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VANUATU (New Hebrides)

Dr. Gary Greene
Co-Chief Scientist, Leg 134
U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025

Dr. Jean-Yves Collot
Co-Chief Scientist, Leg 134
Laboratoire de Géodynamique
B.P. 48
06230 Villefranche-sur-Mer
France

Dr. Laura Stokking
Staff Scientist, Leg 134
Ocean Drilling Program
Texas A&M University
College Station, Texas 77845-9547

Philip D. Rabinowitz
Director
ODP/TAMU

Audrey W. Meyer
Manager
Science Operations
ODP/TAMU

Louis E. Garrison
Deputy Director
ODP/TAMU

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ABSTRACT

The New Hebrides island arc lies in the southwestern Pacific Ocean, marking the subduction zone of the Australia-India plate, which moves eastward beneath the North Fiji Basin and Pacific plate. The complex tectonics of this arc involves the d'Entrecasteaux zone (DEZ), which is an aseismic ridge that is colliding with the central New Hebrides arc, clogging the trench, deforming the arc, and providing an opportunity to investigate by drilling the processes governing such collisions. Other major geologic problems that can be investigated by drilling in this arc include (1) the processes involved in the evolution of an intra-arc basin located within the zone of influence of arc-ridge collision and (2) the magmatic evolution of arcs during major changes in tectonic environment, including arc-ridge collision and a possible change in the polarity of subduction.

REGIONAL GEOLOGIC SETTING AND TECTONIC EVOLUTION OF THE NEW HEBRIDES ARC

The New Hebrides island arc is part of a narrow, sinuous Cenozoic volcanic chain that extends from Papua New Guinea through the Solomon Islands, Vanuatu (New Hebrides), Fiji, Tonga, and the Kermadec Islands to New Zealand. The New Hebrides arc extends for a distance of 1700 km from the Santa Cruz Islands (eastern part of the Solomon Islands) in the north to the Matthew and Hunter islands (eastern part of the territories of New Caledonia) in the south. The territorial islands of Vanuatu extend for 1450 km from north to south (Chase et al., 1988; Fig. 1).

The New Hebrides Trench trends northwest-southeast and marks the boundary between the Australia-India plate and the Pacific plate (Fig. 1). The maximum depth of this trench ranges from over 8000 m in the north, near the west-trending San Cristobal Trench of the Solomon Islands, to over 7500 m at its southern terminus near the east-trending Hunter Trench. The geomorphic trench is absent opposite Malakula and Espiritu Santo islands where the d'Entrecasteaux Zone (DEZ) abuts the west flank of the arc.

Relative motion between Australia-India and Pacific plates is about 10 cm/yr, with the Australia-India plate moving N 76°E (Minster and Jordan, 1978; Pascal et al., 1978; Isacks et al., 1980). Louat and Pelletier (1989) indicate that the convergence rate between the Australia-India plate and the New Hebrides island arc varies from 12 cm/yr near the southern part of the trench to 16 cm/yr near its northern termination and reaches only 9 cm/yr near the arc/DEZ collision zone.

Between the southern New Hebrides Trench and the Loyalty Ridge (to the west) lies the North Loyalty Basin where the ocean is about 4000-5000 m deep. The Deep Sea Drilling Project (DSDP) drilled into rocks of this basin (DSDP Site 286; Fig. 1) in 1973 and found that the basement consists of middle Eocene oceanic crust (Andrews, Packham et al., 1975). The Loyalty Ridge trends northwest through this oceanic basin and includes volcanic and carbonate rocks that are presently being subducted at the southern New Hebrides Trench.

West of the Loyalty Ridge lies the New Caledonia Ridge, which extends northwestward and becomes the submarine ridge of the DEZ. The DEZ may have been a subduction zone in the late Eocene that was uplifted and exposed in Miocene time (Daniel et al., 1981; Maillet et al., 1983). The DEZ comprises horsts and grabens and is approximately 100 km wide. It extends eastward to end in the central New Hebrides Trench, where it is presently being subducted near Malakula and Espiritu Santo islands (Collot et al., 1985). Near these islands, the DEZ comprises the high relief (2-4 km), east-trending North d'Entrecasteux ridge (NDR) and the South d'Entrecasteaux Chain (SDC) which includes the Bougainville guyot. Paleogene MORB and volcaniclastic rocks were dredged from the NDR (Maillet et al., 1983) and andesites and carbonate rocks were dredged from Bougainville guyot. The NDR is being subducted beneath the arc with little noticeable disturbance of the arc-slope, but subduction correlates with a wide bulge of uplifted arc-slope rocks. The SDC largely deforms the arc-slope and generates well-developed compressive features in arc-slope rocks. The Bougainville guyot may be a piece of the SDC that is being subducted or obducted. The east-dipping Benioff zone is irregular but continuous despite the subduction of the DEZ (Pascal et al., 1978; Isacks et al, 1980; Louat et al., 1988; Macfarlane, et al., 1988).

North of the DEZ lies the oceanic West Torres Plateau, which has an unknown crustal affinity. Water depth over this plateau is as shallow as 750 m.

East of the New Hebrides arc lies the North Fiji Basin (Fig. 1), an active marginal sea of middle to late Miocene age (Malahoff et al., 1982) that has evolved through four tectonic stages in the last 10 million years (Auzende et al., 1988). It is a relatively shallow, open-ocean basin with water depths generally not greater than 3000 m. The basin is floored by oceanic crust that exhibits high heat flow (Larue et al., 1982). The North Fiji Basin is bounded on the north by a ridge that supports the inactive volcanic islands of Mitre and Anuta, which may have been formed during Miocene southwestward subduction of the Pacific plate at the Vitiaz Trench (Jezek et al., 1977). The North Fiji Basin is separated from the Oligocene South Fiji Basin by the northeast-trending Hunter fracture zone.

The forearc of the New Hebrides islands includes a flat-topped ridge, 100-150 km wide, from which Malakula, Espiritu Santo, and the Torres islands project. South of the island of Anatom (Aneityum), the forearc ridge is poorly developed, consisting primarily of a narrow ridge with sharp relief along the crest (Karig and Mammerickx, 1972; Monzier et al., 1984). The volcanic arc lies east of the forearc area and consists of a chain of volcanoes, many of which are active. Most of the volcanoes lie 130-150 km east of the trench; however, volcanoes on Efate, Matthew, and Hunter Islands lie within 100 km east of the trench. The backarc area lies between the volcanic arc and the North Fiji Basin and includes an uplifted horst that supports the islands of Maewo and Pentecost. Also included in this area are the backarc troughs; a series of northern troughs that extends northward from Maewo (Charvis and Pelletier, 1989); and a (single) southern trough, the Coriolis Trough that trends southward from Pentecost Island (Karig and Mammerickx, 1972; Dubois et al., 1975; Recy et al., 1986). The volcanic islands Vot Tande and Futuna are perched on the steep western scarp of the Coriolis Trough.

The summit basins of Vanuatu were first described by Luyendyk et al., (1974) who interpreted them as late-stage extensional features. These basins form a nearly continuous "median sedimentary basin" (Ravenne et al., 1977). The North and South Aoba basins have greater bathymetric expression than does any other basin on the New Hebrides arc summit. Both basins are over 70 km wide and lie beneath 2000-3000 m of water. They are divided by the active volcano forming Aoba Island (Carney and Macfarlane, 1980;

Katz, 1981). Carney and Macfarlane (1980) described these basins as asymmetric in east-west cross-section and containing thick deposits of Miocene to Holocene sediments. Seismic-refraction data suggest that both basins contain 5 to 6 km of sedimentary rocks (Holmes, 1988).

Rocks exposed on the New Hebrides Islands show that three volcanic arcs were active in different areas (Carney et al., 1985). The oldest arc yielded voluminous lower Miocene volcanic rocks that are exposed chiefly along the western chain of islands--Espiritu Santo and Malekula islands. During the late Miocene and Pliocene, the volcanic arc lay along the eastern island chain formed by Pentecost and Maewo Islands. The youngest volcanic arc, active during and since the Pliocene, has built the middle chain of islands that extends from Matthew and Hunter islands in the south to the Tinakula volcano in the Santa Cruz Islands to the north.

The evolution of the New Hebrides arc is poorly understood and many hypotheses have been advanced to explain formation of the forearc ridge, volcanic arc, and backarc (e.g., Chase, 1971; Pascal et al., 1978; Falvey, 1975; Coleman and Packham, 1976; Ravenne et al., 1977; Carney and Macfarlane, 1977, 1980; Katz, 1988.). In one hypothesis, a reversal of subduction polarity occurred in late middle Miocene time. Prior to this reversal, the Vitiaz Trench was an active subduction zone formed as a west-dipping slab of the Pacific plate that was being subducted beneath the Australia-India plate. The direction of subduction shifted to an east-dipping Benioff zone, with the Australia-India plate being subducted beneath the Pacific plate (Chase, 1971; Carney and Macfarlane, 1977, 1980; Carney et al., 1985). In an alternative hypothesis, no shift in subduction direction occurred, and the present arc configuration is the result of a continuous east-dipping subduction zone (Luyendyk et al., 1974; Carney and Macfarlane, 1977; Hanus and Vanek, 1983; Katz, 1988.). On the basis of the distribution of earthquake foci along the New Hebrides Benioff zone, Hanus and Vanek (1983) concluded that two differently inclined slabs exist at intermediate depths. They argued that these slabs were produced from two consecutive subduction cycles of the same polarity and that these two cycles could explain the shifting volcanic axis and the formation of the North and South Aoba basins. Similarly, Louat et al., (1988) concluded that there has only been eastward subduction, and that a steepening Benioff zone has been responsible for the migration of the volcanic axis.

SCIENTIFIC OBJECTIVES

Drilling in the central part of the New Hebrides arc will permit the investigation of the overall response of the arc to a wide variety of tectonic events within a small geographic area. Six sites forming two groups are proposed within the central part of this arc. The first group consists of four sites in the collision zone between the New Hebrides arc and the d'Entrecasteaux zone (DEZ sites in Fig. 2). The second group contains two sites in the intra-arc Aoba basin (IAB sites in Fig. 2). These two groups of sites will form a transect across the arc and will provide crucial information about the arc processes involved in arc-ridge collision, subduction-polarity reversal, and the formation of intra-arc basins.

The impingement of the DEZ against the arc has altered greatly the arc's morphology and structure in that near the impact zone, mountainous islands (Espiritu Santo, Malakula) have risen adjacent to the trench. A large, intra-arc basin (the Aoba basin), substantially deeper than any other basin in this arc, formed directly east of the impact zone. Furthermore, in the backarc area an extensional province that extends nearly continuously along the arc disappears abruptly, directly east of the collision.

Several marine geophysical cruises have been conducted aboard U.S. and French vessels over the eastern d'Entrecasteaux zone and the central New Hebrides island arc to locate the drilling sites. During the 1985 SEAPSO and 1987 MULTIPSO cruises of the R/V *J. Charcot,* Seabeam bathymetric data were obtained over both the DEZ-arc collision zone (Fig. 3a and 3b) and the eastern flank of the Aoba basin. In 1982 and 1984, the *S. P. Lee* cruises (L6-82-SP and L5-84-SP) acquired high-quality multichannel seismic data over the entire Aoba basin and the accretionary complex of the collision zone. These data were augmented in 1987 by other multichannel seismic lines collected during the MULTIPSO site survey cruise. In addition to geophysical data, seven dives of the French submersible *Nautile* were conducted in the DEZ-arc collision zone during the 1989 SUBPSO cruise of the R/V *Nadir.*

<u>Arc-Ridge Collision Sites: DEZ-1, -2, -4, -5</u>

Geological data suggest that the NDR and the SDC of the DEZ differ greatly in morphology, genesis and lithology. These differences are mirrored by the contrasting arc-slope deformation caused by the collision of ridge and arc. Geophysical data indicate that across the accretionary complex, the slightly oblique (14°) subduction of the NDR has produced an asymmetric tectonic pattern which results in strong tectonic erosion (Collot and Fisher, 1989); in this collision zone, large mass wasting deposits formed across the arc slope instead of a bow wave of large anticline and thrust faults (Fisher et al., 1986). The Bougainville guyot largely impinges the arc-slope (Daniel et al., 1986) and generates well-developed compressive features in arc-slope rocks (Collot and Fisher, 1989). However, observations made during a recent deep-sea submersible survey (Collot et al., 1989) revealed that the bedding of the arc-slope rocks, which generally slope trenchward in this collision zone (Fisher, 1986), dips steeply arcward near the contact of both colliding features. Rocks sampled during these dives indicate that, in the collision zone, the arc slope is primarily composed of volcanic and volcaniclastic rocks but also includes brownish clay or mudstone and some limestone. The proposed drill holes will help characterize the contrasting mechanisms of subduction and accretion by showing the composition, physical properties, and age of rocks in each ridge. Other holes will penetrate the arc-slope rocks, not only to determine their lithology but also to provide an estimate of the amount of ridge rocks that are incorporated into the accretionary wedge, and whether such incorporated rocks form large blocks. The role of pore fluids in the development of collision structures will be determined by measuring pore-fluid pressure at these drill sites.

Sites within the collision zone are designed to determine what influence ridge composition and structure exert on the style of accretion and type of arc structures produced during collision. Sites DEZ-1 and DEZ-2 are located where the north ridge of the DEZ and the arc collide (Figs. 2 and 3a,b). Site DEZ-1 will document the nature and age of the NDR and will provide a critical reference section of north-ridge rocks to enable recognition of these rocks in other drill holes. Information collected at this site will be used to determine the reaction of the accretionary wedge to the impact of the north ridge. Site DEZ-2 will penetrate the lowermost accretionary wedge, the interplate thrust fault, and the north ridge itself. This site will show whether north-ridge rocks have been accreted onto the arc and will also reveal the age and mechanical properties of rocks where, despite the great relief of the subducted ridge, the collision has caused little large-scale forearc deformation. Other objectives include stress analysis and the study of fluid circulation.

Proposed sites DEZ-4 and DEZ-5 are located where the Bougainville guyot has collided with the arc, causing considerable forearc deformation (Figs. 2 and 3c). Site DEZ-4 will penetrate imbricated arc rocks to test whether these rocks are part of an uplifted old accretionary wedge, recently accreted guyot rocks, or island-arc basement. Other objectives include the study of stress orientation, fluid circulation, and Late Cenozoic uplift of the forearc. Site DEZ-5 will penetrate the platform of the Bougainville guyot and reach volcanic basement; this site will show the lithology, age, paleobathymetry, and mechanical properties of the guyot. This information will be used to determine the reaction of the accretionary wedge to the impact of the guyot.

Results obtained from drilling near the guyot will be contrasted with those obtained near the north ridge to determine why arc structures induced by the collision are so different. The rate of uplift of the accretionary wedge will be determined and compared to the rate at which onshore areas emerged; this emergence occurred synchronously with collision, and onshore areas rose at Holocene rates exceeding 5 mm/yr (Taylor et al., 1987).

Intra-Arc Basin Sites: Sites IAB-1,-2

The purpose of drilling in the Aoba Basin is to investigate how arc-ridge collision affected the development of the intra-arc basins and the evolution of the magmatic arc. In addition, volcanic ash within basin rocks may contain a record of the hypothesized reversal in arc polarity.

To investigate the evolution of intra-arc basins, two holes will be drilled in the summit basin, the North Aoba Basin. The crucial topic to be resolved is the age of a major discordance in the basin fill that appears to correlate temporally with the beginning of collision of the DEZ with the arc, providing one of the best estimates for the age of this event. This basin contains rocks of probable Miocene and younger age. The drill holes in the North Aoba Basin will show the provenance, age, paleobathymetry, and lithology of basin fill, from which the rate and timing of basin subsidence and filling can be derived.

The magmatic evolution of this island arc can be investigated using data from the proposed drill sites in the intra-arc basins. The main goals are to establish major compositional trends of volcanic ashes and the timing of volcanic pulses. An important facet of this study is to relate volcanic processes to the unsteady tectonic environment of this arc caused by the collision of the DEZ and the hypothesized Late Cenozoic flip in subduction polarity. The chronology and chemistry of volcanic ashes will be most useful when the results from sites near the collision zone of the DEZ are compared to results from the site away from this zone. If the polarity of subduction reversed, ash chemistry may show a distinct change that marked magma generation first from crust of the Pacific plate and later from crust of the Australia-India plate.

Proposed site IAB-1 is located within the center of the Aoba Basin (Fig. 2). Crucial information to be obtained at this site includes the age of a major unconformity that likely correlates with the onset of arc-ridge collision and will provide one of the better estimates of when this onset occurred. The chemistry of Quaternary volcanic ashes may show whether the magmatic arc has been affected by subduction of the DEZ.

Proposed site IAB-2 is located along the eastern flank of the Aoba Basin (Fig. 2), where basin rocks include two unconformities. The shallower one will show when the backarc area was deformed, possibly as a direct result of the collision. The deeper unconformity lies along the top of the oldest basin rocks, and drilling at this site will show the Late Cenozoic evolution of the magmatic arc. The chemistry of volcanic ash should show whether the magmatic arc was affected by arc polarity change.

OPERATIONS PLAN

Leg 134 is scheduled to depart Townsville, Australia, on 16 October 1990 after a five-day port call and arrive in Suva, Fiji, on 17 December 1990 after 62 operational days at sea. Six sites have been identified to meet the cruise objectives of Leg 134: four sites (DEZ-1, -2, -4, and -5) in the forearc and two (IAB-1 and -2) in the intra-arc basin.

Leg 134 will transit (4.3 days) to the Vanuatu region and core the DEZ sites first (Table 2). The first hole at DEZ-2 will be APC/XCB-cored to refusal (estimated at 500 m); the second will be washed to that depth, then RCB-cored to 800 m and logged. Standard Schlumberger, formation microscanner, and digital borehole televiewer data will be collected. Proposed site DEZ-1 will be APC/XCB-cored to 300 m, then logged using the standard Schlumberger suites and the formation microscanner. The first hole at proposed site DEZ-4 will be APC/XCB-cored to refusal (estimated at 500 m); the second will be washed to 500 m, then RCB-cored to 1000 m. Logging of the second hole will include the standard Schlumberger suites and the formation microscanner. Proposed site DEZ-5 will be RCB-cored to 750 m, then logged with the standard Schlumberger suites and the formation microscanner. APC cores will be oriented at proposed sites DEZ-2, -1, and -4.

Leg 134 will then transit (0.3 day) to the intra-arc basin sites. The first hole at each of the IAB sites will be APC/XCB-cored to refusal (estimated at 500 m at IAB-1 and 300 m at IAB-2), and the second will be washed to the refusal depth, then RCB-cored to total depth (700 m at IAB-1 and 1000 m at IAB-2). Logging at the intra-arc basin sites will include the standard Schlumberger suites and the formation microscanner.

Two new tools will be employed to log downhole magnetic properties (the natural remanent magnetization tool, or NRMT, and the magnetic susceptibility tool, or SUMT) at DEZ-5 and IAB-1. The tools, which meet Schlumberger requirements, have been developed by a French team (CAE-Total CFP). These logs will complement the paleomagnetic measurements performed on board and augment the knowledge of magnetic properties downhole.

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Table 1: Leg 134 Proposed Drill Sites

Site Number	Latitude/ Longitude	Water Depth (m)	Penetration (sed)	Penetration (bsmt)	Time Estimates (days) Drill	Time Estimates (days) Log	Time Estimates (days) Total
DEZ-1	15° 17.4'S 166° 17.4'E	3200	300	---	3.3	0.8	4.1
DEZ-2	15° 19.6'S 166° 21.3'E	2650	790	10	8.5	2.2	10.7
DEZ-4	15° 56.6'S 166° 47.3'E	925	1000	---	7.9	1.4	9.3
DEZ-5	16° 01.1'S 166° 40.6'E	1050	700	50	5.4	1.6	7.0
IAB-1	14° 47.8'S 167° 34.4'E	3098	700	---	8.1	2.1	10.2
IAB-2	14° 52.4'S 167° 53.0'E	2600	1000	---	11.5	1.6	13.1

Table 2: Tentative drilling schedule, Leg 134

Leg 134 departs Townsville on 16 October 1990.

	Date	Time on Site (days)	Transit Time (days)
Transit from Townsville to DEZ-2			4.3
AR DEZ-2	20 October 1990		
LV DEZ-2	31 October	10.7	
Transit			0.1
AR DEZ-1	31 October		
LV DEZ-1	4 November	4.1	
Transit			0.2
AR DEZ-4	4 November		
LV DEZ-4	13 November	9.3	
Transit			0.1
AR DEZ-5	13 November		
LV DEZ-5	20 November	7.0	
Transit			0.3
AR IAB-1	21 November		
LV IAB-1	1 December	10.2	
Transit			0.1
AR IAB-2	1 December		
LV IAB-2	14 December	13.1	
Transit to Suva, Fiji			2.5
AR Suva	17 December 1990		

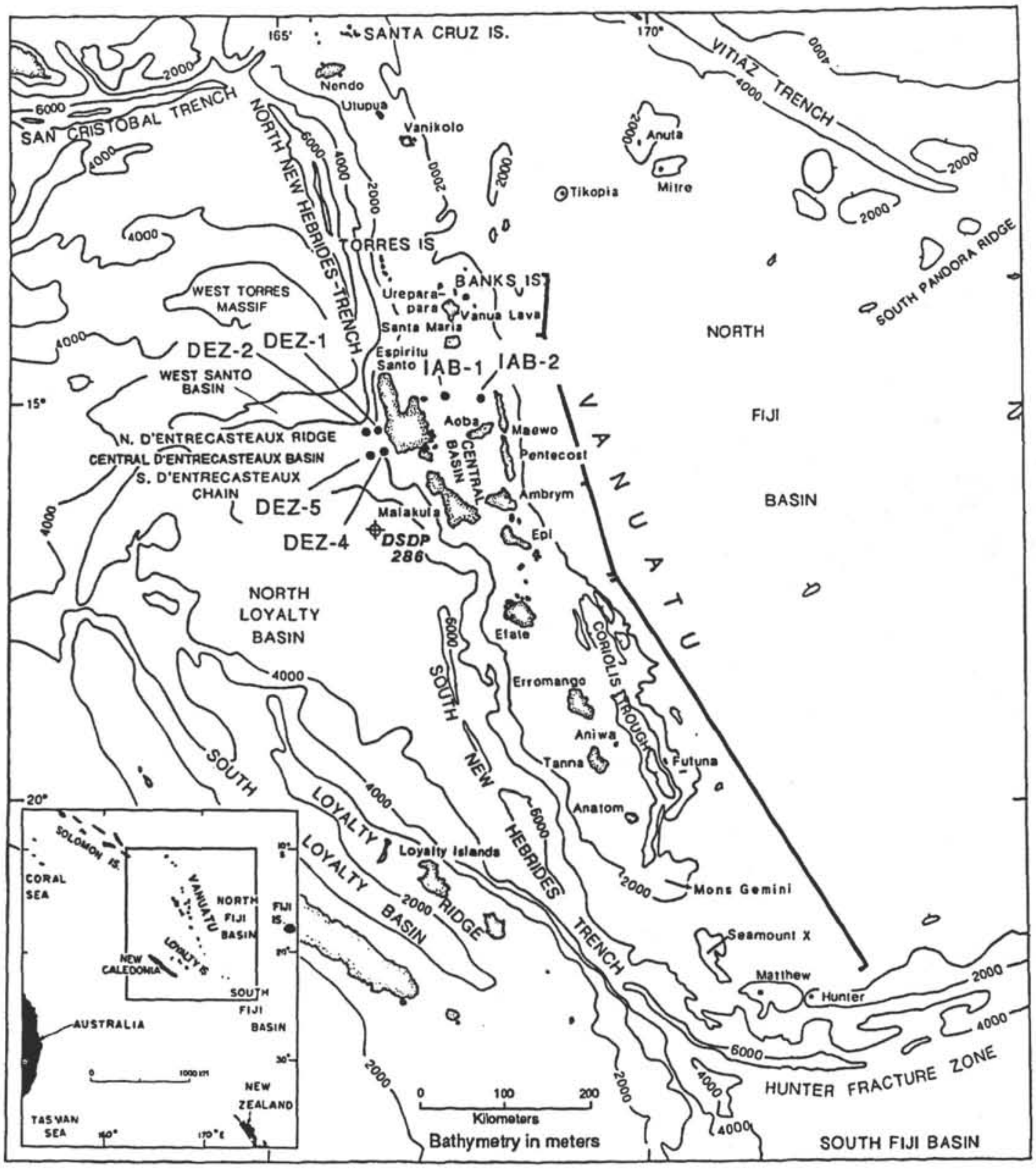


Figure 1: Regional bathymetry of the southwest Pacific showing approximate locations of drill sites proposed for Leg 134 (modified after Kroenke et al., 1983).

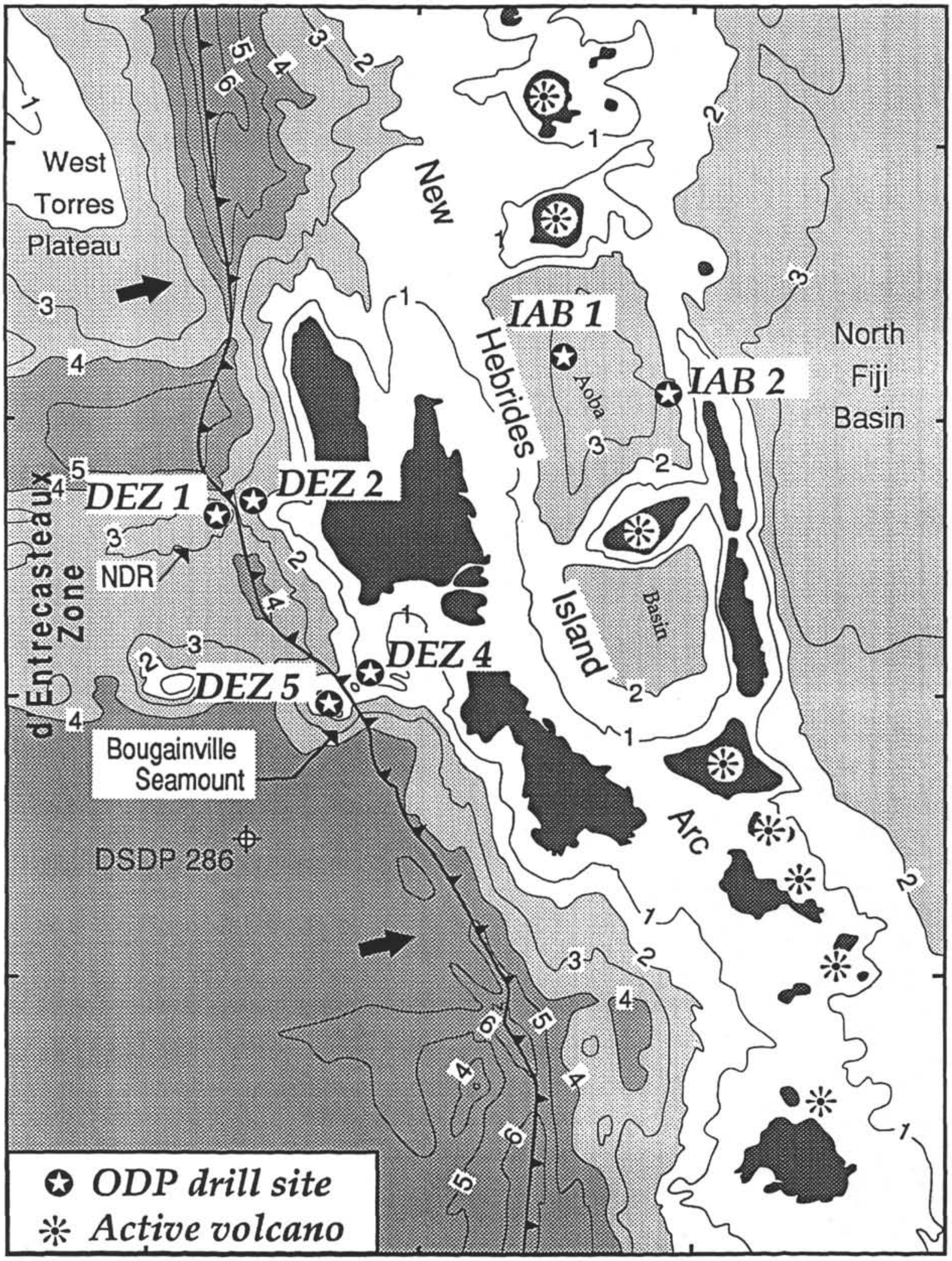


Figure 2: Geographic features of the New Hebrides island arc, DSDP Site 286, sites proposed for ODP Leg 134, and active volcanoes are shown. The barbed line indicates subduction.

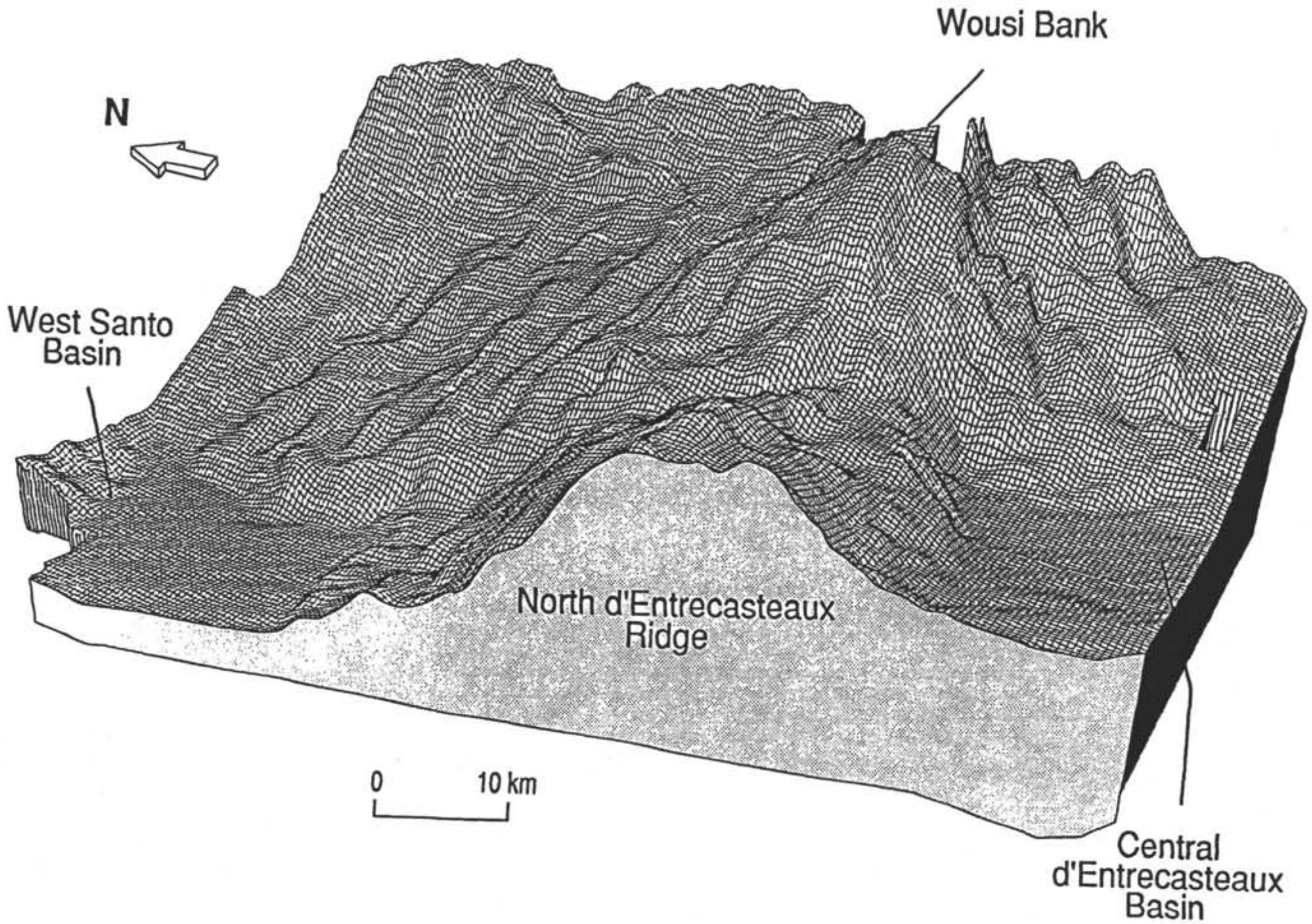


Figure 3A: Three-dimensional image of Seabeam bathymetry in the Vanuatu region, North d'Entrecasteaux Ridge.

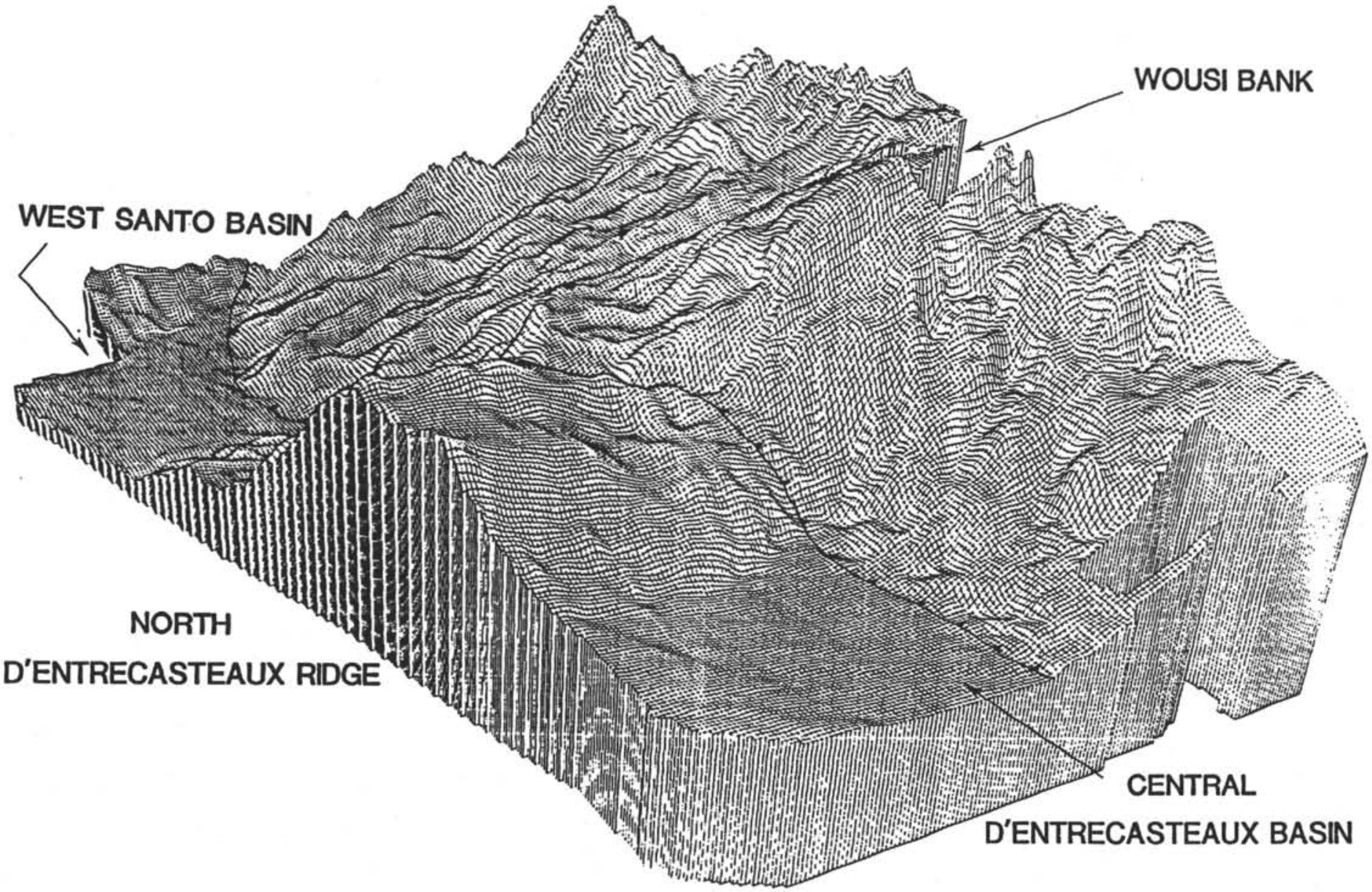


Figure 3B: Three-dimensional image of Seabeam bathymetry in the Vanuatu region, Central d'Entrecasteaux Basin.

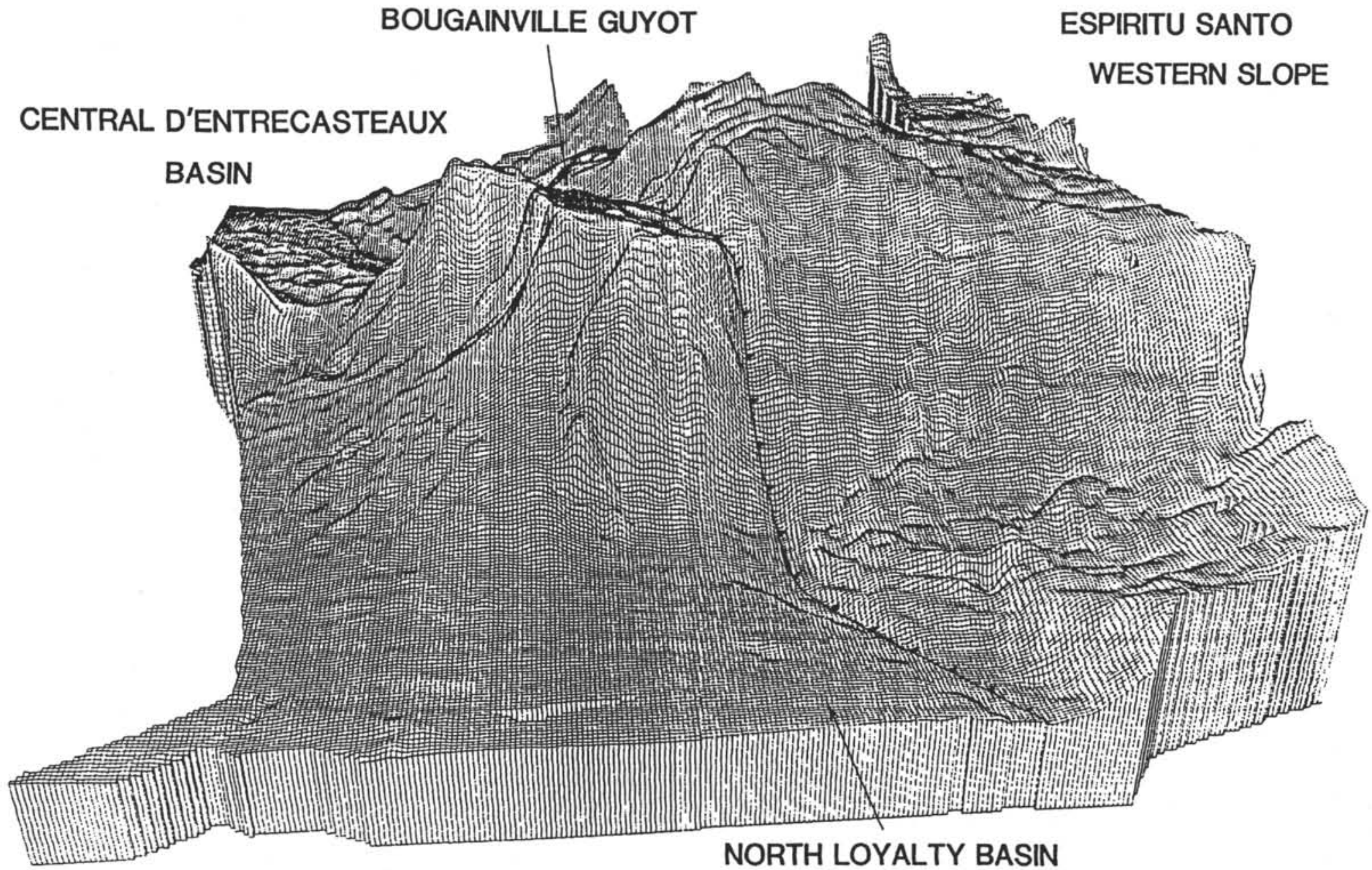


Figure 3C: Three-dimensional image of Seabeam bathymetry in the Vanuatu region, Bougainville guyot.

Site: DEZ-1 Priority: 1

Position: 15° 17.4'S
166° 17.4'E

Water Depth: 3200 m Sediment Thickness: 300 m

Proposed Drilling Program: APC/XCB to 300 mbsf.

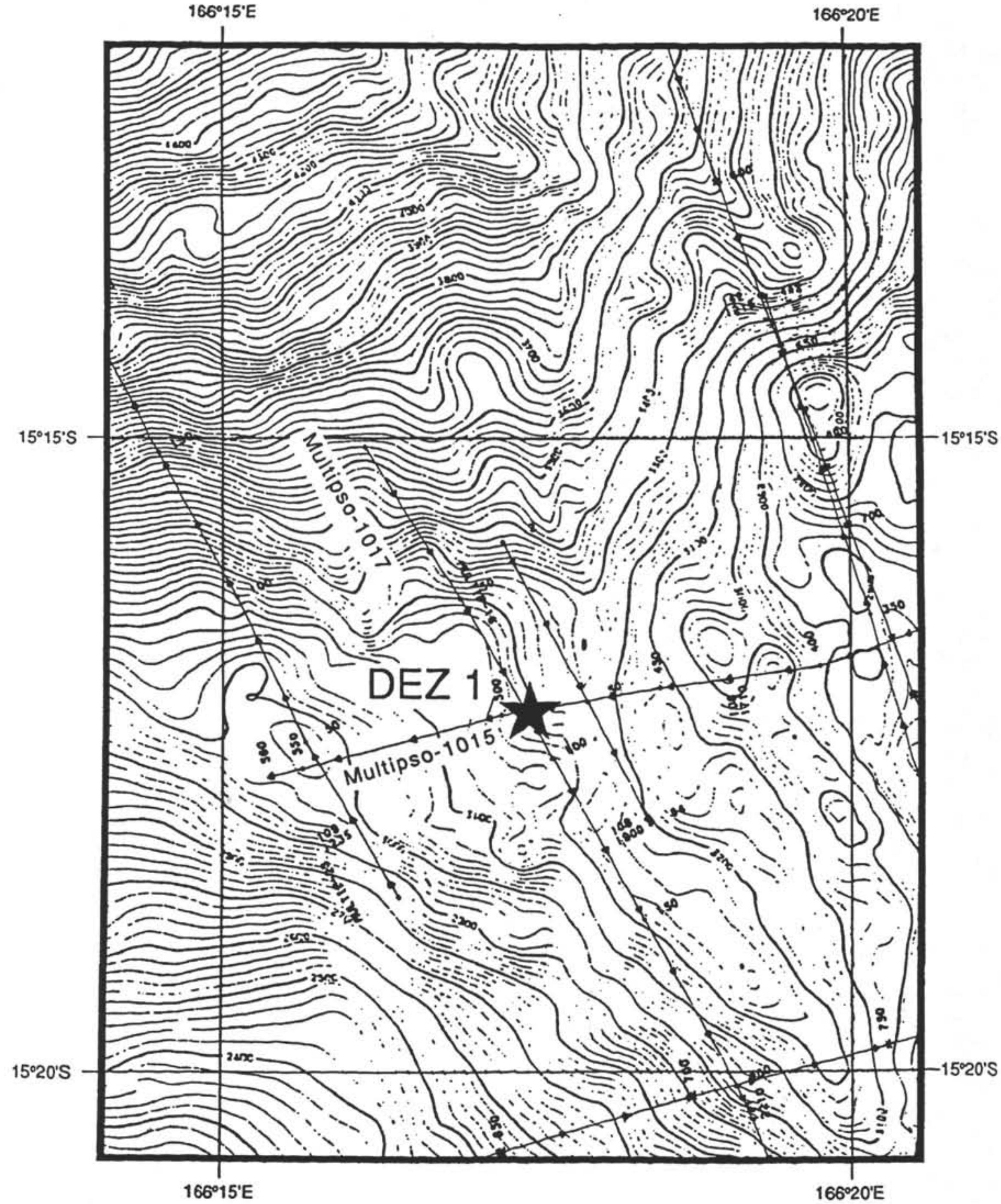
Seismic Record: Multipso (French) 1015, SP 490; Cross line Multipso (French) 1017, SP 85.

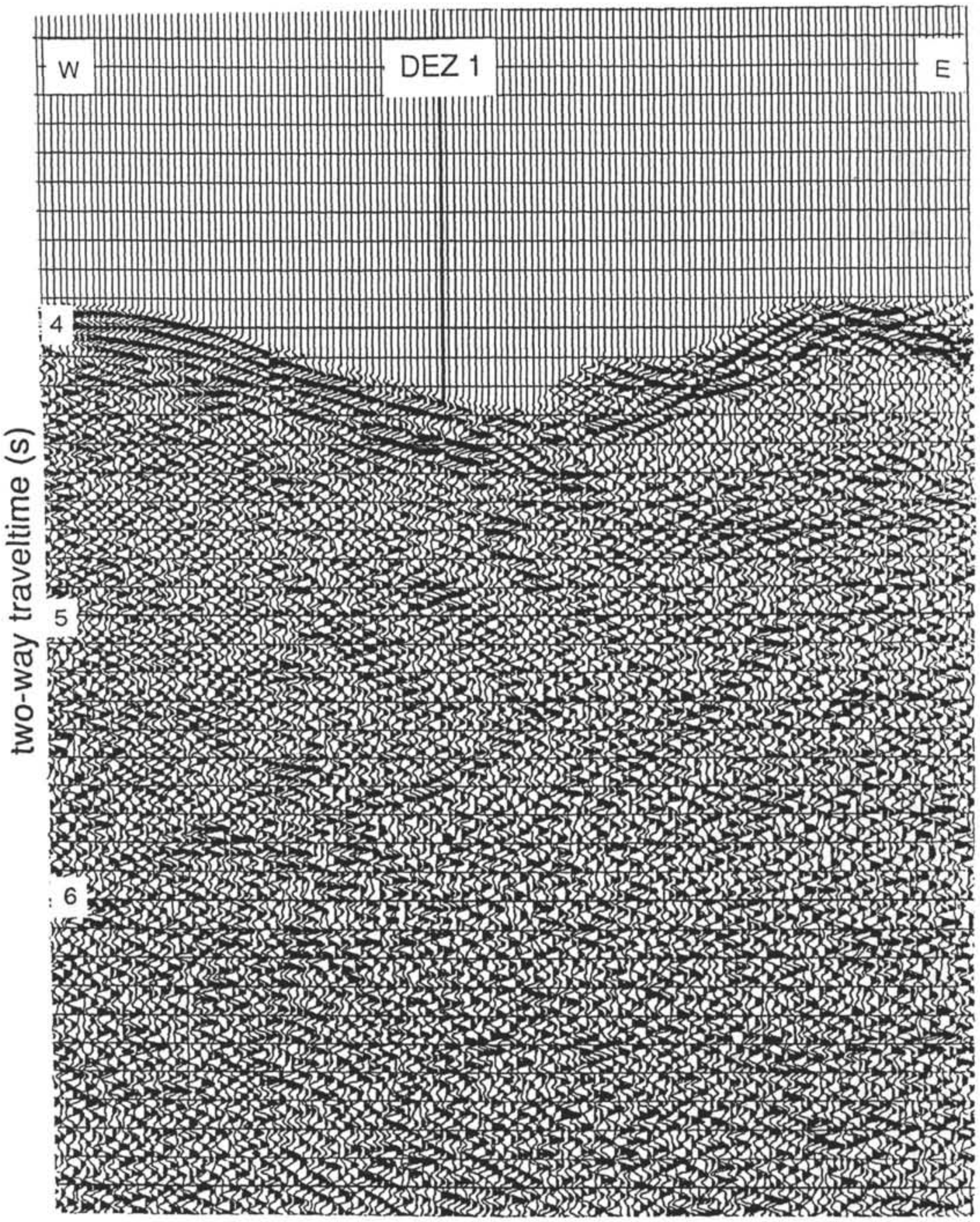
Water Sampler: Yes.

Logging: Standard Schlumberger logging and formation microscanner.

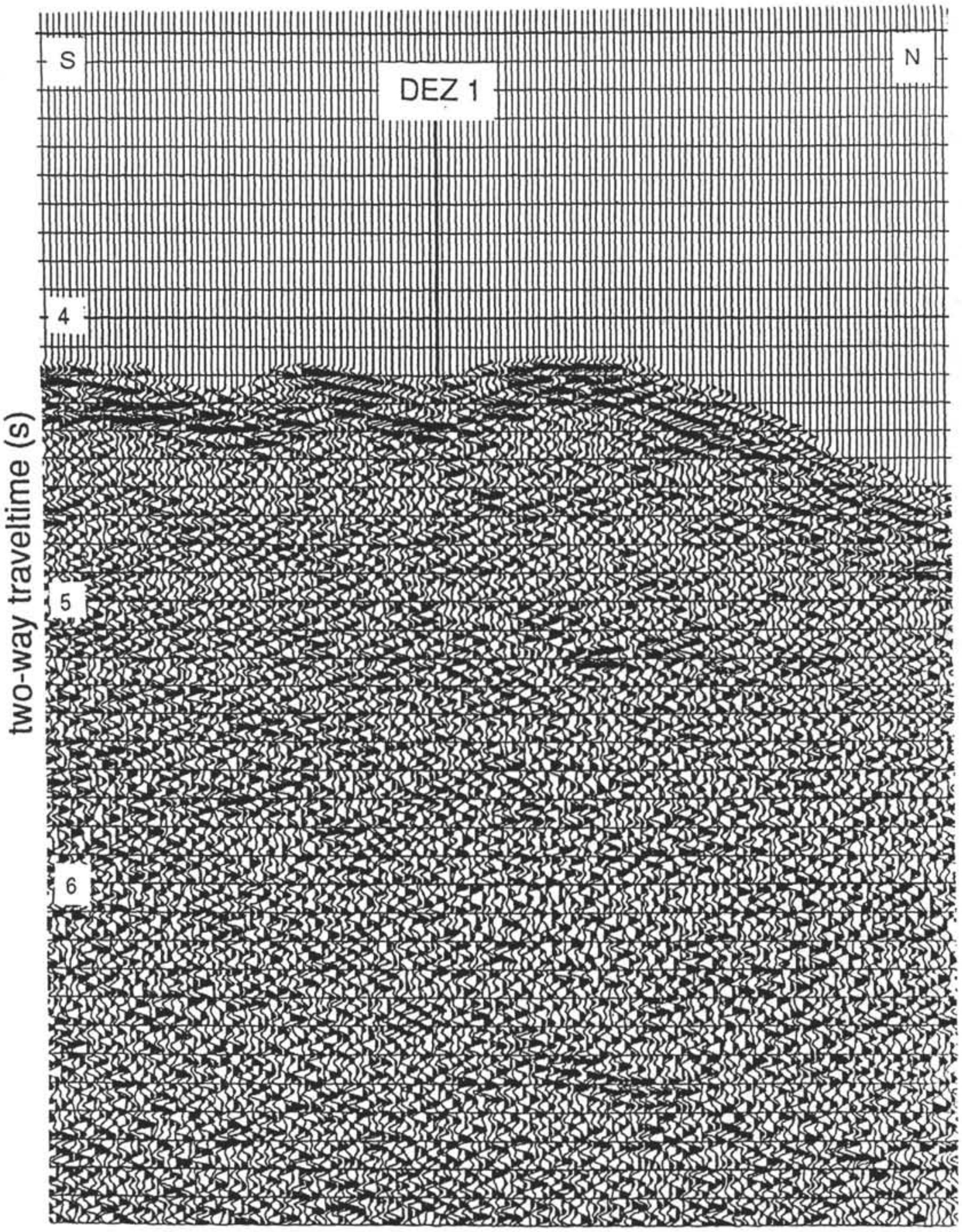
Objectives: To penetrate through thin cover of sedimentary rocks into basement rock (reference hole for DEZ-2 and DEZ-4).

Nature of Sediment/Rocks Anticipated: Pelagic muds, tuffs, and basaltic rocks.


166°15'E
166°20'E
15°15'S
15°15'S
15°20'S
15°20'S
166°15'E
166°20'E
Multipso-1017
DEZ 1
Multipso-1015



Multipso 1015, ShotPoint 490



Multipso 1017, ShotPoint 85

Site: DEZ-2 Priority: 1

Position: 15° 19.6'S
166° 21.3'E

Water Depth: 2650 m Sediment Thickness: 790 m

Proposed Drilling Program: Hole A: APC/XCB to refusal (est. 500 mbsf).
Hole B: Wash to 500 mbsf, RCB to 800 mbsf.

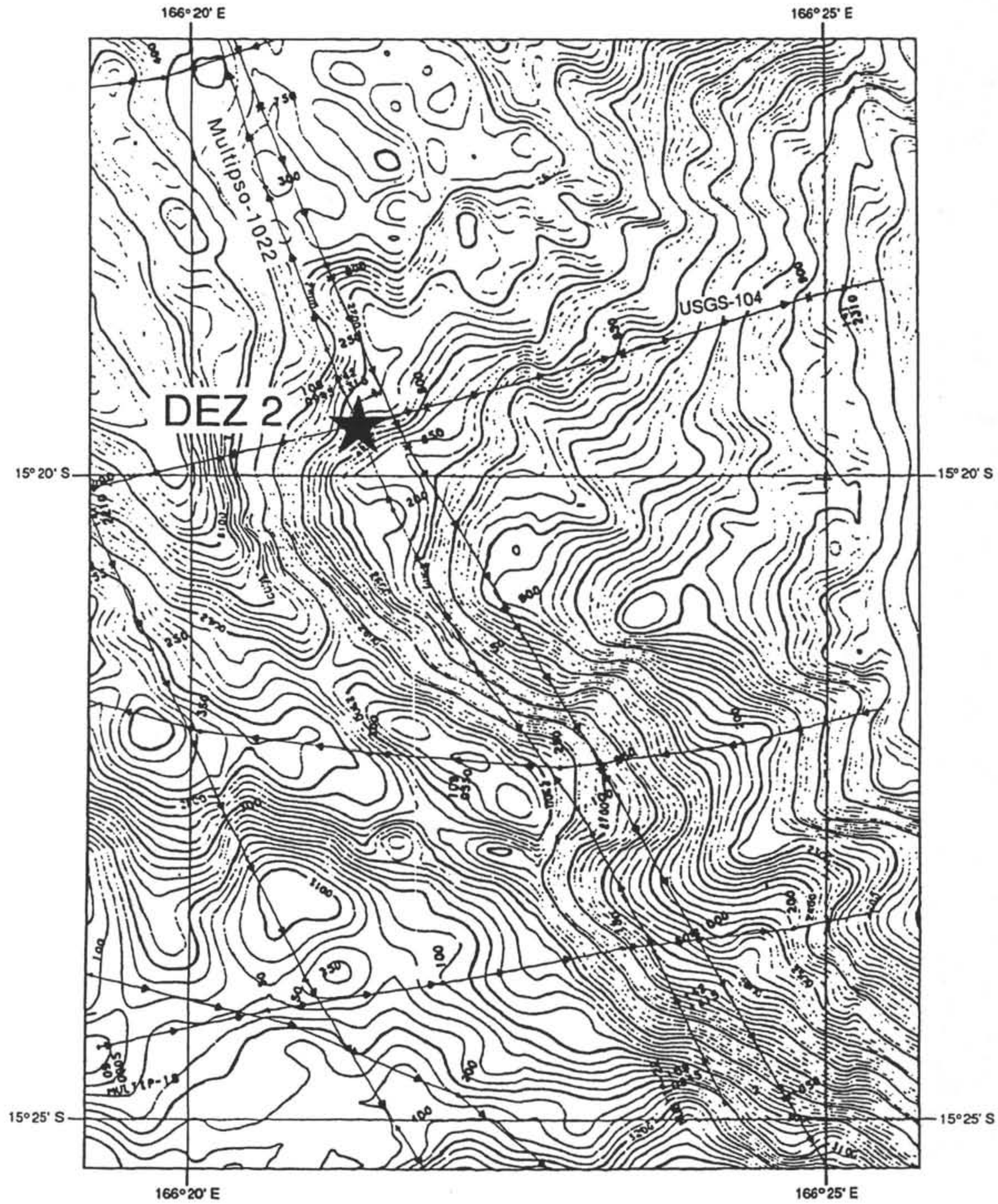
Seismic Record: USGS (Lee) Line 104, L5-84-SP,SP 780; Cross line Multipso (French) 1022, SP 225.

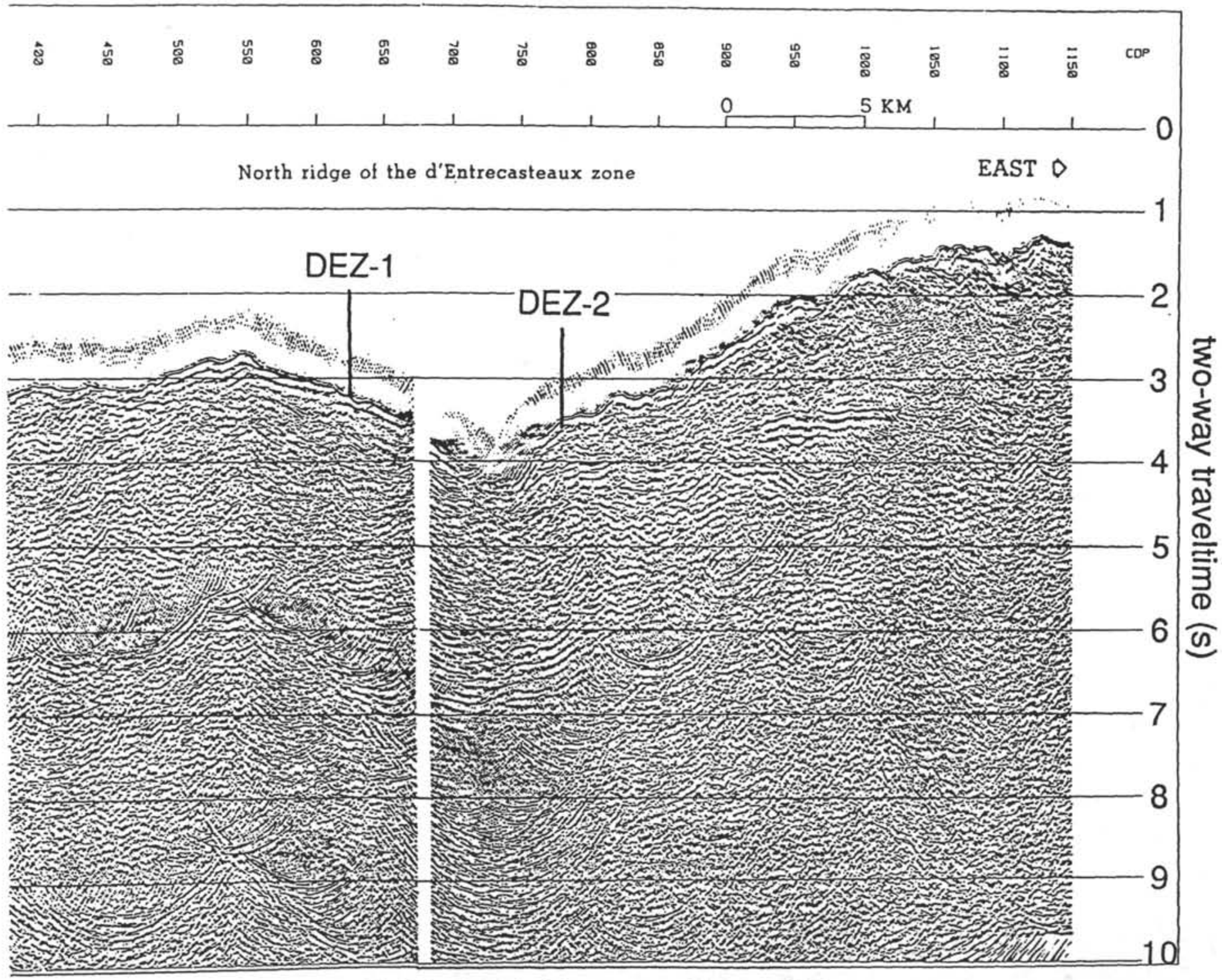
Water Sampler: Yes.

Logging: Standard Schlumberger logging, formation microscanner, digital borehole televiewer.

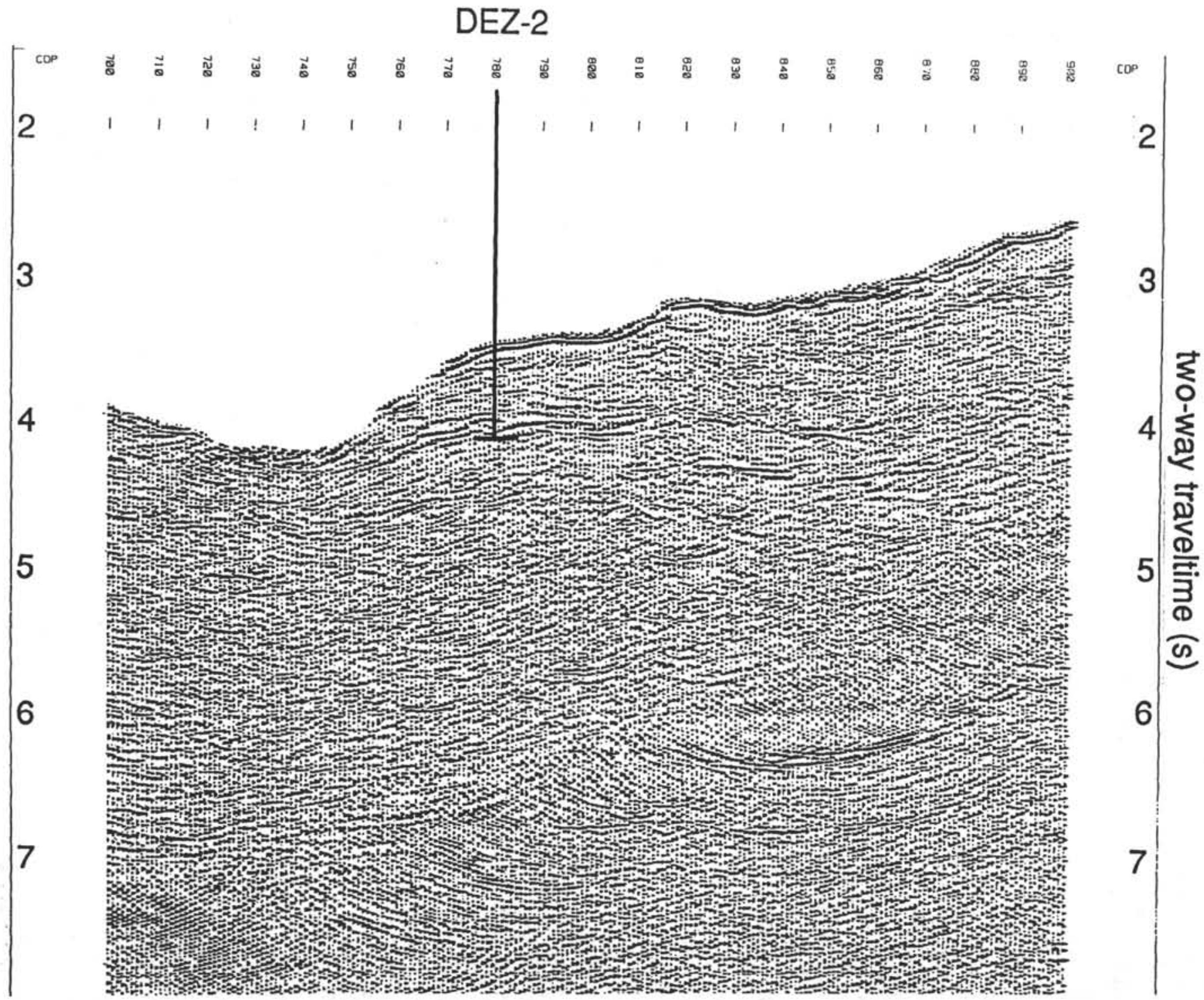
Objectives: To determine age, lithologies and deformation of forearc; penetrate tuffs and decollement and recover basement rock from the subducted NDR. Drilling data will show the amount of material stripped from the ridge, the effect of ridge compaction on the type of slope structures formed.

Nature of Sediment/Rocks Anticipated: Volcaniclastic rocks and sediments.

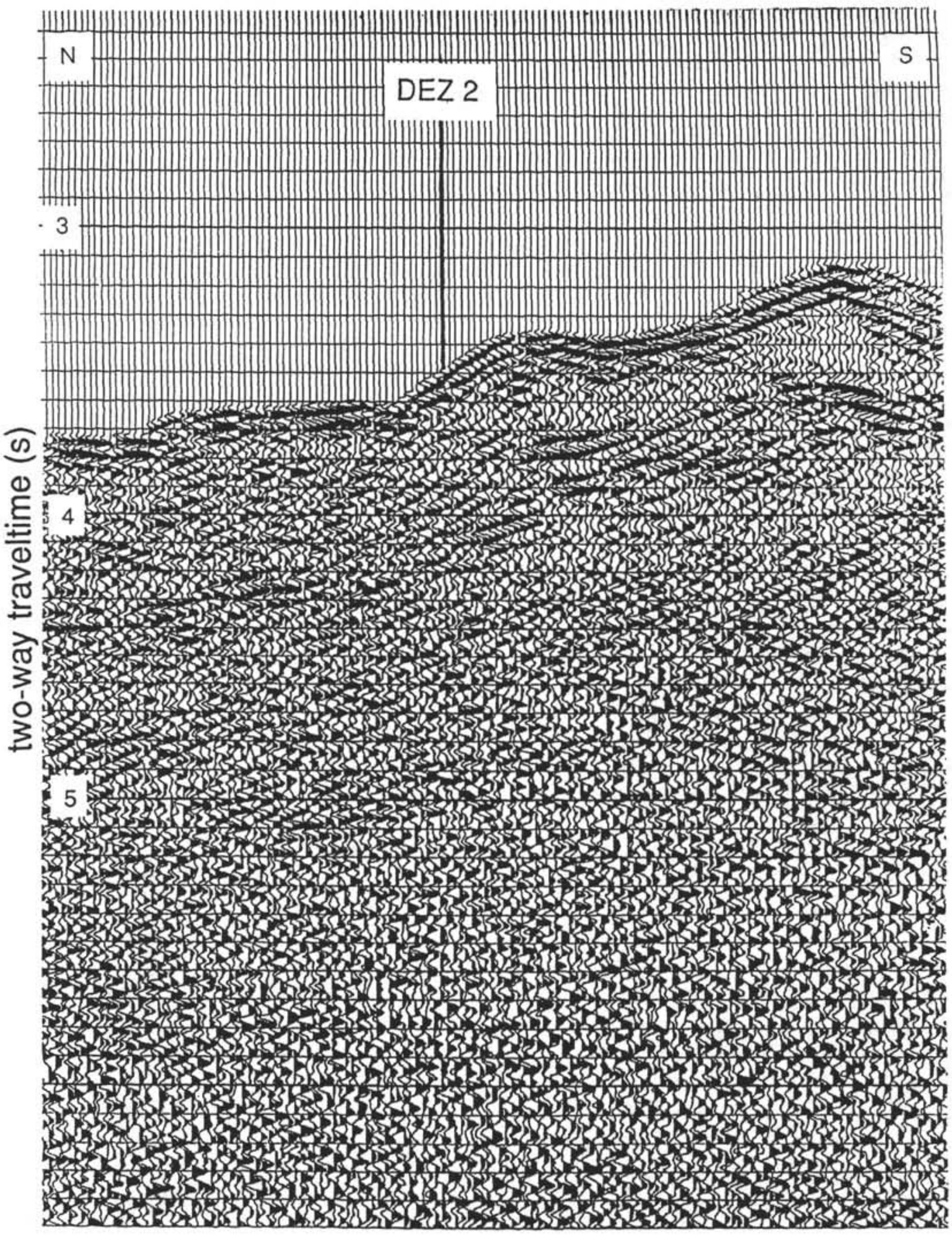

166° 20' E
166° 25' E
Multipso-1022
USGS-104
DEZ 2
15° 20' S
15° 20' S
15° 25' S
15° 25' S
166° 20' E
166° 25' E



USGS (Lee) Line 104, L5-84-SP



USGS (Lee) Line 104, L5-84-SP ShotPoint 780



Multipso 1022, ShotPoint 225

Site: DEZ-4 Priority: 1

Position: 15° 56.6'S
166° 47.3'E

Water Depth: 925 m Sediment Thickness: 1000 m

Proposed Drilling Program: Hole A: APC/XCB to refusal (est. 500 mbsf).
Hole B: Wash to 500 mbsf, RCB to 1000 mbsf.

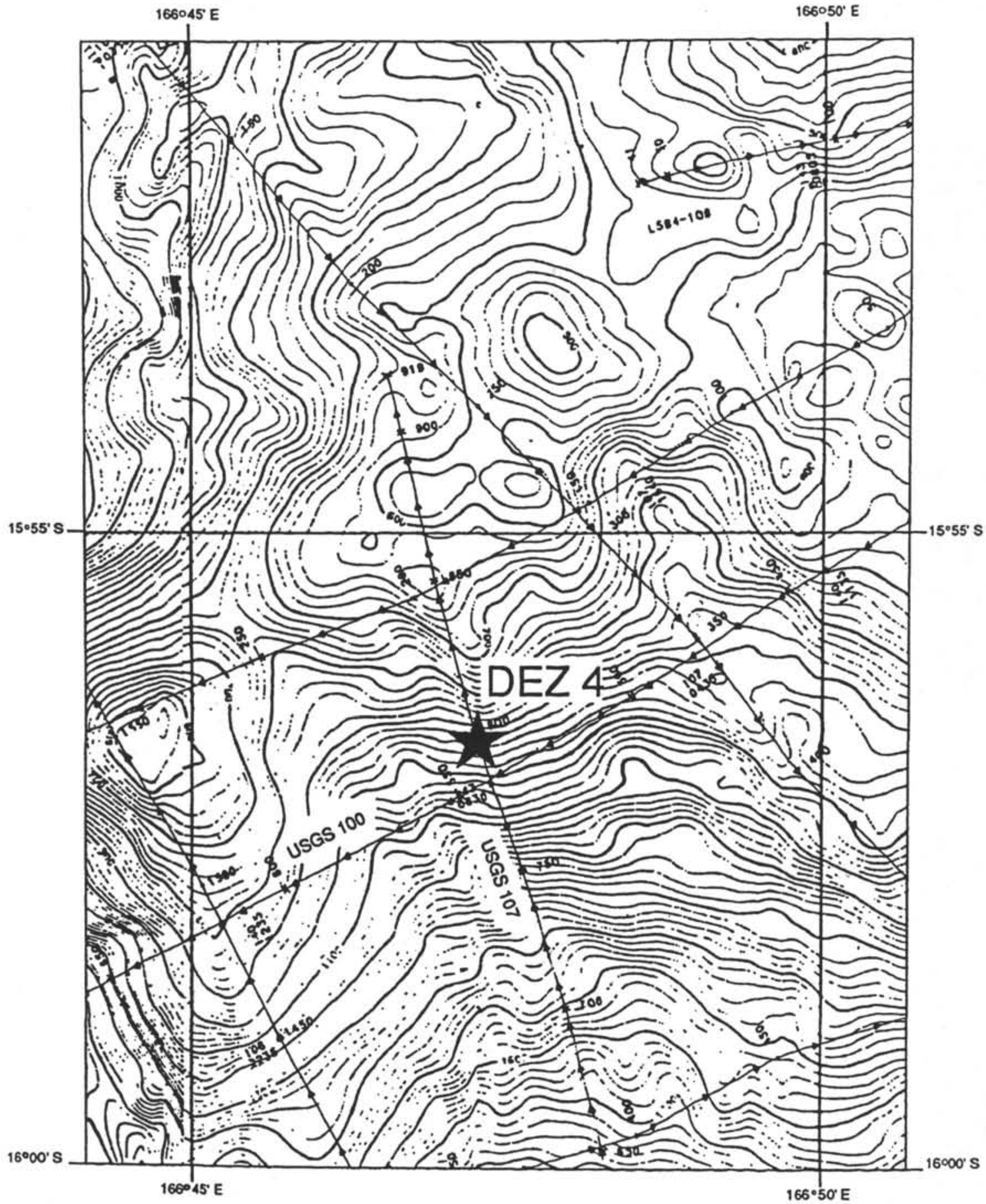
Seismic Record: USGS (Lee) Line 107, L5-84-SP, SP 800; near crossing with USGS (Lee) L5-84-SP, Line 100, SP 545.

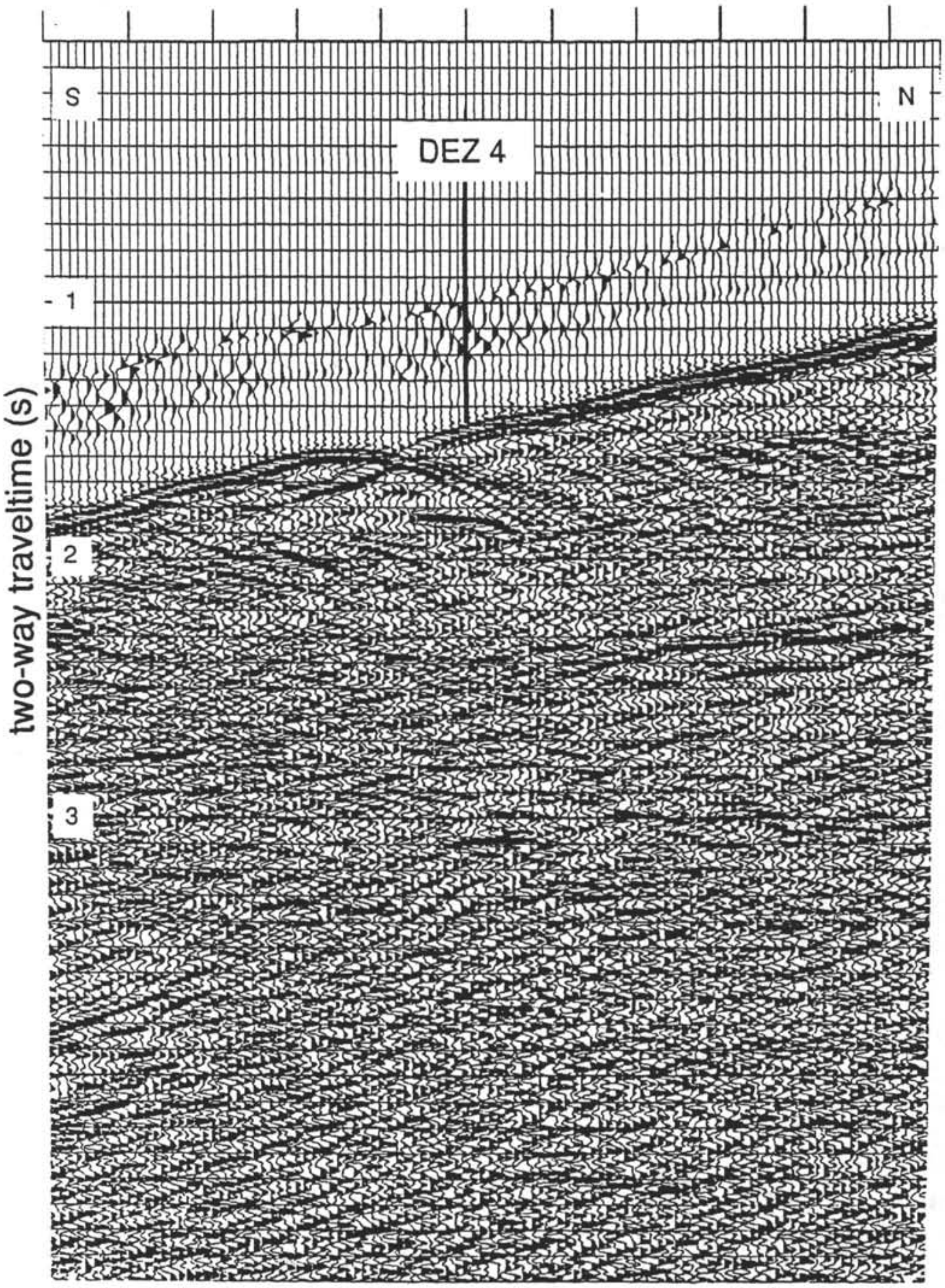
Water Sampler: Yes.

Logging: Standard Schlumberger logging and formation microscanner.

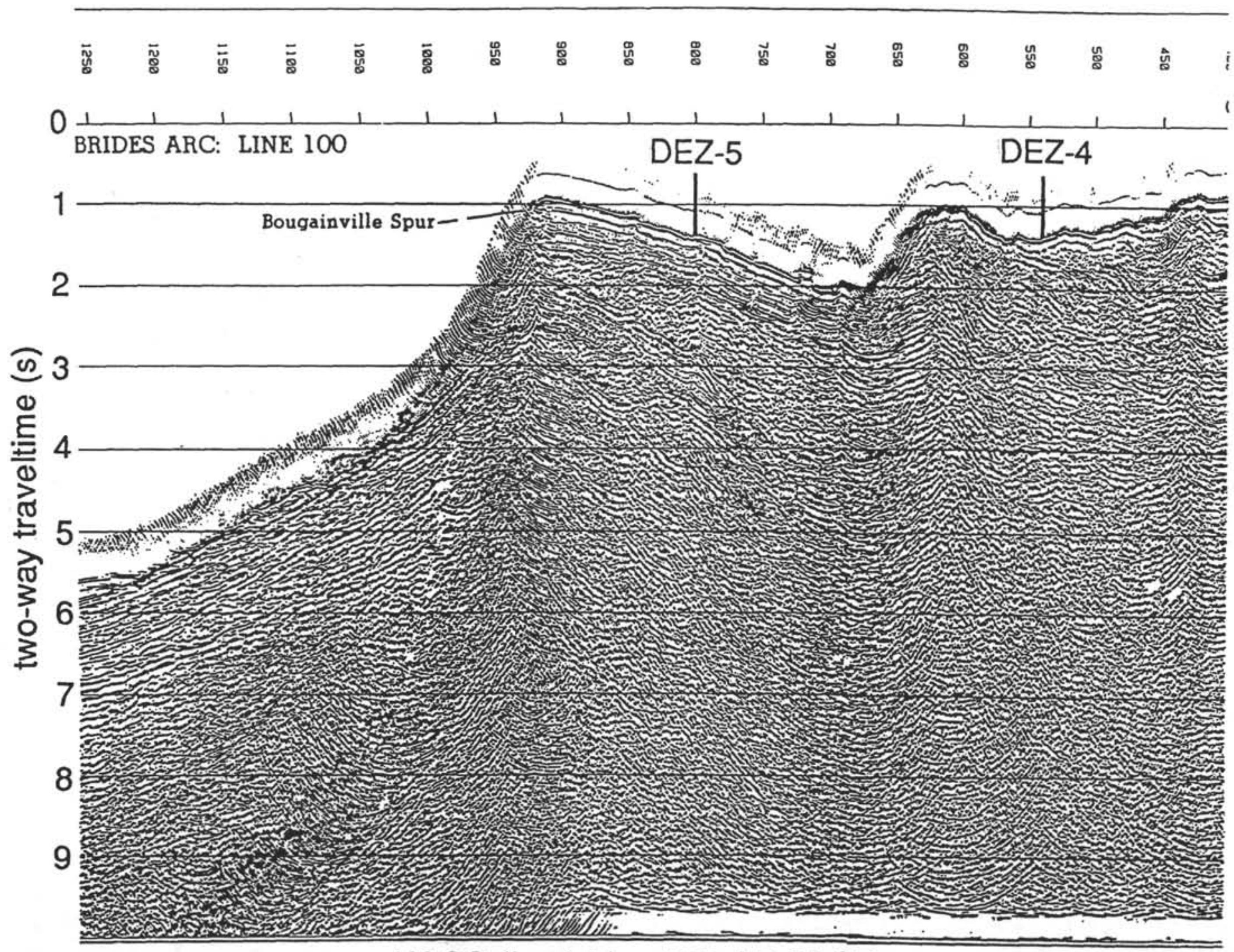
Objectives: To determine age, lithologies and deformation of imbricated forearc rocks in the collision zone of the Bougainville Guyot. Drilling will show whether these rocks are an old accretionary wedge, guyot rocks, or island-arc basement. This information will be used to determine the reaction of the arc-slope rocks to the impact of the guyot.

Nature of Sediment/Rocks Anticipated: Arc-accretion and guyot-underplated rocks.


166°45' E
166°50' E
15°55' S
15°55' S
16°00' S
16°00' S
166°45' E
166°50' E
DEZ 4
USGS 100
USGS 107
L584-108



USGS (Lee) Line 107, L5-84-SP, ShotPoint 800



USGS (Lee) Line 100, L5-84-SP

Site: DEZ-5 Priority: 1

Position: 16° 01.1'S
166° 40.6'E

Water Depth: 1050 m Sediment Thickness: 700 m

Proposed Drilling Program: RCB to 750 mbsf.

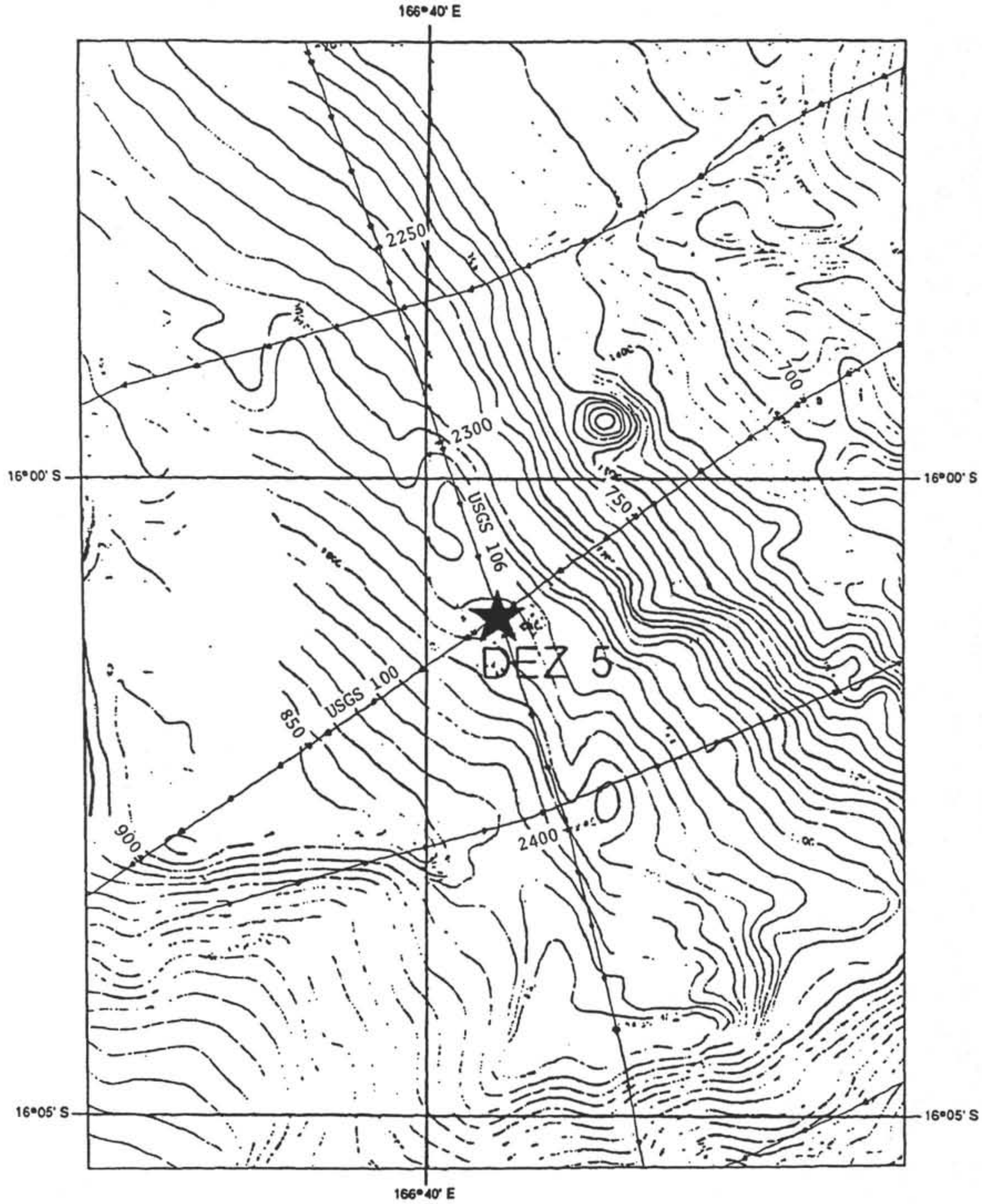
Seismic Record: USGS (Lee) Line 100, L5-84-SP, SP 780; Cross line USGS (Lee) 106, L5-84-SP, SP 2345.

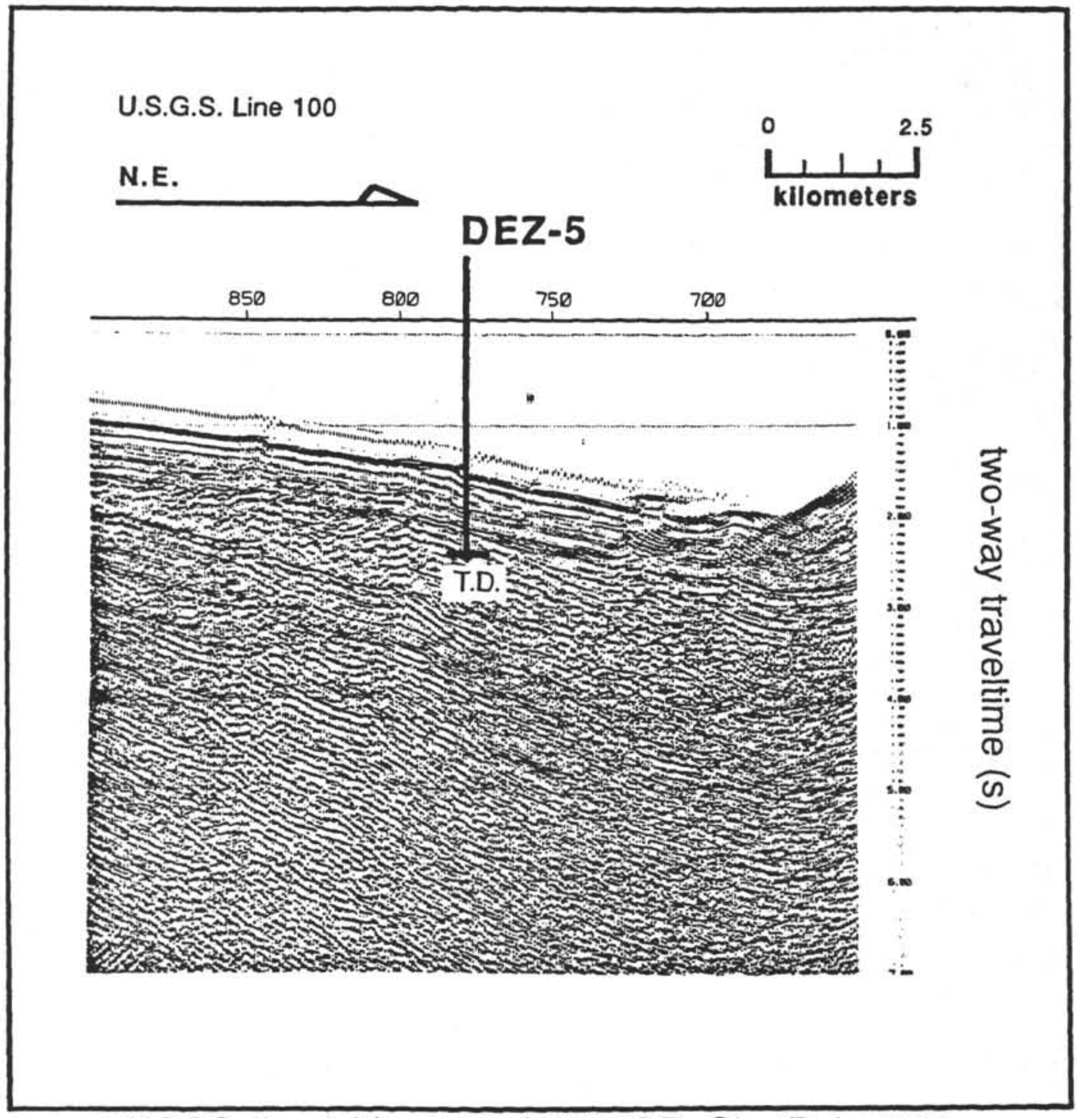
Water Sampler: No.

Logging: Standard Schlumberger logging, formation microscanner, French magnetometer.

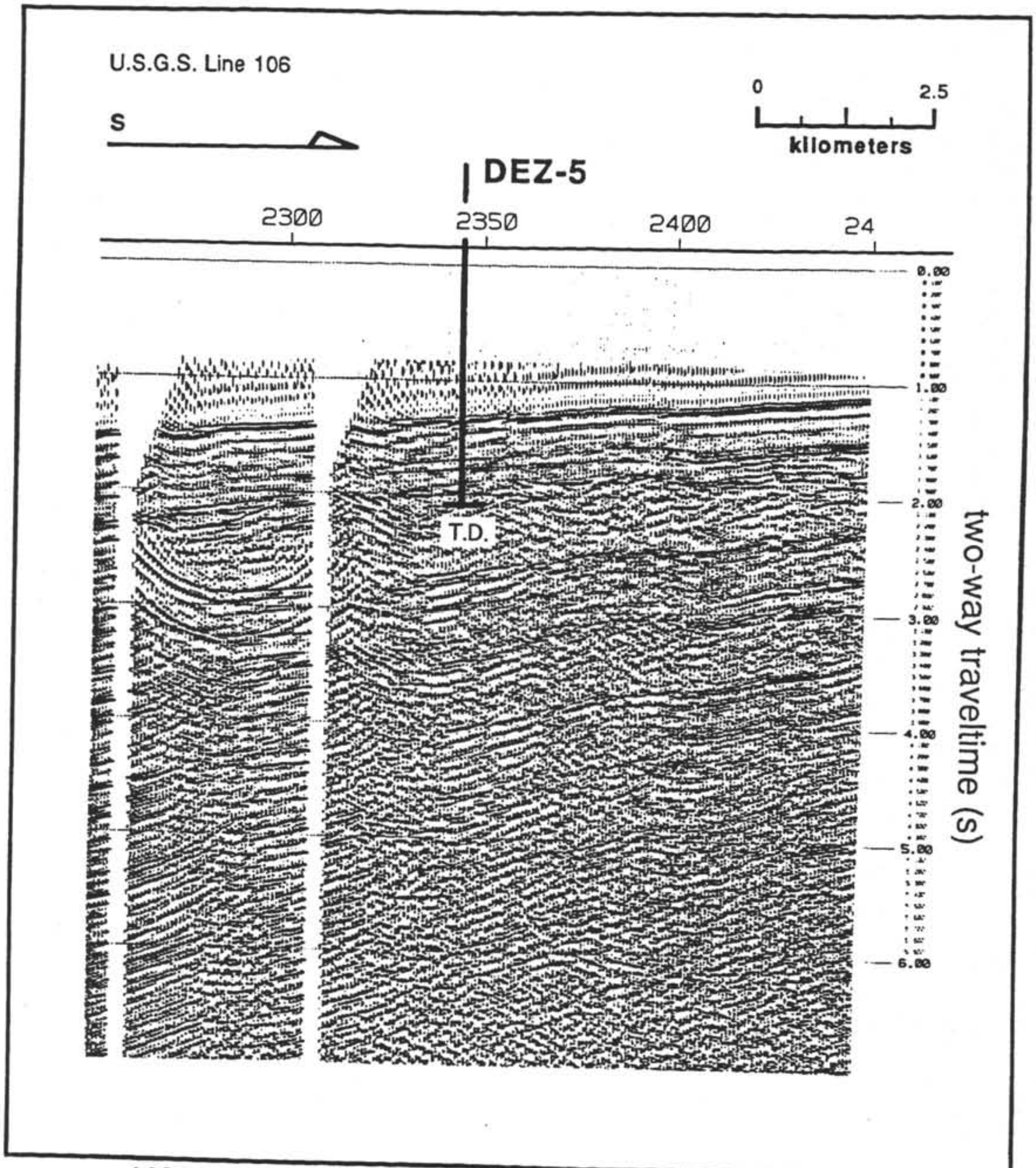
Objectives: To drill through a shallow parallel-bedded sequence to determine the age, lithologies, and physical properties of rocks forming the colliding guyot. The rapid subsidence of the guyot will provide the opportunity to study the interactions between subsidence, sealevel change, and carbonate diagenesis. Magnetic analyses will provide information about the trajectory of the guyot since the Eocene.

Nature of Sediment/Rocks Anticipated: Carbonate and volcanic rocks.


166°40' E
2250
2300
700
16°00' S
16°00' S
750
USGS 106
DEZ 5
USGS 100
850
900
2400
16°05' S
16°05' S
166°40' E



USGS (Lee) Line 100, L5-84-SP, ShotPoint 780



USGS (Lee) Line 106, L5-84-SP, ShotPoint 2345

Site: IAB-1 Priority: 1

Position: 14° 47.8'S
167° 34.4'E

Water Depth: 3098 m Sediment Thickness: 700 m

Proposed Drilling Program: Hole A: APC/XCB to refusal (est. 500 mbsf).
Hole B: Wash to 500 mbsf, RCB to 700 mbsf.

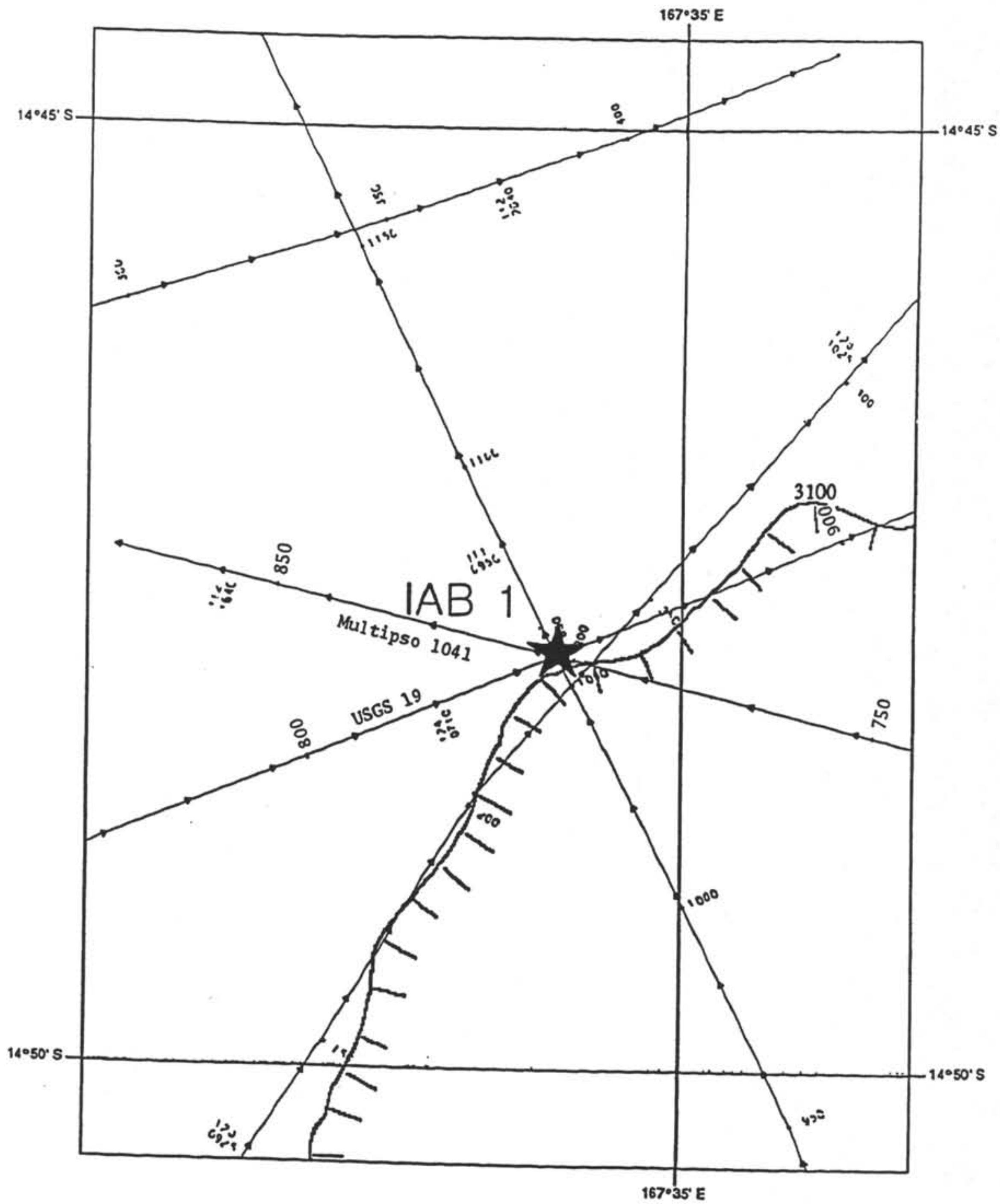
Seismic Record: USGS (Lee) Line 19, L6-82-SP, SP 850; Cross line Multipso (French) 1041, SP 800.

Water Sampler: Yes.

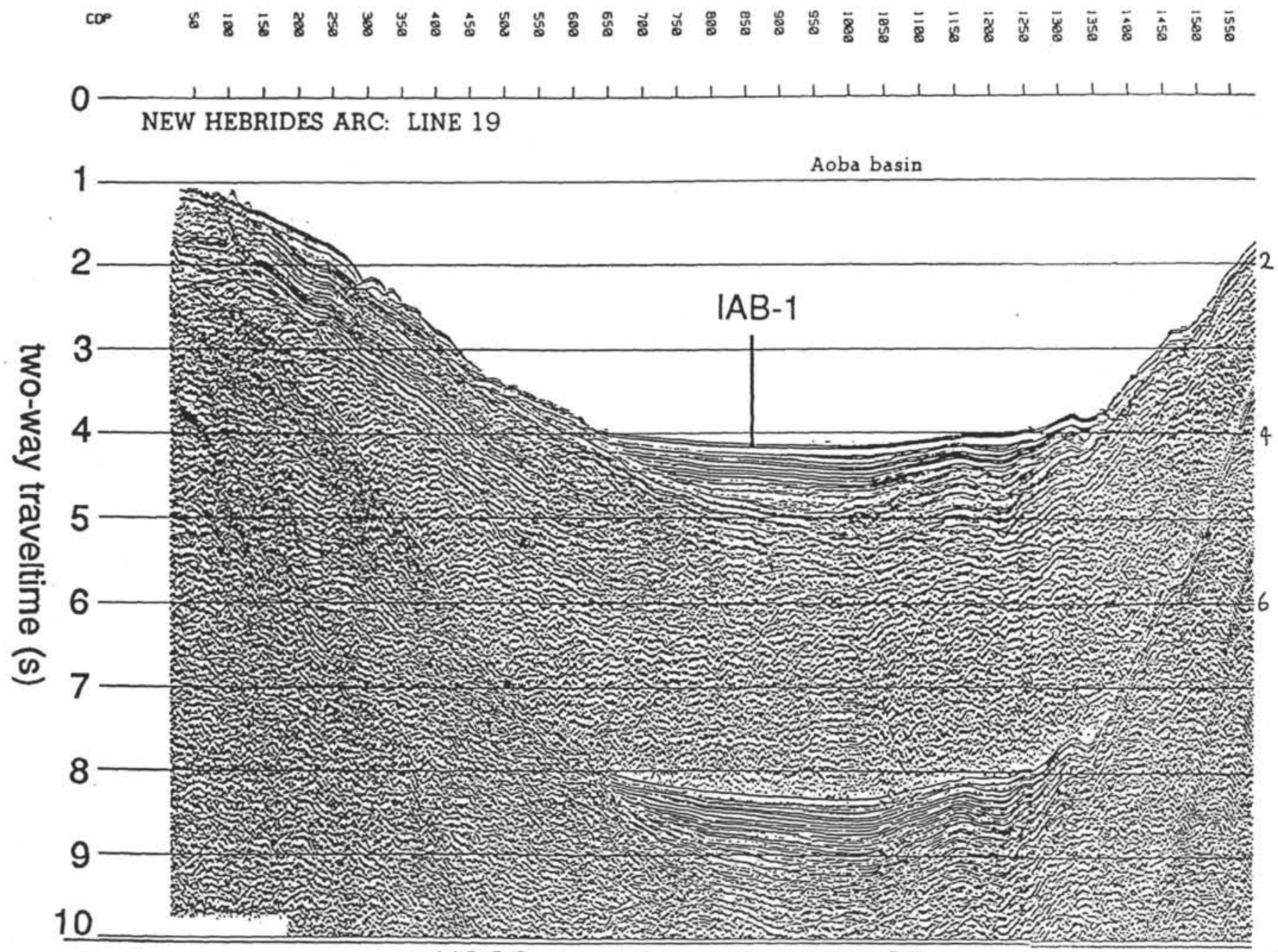
Logging: Standard Schlumberger logging, formation microscanner, and French magnetometer.

Objectives: To determine age, lithologies and physical properties of rocks forming the recent intra-arc basin. To determine whether the age of a major unconformity within the basin correlates with the time of arc-ridge collision, showing perhaps how collision modifies the evolution of an intra-arc basin. The chemistry of volcanic ashes may show how the magmatic arc has been modified by collision and help to determine when and whether subduction polarity flipped.

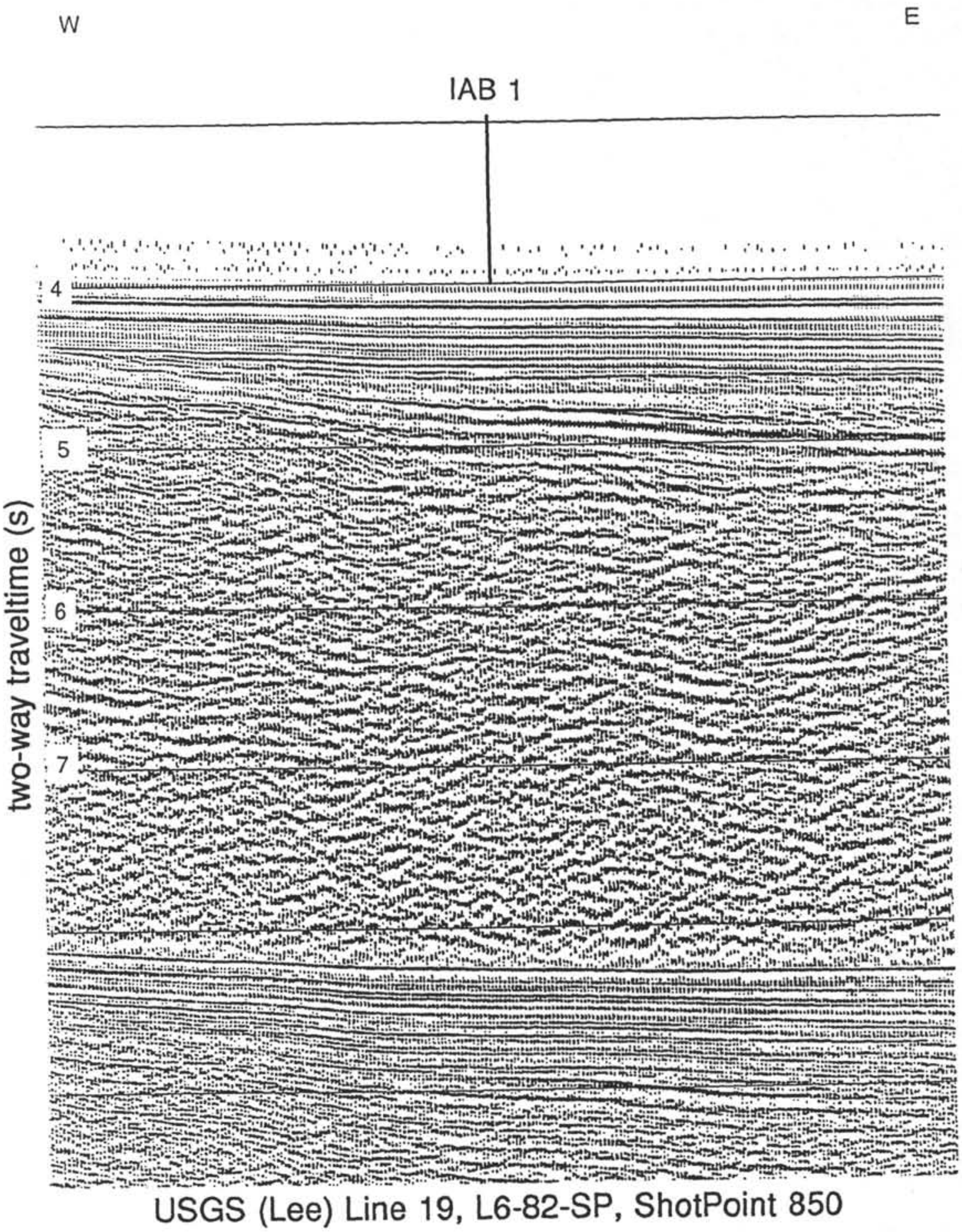
Nature of Sediment/Rocks Anticipated: Well-stratified volcanic ash, clastic and pelagic sediments.



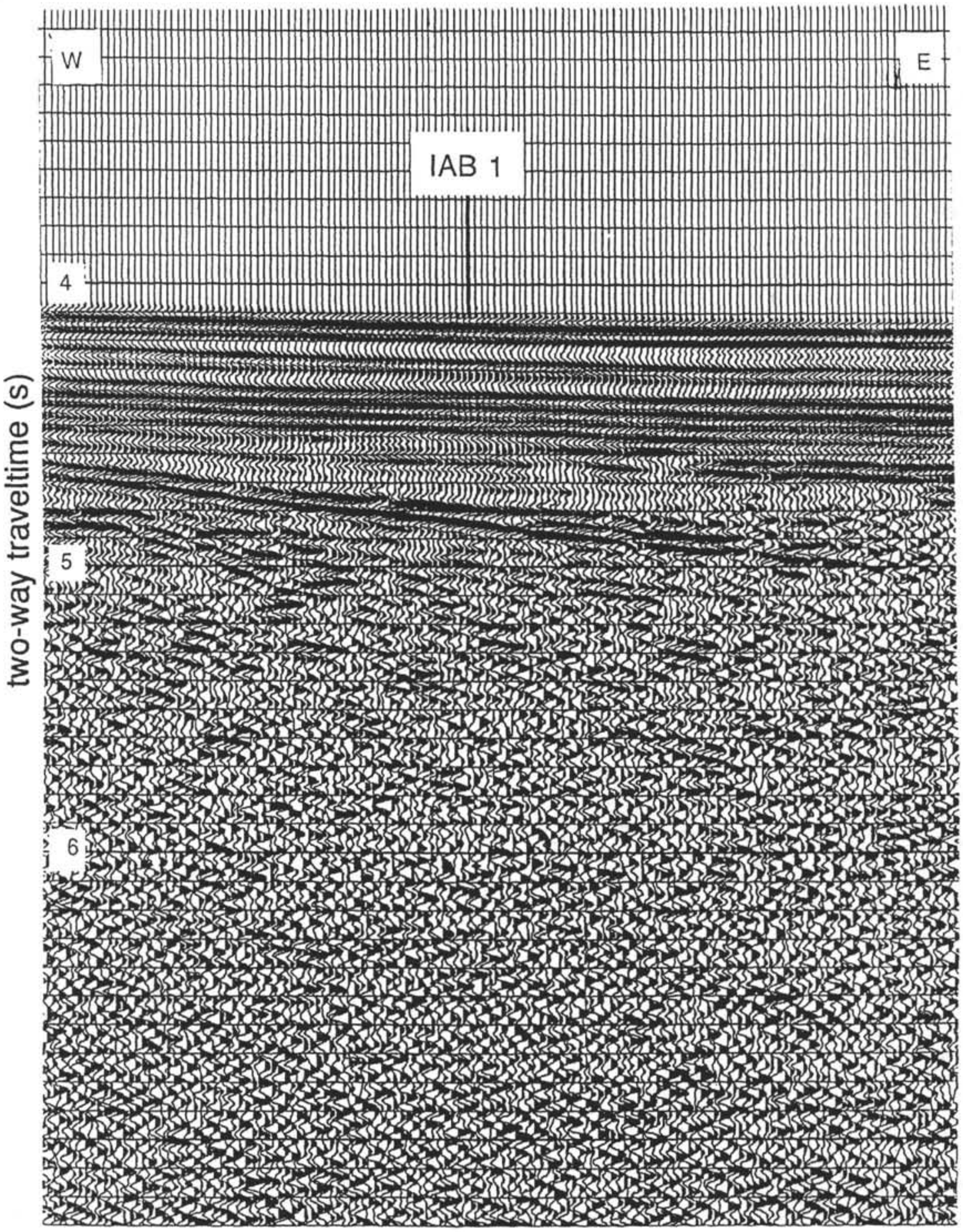
USGS (Lee) Line 19, L6-82-SP, ShotPoint 850
Multipso 1041, ShotPoint 800



USGS (Lee) Line 19, L6-82-SP



USGS (Lee) Line 19, L6-82-SP, ShotPoint 850



Multipso 1041, ShotPoint 800

Site: IAB-2 Priority: 1

Position: 14° 52.4'S
167° 53.0'E

Water Depth: 2600 m Sediment Thickness: 1000 m

Proposed Drilling Program: Hole A: APC/XCB to refusal (est. 300 mbsf).
Hole B: Wash to 300 mbsf, RCB to 1000 mbsf.

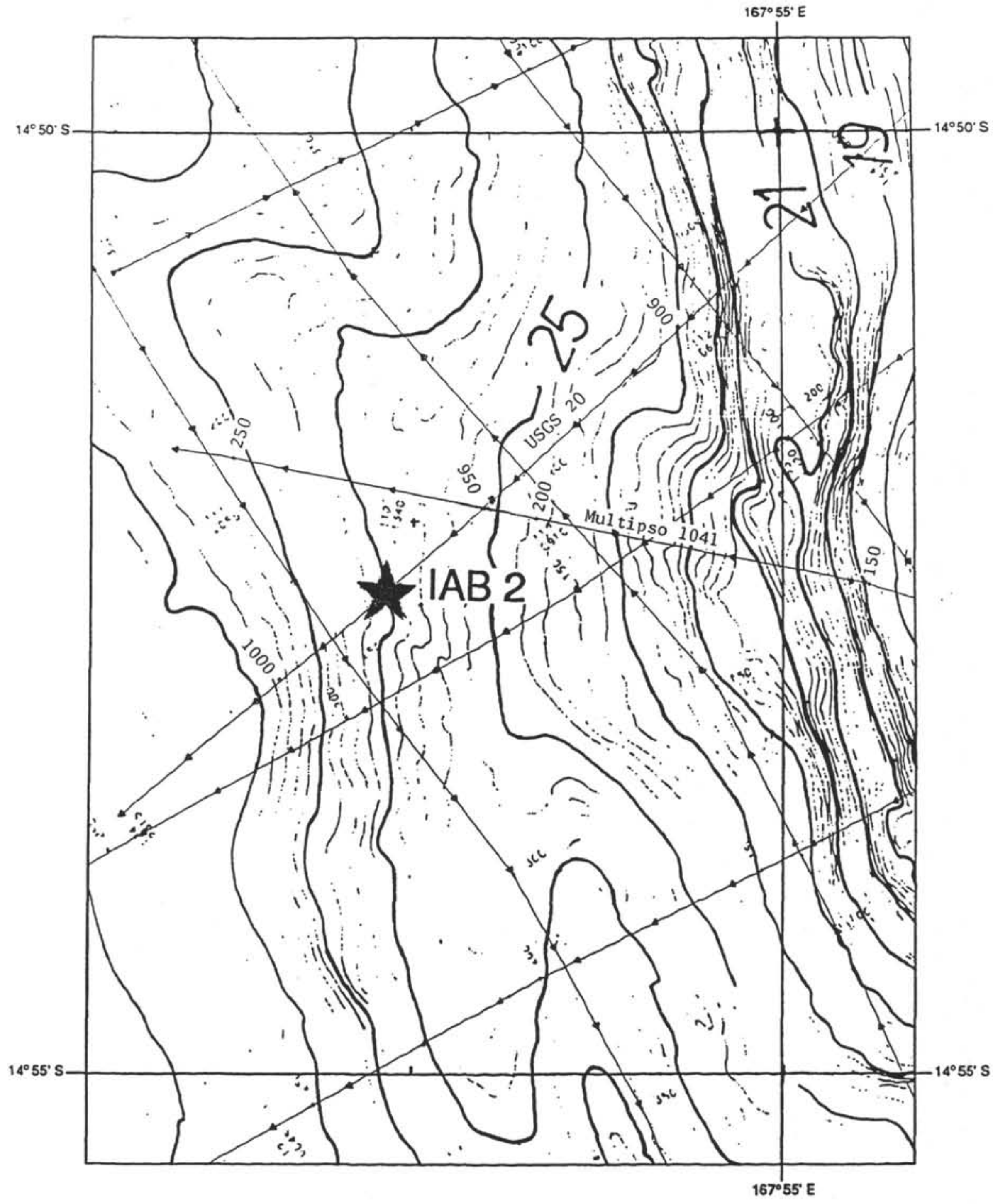
Seismic Record: USGS (Lee) Line 20, L6-82-SP, SP 975; near crossing with Multipso (French) 1041, SP 209.

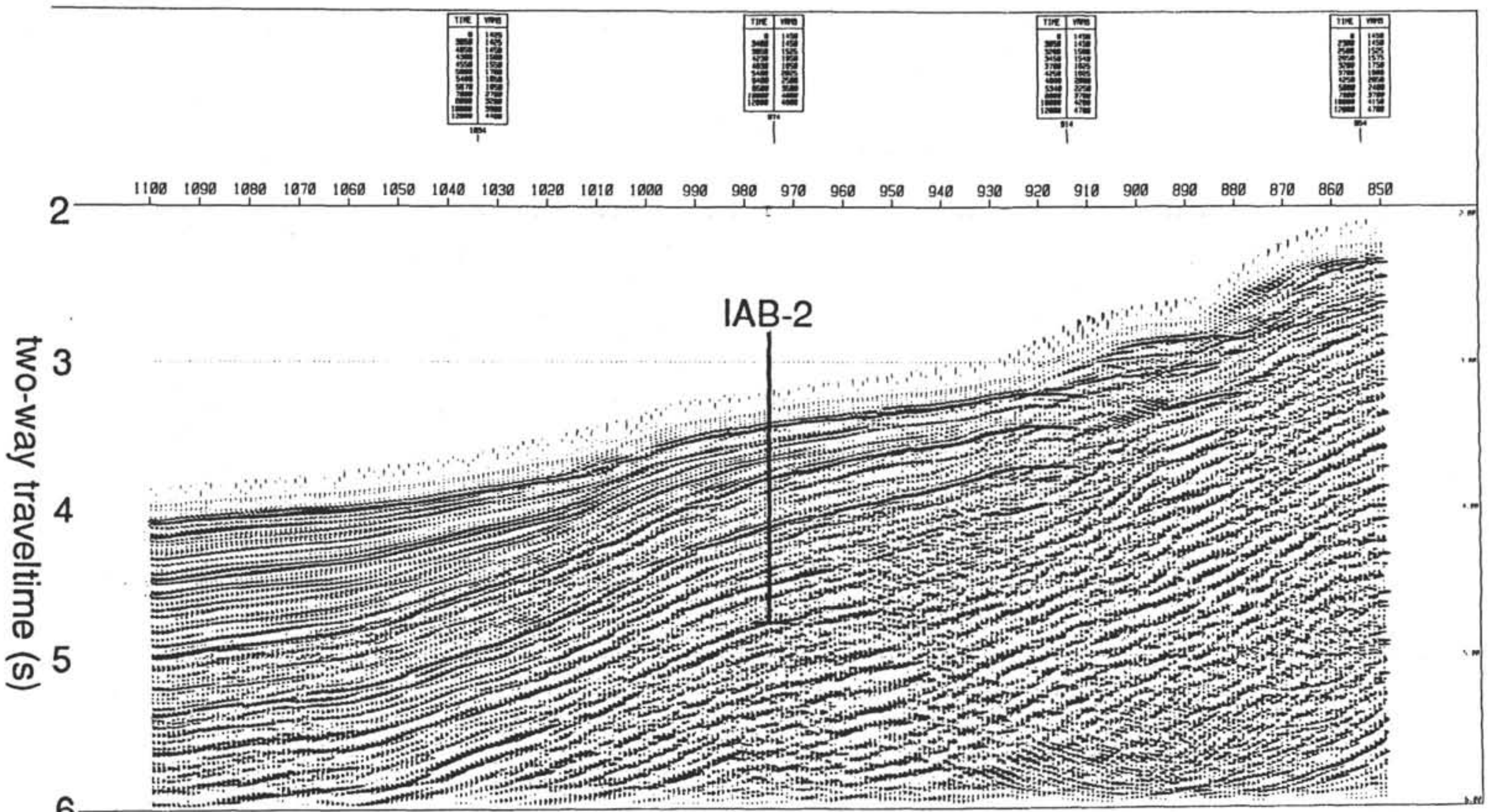
Water Sampler: Yes.

Logging: Standard Schlumberger logging and formation microscanner.

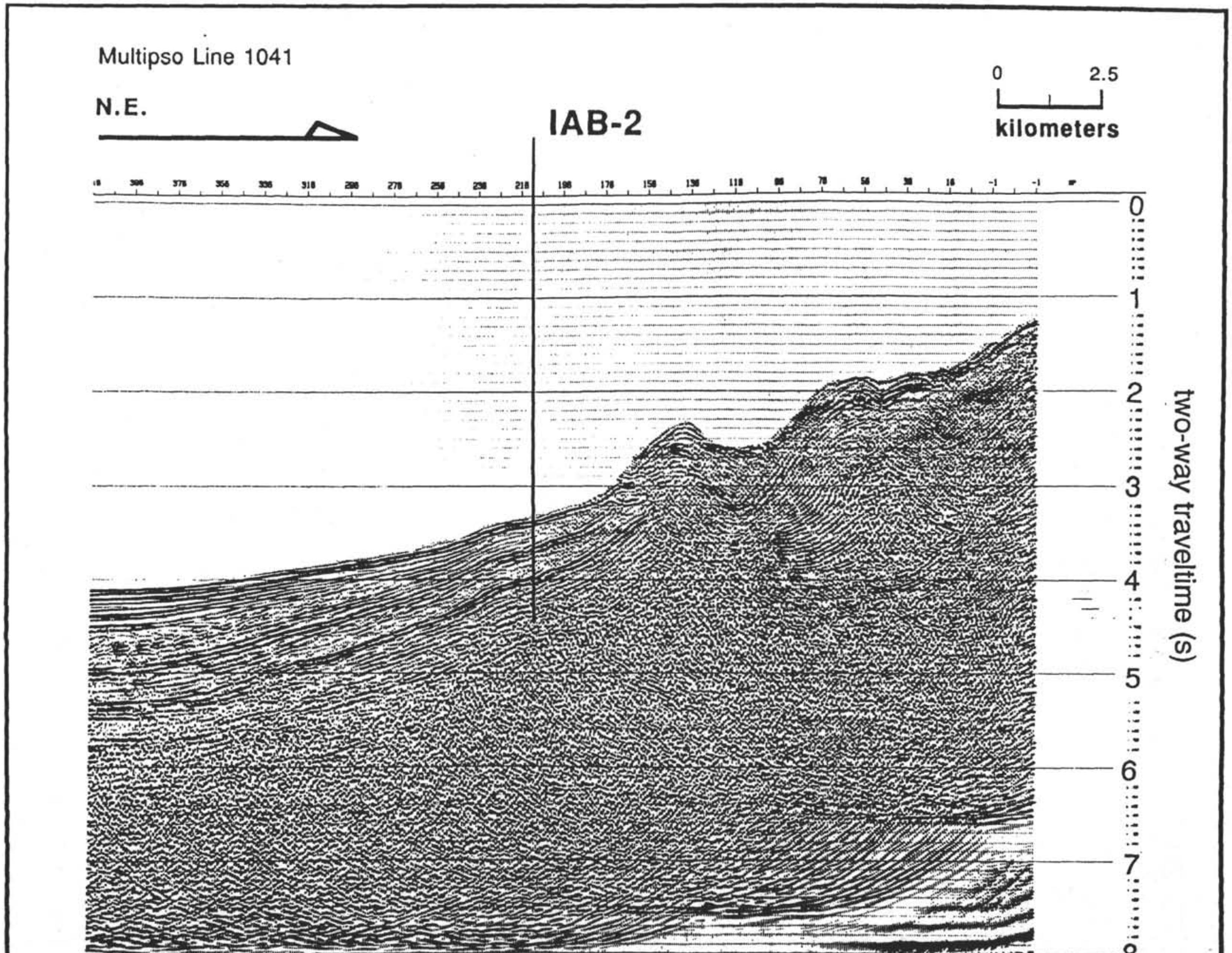
Objectives: Drilling at this site will sample the deep fill in the Aoba Basin to provide a composite stratigraphic section (with data from IAB-1) that straddles chronologically the arc-ridge collision and possible flip in subduction polarity. Basin history and evolution of the magmatic arc during this time of unsteady geologic environment can be studied.

Nature of Sediment/Rocks Anticipated: Well-stratified volcanic ash, clastic and pelagic sediments.


167° 55' E
14° 50' S
14° 50' S
14° 55' S
14° 55' S
167° 55' E
IAB 2
USGS 20
Multipso 1041
25
21
19
900
950
200
250
1000
150



USGS (Lee) Line 20, L6-82-SP, ShotPoint 975



Multipso 1041, ShotPoint 209

SCIENTIFIC PARTICIPANTS

OCEAN DRILLING PROGRAM LEG 134

Co-Chief Scientist:	Jean-Yves Collot Laboratoire de Géodynamique B.P. 48-06230 Villefranche-sur-mer France
Co-Chief Scientist:	Gary Greene U.S. Geological Survey 345 Middlefield Road Menlo Park, CA 94025
Staff Scientist/Paleomagnetist:	Laura Stokking Ocean Drilling Program 1000 Discovery Drive Texas A&M Research Park College Station, TX 77845-9547
Sedimentologist:	Terrence M. Quinn Department of Geological Sciences University of Michigan Ann Arbor, MI 48109-1063
Sedimentologist:	Pamela Reid Rosenthiel School of Marine and Atmospheric Science 4600 Rickenbacker Causeway Miami, FL 33149
Sedimentologist:	Frederick W. Taylor Institute for Geophysics University of Texas 871 Mopac Blvd. Austin, TX 78749-8345
Sedimentologist:	TO BE NAMED
Structural Geologist/Sedimentologist:	Martin Meschede Institut für Geologie Universität Tubingen Sigwartstrasse 10 D-7400 Tubingen Federal Republic of Germany

Structural Geologist/Sedimentologist: Bernard Pelletier
Orstum B.P.A 5 Noumea
New Caledonia
France

Sedimentologist/Radiolarian Paleontologist: William R. Riedel
Geological Research Division A-020
Scripps Inst. of Oceanography
University of California/San Diego
La Jolla, CA 92093

Paleontologist (nannofossils): Thomas S. Staerker
Department of Geology
Florida State University
Tallahassee, FL 32306

Paleontologist (foraminifers): Russell C.B. Perembo
Department of Geology
University of Western Australia
Nedlands, Western Australia 6009

Paleontologist (foraminifers): TO BE NAMED

Phys. Props. Specialist: Maria V.S. Ask
Div. of Rock Mechanics
Luleå University of Technology
S-951 87 Luleå, Sweden

Phys. Props. Specialist: John Leonard
Department of Oceanography
Texas A&M University
College Station, TX 77840-3146

Paleomagnetist: Pierrick Roperch
Laboratoire de Géodynamique Sous-Marine
Centre d'Etudes et de Recherches
Oceanographiques de Villefranch-sur-Mer
B.P. 48, 06230
Villefranch-sur-Mer France

Paleomagnetist: Xixi Zhao
Department of Geophysics
Texas A&M University
College Station, TX 77840

Igneous Petrologist:	Peter Edward Baker Department of Earth Sciences University of Leeds Leeds LS2 9JT U.K.
Igneous Petrologist:	Massimo Coltorti Mineralogy Institute Ferrara University C.so E. 1 d.'Este 32, 44100 Ferrara, Italy
Igneous Petrologist:	Toshiaki Hasenaka Institute of Mineralogy Faculty of Science Tohoku University Aoba, Sendai, Miyagi 980 Japan
Igneous Petrologist:	John Malpas Centre for Earth Resource Research Department of Earth Sciences Memorial University St. John's Newfoundland A1B 3X5 Canada
Igneous Petrologist:	Louis Briqueu C.N.R.S. France Laboratoire de Tectonique U.S.T.L. C.P. 066 34095 Montpellier Cedex 2 France
Igneous Petrologist	Patrick J. Maillet ORSTROM c/o IFREMER BP 70 29263 Plouzane France
Inorganic Geochemist:	TO BE NAMED
Logging Scientist:	Anton Krammer Geophysical Institute Hertzstr. 16, D-7500 Karisruhe 21 F.R.G.

Geophysicist/Logging Scientist:	Michael A. Fisher U.S. Geological Survey 345 Middlefield Road MS-999 Menlo Park, CA 94025
LDGO Logging Scientist:	Mike Hobart Lamont-Doherty Geological Observatory Palisades, NY 10964
Borehole TV Technician	Steve Menger Deutsche Montan Technologie Institute für Angewandte Geophysik Herner Str. 45 D-4630 Bochum West Germany
LDGO Logging Trainee:	Robin Reynolds Lamont-Doherty Geological Observatory Palisades, NY 10964
Schlumberger Engineer:	TO BE NAMED
Operations Superintendent:	Glen Foss Ocean Drilling Program 1000 Discovery Drive Texas A&M Univ. Research Park College Station, TX 77845-9547
Development Engineer	Dave Huey Ocean Drilling Program 1000 Discovery Drive Texas A&M Univ. Research Park College Station, TX 77845-9547
Lab Officer:	Bill Mills Ocean Drilling Program 1000 Discovery Drive Texas A&M Univ. Research Park College Station, TX 77845-9547
Assistant Lab Officer:	Matt Mefferd Ocean Drilling Program 1000 Discovery Drive Texas A&M Univ. Research Park College Station, TX 77845-9547

Yeoperson:	Michiko Hitchcox Ocean Drilling Program 1000 Discovery Drive Texas A&M Univ. Research Park College Station, TX 77845-9547
Photographer:	John Beck Ocean Drilling Program 1000 Discovery Drive Texas A&M Univ. Research Park College Station, TX 77845-9547
Photographer:	Stacey DuVall Ocean Drilling Program 1000 Discovery Drive Texas A&M Univ. Research Park College Station, TX 77845-9547
Chemistry Tecnician:	Mary Ann Cusimano Ocean Drilling Program 1000 Discovery Drive Texas A&M Univ. Research Park College Station, TX 77845-9547
Chemistry Technician:	Mark Simpson Ocean Drilling Program 1000 Discovery Drive Texas A&M Univ. Research Park College Station, TX 77845-9547
Electronics Technician:	Barry Weber Ocean Drilling Program 1000 Discovery Drive Texas A&M Univ. Research Park College Station, TX 77845-9547
Electronics Technician:	Bill Stevens Ocean Drilling Program 1000 Discovery Drive Texas A&M Univ. Research Park College Station, TX 77845-9547
Electronics Technician:	TO BE NAMED
Curatorial Representative:	Peggy Myre Ocean Drilling Program 1000 Discovery Drive Texas A&M Univ. Research Park College Station, TX 77845-9547

System Manager:	Bill Meyer Ocean Drilling Program 1000 Discovery Drive Texas A&M Univ. Research Park College Station, TX 77845-9547
Marine Technician:	Don Sims Ocean Drilling Program 1000 Discovery Drive Texas A&M Univ. Research Park College Station, TX 77845-9547
Marine Technician:	"Gus" Gustafson Ocean Drilling Program 1000 Discovery Drive Texas A&M Univ. Research Park College Station, TX 77845-9547
Marine Technician:	Chuck Williamson Ocean Drilling Program 1000 Discovery Drive Texas A&M Univ. Research Park College Station, TX 77845-9547
Marine Technician:	Ken DuVall Ocean Drilling Program 1000 Discovery Drive Texas A&M Univ. Research Park College Station, TX 77845-9547
Marine Technician:	Laura Heintschel Ocean Drilling Program 1000 Discovery Drive Texas A&M Univ. Research Park College Station, TX 77845-9547
Marine Technician:	TO BE NAMED
Marine Technician:	TO BE NAMED