7. SITE 308: KŌKO GUYOT

The Shipboard Scientific Party[1]

SITE DATA

Date Occupied: 16 September 1973 (1830)

Date Departed: 17 September 1973 (1354)

Time on Site: 19.4 hours

Position: 34°58.94′N, 172°08.98′E

Water Depth: 1331 corrected meters (echo sounding)

Bottom Felt With Drill Pipe At: 1346 meters below rig floor

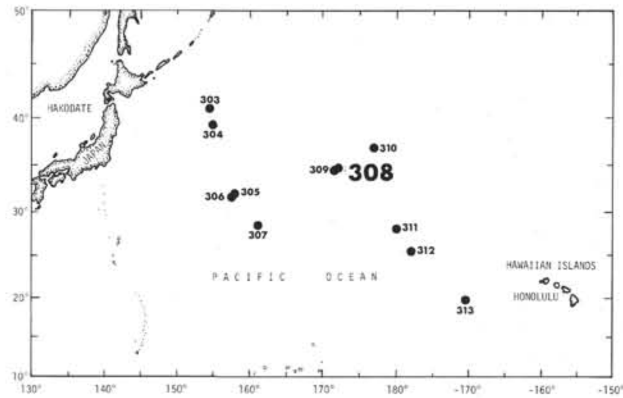
Penetration: 68.5 meters

Number of Holes: 1

Number of Cores: 4

Total Length of Cored Section: 30.5 meters

Total Core Recovered: 7.3 meters



BACKGROUND AND OBJECTIVES

The possible origin of the Hawaiian Islands by the passage of the lithosphere, on which volcanoes are formed, over their source area, a hot region of the mantle, was proposed by Wilson (1963) and renewed by Morgan (1971). Leg 33 is designed to test the hot-spot theory with respect to the Line Islands. However, as has been pointed out by Jackson et al. (1972), aided by the work of Winterer (1973) and Clague and Jarrard (1973), and based in large part on Grommé and Vine's (1972) results from Midway Islands, samples from the Emperor Seamounts will provide a test for a particular aspect of the hot-spot theory. It has been suggested that the melting anomalies or plumes lie deep in the mesosphere and thus are very nearly fixed with respect to the earth's spin axis and equator. The magnetic paleolatitude of an Emperor Seamount can be compared to that of Midway (15° ±4°) and the active Hawaiian volcanoes (19.5°). If all three are similar, they may have been formed over a fixed spot deep in the mantle, whereas if their paleolatitudes are dissimilar, the site of magma generation could not have been fixed. This important test will require cores, some oriented, through numerous flow units of the volcanic edifice. Koko Guyot (Figure 1) has been selected for this test mainly because it has recently been surveyed (Davies et al., 1972). A seamount farther north would be more desirable for the latitude test, but

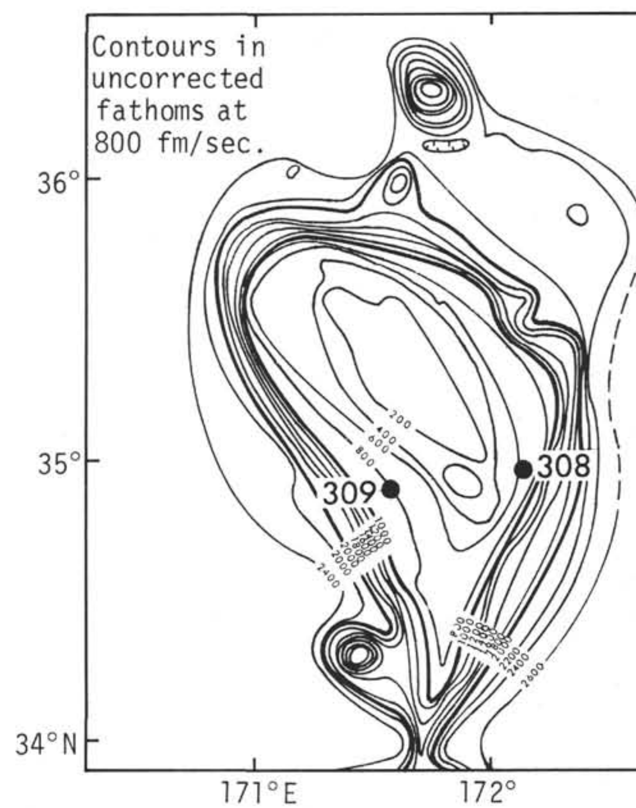


Figure 1. *Bathymetry in the region of Site 308 (after Davies et al., 1972). Contour interval 200 fm uncorrected.*

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there are neither reflection surveys nor sufficient travel time available. Kōko will be adequate, and moreover, its radiometric and paleontologic age, and petrography from dredge hauls, are items of current study and interest.

Basement of a volcanic seamount has not yet been cored on a DSDP leg. Although the main interest at Site 308 is a combined tectonic and geophysical one (test of fixed hot-spot theory), the petrography and chemistry of the lavas will be thoroughly studied. They are predicted to be flows of ocean-island tholeiite-type (commonly quartz-normative), that could be subaerial or submarine. Two dangers are, first that the site may be in the much thicker alkalic flows that cap many oceanic volcanoes· and that are known from dredge hauls from Kōko (Clague and Greenslate, 1972). Thereby, fewer flows and fewer magnetic measurements would result. Second, if the site is in a rift zone, there may be so much coarse and fine tephra and so few flows that again the paleomagnetic statistics might be poor (witness the section of tephra encountered by the disappointed driller of a geothermal test hole on Kilauea volcano, spring 1973). In either event, the petrographic information from Kōko would be of value, but unfortunately not to the degree to offset the loss of paleomagnetic data.

Diagenetic studies of the rubble of shallow-water origin expected in the sediment cap at Site 308 may be of interest.

OPERATIONS

The intensive survey of Kōko Guyot by the *Aries*-7 expedition showed the feature to be topped by an eroded, relatively flat volcanic platform that is in turn overlain by a coral cap on the central portion of the platform. Our Site 308 is on the southeast side of the platform below the coral cap in an area that appears to have about 100 meters of sedimentary cover.

We approached Site 308 on Kōko Guyot from the southwest on a line from Site 307 on anomaly M-21 (Figures 2 and 3). A current set us about 2 km to the south of the original site location. We ran to a point about 4 km east of the site location, turned north, and slowed to 7 knots to conduct a brief site survey that would determine the extent of the sedimentary cover. We ran for about 9 km on this track and observed about 0.1 sec of sediment on the profiler. Then we turned west and ran 6 km until we encountered the coral cap. We then changed course to 104° and headed back toward the maximum sediment thickness observed on the northern leg of our survey. After running 4 km, we slowed to 4 knots, in preparation to dropping the beacon. At 0620Z on 16 September 1973, we dropped a presoaked beacon on the run in 714 fm (1341 m corrected to the rig floor).

After dropping the beacon and on returning to its location, we discovered that our site was close to what appeared to be the eastern edge of the sedimentary area. Although the beacon was definitely on the sedimentary pile, we offset our drilling location 100 ft north and 400 ft west of the beacon location. This put us over a more central portion of the sedimentary pile back to the west along our track.

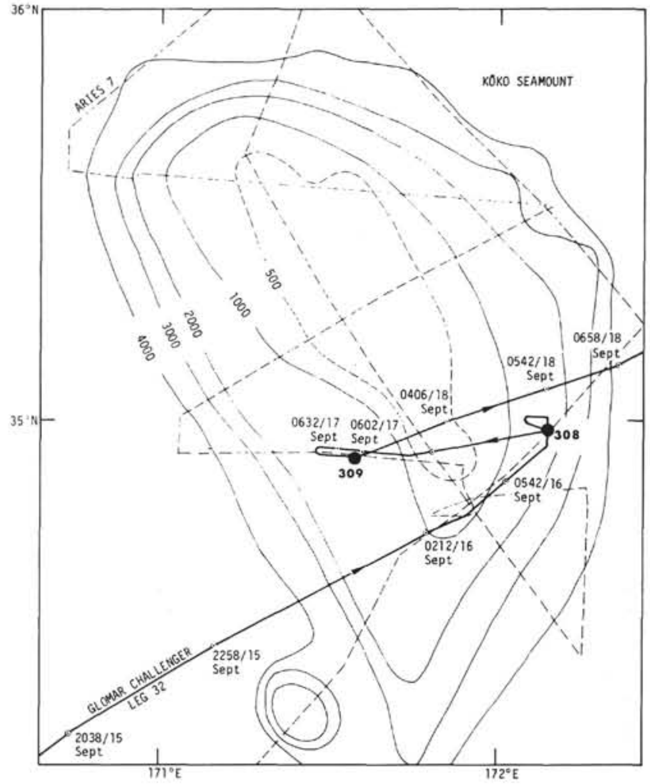


Figure 2. *Bathymetry in corrected meters of Kōko Seamount (after Davies et al., 1972) and track chart across the feature. Solid track is Leg 32* Glomar Challenger, *dashed track is* Aries-7. Challenger *navigation points indicated by open circles and annotated time/day-month.*

No sonobuoy was run on this site because of the thin cover of sediment and the steep surrounding topography.

We were underway from the site at 0154Z on 17 September 1973. We steamed easterly to the edge of the guyot platform while streaming the running gear (Figure 3). We then turned, recrossed the site while maneuvering on various courses and speeds, and headed for Site 309 on a course of 260°.

We reached the sea floor 3 hr after beginning to run in pipe with the help of the power tongs. The sea floor proved to be firm, and a core revealed a calcareous, volcanic clay with shallow-water lagoon debris. The seafloor core was only 3 meters long, and we had to pull out of that hole on retrieving the core. We then respudded the bit and drilled into 12.5 meters where we cored again (see Table 1 for summary). The drilling and coring of 50 meters were very slow as the volcanic clay was very firm. Throughout this period a 3-meter swell from the northwest and a strong current from the northeast combined to produce large excursions (>80 ft) from the beacon and large (0-40,000 lb) fluctuations of the bit weight. Rotation had to be stopped several times while we regained our position over the beacon.

The drilling from 50 to 65 meters went very quickly, but the bit then encountered an epiclastic volcanic sandstone that slowed the penetration rate abruptly. After retrieving Core 4 we rotated for 1.5 hr and

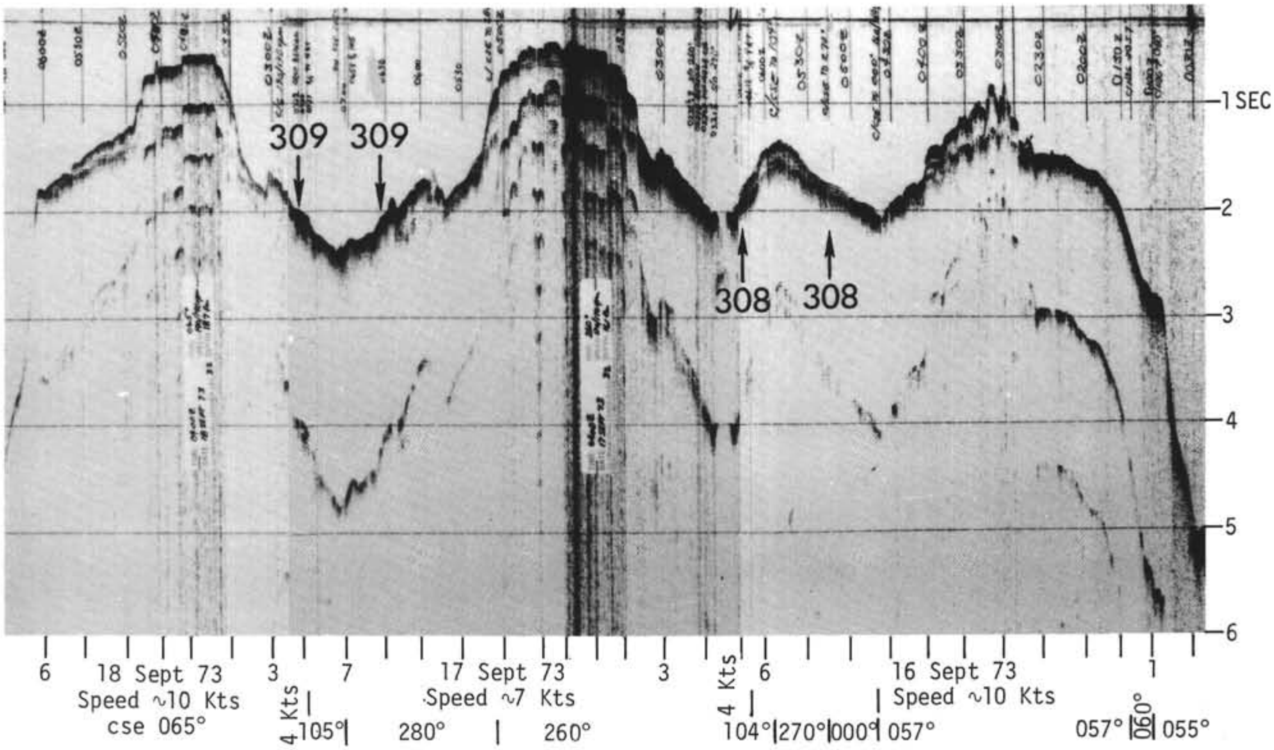


Figure 3. *Seismic profiler section approaching and leaving Sites 308 and 309.*

TABLE 1
Coring Summary

Core	Date (Sept. 1973)	Time	Depth From Drill Floor (m)	Depth Below Sea Floor (m)	Length Cored (m)	Length Recovered (m)	Recovery (%)
1	17	0000	1346.0-1349.0	0.0-3.0	3.0	1.7	57
2	17	0220	1358.5-1367.5	12.5-21.5	9.0	2.0	22
3	17	0420	1386.5-1395.5	40.5-49.5	9.0	1.7	19
4	17	0530	1405.0-1414.5	59.0-68.5	9.5	1.9	20
Total					30.5	7.3	23.9

penetrated about 1 to 1.5 meters. On retrieving the core, we found it empty and the sediment sock in place, indicating nothing had entered the core.

During the period of slow drilling after Core 4, we experienced two extreme (~400 ft) excursions from the beacon location that threatened to bend or break the bottom-hole assembly. The combination of possible bottom-hole assembly damage, heavy seas that were predicted to continue all day, and lack of penetration progress in the hard formation resulted in our decision to abandon the site. This would allow us to wait for the seas to abate, inspect the bottom-hole assembly, and try to find a spot with softer sediments.

LITHOLOGIC SUMMARY

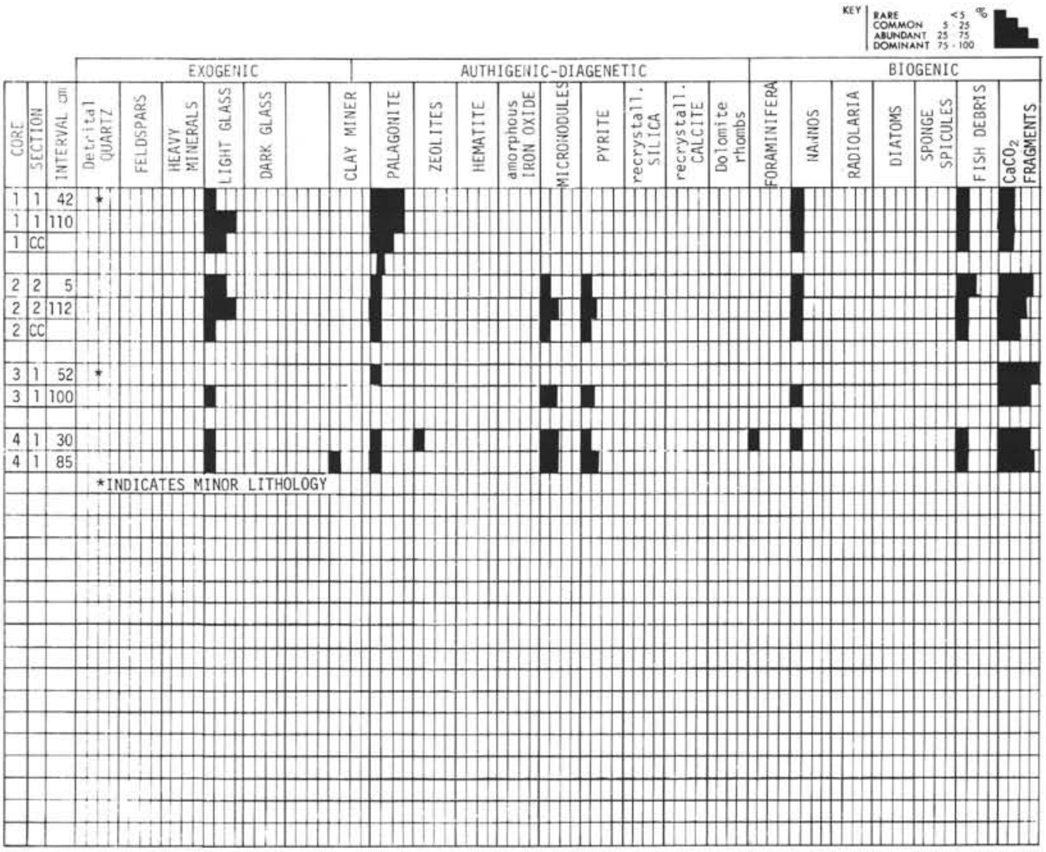
Four intervals were cored at Site 308 before the drilling was terminated prematurely because of operational difficulties. Core recovery was relatively good and drilling disturbance was minimal.

The cored sections fall within one lithologic unit, an altered volcanic silt to biogenic volcanic sandstone, the primary difference being the degree of cementation and the abundance of coarse debris. The unit ranges from an uncemented palagonite-rich altered volcanic sand (Core 1) to a biogenic volcanic silt (Cores 2 and 3) to a well-cemented biogenic volcanic sandstone (Core 4) with a sharp contact between the siltstone and sandstone. Both the degree of calcite cementation and abundance of well-rounded volcanic sand and rock fragments increases with depth. Cementation is evident as reprecipitated fibrous and blocky calcite. Bryozoan, coral, and mollusk fragments, ostracodes, benthonic foraminifers, and oolites are found throughout Cores 2, 3, and 4, and molds and casts of mollusks and solitary corals were recovered in Core 4. Pyrite micronodules are common in Cores 2, 3, and 4. A summary of the smear slides is given in Table 2.

Conclusions

The depositional environment for the sediments recovered at Site 308 is assigned as shallow water, based on the following observed criteria:

TABLE 2
Smear Slide Summary, Site 308



1) Well-rounded volcanic rock fragments;
2) Well-sorted texture;
3) Presence of sparry calcite cement;
4) Presence of miliolids (benthonic forams), oolites, and coralline algae;
5) Sharp contact between coarse- and fine-grained sediments;
6) Lack of a faunal difference between the coarse- and fine-grained sediments; and
7) Lack of a pelagic foraminiferal assemblage.

Further, generation within a moderate to high energy environment is suggested by the well-rounded and well-sorted nature of the sediment, by the presence of oolites, and the lack of micritic cement at some levels.

Although the location of Site 308 might suggest that the sediments should represent a talus deposit of some type, the sediment characteristics do not bear this out. Rather, it seems that this locality must have subsided from a depth within about 60 meters of sea level to its present depth, approximately 1331 meters. This depth gives a minimum subsidence rate, using the early Eocene age assigned by forams and nannofossils, of 25 to 26.5 m/m.y.

GEOCHEMICAL MEASUREMENTS

Due to lithified sediments and shallow hole depth, only one interstitial water sample was taken from this site. The sample was from 15.5 meters below the sea floor. The *p*H, alkalinity, and salinity for the sample are given in Table 3.

PHYSICAL PROPERTIES

Density and Porosity of Soft Sediments

The density of the stiff, semilithified altered volcanic silt recovered in Core 1, as measured by the GRAPE, varies between 1.6 and 1.7 g/cc. The GRAPE value (1.68 g/cc) agrees very well with the syringe value (1.69 g/cc). Combining the GRAPE and syringe data gives a porosity of 57%-63%.

Sonic Velocity

The sonic velocity, Vp, of the volcanic sediments and sedimentary rocks recovered at this site increases with lithification and, apparently, grain size. Vp of the stiff-semilithified volcanic silt is 1.6 km/sec. It increases to 2.4 km/sec in the semilithified, biogenous siltstone, and is 2.8 and 3.5 km/sec in the biogenous, well-cemented, fine- and coarse-grained sandstone, respectively. Figure 4 shows a summary of Site 308 physical properties.

BIOSTRATIGRAPHIC SUMMARY

All samples from the four cores recovered at this site are rich in benthonic foraminifera, ostracodes, fragments of corals (mainly alcyonarians), and bryozoans. Molds of small snails are found in almost all samples. The composition of the microfaunas indicates a near-shore environment with probably normal salinity. Bryozoans indicate a depositional depth of not much less than 60 meters.

TABLE 3
Summary of Shipboard Goechemical Data

Sample (Interval in cm)	Depth Below Sea Floor (m)	pH Punch-in	pH Flow-through	Alkalinity (meq/kg)	Salinity (°/oo)	Remarks (Combination Electrode pH)
Surface Seawater		8.19	8.25	2.29	34.4	8.27
2-2, 0-6	15.5	8.36	8.59	1.25	34.6	8.62

Coccoliths found in Cores 1 and 2 are typical for the early Eocene *Discoaster lodoensis* Zone. Rare planktonic foraminifera occur in Cores 1, 2, 3, and at the top of Core 4. They are all characteristic for the early Eocene *Globorotalia formosa formosa* Zone. A biostratigraphic summary of Site 308 appears in Table 4.

Foraminifera

The assemblages of benthonic foraminifera are in general dominated by calcareous species. In a few samples (Samples 3-1, 30-32; 3, CC; and 4-1, 30-32 cm) arenaceous species represent approximately 20% of the foraminiferal assemblage.

Among the most common calcareous benthonic foraminifera are: *Discorbis perovalis*, *Discorbis* sp. cf. *D. perovalis*, *Valvulineria scrobiculata*, *Cibicides* sp. aff. *C. robustus*, *Cibicides* sp. ex gr. *C. lobatulus*, *Cibicides* sp. aff. *C. pseudoungerianus*, *Lamarckina ovula*, *L. rugulosa*, and *Stomatorbina torrei*. The arenaceous foraminifera are represented by several species of the genus *Valvulina* (*V. angulosa*, *V. limbata*, *Valvulina* sp. aff. *V. angulosa*, *Valvulina* sp. aff. *V. limbata*, and *Clavulina columnatortilis*. *Remanellina* sp., a microfossil incertae sedis, is present in some samples (Ferrer, this volume).

Planktonic foraminifera are rare to very rare in all samples, but allow Cores 1, 2, 3, and the top of Core 4 to be dated. All samples with planktonic foraminifera are attributed to the early Eocene *Globorotalia formosa formosa* Zone.

Coccoliths

Sparse late Quaternary assemblages are present in the upper half meter of Core 1. Early Eocene *Discoaster lodoensis* Zone shallow-water assemblages are present in Cores 1 and 2 (0.5-22 m). Cores 3 and 4 (41-69 m) contain only rare undiagnostic placoliths. The common occurrence of genera *Braarudosphaera*, *Micrantholithus*, and *Rhabdosphaera* indicates shallow-water deposition. The stratigraphic coincidence of *Discoaster lodoensis* and *Lophodolithus nascens* in the absence of *Tribrachiatus orthostylus* and *Discoaster sublodoensis* is used to zone the assemblages of Cores 1 and 2. The *Discoaster lodoensis* Zone nominally represents the period 50 to 51 m.y. Therefore, the age and age-error estimate for Cores 1 to 2 is 50.5 ±3.5 m.y.

Radiolaria

No Radiolaria or other siliceous fossils were found in the core catchers of Cores 1 to 3.

Ostracodes (H. J. Oertli, SNPA, Paris, France)

The ostracodes represent a rich nearshore assemblage which needs and justifies a detailed investigation that could not yet be undertaken. Without being the same specific assemblage, the general aspect of the faunas resembles those described by Hazel and Holden (1971) from Tonga. (See Ferrer, this volume.)

Bryozoa (A. H. Cheetham, Smithsonian Institution, Washington)

Five samples from Cores 1 to 3 yielded more than 700 specimens of bryozoa. Although most specimens are fragments, they show no obvious abrasion. A few of the encrusting colonies are attached to substrates, and some erect colonies have basal attachments preserved; a very few have growing edges preserved.

About one-third of the specimens recovered are referable to the order Cheilostomata. Although more numerous in specimens, cyclostomes seem to be less diversified than the cheilostomes. Most of the identifiable cheilostome species and some of the genera appear to be undescribed.

TABLE 4
Distribution, Age, and Frequency of Investigated Microfossils

Core	Depth in (m)	Recovery (%)	Foraminifera Plankt.	Foraminifera Benth.	Foraminifera	Calcareous Nannoplankton		Radiolaria	
1	0.0-3.0	57	+	•	Early Eocene	•	Early Eocene top Quaternary	–	–
2	12.5-21.5	22	+	•	Early Eocene	•	Early Eocene	–	–
3	40.5-49.5	19	+	•	Early Eocene	–		–	–
4	59.0-68.5	20	+	•	Early Eocene	–	–	–	–

•abundant; o common; * frequent; + rare; – absent.

More than half the cheilostome specimens recovered belong to two undescribed species of the genus *Tubucella*.

The apparent affinities of cheilostomes recovered from Cores 1 to 3 are consistent with an early Eocene age obtained from foraminiferal and nannoplankton evidence. In France, bryozoan assemblages of middle and late Eocene age somewhat comparable to those from Site 308 have been interpreted as having lived at sublittoral depths, considerably shallower than the present 1331-meter water depth at Site 308. The presence of *Poricellaria* in the assemblage at Site 308 seems especially significant, because modern representatives of this genus are tropical reef-associated forms found only at depths less than 60 meters. The much greater abundance of colonies with rigidly erect form than at those with jointed forms in the Site 308 assemblage argues for a depth of accumulation not much less than the 60-meter maximum suggested by the presence of *Poricellaria*. (For more details, see Cheetham, this volume.)

SUMMARY AND CONCLUSIONS

No basement cores were abtained so we were not able to satisfy our primary objective of determining the paleolatitude of Kōko Guyot, or our secondary one of describing in detail the volcanic petrology of a cored section there. See Figure 4 for summary of Site 308.

The early Eocene age of the sediments is of significance to the tectonic history of linear volcanic chains. The *Discoaster lodoensis* Zone is about 50 to 51 m.y. old, significantly older than the 46-m.y. radiometric age of dredged rocks from Kōko Guyot. In any analysis of the progression of volcanic activity two new items must now be considered: first, that volcanism continued in the vicinity of Kōko Guyot for at least 6 m.y., and second, that in extrapolating the Hawaiian to Midway age gradient back to Kōko, an even greater change in rate occurs than had been identified up to now. Results at Site 309 on the west side of Kōko, and at Site 311 on the archipelagic apron of a seamount northwest of Midway, also bear on the problem of the evolution of volcanic chains, and are discussed in those site chapters.

The type of sediment recovered and the character of the profiler records across the guyot support the theory for the origin of guyots that most investigators favor: the characteristic topography of guyots is formed in shallow water by the erosional truncation of the volcanic edifice coupled with paralic sedimentation. The sediments recovered at Site 308 are generally similar in composition and texture to those now forming at depths between sea level and a few hundred meters around the Hawaiian Islands (Moberly, 1968). The main differences are the calcite cement, due to the age, and the high bryozoan content, perhaps due to a different faunal province or to cooler water, of the Kōko samples. Further discussion of these sediments is by Matter and Gardner and by Moberly and Keene, this volume. The wealth of ostracodes and rarity of planktonic foraminifers suggest that these Kōko sediments formed near sea level, probably no deeper than 60 meters (Cheetham, this volume). Therefore, the guyot at Site 308 has subsided at least 1300 meters. The moat shown on reflection profiles suggests that subsidence continues even today.

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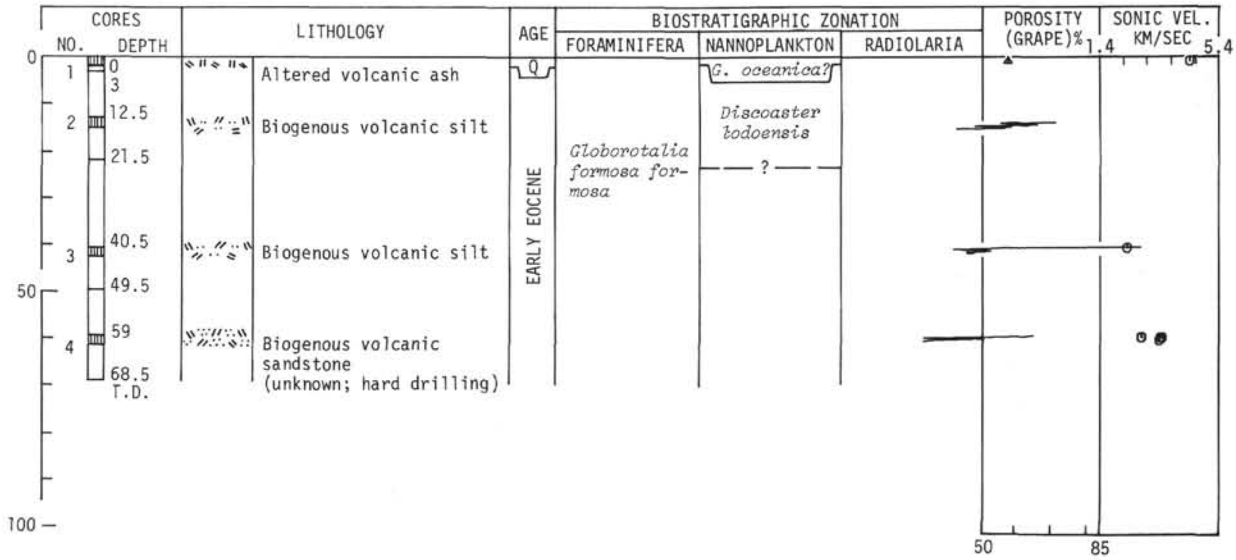


Figure 4. *Summary of coring, lithology, biostratigraphy, and physical properties at Site 308.*

Site 308 Hole Core 1 Cored Interval: 0.0-3.0 m

AGE	ZONE (NANNOS / FORAMS / RADS)	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE
					0				
QUAT. ▲ / EARLY EOCENE	Discoaster lodoensis / Globorotalia formosa formosa	N	F	M	1	0.5, 1.0	VOID		*42, *110
		R / N / F	— / F / A	— / M / G	Core Catcher				*CC

▲ Gephyrocapsa oceanica
Emiliania huxleyi

10YR 3/4

LITHOLOGIC DESCRIPTION

BIOGENOUS VOLCANIC SILT AND SAND, dark yellowish brown (10YR 3/4), stiff to semilithified, homogeneous, with similar material of medium dark gray (N4) composing layers 2 to 5 mm thick and at 5 to 10 cm intervals above 82 cm.

Smear Slide at 1-42

Texture	Composition	
(R-O-A)	Palagonite	A
	Volcanic glass	R
	Carbonate fragments	R
	Nannos	R
	Fish debris	R

Smear Slide at 1-110

Texture	Composition	
(O-C-A)	Volcanic glass	A
	Palagonite	A
	Carbonate fragments	R-C
	Nannos	R
	Fish debris	R
	Unknown crystals	R

Smear Slide at 1-CC

Texture	Composition	
(O-C-A)	Volcanic glass	C
	Palagonite	C
	Carbonate fragments	R-C
	Nannos	R
	Fish debris	R

Carbon-Carbonate
1-115 (0.3-0.1-2.0)
1-120 (0.5-0.1-3.0)

X-ray 1-110

Calc	6.9%	Clin	5.4%
Quar	3.9%	Pyri	1.0%
K-Fe	37.0%	Augi	5.4%
Plag	16.7%	Amor	78.2%
Mont	23.8%		

Site 308 Hole Core 2 Cored Interval:

AGE	ZONE (NANNOS / FORAMS / RADS)	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE
					0				
EARLY EOCENE	Discoaster lodoensis / Globorotalia formosa formosa				1	0.5, 1.0	VOID		
		N	C	M	2		VOID		*5, *112
		F	A	G					
		R / N / F	— / F / C	— / P / G	Core Catcher				*CC

N4

LITHOLOGIC DESCRIPTION

BIOGENOUS VOLCANIC SILT, medium dark gray (N4), soupy at top becoming stiff, homogeneous with abundant thin-walled and partically dissolved pelecypod fragments. Alternation of semilithified and stiff sections throughout Section 2.

Binocular observations reveal abundant well-rounded silt- and sand-sized volcanic rock fragments with abundant benthonic foraminifers, rare bryozoa, ostracods, and small gastropods, all within a fine-grained matrix.

Smear Slide at 2-5

Texture	Composition	
(O-D-O)	Carbonate fragments	A
	Volcanic glass	R-C
	Palagonite	R
	Pyrite micronodules	R
	Nannos	R
	Fish debris	R
	Zeolites	R

Smear Slide at 2-112

Texture	Composition	
(O-A-C)	Carbonate fragments	A-C
	Volcanic glass	C
	Palagonite	R
	Pyrite micronodules	C-R
	Nannos	R
	Fish debris	R
	Zeolites	R-C

Smear Slide at CC

Texture	Composition	
(O-D-O)	Carbonate fragments	C
	Volcanic glass	R
	Palagonite	R
	Pyrite micronodules	R
	Zeolites	C
	Nannos	R
	Fish debris	R

Zeolites predominately clinoptilolite.

Grain Size
2-50 (14.8-50.6-34.6) clayey silt

Carbon-Carbonate
2-50 (5.4-0.3-43)

X-ray 2-50

Calc	56.4%	Clin	6.0%
K-Fe	10.3%	Pyri	2.9%
Plag	6.6%	Ilme	5.9%
Mont	11.9%	Amor	64.2%

Explanatory notes in Chapter 1

Site 308 Hole Core 3 Cored Interval: 40.5-49.5 m

AGE	ZONE (NANNOS / FORAMS / RADS)	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
					0		VOID			
EARLY EOCENE	Globorotalia formosa formosa				1	0.5, 1.0	V		*52, *100	N4
		R / N / F	— / R / C	— / P / G	Core Catcher		V			

BIOGENOUS VOLCANIC SILT, medium dark gray (N4), semilithified, homogeneous, with scattered pelecypod fragments.

Smear Slide at 52 cm is in a pelecypod fragment.

Smear Slide at 1-100

Texture	Composition	
(O-A-A)	Carbonate fragments	A
	Pyrite micronodules	R-C
	Volcanic glass	R
	Palagonite	R
	Nannos	R

Grain Size
1-110 (19.2-60-20.8) clayey silt

Carbon-Carbonate
1-110 (7.4-0.4-58)

X-ray 1-110

Calc	85.9%	Ilme	2.9%
Mont	3.4%	Unident	TR%
Pyri	7.1%	Amor	61.5%
Anhy	0.6%		

Site 308 Hole Core 4 Cored Interval: 59.0-68.5 m

AGE	ZONE (NANNOS / FORAMS / RADS)	FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
					0		VOID			
EARLY EOCENE	Globorotolia formosa formosa	N	R	P	1	0.5, 1.0	V		*30, *85	N4
		N / F	— / C	— / P	Core Catcher		V			

BIOGENIC VOLCANIC SANDSTONE, medium dark gray (N4), calcite cemented, dominantly well-rounded sand-sized volcanic rock fragments of a variety of colors together with abundant biogenic debris (pelecypods, gastropods, benthonic foraminifers, [many miliolids], bryozoa, and solitary corals).

The volcanic pebbles showing elongations are roughly aligned or occasionally imbricated. Aragonitic material (corals, mollusks) are partically dissolved leaving molds, some of which are infilled with carbonate crystals. Palisade structure calcite cement is apparent. Encrusting coralline algae found in core catcher sample.

Smear Slide at 1-30

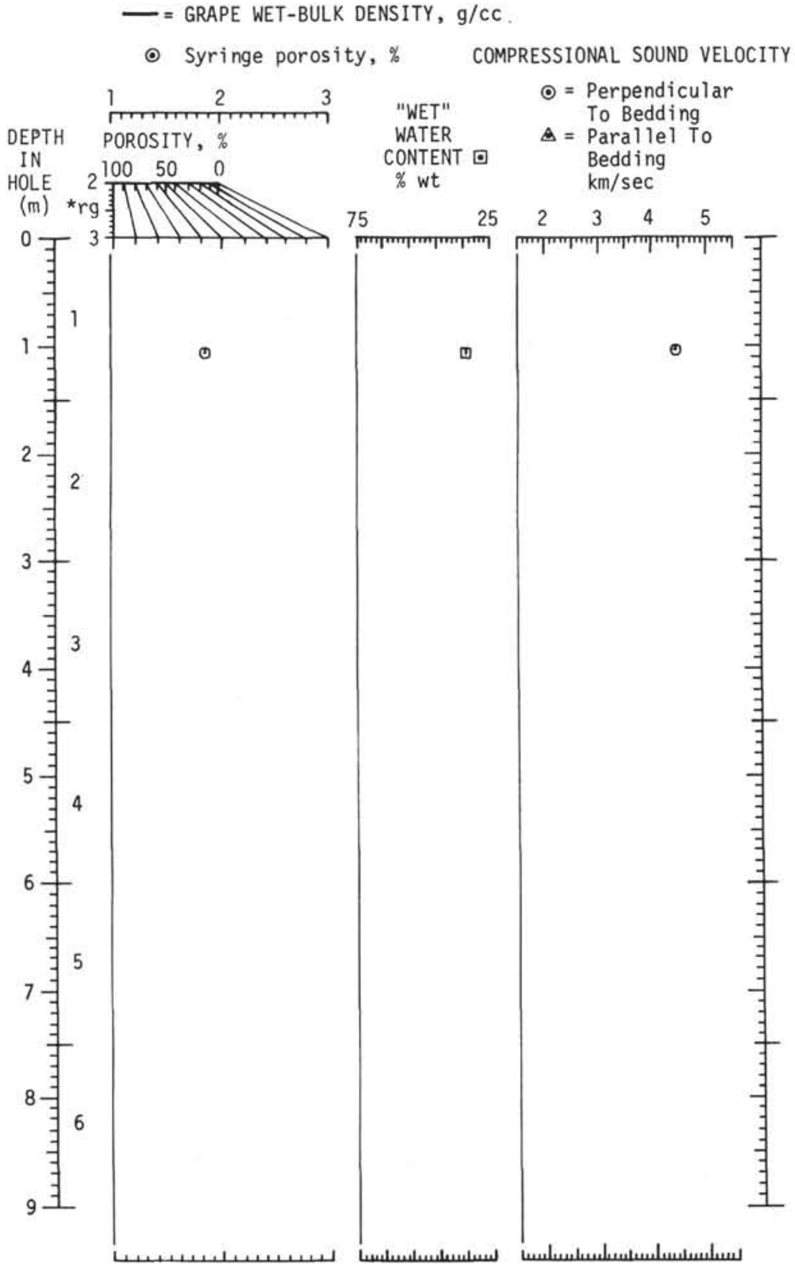
Texture	Composition	
(O-A-O)	Carbonate fragments	A
	Pyrite micronodules	C-R
	Volcanic glass	R
	Palagonite	R
	Zeolites	R
	Forams	R
	Nannos	R
	Fish debris	R

Smear Slide at 1-85

Texture	Composition	
(O-A-C)	Carbonate fragments	A-D
	Pyrite micronodules	C-R
	Volcanic glass	R
	Palagonite	R
	Celadonite	R
	Fish debris	R

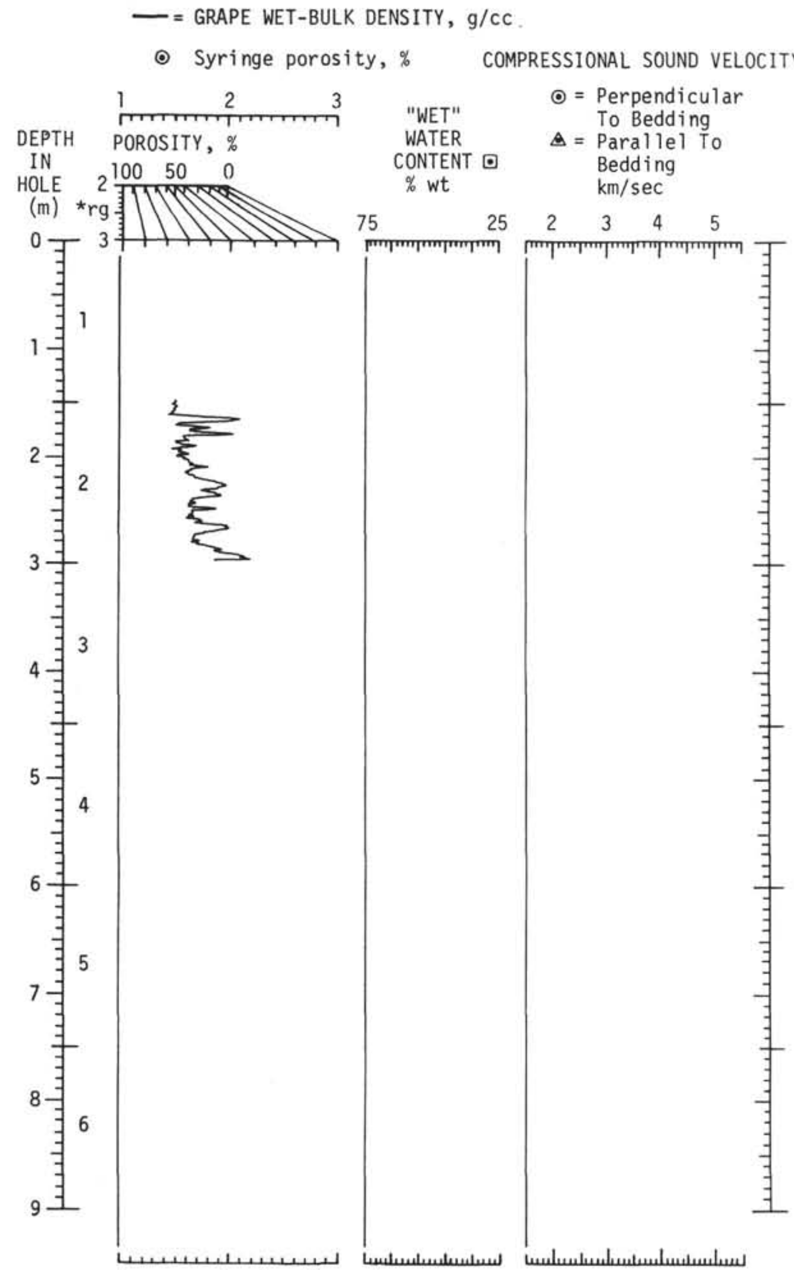
Explanatory notes in Chapter 1

CORE 308-1

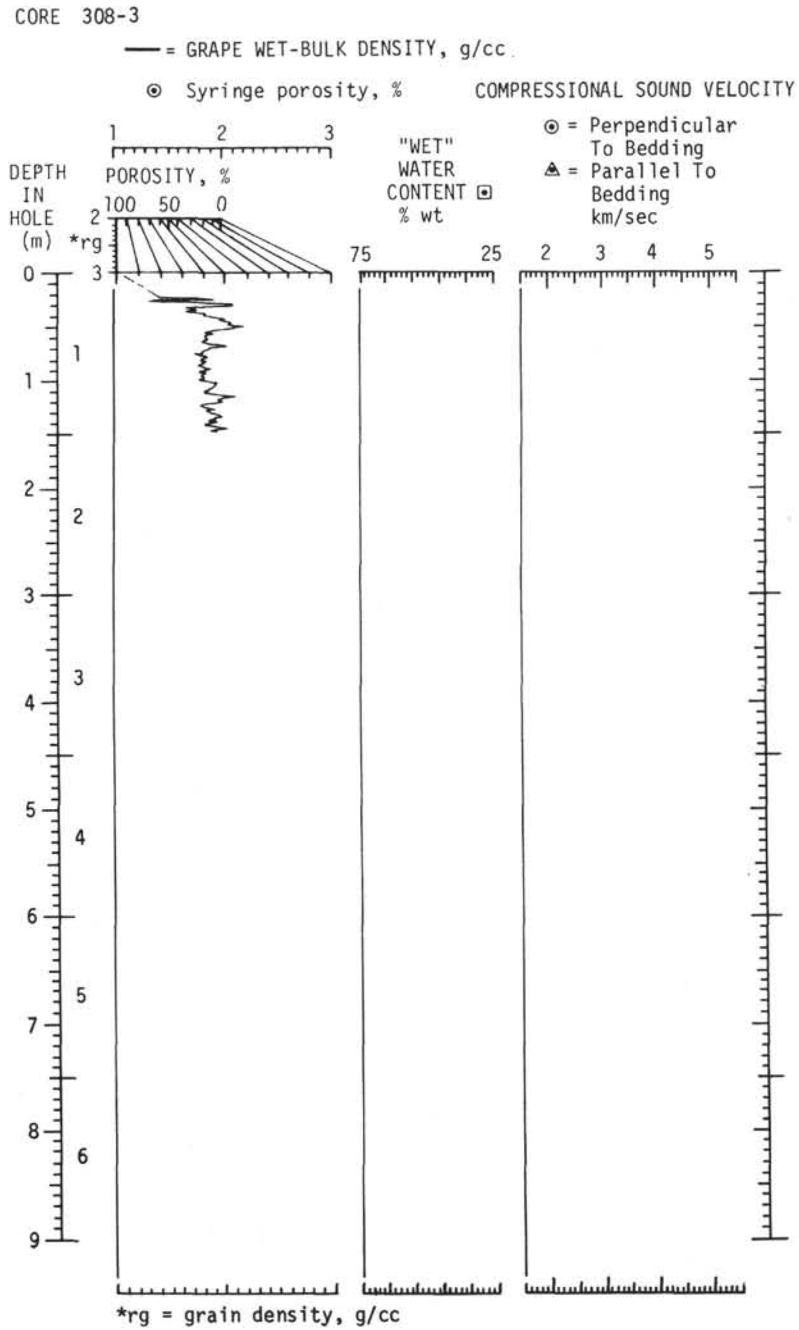


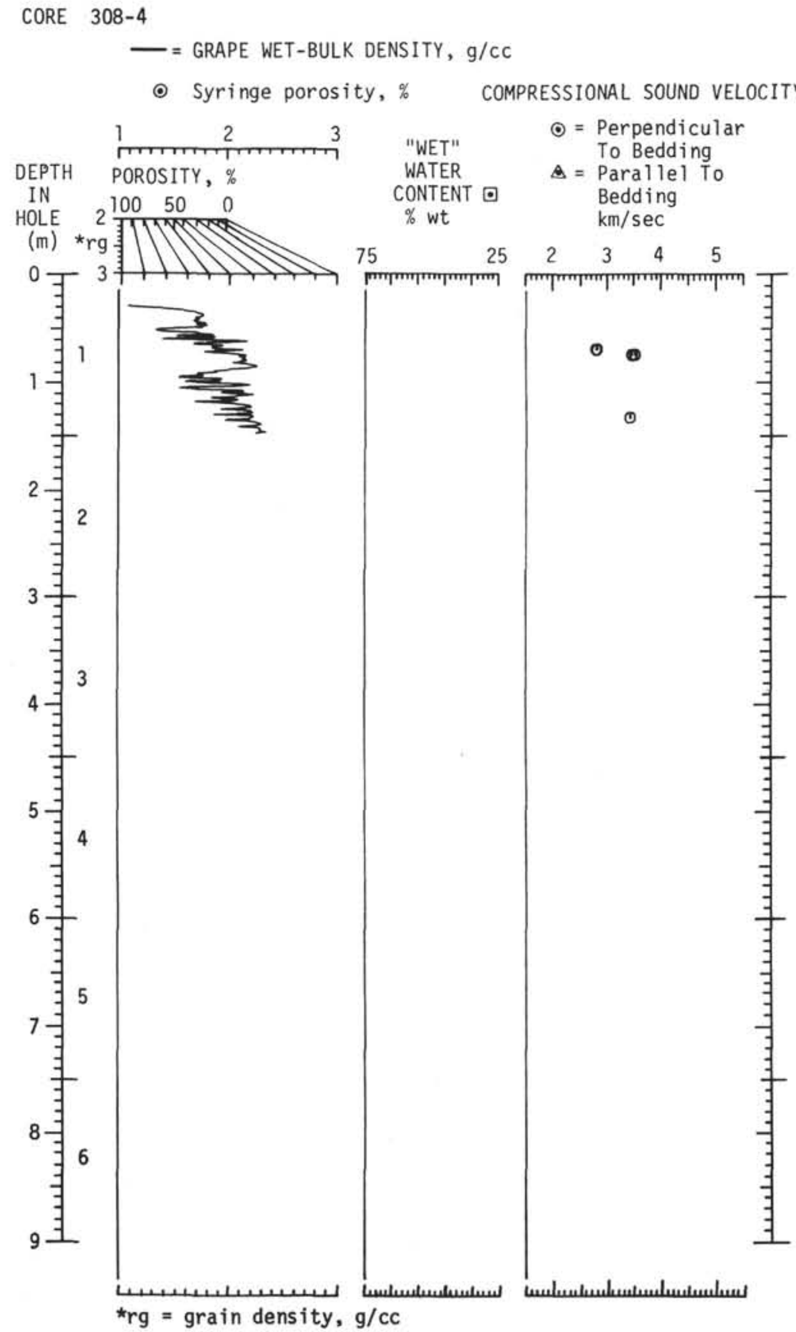
*rg = grain density, g/cc

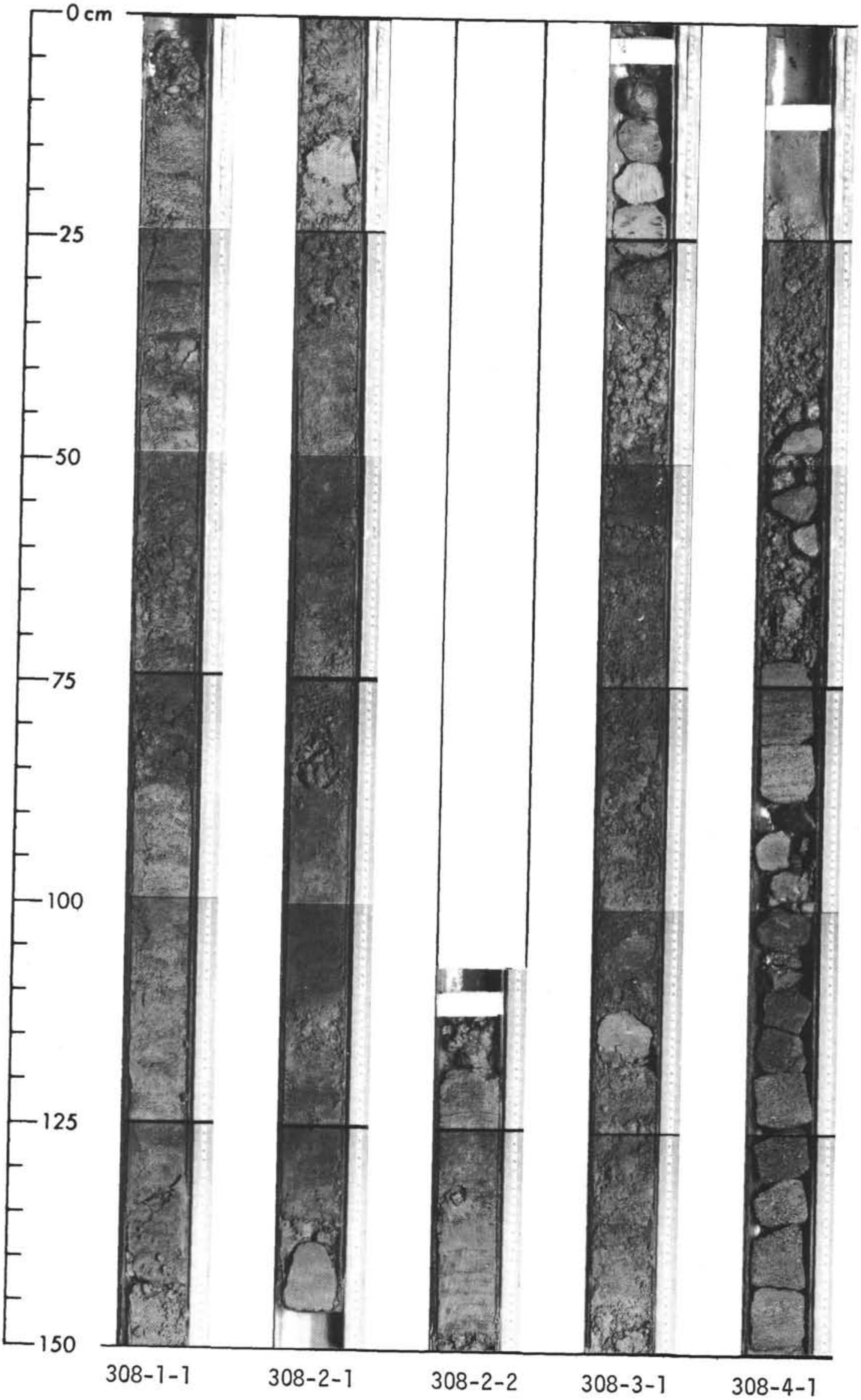
CORE 308-2



*rg = grain density, g/cc


CORE 308-3
— = GRAPE WET-BULK DENSITY, g/cc
⊙ Syringe porosity, %
COMPRESSIONAL SOUND VELOCITY
⊙ = Perpendicular To Bedding
▲ = Parallel To Bedding
km/sec
DEPTH IN HOLE (m)
*rg
POROSITY, %
100 50 0
"WET" WATER CONTENT ⊡ % wt
75 25
2 3 4 5
*rg = grain density, g/cc


CORE 308-4
— = GRAPE WET-BULK DENSITY, g/cc
⊙ Syringe porosity, %
COMPRESSIONAL SOUND VELOCITY
⊙ = Perpendicular To Bedding
▲ = Parallel To Bedding
km/sec
DEPTH IN HOLE (m)
*rg
POROSITY, %
100 50 0
"WET" WATER CONTENT ⊡ % wt
75 25
2 3 4 5
*rg = grain density, g/cc


0 cm
25
50
75
100
125
150
308-1-1
308-2-1
308-2-2
308-3-1
308-4-1