10YR 7/2) with very pale blue green (5BG 8/2) laminae.
		n	C	P	Core Catcher		?			Lithology unrecorded.

Site 169 Hole Core 8 Cored Interval: 201 to 210 meters

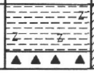
AGE	ZONE	FOSSIL CHARACTER			SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
		FOSSIL	ABUND.	PRES.						
CENOMANIAN	Lithraphidites alatus	n r	C C	M P	Core Catcher				*	Nannofossil chalk: pink (7.5YR 7/4) to bluish white (5B 9/1), with pieces of chert, dark reddish brown (2.5YR 3/4).

Site 169 Hole Core 9 Cored Interval: 210 to 219 meters

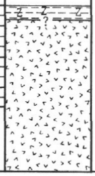
AGE	ZONE	FOSSIL CHARACTER			SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
		FOSSIL	ABUND.	PRES.						
EARLY CENOMANIAN	R. evoluta L. alatus	f n r	R C C	P M P	Core Catcher			▨		Nannofossil chalk: white (N9). Chert: dusky red (2.5YR 3/2).

Explanatory notes in Chapter 1

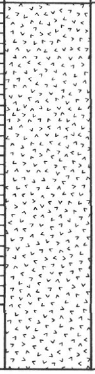
Site 169 Hole Core 10 Cored Interval: 219 to 225 meters

AGE	ZONE	FOSSIL CHARACTER			SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
		FOSSIL	ABUND.	PRES.						
LATE ALBIAN	Eiffellithus turriseiffeli	n r	F C	P P	Core Catcher			▨		Claystone: light brown (7.5YR 6/4) nannofossil-bearing, zeolitic. Chert: dark brown (7.5YR 3/2), laminated.

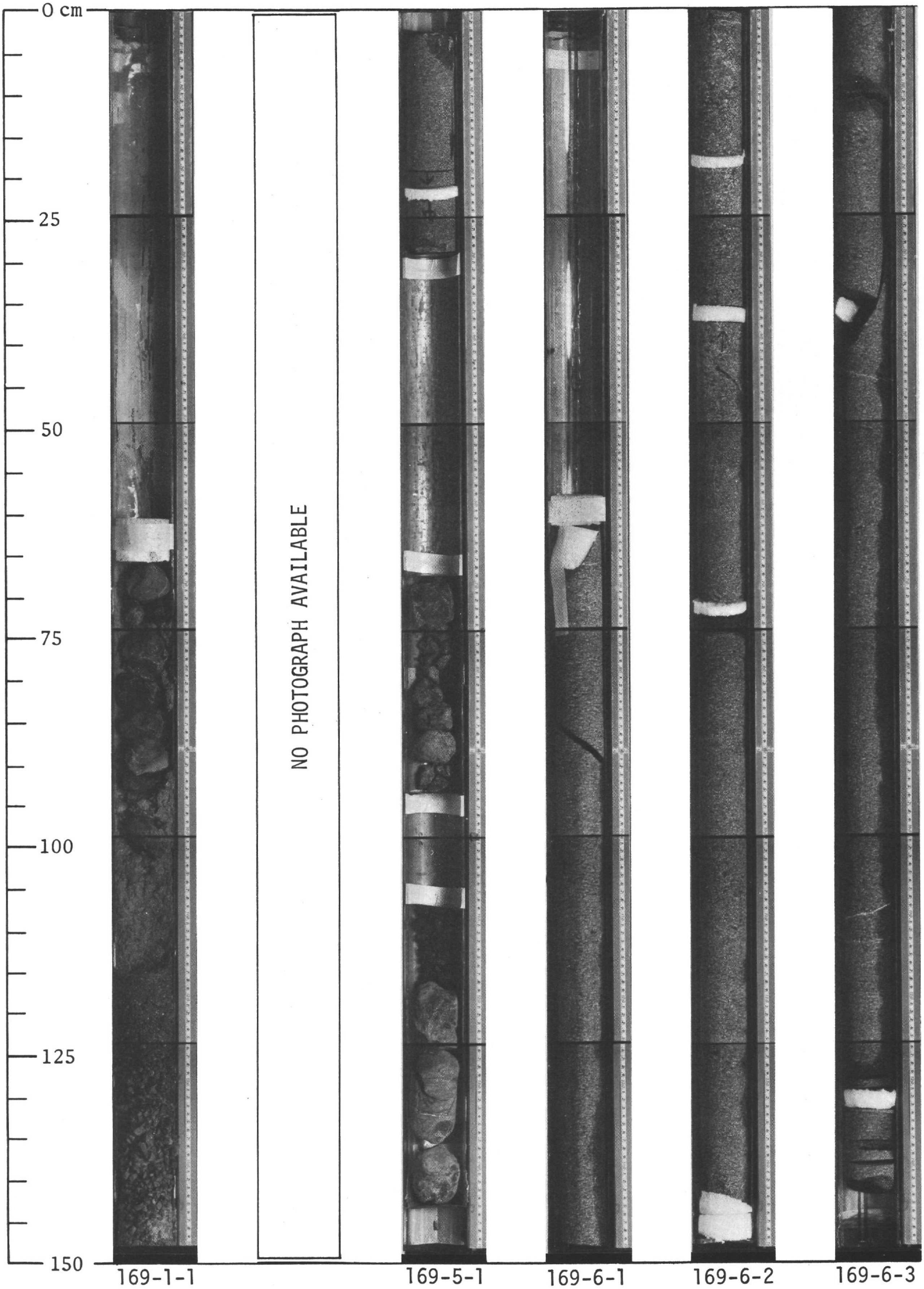
Site 169 Hole Core 11 Cored Interval: 225 to 230 meters

AGE	ZONE	FOSSIL CHARACTER			SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
		FOSSIL	ABUND.	PRES.						
					1	0.5 1.0	VOID 			50 to 55 cm: Claystone: brown (7.5YR 5/4), zeolitic. 55 to 150 cm: Basalt: dark gray (N3) with numerous veins of white (N9) calcite. Rinds of greenish black (5GY 2/1) to black (N1) glass present.
					Core Catcher					

Site 169 Hole Core 12 Cored Interval: 230 to 238 meters

AGE	ZONE	FOSSIL CHARACTER			SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
		FOSSIL	ABUND.	PRES.						
					1	0.5 1.0				Basalt: dark gray (N3) cut through by numerous white (N9) calcite veins. At 146 to 150 cm: Steeply dipping contact between two basalt units shown by black (N1) glassy zone. At 0 to 3 cm: Black (N1) glass zone. At 36 to 41 cm: Black (N1) glass zone.
					2					
					Core Catcher					

Explanatory notes in Chapter 1


0 cm
25
50
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125
150
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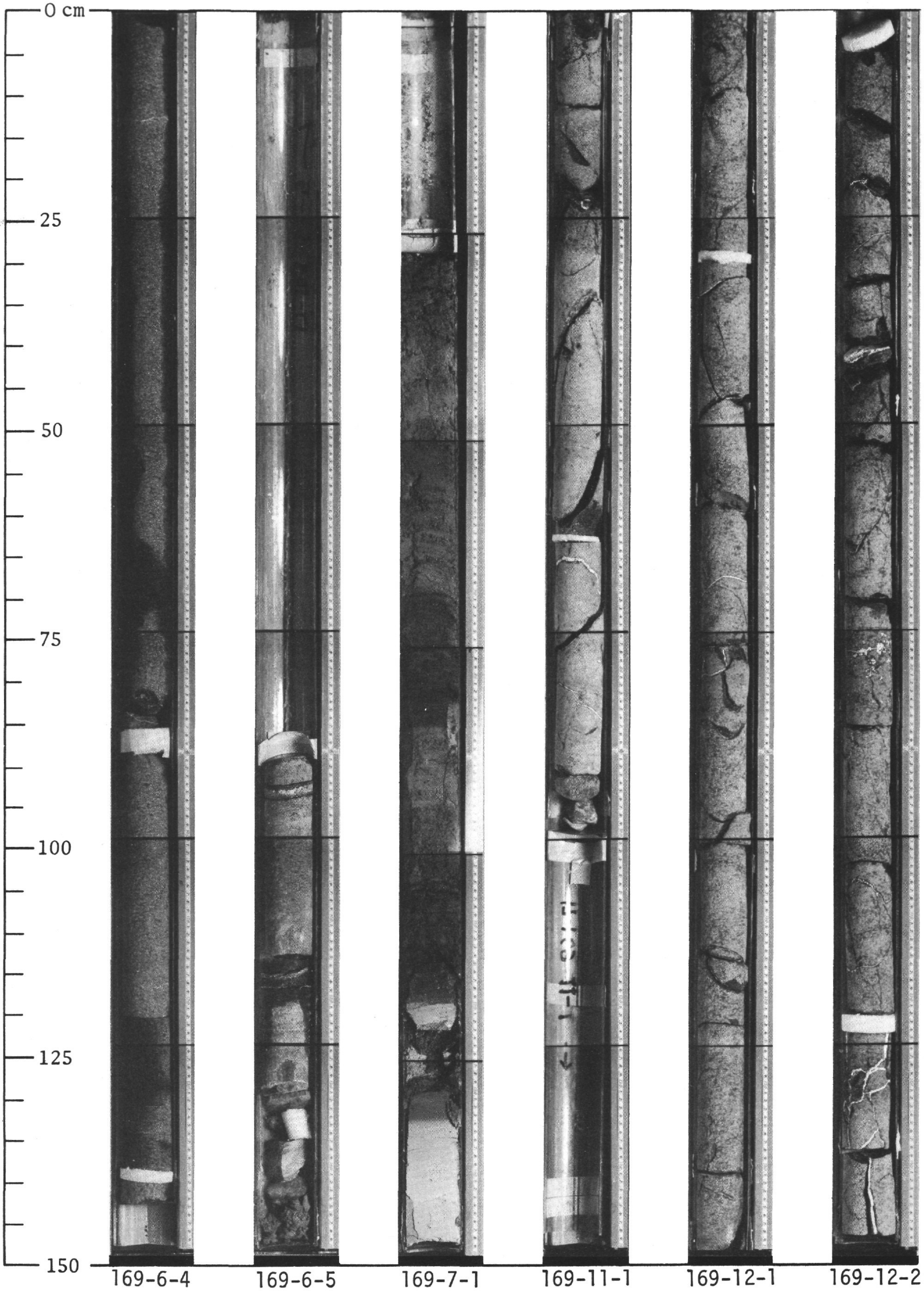
169-1-1
169-5-1
169-6-1
169-6-2
169-6-3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150
169-6-4
169-6-5
169-7-1
169-11-1
169-12-1
169-12-2