8. SITE 309: KŌKO GUYOT

The Shipboard Scientific Party[1]

SITE DATA

Date Occupied: 17 September 1973 (1932)

Date Departed: 18 September 1973 (1430)

Time on Site: 19 hours

Position: 34°54.32′N, 171°33.67′E

Water Depth: 1454 corrected meters (echo sounding)

Bottom Felt With Drill Pipe At: 1470 meters below rig floor

Penetration: 12 meters

Number of Holes: 1

Number of Cores: 1

Total Length of Cored Section: 2 meters

Total Core Recovered: trace

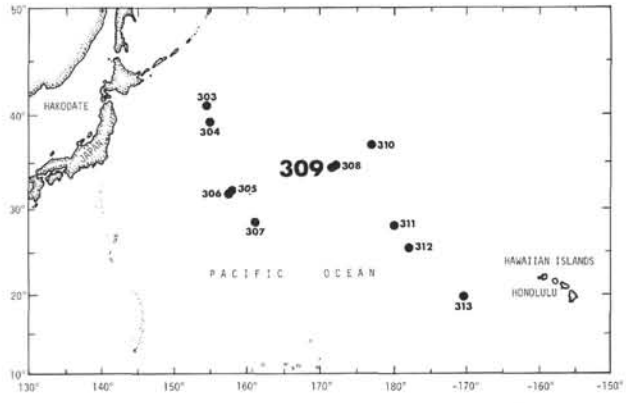
BACKGROUND AND OBJECTIVES

The 3-meter swell while drilling at depths of about 1400 meters forced our abandonment of Site 308, on the southeast flank of Kōko Guyot before reaching basement. Therefore, the principal objective of Site 308 was not met, and we moved to an alternate site while waiting for the swell to subside.

Our objective for Site 309 was that described in more detail in the preceding site report chapter, namely, to determine the paleolatitude of a specific period of volcanicity on the Emperor Seamount Chain, Kōko Guyot, which, when compared with the paleolatitude of Midway Islands and the present-day latitude of the active volcanoes on Hawaii, can test a version of the hot-spot theory: that a source of magma generation has remained fixed in the earth's mesosphere while the Pacific lithospheric plate has moved across it, with resultant volcanoes forming first the Emperor Seamounts and, after a change in direction of plate motion, the Hawaiian Ridge.

OPERATIONS

After our encounter with the hard, volcanic clays and sandstones at Site 308, we moved to the southwest side of the volcanic platform (Figure 1) in the hopes of finding softer sediment. We approached Site 309 on a westerly heading that was a close approximation of an *Aries*-7 profile (Figure 2). Two satellite fixes placed our



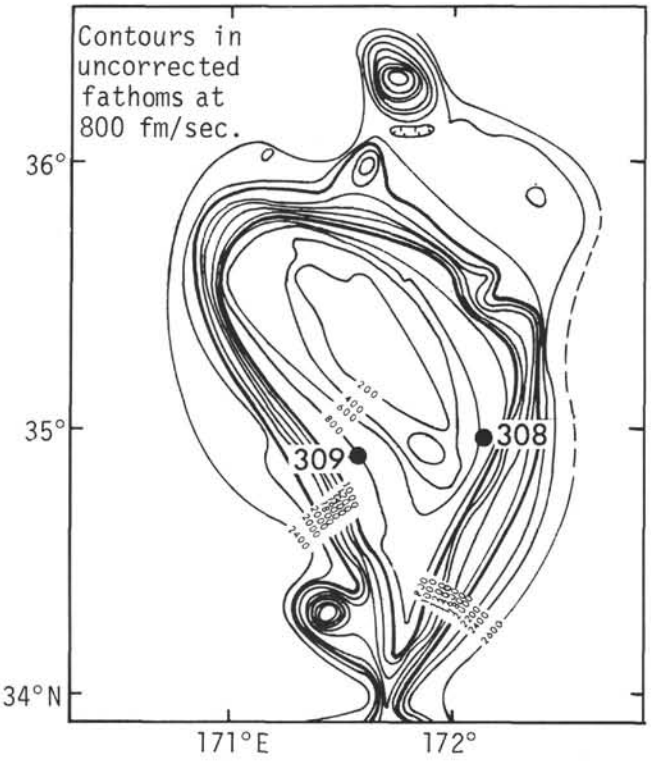


Figure 1. *Bathymetry in the region of Site 309 (after Davies et al., 1972). Contour interval 200 fm uncorrected.*

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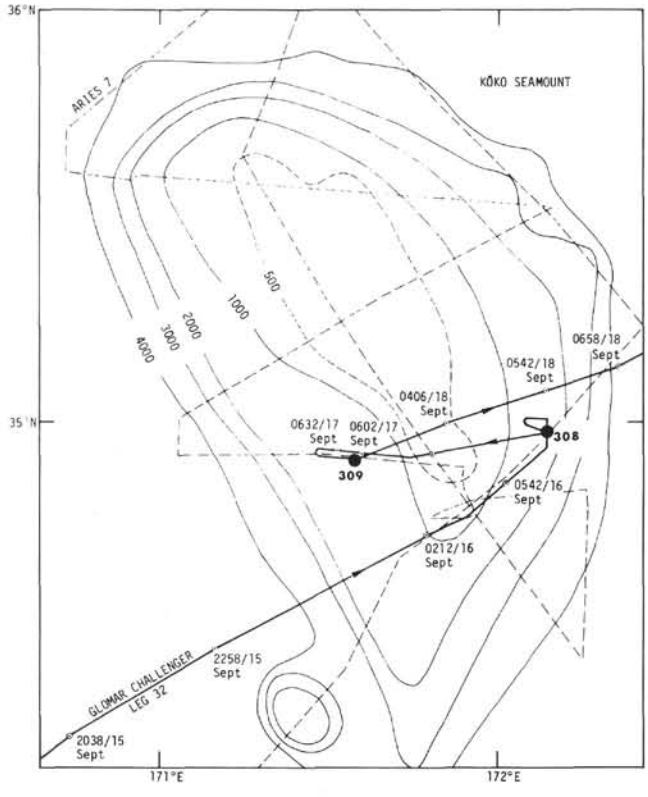


Figure 2. *Bathymetry in corrected meters of KōKo Seamount (after Davies et al., 1972) and track chart across the feature. Solid track is Leg 32* Glomar Challenger, *dashed track is* Aries-7. Challenger *navigation points indicated by open circles and annotated time/day-month.*

line about 2 km north of the *Aries*-7 line, and our profiler revealed no sediment cover. We ran west of the site location about 10 km, made a wide turn to port, and came back parallel to our original track 2 km to the south. This appeared to put us exactly on the *Aries*-7 profile. After running east for about 9 km, we slowed to 4 knots prior to the beacon drop. At 0732Z on 17 September 1973, we dropped a presoaked beacon in 780 fm of water (1464 m corrected to the rig floor).

No sonobuoy was run on this site due to the thin sedimentary cover and the steep topography.

At 0230Z on 18 September 1973, we got underway from Site 309 enroute to Site 310 (Figure 3). Because of our nearly nil results at this site, we did not make a pass across the beacon, but rather streamed the running gear and proceeded directly to Site 310.

We reached the sea floor about 3.5 hr after beginning to run in pipe. The swell was reduced to about 2 meters by this time, and a moderate current was running. Positioning at this site was not too difficult except for occasional excursions during brief gusts of wind. The mudline was hard at this location, and the sea-floor core consisted of a sample of coral, foraminifera, and volcanic debris as sand-sized particles scraped from the inside of the core catcher. Rotation and pump pressure up to 25 spm (strokes per minute) were initiated in an attempt to wash in through the sea bottom. The "patting" of the drill string and occasional, erratic jumps in bit weight indicated a hard formation at the surface. After about 3 hr of drilling and about 6 meters of penetration (Table 1), the drill string began to torque moderately. After 5.5 hr of drilling and only 12 meters of penetration at 0745L on 18 September 1973, the pump pressure and torque

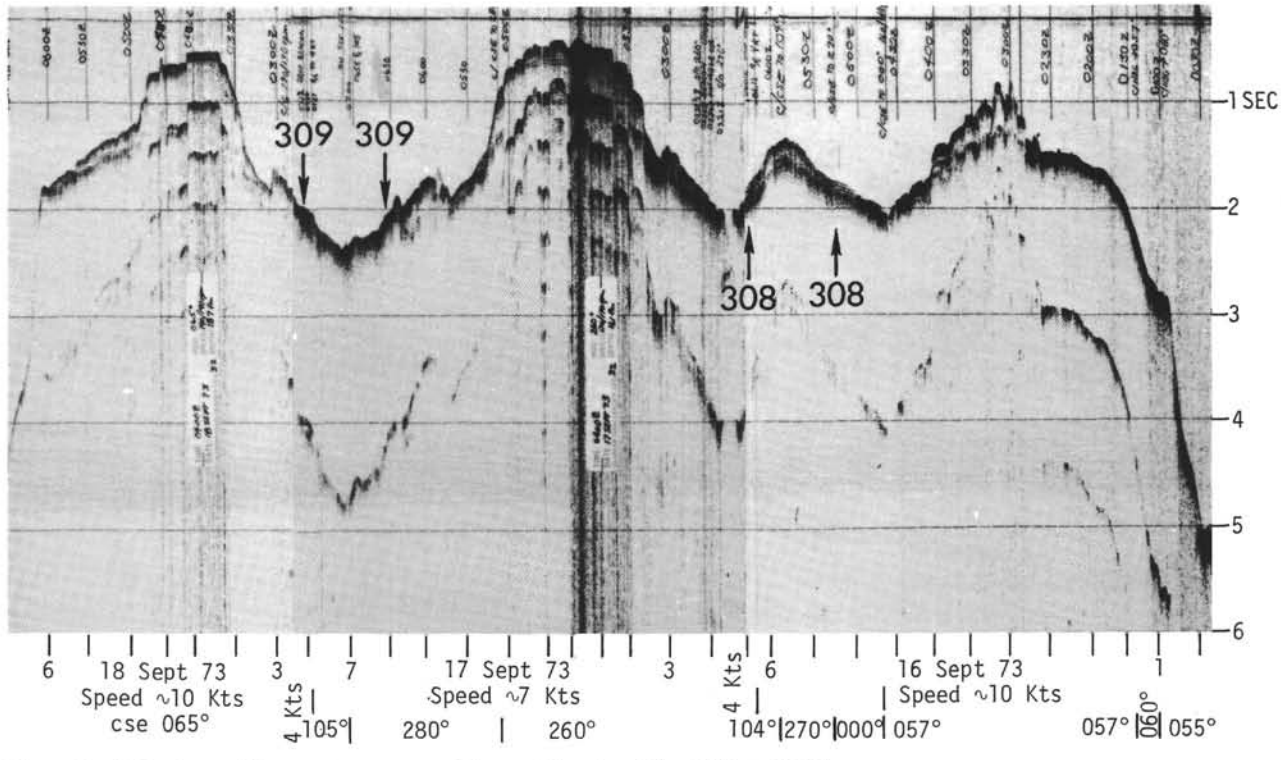


Figure 3. *Seismic profiler section approaching and leaving Sites 308 and 309.*

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	18	0250	1470.0-1472.0	0.0-2.0	2.0	tr	<1

dropped to zero, and we lost ~10,000 lb of drill-string weight, indicating that we had twisted off a portion of the bottom-hole assembly. We pulled up the drill string and discovered that the joint above the upper bumper sub of the lower bumper sub pair had ruptured, leaving two bumper subs, two standard drill collars, one monel drill collar, and the drill bit. The joint above this was visibly strained and also nearly sheared off. The failures occurred as the result of a constant pounding of the bottom-hole assembly on a hard formation with no lateral support.

LITHOLOGIC SUMMARY

Only one small sample was recovered at Site 309 because of operational difficulties. The recovered sediment consists of an unconsolidated foram-bearing biogenic carbonate sand. The components of the sediment seem to comprise two distinct facies: a pelagic facies of planktonic foraminifers, radiolarians, and coccoliths, and a reefal facies of coral and mollusk fragments and larger foraminifers. Whether these two facies were originally stratified one upon the other and disturbed by coring or whether they represent talus debris is indeterminate. The drilling indicated very firm sediment, and there were fragments of sparry calcite, so perhaps there was a thin layer of the Recent pelagic fossils on older cemented rock. A summary of a smear slide from the lone sample is given in Table 2.

BIOSTRATIGRAPHIC SUMMARY

Only a small amount of cuttings was obtained from the uppermost 2 meters cored at this site. They furnished two different types of assemblages:

1) Warm-water pelagic microfossils of Quaternary age (coccoliths, *Gephyrocapsa oceanica* Zone; diatoms, *Pseudoeunotia doliolus* Zone; planktonic foraminifers, *Globorotalia truncatulinoides* Zone), with an associated rich and varied assemblage of bathyal benthonic foraminifera. Fragments of siliceous sponges are relatively frequent.

2) Larger foraminifera and sturdy *Rotalia* spp. of late Oligocene (to early Miocene?) age which are associated with fragments of colonial corals and encrusting algae.

Foraminifera

The larger foraminifera associated with reef debris belong to the genera *Spiroclypeus* (frequent), *Heterostegina* (rare), *Sphaerogypsina* (very rare), and *Amphistegina* (very frequent). The representatives of the genus *Spiroclypeus* indicate a late Oligocene age, those of the genus *Heterostegina* a late Oligocene to early Miocene age (see Hottinger, this volume).

Coccoliths

A Quaternary *Gephyrocapsa oceanica* Zone assemblage is present in Core 1 core-catcher sample (0-2 m). *Ceratolithus cristatus* and several forms of *Gephyrocapsa* are present, suggesting deposition from relatively warm water. Very rare *Discoaster* specimens are the only indicators of possible reworking.

Radiolaria

The small recovery in the core catcher of Core 1 did not provide enough sediment to allow a preparation for Radiolaria.

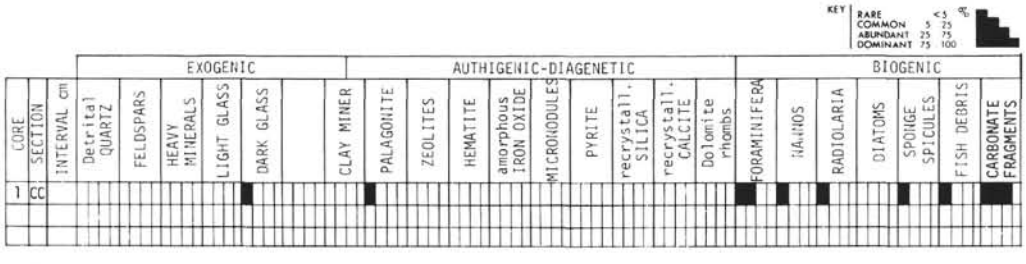
Diatoms

A Quaternary *Pseudoeunotia doliolus* Zone assemblage is present in Sample 1, CC (0-2 m). The rare, poorly preserved specimens of *Pseudoeunotia doliolus*, *Hemidiscus cuneiformis*, and *Coscinodiscus lineatus* suggest deposition from relatively warm water.

SUMMARY AND CONCLUSIONS

The meager information given by the few grams of sediment recovered at Site 309 (Figure 4) tends to support the general conclusions for Site 308, also on Kōko Guyot. These are, that no magnetic paleolatitude or igneous petrologic studies can be made from Leg 32 material, and that the guyot has subsided more than 1000 meters during the Cenozoic.

TABLE 2
Smear Slide Summary, Site 309



The Site 309 region of Kōko Guyot, or an area upslope from it, was relatively shallow in the late Oligocene or early Miocene. Volcanism may have recurred well after the 6-m.y. long period of volcanism recorded by fossils at Site 308 and by dates on rocks dredged from the guyot (Clague and Dalrymple, 1973). Another, perhaps less likely, possibility is that the west side (Site 309) of the large guyot may have been formed as a volcanic edifice at the same time as the east side (Site 308), but some accident of faulting, tilting, or perhaps erosion of Kōko Island, put the west side in shallower water in the late Oligocene. Certainly the history of linear volcanic chains is more complicated than some have speculated.

REFERENCES

Clague, D. A. and Dalrymple, G. B., 1973. Age of Kōko Seamount, Emperor Seamount Chain: Earth Planet. Sci. Lett., v. 17, p. 411-415.

Davies, T. A., Wilde, P., and Clague, D. A., 1972. Kōko Seamount: A major guyot at the southern end of the Emperor Seamounts: Marine Geol., v. 13, p. 311-321.

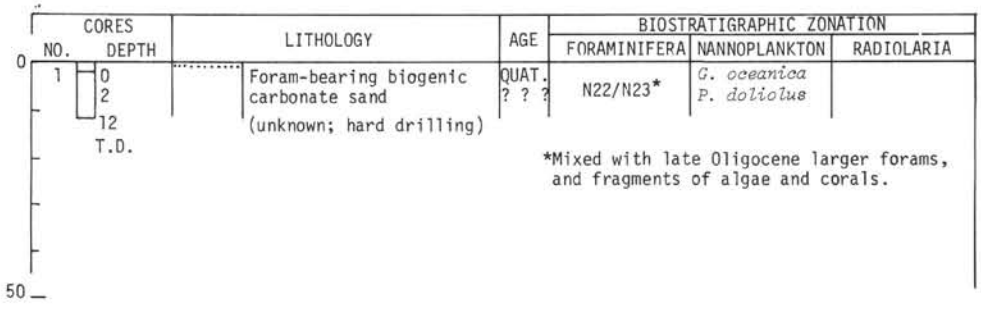


Figure 4. *Summary of coring, lithology, and biostratigraphy at Site 309.*

Site 309 Hole Core 1 Cored Interval: 0.0-2.0 m

AGE	ZONE: NANNOS FORAMS RADS	FOSSIL CHARACTER: FOSSIL	ABUND.	PRES.	SECTION	METERS	LITHOLOGY	DEFORMATION	LITHO.SAMPLE	LITHOLOGIC DESCRIPTION
					0					Description from Smear Slide only.
QUATERNARY	Gephyrocapsa oceanica and Emiliania huxley1 N22/N23	D N	R C	P M	Core Catcher					5Y 4/4 FORAM-BEARING BIOGENIC CARBONATE SAND, moderate olive brown (5Y 4/4).

Smear Slide at CC

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

Explanatory notes in Chapter 1