PART I

I. OUTLINE OF THE GH79-1 CRUISE

Atsuyuki Mizuno, Keiji Handa, Yoshiro Masai, Teruki Miyazaki, Akira Nishimura, Koji Onodera, Kensaku Tamaki, Manabu Tanahashi, and Katsuya Tsurusaki**

Introduction

We carried out the Hakurei-Maru GH79-1 cruise in the northern Central Pacific Basin in early 1979 with the purpose of manganese nodule research. This cruise report comprises the outline and results of our shipboard works (Chapters I to XIII, Part I) and the results of shore-based mineralogical and chemical analyses of sediments and manganese nodules (Chapters XIV to XXIII, Part II). Synthetic discussions and summaries on manganese nodules appear in Chapter XXIV, Part II.

The Geological Survey of Japan (GSJ) has carried out, since F.Y. 1974, the special research program funded by the Agency of Industrial Science and Technology, MITI, *Basic Study on Exploration of Deep-sea Mineral Resources*, for the extensive area of the northern Central Pacific Basin. It lies on 5°–13°N and 175°E–165°W with an area of approximately 2,100 km by 800 km, bounded by the Line Islands to the east, the Marshall Islands to the west, and the Mid-Pacific Mountains to the north (Fig. I-1, Table I-1). The research program aims at providing basic information on the regional distribution of manganese nodules and their origin in the central Pacific.

Four research cruises by the R/V Hakurei-Maru from F.Y. 1974 to F.Y. 1977 revealed a general tendency of manganese nodule distribution in each surveyed area, as seen in the published cruise reports. Increasingly accumulated were the data that there is an inverse correlation between abundance and nickel plus copper grade of nodules throughout the surveyed areas and that the grade depends on the morphology and mineral composition of the nodules and sedimentary history (MIZUNO and MORITANI, 1978; MIZUNO, 1979).

Our works in the GH79-1 cruise were mainly to obtain regional data of manganese nodule distribution in the area of 10°–13°N and 165°W–180°, which has remained unsurveyed, and additionally to obtain detailed data of horizontal variation of chemical and physical properties of nodules at a small area which is included in the northern part of the GH 74-5 area. The work in the small area aimed at contributing to understand both regional and local problems of manganese nodules in the entire target area of the central Pacific as the final phase of the five-year research program. Also, our cruise included the shipboard works of the research program, *Mining Technology for Marine Mineral Resources*, by the National Research Institute for Pollution and Resources (NRIPR),

*National Research Institute for Pollution and Resources, Tsukuba.

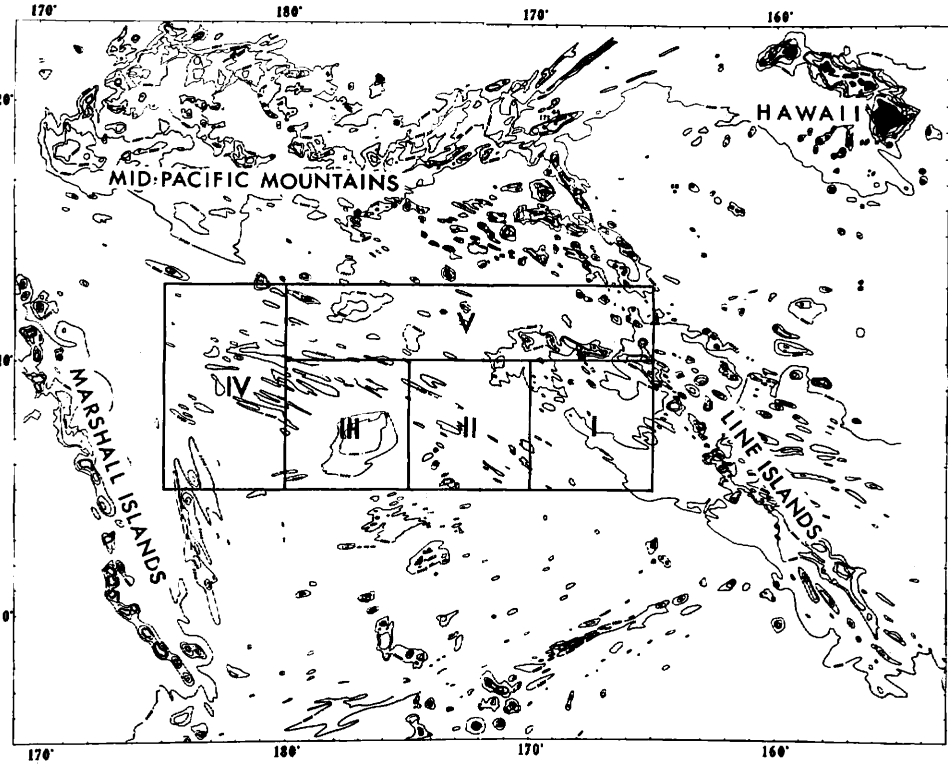

Fig. I-1 Submarine topography and the survey areas in the Central Pacific Basin. I, GH 74-5 area; II, GH76-1 area; III, GH77-1 area; IV, GH78-1 area; V, GH79-1 area. Data source of topography: WINTERER, EWING, *et al.* (1973).

Table I-1. Survey program in the northern Central Pacific Basin, F.Y. 1974 through F.Y. 1978, by the R/V Hakurei-Maru.

F.Y. year	Survey area	Survey date	Cruise	Chief scientist	GSJ Cruise Report
F.Y. 1974	5°–10°N, 165°–170°W	August 14 to October 17, 1974 (65 days)	GH74–5	A. MIZUNO	No. 4 (1975)
F.Y. 1975	5°–10°N, 170°–175°W	January 10 to March 9, 1976 (60 days)	GH76–1	A. MIZUNO	No. 8 (1977)
F.Y. 1976	5°–10°N, 175°W–180°	January 12 to March 12, 1977 (60 days)	GH77–1	T. MORITANI	No. 12 (1979)
F.Y. 1977	5°–13°N, 175°E–180°	January 7 to March 7, 1978 (60 days)	GH78–1	T. MORITANI	*in preparation*
F.Y. 1978	10°–13°N, 165°E–180°	January 13 to March 13, 1979 (60 days)	GH79–1	A. MIZUNO	No. 15 (1981)

which have been hitherto carried out in every Hakurei-Maru cruise as well in the central Pacific.

The Line Islands chain is crossed by WNW–ESE trending three rows of seamount chain, which are called the Cross Trend chains (or ridges) (WINTERER, 1976). The survey area of GH79–1 cruise extends from the intersection of the Line Islands chain and the middle row of the Cross Trend chains toward the west and the northwest and includes the middle row in its southeastern part and a part of the seamounts of the Line Islands chain in its eastern margin. The published bathymetric map shows a general tendency of arrangement of topographic relief in the Cross Trend direction in the survey area (WINTERER, EWING, *et al.*, 1973). TAMAKI *et al.* (1979) have clarified a peculiar nature of the fan-shaped Magellan lineations and have discussed its implication on the Mesozoic evolution of the central Pacific, based on magnetic anomaly lineation data on immediately south of the western half of the present area. The northern wing of the Magellan lineations is expected to extend into the present area and might be related to the topographic arrangement.

RAWSON and RYAN (1978) have shown that surficial sediment in abyssal basins of this area is mostly occupied by radiolarian mud with relatively not so frequent occurrence of manganese nodules, whereas wide distribution of pelagic clay had been shown by HORN *et al.* (1972). Manganese nodules are suggested to have a low content of approxi-

Table I-2 Shipboard scientific members.

Name	Organization	Speciality and responsibility
Atsuyuki MIZUNO	G.S.J.	*Chief scientist*; geology and sedimentology; in charge of the research program, *Basic study on deep sea mineral resources prospecting.*
Koji ONODERA	G.S.J.	Technical official; bathymetry and general affairs.
Teruki MIYAZAKI	G.S.J.	Geophysicist; magnetic and gravimetric survey and NNSS positioning.
Kensaku TAMAKI	G.S.J.	Geologist; seismic reflection and refraction survey and magnetic survey.
Akira NISHIMURA	G.S.J.	Geologist; sedimentology and micropaleontology.
Manabu TANAHASHI	G.S.J.	Geologist; seismic reflection and refraction survey and magnetic survey.
Yoshiro MASAI	G.S.J.	Photographer.
Katsuya TSURUSAKI	N.R.I.P.R.	Mining engineer; geotechnical study on sediments.
Keiji HANDA	N.R.I.P.R.	Mining engineer; geotechnical study on manganese nodules.
Haruaki TSUCHIYA*	M.M.A.J.	Mining engineer; survey techniques on manganese nodules.
Kenji ISHII**	M.M.A.J.	Mining engineer; survey techniques on manganese nodules.
Naoki DOI	Tokai Univ.	Graduate student; technical assistant.
Kokichi IIZASA	Univ. Tokyo	Graduate student; technical assistant.
Akiyoshi FUNABIKI	Kobe Univ.	Undergradiate student; technical assistant.
Masayuki MAMIYA	Chiba Univ.	Undergraduate student; technical assistant.
Fuminori YAMAMOTO	Kochi Univ.	Graduate student; technical assistant.
Tomonori YOHENA	Univ. Ryukyus	Undergraduate student; technical assistant.
Osamu UEDA	Univ. Ryukyus	Undergraduate student; technical assistant.
Tomoaki HACHIMURA	Univ. Ryukyus	Undergraduate student; technical assistant.
Talanoafuka KITEKEI'AHO	Government of the Kingdom of Tonga	Trainee; survey techniques on manganese nodules.
David Z. PIPER**	U.S.G.S.	Visiting scientist; geochemistry and mineralogy.

*From Funabashi to Honolulu.
**From Kahului to Funabashi.

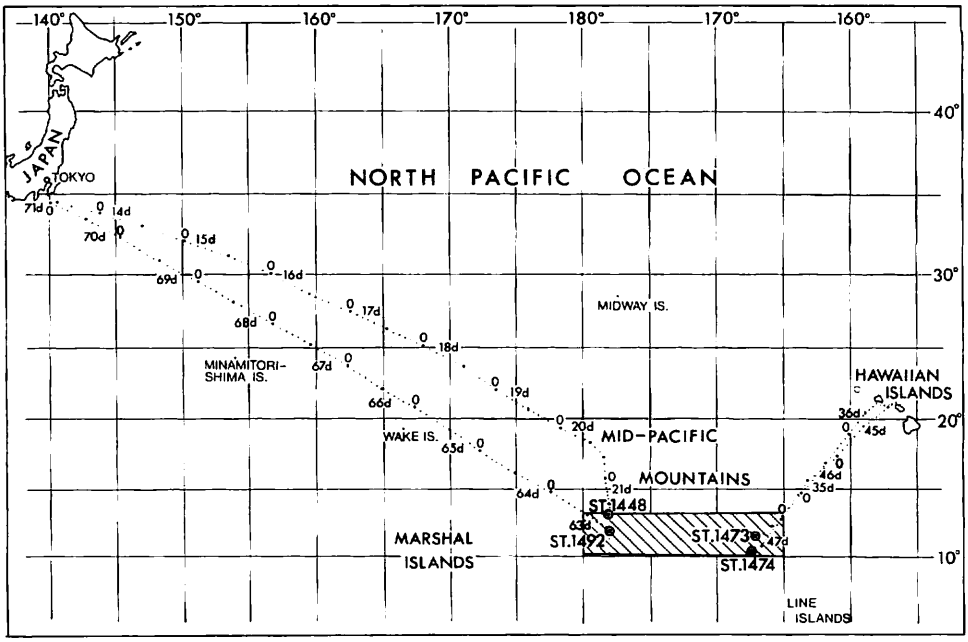

Fig. I-2 Geophysical tracks between Funabashi and the survey area and between Hawaii and the survey area.

Table I-3 Summary of cruise program.

January 13	Lv. Funabashi (14:00). Geophysical survey from off Boso to the survey area.
January 21	Ar. the survey area. Geological and geophysical survey in the Central Pacific.
February 2	Lv. the survey area. Geophysical survey from the survey area to Honolulu.
February 5	Ar. Honolulu (08:30).
February 8	Lv. Honolulu (17:00).
February 9	Ar. Kahului (09:00).
February 13	Lv. Kahului (13:00).
February 16	Ar. the survey area. Geological and geophysical survey in the Central Pacific.
March 3	Lv. the survey area. Geophysical survey from the survey area to off Boso.
March 13	Ar. Funabashi (09:00).

mately 1 per cent nickel plus copper in the average (RAWSON and RYAN, 1978). Deep-sea drilling data have been reported from two sites of 165 and 170, both in adjacent areas. The lithologic sequences obtained by the drillings are expected to help our interpretation of the results of bottom sampling and seismic reflection survey.

Outline of the GH79–1 cruise

Six scientists and one photographer from GSJ, two scientists from NRIPR, two mining engineers from the Metal Mining Agency of Japan (MMAJ) joined this cruise, together

Table I-4 Daily program of the GH79-1 cruise.

Total cruising day; 60 days; total cruising time, 1,213 h 30 min.; total cruising distance, 12,981.7 nautical miles (24,042 km).

Date	Weather	Cruising time	Cruising distance (in n.m.)	Remarks
Jan. 13	Snow	09.30	131.9	Lv. Funabashi (14:00).
14	Cloudy	23.30	339.2	Geophysical survey (3)†.
15	Cloudy	23.30	343.7	Geophysical survey (3).
16	Cloudy	23.30	338.6	Geophysical survey (3); test of proton magnetometer.
17	Cloudy	23.30	329.9	Geophysical survey (3); test of air gun.
18	Cloudy to fine	23.30	341.4	Geophysical survey (3).
19	Fine	23.30	322.8	Geophysical survey (3); test of air-gun.
20	Fine	23.30	308.7	Geophysical survey (3); test of air-gun; passed the 180° meridian.
20	Fine	23.30	287.6	Geophysical survey (1)†.
21	Fine	24.00	151.2	Geophysical survey (1) and sampling* (Sts. 1448 and 1449).
22	Fine	24.00	165.0	Geophysical survey (1) and sampling (Sts. 1450 and 1451).
23	Fine	24.00	163.1	Geophysical survey (1) and sampling (Sts. 1452 and 1453).
24	Fine	24.00	169.0	Geophysical survey (1) and sampling (Sts. 1454 and 1455).
25	Fine	24.00	176.1	Geophysical survey (1) and sampling (Sts. 1456 and 1457).
26	Fine	24.00	158.7	Geophysical survey (1) and sampling (Sts. 1458 and 1459).
27	Fine	24.00	173.6	Geophysical survey (1) and sampling (Sts. 1460 and 1461).
28	Fine	24.00	186.6	Geophysical survey (1) and sampling (Sts. 1462 and 1463).
29	Fine	24.00	184.3	Geophysical survey (1) and sampling (Sts. 1464 and 1465).
30	Fine	24.00	166.7	Geophysical survey (1) and sampling (Sts. 1466 and 1467).
31	Fine	24.00	186.3	Geophysical survey (1) and sampling (Sts. 1468 and 1469).
Feb. 1	Fine	24.00	197.2	Geophysical survey (1) and sampling (Sts. 1470 and 1471).
2	Fine	24.00	201.7	Geophysical survey (1) and sampling (Sts. 1472 and 1473).
3	Fine	23.30	319.3	Geophysical survey (2)†.
4	Cloudy	23.30	306.5	Geophysical survey (3).
5	Cloudy	08.30	65.9	Geophysical survey (3); ar. Honolulu (08:30).
6	Fine	0	0	—
7	Fine	0	0	—
8	Cloudy	07.00	65.2	Lv. Honolulu (17:00); geophysical survey (3).
9	Cloudy	09.00	32.9	Ar. Kahului (09:00); open house.
10	Rain	0	0	—
11	Fine	0	0	—

Table I-4 (Continued)

Date	Weather	Cruising time	Cruising distance (in n.m.)	Remarks
12	Fine	0	0	—
13	Fine	11.00	151.0	Lv. Kahului (13:00); geophysical survey (3).
14	Cloudy	24.30	367.4	Geophysical survey (3).
15	Clouly	24.30	371.4	Geophysical survey (3).
16	Cloudy	24.00	147.4	Geophysical survey (1) and sampling (Sts. 1474, 1475, and 1476).
17	Cloudy	24.00	122.0	Geophysical survey (1) and sampling (Sts. 1477, 1478, and 1479).
18	Fine	24.00	106.7	Geophysical survey (1) and sampling (Sts. 1480, 1481, and 1482).
19	Fine	24.00	126.1	Geophysical survey (1) and sampling (Sts. 1483, 1484, and 1485).
20	Fine	24.00	162.1	Geophysical survey (1) and sampling (St. 1481A).
21	Fine	24.00	251.2	Geophysical survey (2) and sampling (Sts. 1481A1–1484A and 1484A1–1478A).
22	Fine	24.00	175.4	Geophysical survey (2) and sampling (Sts. 1481A2 and 1486).
23	Fine	24.00	321.5	Geophysical survey (1).
24	Fine	24.00	348.6	Geophysical survey (2).
25	Fine	24.00	328.0	Geophysical survey (1).
26	Fine	24.00	257.1	Geophysical survey (1) and sampling (St. 1452A).
27	Fine	24.00	186.1	Geophysical survey (1) and sampling (Sts. 1487 and 1488).
28	Fine	24.00	325.2	Geophysical survey (1).
Mar. 1	Fine	24.00	231.1	Geophysical survey (1) and sampling (St. 1489).
2	Fine	24.00	292.5	Geophysical survey (1) and sampling (St. 1490).
3	Fine	24.30	262.5	Geophysical survey (1) and sampling (Sts. 1491 and 1492).
4	Fine	24.30	367.5	Geophysical survey (2); passed the 180° meridian.
6	Fine	24.30	347.9	Geophysical survey (2).
7	Cloudy	24.30	341.2	Geophysical survey (2).
8	Fine	24.30	355.6	Geophysical survey (2).
9	Fine	24.30	355.2	Geophysical survey (2).
10	Cloudy	24.30	353.2	Geophysical survey (2).
11	Cloudy	24.30	320.4	Geophysical survey (2).
12	Cloudy	15.00	186.3	Geophysical survey (2); ar. off chiba (15:00).
13	Rain	1.00	7.0	Ar. Funabashi (09:00).

*Sampling includes bottom photographing by a photoboomerang and partly a test of *in-situ* measurement of freefall vane tester.

†Geophysical survey (1) comprises continuous seismic reflection profiling, magnetic measurement, and gravity measurement.

Geophysical survey (2) means the survey with magnetic measurement and gravity measurement.

Geophysical survey (3) means the survey with gravity measurement.

Table I-5 Observation method in GH79-1 Cruise.
The right-hand column shows a survey line length and an observation number of respective work.

Cruising and positioning by NNSS	
Geophysical method	
Bathymetric survey by 12 kHz PDR	20,600 km
Subbottom profiling by 3.5 kHz PDR	20,600 km
Continuous seismic reflection profiling by air-gun	5,250 km
Sono-buoy refraction survey	65 km (3 sites)
Magnetic survey by proton magnetometer	16,200 km
Gravimetric survey by on-board gravimeter	24,042 km
Geological and optical methods	
Bottom sampling by double spade box corer Bottom sampling by single spade box corer	G915–956
Bottom sampling and photography by freefall grab with camera	FG115–164C
Bottom sampling by piston corer	P137–141
Bottom sampling by dredge	D314–315
Bottom photography by deep-sea camera	C15
Others	
In-situ measurement test of freefall vane tester	FV1
Onboard examinations on sediment and manganese nodule samples	
Sediment—visual description, smear slide observation, coarse fraction analysis by sedimentation tube, and radiography.	
Manganese nodule—visual description and morphological classification; measurement of diameter and weight.	

with eight technical assistants of students from universities (Table I-2). Also, David Z. PIPER and Talanoafuka KITEKEI'AHO participated in the cruise as a visiting scientist from the United States Geological Survey under the cooperative program of UJNR and as a trainee from the Government of the Kingdom of Tonga under the request from the Government through ESCAP, respectively.

The R/V Hakurei-Maru commanded by Captain H. Okumura sailed from the Hakurei-Maru Berth at Funabashi near Tokyo on January 13, 1979 and returned to the berth on March 13 after sixty days cruise with port call at Honolulu and Kahului in the Hawaii Islands (Fig. I-2). Rough summary and daily program of the cruise are shown in Tables I-3, -4. Of the total sailing length of 24,042 km, about 6,000 km was spent for geological and geophysical observations in the survey area of the central Pacific during 29 days. Magnetic observation and bathymetric survey were carried out through larger parts of the course from Japan to the central Pacific, and gravity measurement was done through the entire sailing of the cruise (Table I-5).

Twenty-two days were spent for on-site observations (bottom sampling and photographing) and geophysical observations (continuous seismic reflection profiling and others) in the area of 10°–13°N and 165°W–180°. The area includes the middle row of the Cross Trend chains and is called the *main survey area* in convenience. Seven days were spent at the small area of 9°50′–10°10′N and 167°20′–167°50′W for detailed on-site and geophysical observations. The small area is on the immediately south of the Cross Trend chain and is called *the detailed survey area* in this report. Style of survey in both the survey areas is graphically summarized in Fig. I-3.

Survey method in the GH79–1 cruise

General survey method

General survey method in this cruise is summarized in Table I-5.

In the main survey area, on-site observations of bottom sampling and photographing with a box corer and two or four sets of freefall grab with and/or without a one-shot camera were done at 33 stations about 110 km (1 degree in latitude and longitude) away each other (Fig. I-4). Geophysical tracks with or without seismic reflection profiling were arranged so as to get the data for interpreting general geological and geophysical structures, connecting the stations (Fig. I-5). The observations were done mostly under a ship speed of approximately 10 knots. Piston cores were obtained at three stations along the 174°W meridian, and sonobuoy refraction survey was done at two sites in the central part of the main survey area for obtaining the data of crustal structure. Three seamounts in the eastern part belonging to the middle row of the Cross Trend chains and the Line Islands chain were measured magnetically in detail and the rocks of them were partly dredged in order to interpret their origin.

In the detailed survey area, fundamental twelve stations of bottom sampling and

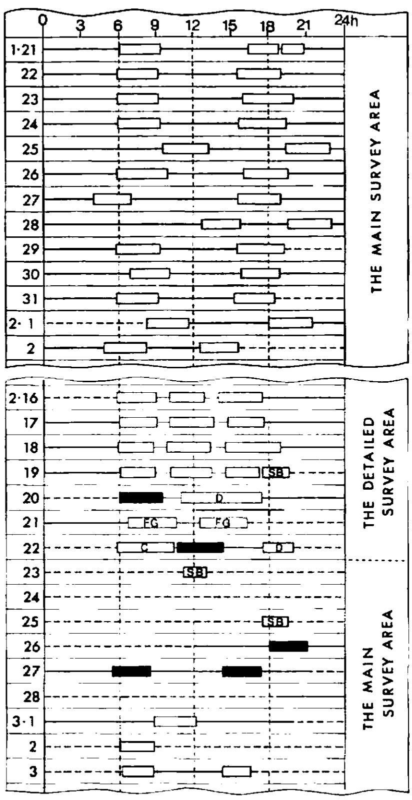

Fig. I-3 Graphic summary of survey style in the GH79-1 cruise. Solid line, geophysical survey with seismic reflection profiling; dashed line, geophysical survey without seismic reflection profiling; rectangle without symbol, box-core sampling; solid rectangle, piston-core sampling, D, dredging; FG, freefall sampling and photographing; C, photographing by deep-sea camera. SB, sono-buoy refraction survey.

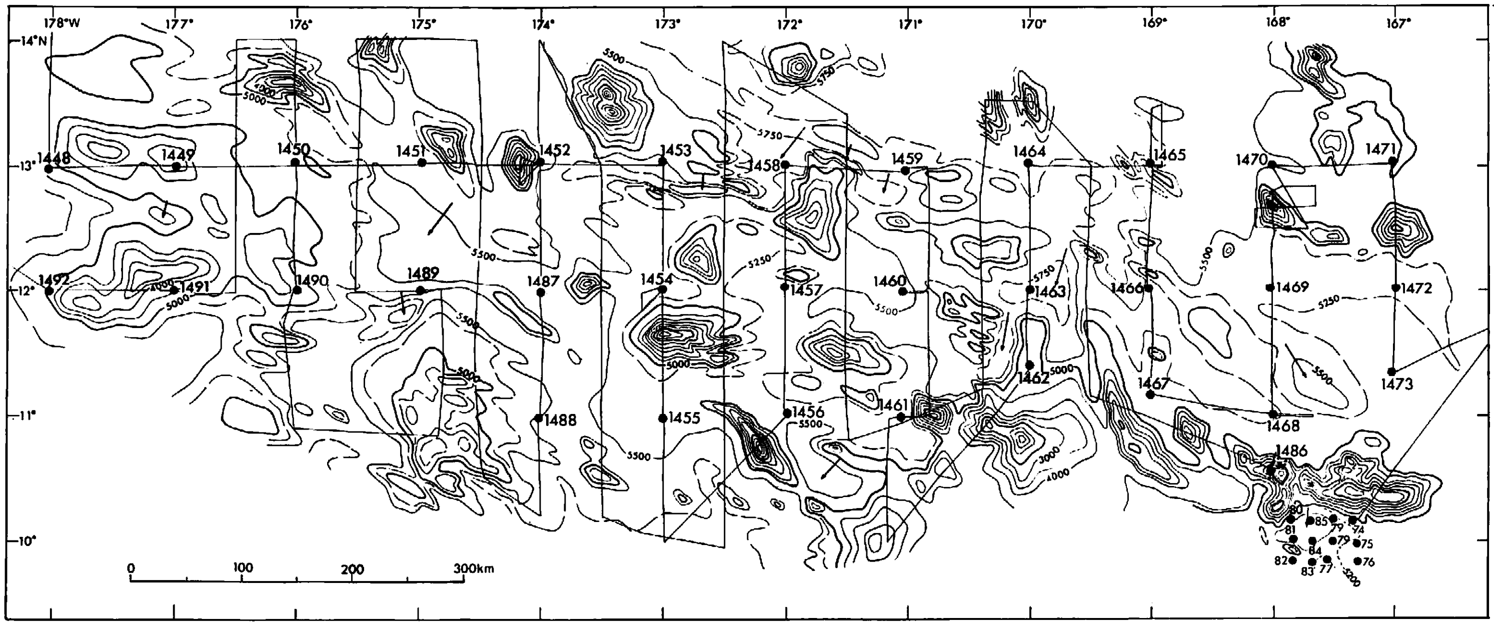

Fig. I-4 Bathymetry and stations in the main survey area.

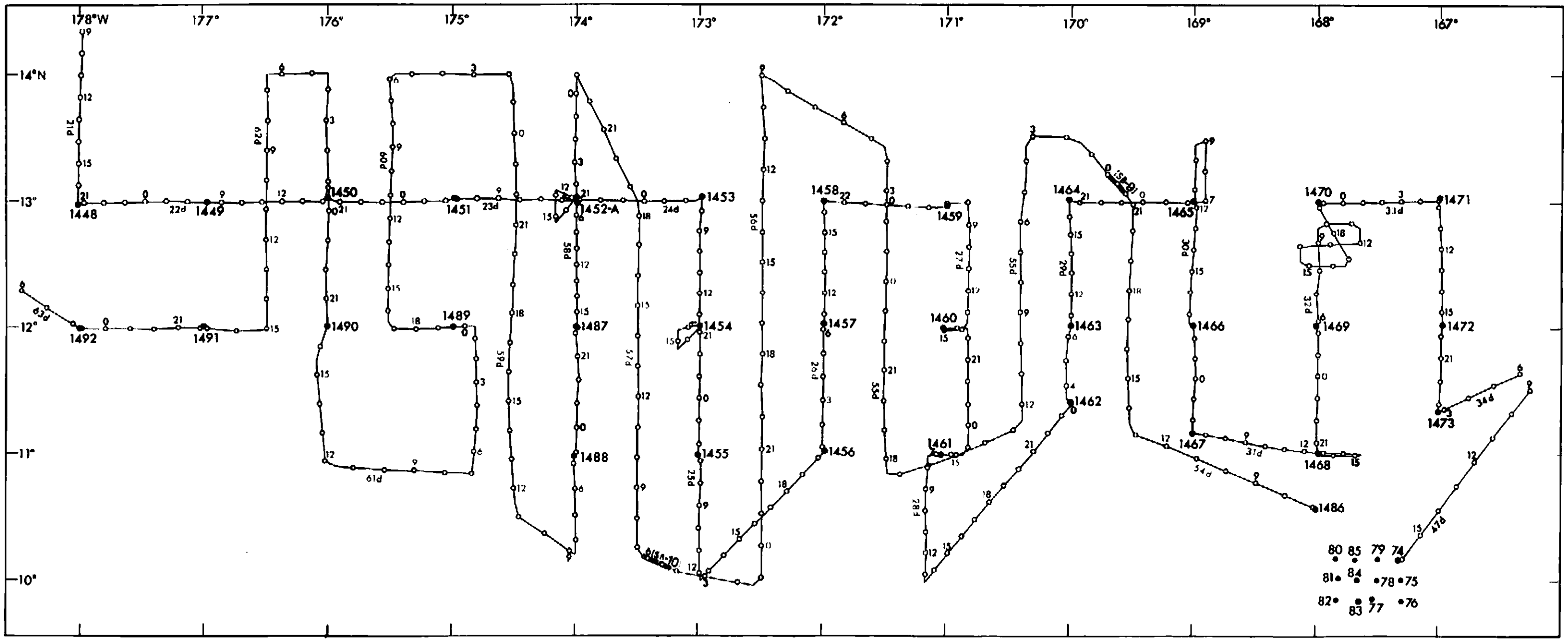

Fig. I-5 Geophysical tracks in the main survey area.

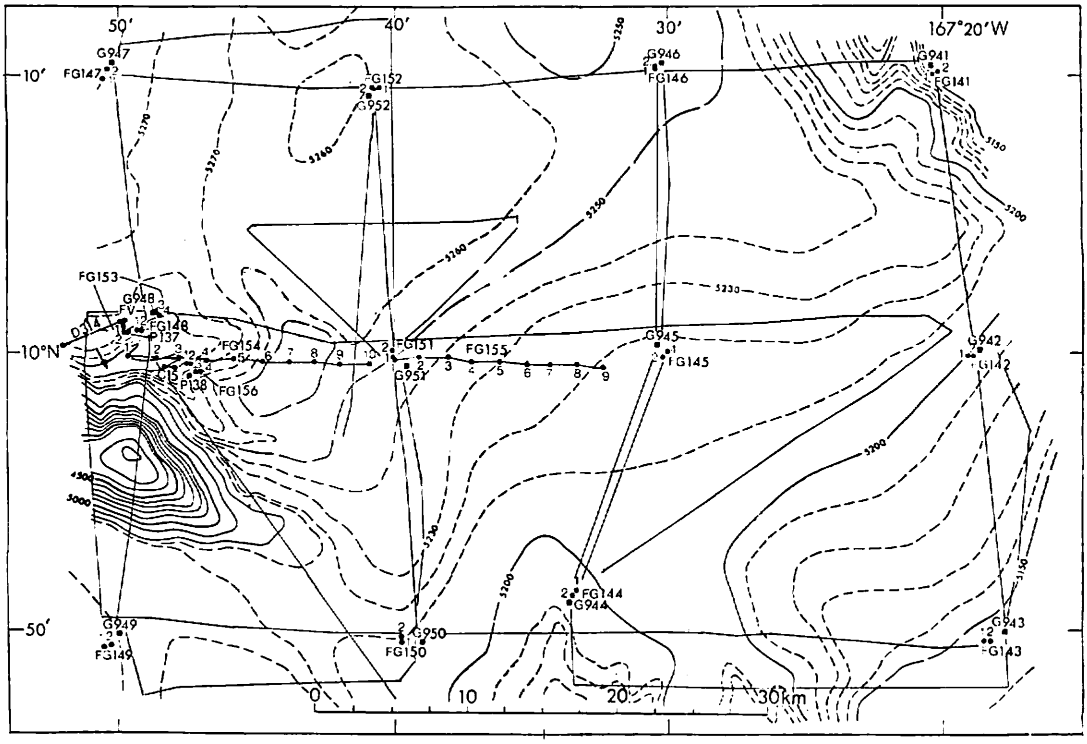

Fig. I-6 Bathymetry and stations in the detailed survey area.

photographing with a box corer and two sets of freefall grab with a one-shot camera (photo-boomerang) were arranged in grids about 18 km (1 minute in latitude and longitude). They were connected by the tracks of continuous seismic reflection survey and bathymetric survey under a ship speed of 8 knots (Figs. I-6, -7). According to the results of the surveys, additional surveys were done in the western to central area. We carried out there two piston core sampling, photo-boomerang works at intervals of about 1.8 km (1 second) or less along east-west line of about 30 km long, one deep-sea camera photography, and the tests of mass collecting of manganese nodules by a large box dredge and *in-situ* measurement of freefall vane tester newly designed.

Bottom sampling and photographing as a rountine work

We obtained little disturbed samples of sediment and nodule throughout nearly all the stations with a box corer. Routinely used was a double spade box corer. This smaller type box corer was designed specifically so as to fit to a deck work on the R/V Hakurei-Maru and was first introduced to the GH77-1 cruise in the central Pacific (KINOSHITA and MORITANI, in MORITANI, *ed.*, 1980) (Fig. I-8). A large box corer with single spade (Fig. I-9) was used at four stations. Associated with all the on-site observations including piston core sampling, dredge sampling, and others, freefall grab sampling and photographing were done. When the ship was arriving at a station, two pairs of a freefall grab and freefall grab with a camera (photoboomerang) (in the earlier half cruise) or two photoboomerangs (in the later half cruise) were successively thrown down at an interval

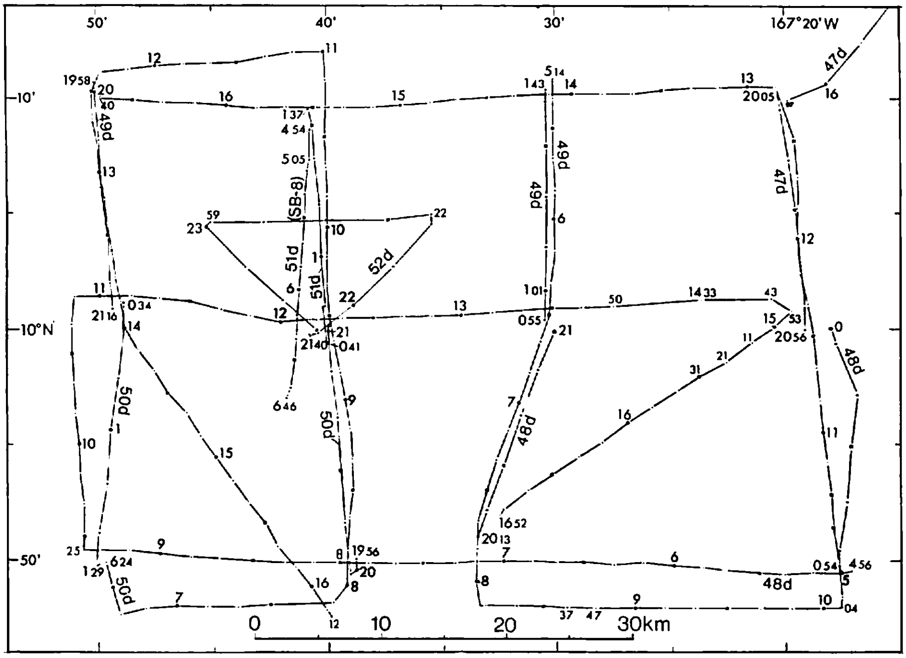

Fig. I-7 Geophysical tracks in the detailed survey area.

of about 5 minutes under a ship speed of 2 to 2.5 knots (Fig. I-10). Subsequently a wire-line work such as box core sampling was done, after the ship stopped. The photo-boomerang is equipped with a small sediment-sampling tube inside (Fig. I-11). The works enabled to obtain the data of horizontal distribution of surficial sediment and nodule within a very limited one station area, in most cases within a distance of 1 to 1.5 km. From cubic sediment sample of 40 cm by 40 cm with heights of 30 to 40 cm, collected by a box corer, several subcores were obtained by polyvenil pipes for subsequent observations and analyses.

Positioning and preparation of detailed station map

Throughout the entire sailing and observations, NNSS was applied for positioning. The real time positions were recalculated based on estimated water current to make the accuracy as high as possible. In a station area, we attempted to make a local bathymetric map according to the recalculated positions and echo-sounding by 12 kHz PDR (measured depth was all collected for the velocity of sound in seawater by MATTHEW's table), utilizing the observation data along the ship's drifting tracks during the entire work of 4 hours or so. This provided useful data on the relationship between local variation of nodule's attribute and topography. In the later half cruise, we examined to estimate bottom-hitting position of freefall grab and obtained the conclusion that the throwing-in point can be reasonably estimated as the bottom-hitting point.

Shipboard sample works

Sediment samples: All the subcores from a box core and piston cores were longi-

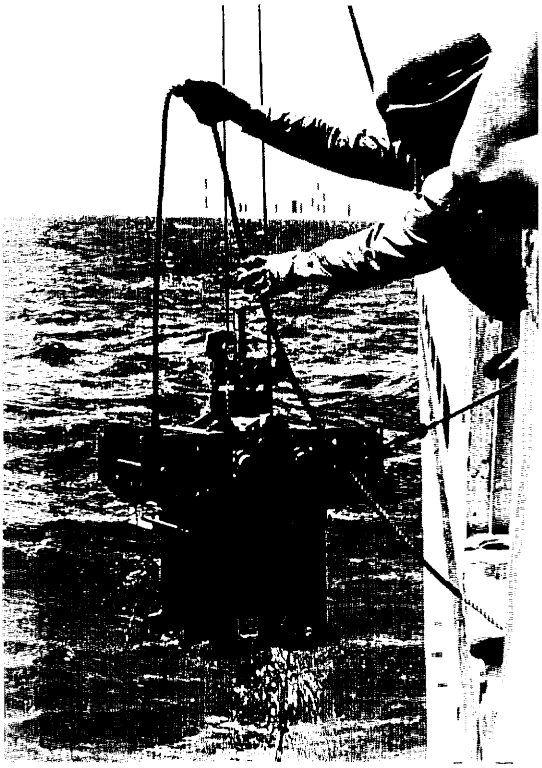

Fig. I-8 A double spade box corer.

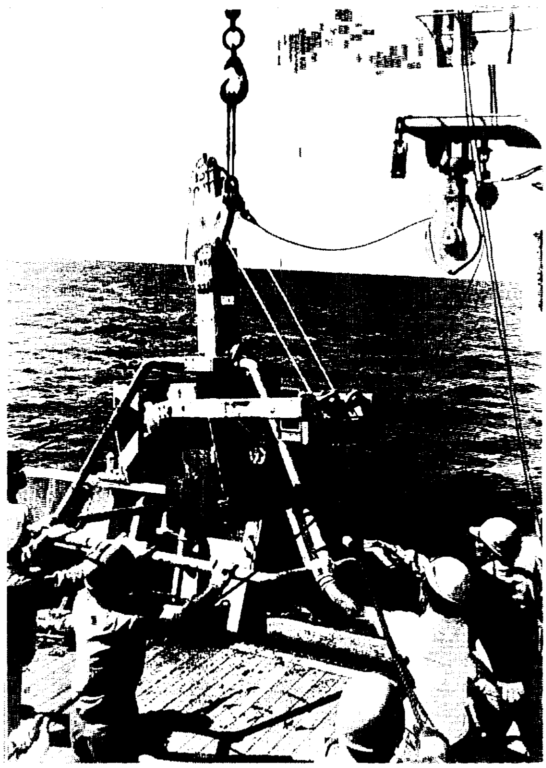

Fig. I-9 A large box corer with single spade.

Fig. I-10 Freefall grab.

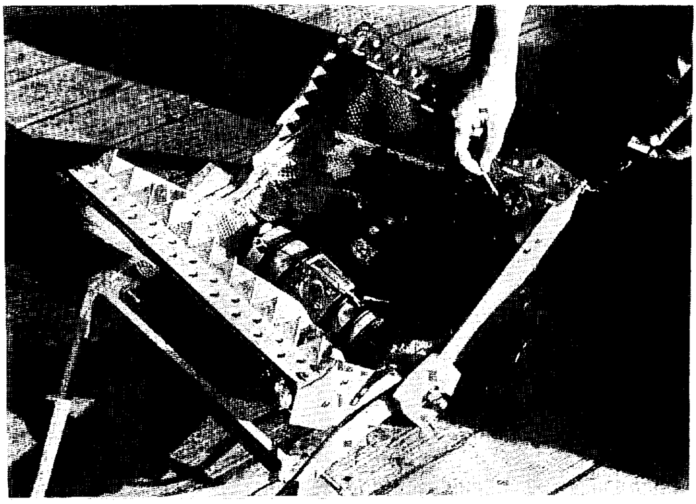

Fig. I-11 A camera and a sediment-sampling tube inside a photoboomerang.

tudinally split. The split halves were visually described and X-radiographed. Lithologic name of sediment was determined by the results of observations of smear slides of sediments under a microscope, with a correction of coarse fraction content by the results of sedimentation tube analysis (ARITA, in MIZUNO and Moritani, 1977) separately done. This procedure was done for all the subcore samples, piston core samples, and the samples from a sampling tube inside a freefall grab. For geotechnical purpose, vane shear strength and water content were measured for all the box core and piston core samples. Materials for onshore analyses were sampled from given parts of the split halves of subcore and piston core, and from surficial sediments after subcore pipes were pushed in.

Manganese nodule samples: Nodule samples were weighed in wet state for estimation of abundance and the size of nodules were measured every hauls. Morphological classification was done basically according to MORITANI *et al.* (in MIZUNO and MORITANI, 1977)'s scheme. Observation of internal structure was made for the samples cut by a diamond saw. For box core samples, cohesiveness between manganese nodules and surficial sediments was measured before subcore pipes were pushed in. Occurrence of nodules on the sea floor was also examined by photographs obtained by freefall camera, which provide the data of benthic biotic activities also.

Shore-based analyses of samples

Shore-based analyses of sediment and nodule samples were performed by both the shipboard and non-shipboard scientists. Those include chemical analysis and mineralogical analysis of manganese nodules, chemical analysis of sediments, nannofossil analysis of selected sediments from piston cores, remanent magnetization measurement of piston cores, clay mineral analysis of sediments, determination of growth rate of selected manganese nodules, petrographic study of dredged rocks, etc. The results mostly appear in Part II of this report.

Results of on-site observations

Results of our on-site observations are summarized in Table I-6. The table includes the data of recalculated position, corrected depth, lithology of surficial sediment, morphologic type and abundance and/or coverage of manganese nodules, and topographic and acoustic features at each stations. At a station, a wire-line sampling and each of freefall sampling were separately worked, and the positions, water depths and results of observations are given to each work shown as the observation number in the table. Results of piston-core sampling are briefly noted in the column of "topography and others".

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Table I-6 Results of on-site

St. no.	Observ. no.	Date		Recalculated position						Corrected depth (m)
		Julian	Local	Lat. (N)			Long. (W)			
1448	G(B)915	21	Jan. 21	12	58	41	178	01	81	5171
	FG115-1	21	21	12	58	94	178	01	81	5165
	FG115C-1	21	21	12	58	88	178	01	85	5154
	FG115-2	21	21	12	58	75	178	01	93	5154
	FG115C-2	21	21	12	58	68	178	01	96	5165
1449	G(B)916A	22	21	12	59	58	176	59	61	3957
	FG116-1	22	21	12	59	73	177	00	12	3916
	FG116C-1	22	21	12	59	75	177	00	08	3926
	FG116-2	22	21	12	59	80	176	59	96	3957
	FG116C-2	22	21	12	59	83	176	59	89	3977
1450	G(B)917	22	22	13	01	09	176	01	08	5118
	FG117-1	22	22	13	00	62	176	01	35	5118
	FG117C-1	22	22	13	00	71	176	01	31	5119
	FG117-2	22	22	13	00	83	176	01	29	5119
	FG117C-2	22	22	13	00	89	176	01	28	5119
1451	G(B) 918	23	22	13	01	63	174	59	13	5502
	FG118-1	23	22	13	00	82	174	59	61	5540
	FG118C-1	23	22	13	00	86	174	59	59	5541
	FG118-2	23	22	13	00	98	174	59	50	5505
	FG118C-2	23	22	13	01	02	174	59	48	5484
1452	G(B)919	23	23	13	02	68	174	00	10	5526
	FG119-1	23	23	13	01	86	174	00	34	5526
	FG119C-1	23	23	13	01	93	174	00	31	5532
	FG119-2	23	23	13	02	08	174	00	23	5536
	FG119C-2	23	23	13	02	17	174	00	19	5542
1452A	FG158C-1	58	Feb. 26	12	59	23	174	00	13	5588
	FG158C-2	58	26	12	58	99	174	00	18	5567
	P139	58	26	12	59	11	174	00	61	5391
1453	G(B)920	24	Jan. 23	13	01	60	172	58	59	5690
	FG120-1	24	23	13	00	81	172	58	94	5729
	FG120C-1	24	23	13	00	86	172	58	96	5729
	FG120-2	24	23	13	01	00	172	58	87	5725
	FG120C-2	24	23	13	01	06	172	58	83	5722

observations, GH79-1 Cruise.

Bottom sediment	Manganese nodules: Morphology etc.	Abun. (kg/m²)	Cover. (%)	Topography and others
Zeolitic clay*	DPs	3.7		Smooth, flat; 3.5 kHz trs. ly. 13 m thick; 30 m thick seismic reflection Unit I, underlain unconformably by unit II. Nodule abundance varies from place to place.
Zeolitic clay	DPs	8.6		
Zeolitic clay	SPs	9.3	50	
Zeolitic clay	SPs	5.3		
Zeolitic clay	DPs	5.4	35	
Calcareous ooze*	Ss	(2.5)		Very rough at the uppermost slope of seamount with relative height of 1300 m; 6 m thick 3.5 kHz trs. ly. Nodule abundance is much more larger than shown in the table, and areally varies, according to the results of photography.
Calcareous ooze	SPs	0.6		
not collected	Ss	0.9	50	
Calcareous ooze	Ss	2.4		
not collected	SPs	0.1	75	
Zeolitic clay*	—	0		Rolled topography area; 3.5 kHz trs. ly. 40 m thick with thin opaque interbed (uppermost trs. ly. 20 m thick).
Zeolitic clay	Small fragments	+		
Zeolitic clay	—	0	0	
Zeolitic clay	Small fragments	+		
Zeolitic clay	—	0	0	
(zeolitic) Siliceous clay*	SPs	+	0	Slightly rolled topography area; 3.5 kHz trs. ly. 13 m thick; seismic reflection Unit I 60 m (Type B). Considerable parts of manganese nodules look buried.
Zeolitic clay	IDPs	3.2		
Zeolitic clay	IDPs	9.9	20	
Zeolitic clay	DPs	8.1		
Zeolitic clay	DPs	8.2	30	
(zeolite rich) Clay*	SPs	2.4		Small sediment pond at the lowest slope of seamount; 3.5 kHz trs. ly. 13 m thick. Nodule abundance is much more larger than shown in the table from the data of photography. FG119-2 haul includes basalt? pieces.
(zeolite rich) Clay	SPs	3.9		
(zeolite rich) Clay	SPs	4.1	40	
(zeolite rich) Clay	IDPs	2.0		
Clay	SPs	2.1	40	
not collected	Fragments	0.2	70	Rough; 3.5 kHz trs. ly. not present; seismic reflection Unit I not developed. P139 core consists only of hard shale in core catcher. *including pebbles of rock.
(zeolite rich) Clay	V (rocks coated with manganese layer)	4.0	90*	
—	—	—		
(zeolite rich) Clay*	DPr	1.0		Rolled topography area; 3.5 kHz trs. ly. 8 m thick. Nodule morphology and abundance fairly vary from G to FG sites. FG120C-2 haul includes large shark's teeth.
(zeolite rich) Clay	IDPs, V	8.6		
(zeolite rich) Clay	DPs	5.9	20	
Zeolitic clay	DPs	2.4		
Zeolitic clay	IDPs, V	4.3	20	

Bottom sediment:
no mark — by smear slide observation.
* — corrected by coarse fraction analysis result.

Table I-6

St. no.	Observ. no.	Date		Recalculated position						Corrected depth (m)
		Julian	Local	Lat. (N)			Long. (W)			
1454	G(B)921	24	24	12	00	03	173	00	26	5350
	FG121-1	24	24	11	59	10	173	00	35	5350
	FG121C-1	24	24	11	59	19	173	00	32	5350
	FG121-2	24	24	11	59	41	173	00	22	5351
	FG121C-2	24	24	11	59	47	173	00	20	5352
1455	G(B)922	25	24	10	59	18	173	00	07	5557
	FG122-1	25	24	10	58	45	172	59	97	5554
	FG122C-1	25	24	10	58	50	172	59	93	5554
	FG122-2	25	24	10	58	67	172	59	79	5557
	FG122C-2	25	24	10	58	70	172	59	74	5556
1456	G(B)923	25	25	11	01	63	171	59	48	5410
	FG123-1	25	25	11	00	97	171	59	54	5407
	FG123C-1	25	25	11	01	09	171	59	48	5407
	FG123-2	25	25	11	01	23	171	59	39	5407
	FG123C-2	25	25	11	01	30	171	59	35	5407
1457	G(B)924	26	25	12	01	78	172	00	45	5380
	FG124-1	26	25	12	00	23	172	00	13	5365
	FG124C-1	26	25	12	00	22	172	00	22	5367
	FG124-2	26	25	12	00	13	172	00	13	5373
	FG124C-2	26	25	12	00	09	172	00	09	5376
1458	G(B)925	26	26	13	00	21	172	00	28	5900
	FG125-1	26	26	13	00	03	172	00	58	5904
	FG125C-1	26	26	13	00	09	172	00	55	5904
	FG125-2	26	26	13	00	25	172	00	46	5900
	FG125C-2	26	26	13	00	34	172	00	43	5900
1459	G(B)926	27	26	12	57	47	170	59	75	5630
	FG126-1	27	26	12	57	30	171	00	17	5634
	FG126C-1	27	26	12	57	33	171	00	14	5611
	FG126-2	27	26	12	57	45	171	00	02	5553
	FG126C-2	27	26	12	57	49	170	59	98	5524

(Continued)

Bottom sediment	Manganese nodules Morphology etc.	Abun. (kg/m^2)	Cover. (%)	Topography and others
Siliceous clay*	DPs	8.2		Rolled topography area; 3.5 kHz trs. ly. 19 m thick; seismic reflection Unit I with stratification, ca 40 m thick, abuts on the upper surface to Unit II which goes up to seamount.
Clay	DPs	15.5		
Clay	DPs	18.9	80	
Clay	DPs	15.9		
Siliceous clay	DPs	15.9	80	
Siliceous clay*	DPs	(2.3)		Rough in markedly rolled area; 3.5 kHz trs. ly. varies from 35 m to 5 m in thickness; seismic trs. ly. 35 m thick.
(siliceous fossil rich) Clay	DPs	12.1		
(siliceous fossil rich) Clay	SPs/DPs	12.5	—	G922 haul includes pumice piece.
(siliceous fossil rich) Clay	DPs	12.5		
not collected	SPs/DPs	3.2	60	
Zeolitic clay	—	—		Flat, sightly rolled topography area; with 3.5 kHz semi-transp. ly. of 5 m thick; seismic reflection trs. ly. 10 m thick.
(siliceous fossil rich) Clay	Sr(s)	0.5		
(siliceous fossil rich) Clay	Sr(s)	0.5	1	
(siliceous fossil rich) Clay	SPr(s)	0.5		
not collected	Sr(s)	0.2	1	
Siliceous clay*	DPs	2.6		Rather smooth, flat; 3.5 kHz trs. ly. 10 m thick; seismic reflection Unit I, transparent nature, 16–17 m thick.
(siliceous fossil rich) Clay	DPs	7.6		
not collected	DPs	0.7	50	
(siliceous fossil rich) Clay	DPs	5.0		
(siliceous fossil rich) Clay	DPs	7.8	50	
Siliceous clay*	DPs	1.8		Flat, smooth in trough-like depression; 3.5 kHz trs. ly. vague; seismic reflection Unit I appears very thin.
(siliceous fossil rich) Clay	IDPs	6.3		
not collected	DPs	+	35	Nodule abundance seems much more larger than described in table from the data of photography.
Siliceous clay	DPs	+		
not collected	Small fragments	0.2	?	
Siliceous clay*	DPs	11.5		Rolled at the slope of abyssal hill; 3.5 kHz trs. ly. 35 m thick, with an interbed of opaque layer. FG126C-2 took a picture possibly of outcrop of hard rock.
(siliceous fossil rich) Clay	DPs	13.1		
Clay	DPs/IDPs	(5.7)	85	
not collected	Ss	28.6		
(siliceous fossil rich) Clay	—	—	0	

Table I-6

St. no.	Observ. no.	Date		Recalculated position						Corrected depth (m)
		Julian	Local	Lat. (N)			Long. (W)			
1460	G(B)927	27	27	11	58	91	171	03	20	5184
	FG127-1	27	27	11	58	86	171	02	97	5186
	FG127C-1	27	27	11	58	85	171	03	09	5184
	FG127-2	27	27	11	58	84	171	03	40	5181
	FG127C-2	27	27	11	58	83	171	03	51	5181
1461	G(B)928	28	27	10	59	76	171	04	52	5483
	FG128-1	28	27	10	59	48	171	03	95	5523
	FG128C-1	28	27	10	59	52	171	04	04	5514
	FG128-2	28	27	10	59	54	171	04	35	5515
	FG128C-2	28	27	10	59	53	171	04	47	5506
1462	G(B)929	28	28	11	24	81	170	00	17	4846
	FG129-1	28	28	11	24	21	169	59	49	4844
	FG129C-1	28	28	11	24	29	169	59	46	4849
	FG129-2	28	28	11	24	40	169	59	42	4854
	FG129C-2	28	28	11	24	46	169	59	39	4854
1463	G(B)930	29	28	12	01	02	170	06	22	5766
	FG130-1	29	28	12	00	43	169	59	88	5743
	FG130C-1	29	28	12	00	48	169	59	84	5743
	FG130-2	29	28	12	00	65	169	59	72	5743
	FG130C-2	29	28	12	00	70	169	59	69	5748
1464	G(B)931	29	29	13	00	77	170	01	09	5775
	FG131-1	29	29	12	59	95	170	00	79	5775
	FG131C-1	29	29	13	00	03	170	00	79	5775
	FG131-2	29	29	13	00	17	170	00	73	5775
	FG131C-2	29	29	13	00	23	170	00	69	5775
1465	G(B)932	30	29	13	00	31	169	00	21	5385
	FG132-1	30	29	12	59	92	168	59	54	5251
	FG132C-1	30	29	12	59	94	168	59	55	5238
	FG132-2	30	29	13	00	03	168	59	37	5185
	FG132C-2	30	29	13	00	05	168	59	32	5172
1466	G(B)933	30	30	12	00	55	169	00	25	5449
	FG133-1	30	30	12	00	07	169	00	05	5443
	FG133C-1	30	30	12	00	10	168	59	98	5445
	FG133-2	30	30	12	00	24	168	59	42	5446
	FG133C-2	30	30	12	00	28	168	59	77	5442

(Continued)

Bottom sediment	Manganese nodules			Topography and others
	Morphology etc.	Abun. (kg/m²)	Cover. (%)	
Siliceous clay*	DPs	12.3	50	Upper slope of about 2°, at abyssal hill; 3.5 kHz trs. ly. 15 m thick; seismic reflection trs. ly. varies from 0 to 70 m thick. Large shark's teeth, in FG127C-1 haul.
not collected	DPs/IDPs	3.5		
Siliceous clay	IDPs	24.1	80	
Siliceous clay	IDPs	25.0		
Siliceous clay	DPs	22.7	80	
not collected	—	—		Lowermost gentle slope area of seamount with a relative height of 4000 m; 3.5 kHz trs. ly. 9 m thick; seismic reflection Unit I lack.
not collected	Ss/SPs	32.1		
(zeolite rich) Clay	Ss/SPs	33.3	85	
not collected	Ss/SPs	21.3		
not collected	Ss/SPs	7.8	85	
Calcareous clay*	Sr/SPr	0.5		Rolled, sculptured with deep sea channels; 3.5 kHz trs. ly. (Type b) ca 100 m thick with interbeds of opaque layers; seismic reflection Unit I semitransparent nature, underlain by marked reflector.
Calcareous clay	Sr	0.1		
Calcareous clay	Sr	0.2	1	
Calcareous clay	DPs (?)	+		
not collected	Sr	+	3	
Siliceous clay*	SPs	13.6	75	Slightly rolled, bounded by fault cliff to the south; 3.5 kHz trs. ly. 10 m thick. Manganese nodules include three morphologic types in occurrence of sand r surfaces; normal, reverse, and head towel.
not collected	SPs	9.9		
Siliceous clay	SPs	19.1	75	
Siliceous clay	DPs	3.8		
Siliceous clay	SPs	21.9	75	
Siliceous clay*	Ds	6.9		Slightly rolled; 3.5 kHz trs. ly. 20 m thick; seismic reflection Unit I ca 20 m thick (transparent nature).
Siliceous clay	DPs	13.6		
Siliceous clay	DPs	16.0	85	
Siliceous clay	DPs	18.4		
Siliceous clay	Ds	13.8	85	
Clay*	SPs	8.4		Very rugged, on abyssal hill with a relative height of 700 m; depth varies from site to site; 3.5 kHz trs. ly. not developed; seismic reflection acoustic basement. Manganese nodules at FG132C-1 are mostly of platy nature from the data of photography. G932 nodules includes both normal and reverse types.
not collected	Small fragment	+		
not collected	V, DPs	0.2	80	
Clay	DPs/SPs	9.8		
not collected	SPs	3.1	80	
Siliceous ooze*	SPr/Sr	0.2		Slightly rolled area; 3.5 kHz trs. ly. 19 m.
Siliceous ooze	SPr/Sr	+		
not collected	Sr	0.1	0	
Siliceous ooze	Sr	+		
Siliceous ooze	Sr	+	0	

Table I-6

St. no.	Observ. no.	Date		Recalculated position						Corrected depth (m)
		Julian	Local	Lat. (N)			Long. (W)			
1467	G(B)934	31	30	11	09	92	169	00	06	5222
	FG134-1	31	30	11	09	46	169	00	33	5227
	FG134C-1	31	30	11	09	50	169	00	27	5226
	FG134-2	31	30	11	09	59	169	00	10	5225
	FG134C-2	31	30	11	09	62	169	00	06	5225
1468	G(B)935	31	31	11	00	17	167	58	87	5304
	FG135-1	31	31	11	00	15	167	59	24	5303
	FG135C-1	31	31	11	00	17	167	59	14	5304
	FG135-2	31	31	11	00	21	167	58	95	5314
	FG135C-2	31	31	11	00	23	167	58	88	5319
1469	G(B)936	32	31	12	00	77	168	00	87	5371
	FG136-1	32	31	12	00	32	167	59	52	5359
	FG136C-1	32	31	12	00	36	167	59	49	5357
	FG136-2	32	31	12	00	46	167	59	46	5357
	FG136C-2	32	31	12	00	49	167	59	45	5362
1470	G(B)937	32	Feb. 1	12	59	74	168	00	27	5384
	FG137-1	32	1	12	59	60	167	59	97	5505
	FG137C-1	32	1	12	59	64	167	59	95	5485
	FG137-2	32	1	12	59	73	167	59	87	5526
	FG137C-2	32	1	12	59	77	167	59	84	5526
1471	G(B)938	33	1	13	02	32	167	01	58	5009
	FG138-1	33	1	13	01	41	167	00	48	5205
	FG138C-1	33	1	13	01	47	167	00	39	5205
	FG138-2	33	1	13	01	62	167	00	18	5240
	FG138C-2	33	1	13	01	66	167	00	15	5245

(Continued)

Bottom sediment	Manganese nodules			Topography and others
	Morphology etc.	Abun. (kg/m^2)	Cover. (%)	
Siliceous clay*	—	0		Nearly smooth, flat; 3.5 kHz trs. ly. 14 m; seismic reflection Unit I, semi-transparent nature, 50 m thick.
Clay	Sr	+		
(siliceous fossil rich) clay	—	0	0	
(siliceous fossil rich) clay	—	0		
(siliceous fossil rich) clay	SPr	+	0	
not collected	—	—		Rolled topography area; 3.5 kHz trs. ly. 30 m with opaque interbed and uppermost trs. ly. of 10 m thick; seismic reflection Unit 150 m thick with reflective layers.
(siliceous fossil rich) Clay	Sr	0.4		
(siliceous fossil rich) Clay	SP(r)s	2.1	5	
Clay	Sr	0.1		
(siliceous fossil rich) Clay	SP(r)s	6.6	15	
Clay	—	—		Rolled topography area; 3.5 kHz trs. ly. 10 m thick; seismic reflection Unit I very little developed.
(siliceous fossil rich) Clay	V	0.2		
Clay	Sr	+	5	
(siliceous fossil rich) Clay	Sr	0.6		
(siliceous fossil rich) Clay	Sr	+	0	
(siliceous fossil rich) Clay	IDPs(r)	19.8		Rough; 3.5 kHz trs. ly. 20–30 m thick; seismic reflection Unit I, transparent, ca 40 m thick.
(siliceous fossil rich) Clay	DPs(r)	3.2		
Clay	DPr/Dr	6.2	—	
(siliceous fossil rich) Clay	Dr	0.4		
(siliceous fossil rich) Clay	V	0.4	25	
not collected	Small fragments	(+)		Rough, sculptured with deep sea channel; 3.5 kHz trs. ly. 0 to more than 50 m. manganese layer of nodules rather thin.
(siliceous fossil rich) Clay	SPs	4.3		
(siliceous fossil rich) Clay	Ds	+	0	
Clay	Small fragments	0.3		
Clay	Ss, V	0.2	0	

Table I-6

St. no.	Observ. no.	Date		Recalculated position		Corrected depth (m)
		Julian	Local	Lat. (N)	Long. (W)	
1472	G(B)939	33	2	12 00 87	166 58 65	5366
	FG139-1	33	2	12 00 50	166 58 79	5371
	FG139C-1	33	2	12 00 57	166 58 72	5371
	FG139-2	33	2	12 00 69	166 58 63	5396
	FG139C-2	33	2	12 00 75	166 58 57	5409
1473	G(B)940	34	2	11 20 17	167 00 93	4992
	FG140-1	34	2	11 19 67	167 00 37	4983
	FG140C-1	34	2	11 19 71	167 00 32	4985
	FG140-2	34	2	11 19 80	167 00 20	4983
	FG140C-2	34	2	11 19 84	167 00 15	4983
1474	G(B)941	47	16	10 10 30	167 20 43	5153
	FG141C-1	47	16	10 10 06	167 20 30	5178
				*10 10 12	167 20 26	
	FG141C-2	47	16	10 10 27	167 20 19	5154
				*10 10 32	167 20 00	
1475	G(B)942	47	16	10 00 10	167 18 67	5197
	FG142C-1	47	16	09 59 89	167 19 12	5198
				*10 00 03	167 18 94	
	FG142C-2	47	16	09 59 90	167 18 92	5199
				*10 00 05	167 18 72	
1476	G(B′)943	48	16	09 49 96	167 17 68	5151
	FG143C-1	48	16	09 49 71	167 18 45	5160
				*09 49 90	167 18 29	
	FG143C-2	48	16	09 49 73	167 18 28	5160
				*09 49 94	167 18 14	
1477	G(B)944	48	17	09 51 02	167 33 51	5197
	FG144C-1	48	17	09 51 52	167 33 28	5208
	FG144C-2	48	17	09 51 29	167 33 45	5206

(Continued)

Bottom sediment	Manganese nodules Morphology etc.	Abun. (kg/m²)	Cover. (%)	Topography and others
(siliceous fossil rich) Clay	V	3.4		Gently rolled; 3.5 kHz trs. ly. not present; seismic reflection Unit I very little developed. Manganese nodules angular, irregularly shaped. *Zeolitic concretion
(siliceous fossil rich) Clay	V	2.4		
not collected	—	0	30*	
(siliceous fossil rich) Clay	V	2.4		
(siliceous fossil rich) Clay	V	2.6	55	
Clay*	SPr(s)	1.4		Slightly rolled; 3.5 kHz trs. ly. vaguely developed (10 m or more thick).
(siliceous fossil rich) Clay	SPr(s)	9.7		
(siliceous fossil rich) Clay	SPr(s)	7.5	45	
(siliceous fossil rich) Clay	SPr(s)	5.2		
not collected	S(P)r(s)	1.0	50	
Siliceous ooze*	—	0		Slightly rolled at the foot of seamount of cross trend; 3.5 kHz trs. ly. obscurely developed.
(siliceous fossil rich) Clay	—	0	0	
Siliceous clay	—	0	—	
Siliceous clay*	DPr	+		Nearly smooth, flat; 3.5 kHz trs. ly. 20 m thick, with an interbed of opaque layer which is underlain by finely stratified layer on seismic reflection record.
(siliceous fossil rich) Clay	Sr	0.1	0	
Siliceous clay	—	0	0	
(siliceous fossil rich) Clay*	Sr	0.2	<1	Smooth, flat; 3.5 kHz trs. ly. 30 m thick with an interbed of thin opaque layer, and additional 40 m thick interbedded trs. and opaque lys.
Siliceous clay	Sr	+	0	
(siliceous fossil rich) Clay	Sr, SPr	0.9	<1	
(siliceous fossil rich) Clay*	SPr	0.5	1	Smooth, flat; 3.5 kHz trs. ly. 35 m thick, with interbeds of thin opaque layer, and additional 40 m thick stratified opaque ly. which likely correspond to reflective layer on seismic reflection record.
Calcareous ooze	—	0	0	
(siliceous fossil rich) Clay	SPr	2.7	5	

Table I-6

St. no.	Observ. no.	Date		Recalculated position						Corrected depth (m)
		Julian	Local	Lat. (N)			Long. (W)			
1478	G(B′)945	48	17	10	00	29	167	30	35	5221
	FG145C-1	48	17	10	00	10	167	30	03	5225
	FG145C-2	48	17	10	00	16	167	29	88	5221
1479	G(B)946	49	17	10	10	45	167	30	19	5259
	FG146C-1	49	17	10	10	30	167	30	39	5259
	FG146C-2	49	17	10	10	35	167	30	19	5260
1480	G(B)947	49	18	10	10	51	167	50	33	5256
	FG147C-1	49	18	10	09	94	167	50	67	5253
	FG147C-2	49	18	10	10	26	167	50	39	5252
1481	G(B′-C)948	49–50	18	10	01	36	167	48	83	5287
	FG148C-1	49–50	18	10	00	72	167	49	30	5291
	FG148C-2	49–50	18	10	00	85	167	49	29	5291
1481A	P137	51	20	10	00	72	167	49	70	5291
	FV-1	51	20							5284
	FG153C-1	51	20	10	00	93	167	48	94	5285
	FG153C-2	51	20	10	00	71	167	48	92	5288
	FG153C-3	51	20	10	01	41	167	48	69	5289
	FG153C-4	51	20	10	01	27	167	48	56	5289
	D314	52	20	10	00	84	167	50	02	5288
				≀						≀
				10	00	19	167	52	07	5268
1481A1	FG154C-1	52	21	09	59	88	167	49	73	5300
	FG154C-2	52	21	09	59	85	167	48	76	5293
	FG154C-3	52	21	09	59	82	167	47	79	5301
	FG154C-4	52	21	09	59	78	167	46	80	5284
	FG154C-5	52	21	09	59	76	167	45	81	5273

(Continued)

Bottom sediment	Manganese nodules			Topography and others
	Morphology etc.	Abun. (kg/m²)	Cover. (%)	
Siliceous clay*	—	0		Smooth, flat; 3.5 kHz trs. ly. 25 m thick, with interbeds of opaque lys, underlain by stratified opaque ly. 3.5 kHz trs. ly. corresponds to seismic reflection trs. ly. which is underlain by finely stratified reflective lys.
(siliceous fossil rich) Clay	—	—	0	
(siliceous fossil rich) Clay	—	0	0	
Siliceous ooze*	Dr	+		Nearly smooth, flat immediately at the south of small abyssal hill; 3.5 kHz trs. ly. 22 m thick, with an opaque interbed, underlain by finely stratified layer on seismic reflection record.
not collected	—	0	0	
Siliceous clay	—	0	—	
(siliceous fossil rich) Clay*	SPr	2.3	3	Nearly flat, smooth; 3.5 kHz trs. ly. 12 m thick, underlain by opaque layer; 3.5 kHz trs. ly. corresponds to the uppermost transparent veneer on reflection seismic record.
Clay	SPs(r)	8.1	15	
Clay	SPs(r)	4.3	15	
(siliceous fossil rich) Clay*	DPs(r)	12.2	60	Nearly flat, smooth; 3.5 kHz trs. ly. 4 m thick.
(calcareous-siliceous fossil rich) Clay	(I)DPs	18.0	60	
(siliceous fossil rich) Clay	SPs	12.6	60	
(siliceous fossil rich) Clay	SPs	—		Nearly flat, smooth; 3.5 kHz trs. ly. 5 m thick, underlain by opaque layer. P137 core, 3.55 m long, consists of clay, except for top 20 cm and bottom 3 cm intervals which are siliceous fossil rich clay and nanno-foram ooze, respectively.
Clay	IDPs	18.9	55	
Clay	IDPs	19.3	55	
Calcareous ooze	—	0	0	
Clay	SPs	11.6	45	
	IDPs, SPs	(60)		
(siliceous fossil rich) Clay	SPs	17.6	70	3.5 kHz trs. ly. 3 m thick.
(siliceous fossil rich) Clay	SPs	17.7	70	3.5 kHz trs. ly. 4 m thick.
(siliceous fossil rich) Clay	SPs	9.2	50	3.5 kHz trs. ly. not present; possibly eroded out.
(siliceous fossil rich) Clay	SPs	1.1	20	Ibid.
(siliceous fossil rich) Clay	SPs	7.6	15	Ibid.

Table I-6

St. no.	Observ. no.	Date		Recalculated position						Corrected depth (m)
		Julian	Local	Lat. (N)			Long. (W)			
1481A1	FG154C-6	52	21	09	59	73	167	44	82	5253
	FG154C-7	52	21	09	59	71	167	43	84	5247
	FG154C-8	52	21	09	59	68	167	42	86	5249
	FG154C-9	52	21	09	59	64	167	41	89	5254
	FG154C-10	52	21	09	59	61	167	40	90	5251
1481A2	FG156C-1	53	22	09	59	58	167	47	60	5293
	FG156C-2	53	22	09	59	57	167	47	49	5288
	C15	53	22	09	59	43	167	48	04	5300
				~						~
				09	59	53	167	48	42	5299
	FG156C-3	53–54	22	09	59	36	167	46	88	5272
	FG156C-4	53–54	22	09	59	33	167	47	11	5269
	P138	53–54	22	09	59	21	167	47	38	5270
1482	G(B)949	50	18	09	49	85	167	50	02	5222
	FG149C-1	50	18	09	49	41	167	50	46	5220
	FG149C-2	50	18	09	49	52	167	50	08	5220
1483	G(B)950	50	19	09	49	64	167	38	99	5211
	FG150C-1	50	19	09	49	60	167	39	77	5210
	FG150C-2	50	19	09	49	79	167	39	71	5211
1484	G(B′-C)951	50–51	19	09	59	48	167	39	60	5244
	FG151C-1	50–51	19	09	59	93	167	40	02	5250
	FG151C-2	50–51	19	10	00	09	167	40	03	5252
1484A1	FG155C-1	52–53	21	09	59	90	167	40	08	5251
	FG155C-2	52–53	21	09	59	83	167	39	11	5248
	FG155C-3	52–53	21	09	59	80	167	38	13	5242
	FG155C-4	52–53	21	09	59	73	167	37	17	5237

(Continued)

Bottom sediment	Manganese nodules			Topography and others
	Morphology etc.	Abun. (kg/m²)	Cover. (%)	
(siliceous fossil rich) Clay	SPs	7.3	25	3.5 kHz trs. ly. 5 m thick.
(siliceous fossil rich) Clay	SPr	6.6	15	Ibid.
Clay	SPr(s)	3.2	5	3.5 kHz trs. ly. 6 m thick.
Clay	SPr	2.9	10	3.5 kHz trs. ly. 7 m thick.
(siliceous fossil rich) Clay	SPr	1.9	0	3.5 kHz trs. ly. 8 m thick.
not collected	SPs	0.6	40	Nearly flat, smooth; 3.5 kHz trs. ly. not developed, and stratified opaque layer exposes on sea floor.
Clay	SPs	(+)	40	
—	—	—	0	
—	—	—	—	Nearly flat, smooth; 3.5 kHz trs. ly. 5 m thick, underlain by stratified opaque layer. P138 core, 3.95 m long, consists of upper clay interval (0–2.50 m) and lower siliceous ooze and nanno ooze interval (2.50–3.95 m).
(calcareous fossil rich) Clay	SPs	6.0	30	
(siliceous fossil rich) Clay	SPs	—		
Siliceous ooze*	SPr	2.0		Flat, smooth; 3.5 kHz trs. ly. 29 m thick, underlain by finely stratified opaque layer (turbiditic), which is shown as finely stratified layer as well on seismic reflection record.
—	—	—	—	
Siliceous ooze	Sr	0.6	0	
Siliceous clay*	SPr	2.1	5	Nearly flat, smooth; 3.5 kHz trs. ly. 8 m thick; underlain by obscurely stratified opaque layer.
(siliceous fossil rich) Clay	SPr(Sr)	3.9	5	
Siliceous clay	Sr(DPr)	1.1	—	
Siliceous clay*	SPr	1.8	5	Nearly flat, smooth; 3.5 kHz trs. ly. 10 m thick, underlain by finely stratified opaque layer (turbiditic) which is shown by finely reflective layer unconformably cut by the uppermost trs. ly. on seismic reflection record.
(siliceous fossil rich) Clay	SPr	3.6	3	
(siliceous fossil rich) Clay	SPr	3.3	3	
(siliceous fossil rich) Clay	SPr	3.6	10	3.5 kHz trs. ly. 6 m thick.
(siliceous fossil rich) Clay	SPr	3.5	10	3.5 kHz trs. ly. 10 m thick.
(siliceous fossil rich) Clay	Sr	0.5	0	Ibid.
(siliceous fossil rich) Clay	Vr	+	0	3.5 kHz trs. ly. 15 m thick.

Table I-6

St. no.	Observ. no.	Date		Recalculated position						Corrected depth (m)
		Julian	Local	Lat. (N)			Long. (W)			
1484A1	FG155C-5	52–53	21	09	59	69	167	36	21	5231
	FG155C-6	52–53	21	09	59	64	167	35	23	5228
	FG155C-7	52–53	21	09	59	59	167	34	26	5223
	FG155C-8	52–53	21	09	59	55	167	33	28	5223
	FG155C-9	52–53	21	09	59	50	167	32	32	5220
1485	G(B)952	51	19	10	09	34	167	40	87	5261
	FG152C-1	51	19	10	09	47	167	40	76	5259
	FG152C-2	51	19	10	09	61	167	40	80	5262
1486	D315	54	22	10	33	19	168	00	11	1609
	FG157C	55	22	10	34	50	168	00	15	1898
1487	P140	58	27	11	59	29	174	00	80	5601
	FG159C-1	58	27	11	59	40	174	00	58	5608
	FG159C-2	58	27	11	59	58	174	00	56	5614
1488	P141	59	27	10	58	74	174	00	91	5541
	FG160C-1	59	27	10	59	38	174	00	25	5534
	FG160C-2	59	27	10	58	62	174	00	28	5538
1489	G(B)953	60	Mar. 1	11	59	78	174	59	37	5370
	FG161C-1	60	1	11	59	68	174	59	48	5383
	FG161C-2	60	1	11	59	66	174	59	35	5362
1490	G(B)954	61	2	11	59	78	176	00	73	4877
	FG162C-1	61	2	12	00	31	176	00	49	4853
	FG162C-2	61	2	12	00	29	176	00	32	4863
1491	G(B)955	62	3	11	59	61	177	01	12	4517
	FG163C-1	62	3	11	59	72	177	00	65	4566
	FG163C-2	62	3	11	59	72	177	00	88	4529
1492	G(B)956	63	3	12	00	16	178	01	58	4239
	FG164C-1	63	3	11	59	92	178	01	74	4225
	FG164C-2	63	3	11	59	93	178	02	02	4227

(Continued)

Bottom sediment	Manganese nodules: Morphology etc.	Abun. (kg/m²)	Cover. (%)	Topography and others
(siliceous fossil rich) Clay	—	0	0	Ibid.
(siliceous fossil rich) Clay	—	0	0	3.5 kHz trs. ly. 17 m thick.
Siliceous clay	Sr	+	0	3.5 kHz trs. ly. 20 m thick.
(siliceous fossil rich) Clay	—	0	0	3.5 kHz trs. ly. 22 m thick.
(siliceous fossil rich) Clay	—	0	0	3.5 kHz trs. ly. 25 m thick.
Siliceous ooze*	—	0		Nearly flat, smooth; 3.5 kHz trs. ly. 17 m thick, with an opaque interbed.
Siliceous ooze	—	0	0	
Siliceous ooze	—	0	0	
Calcareous ooze				Very rough at the uppermost slope of a seamount of the cross Trend.
not collected	—	0	0	
Clay	—	0		Rolled; 3.5 kHz trs. ly. 14 m thick. P140 core, 4.35 m long, consists of clay (0–4.30 m) underlain by hard shale (4.30–4.35 m).
Clay	D(P)s	15.9	75	
Clay	DPs	19.0	90	
Clay	DPs	—		Rolled topography area; 3.5 kHz trs. ly. 18 m thick; seismic reflection Unit I (Type A) ca. 30 m thick. P141 core, 4.65 m long, consists of dark brown clay.
(siliceous fossil rich) Clay	ID(P)s	17.6	80	
(siliceous fossil rich) Clay	(I)D(P)s	23.7	80	
Clay*	Ss	43.8	80	Rolled, rough in abyssal hill area; 3.5 kHz trs. ly. not present; seismic reflection Unit I obscure.
not collected	—	0.0	80	
not collected	—	0.0	—	
Calcareous clay*	DPs	9.9	75	Rough at the eastern lower slope of "12°N–177°W Rise"; 3.5 kHz semitransparent layer 5 m thick.
Calcareous clay	(I)DPs/Vs	15.7	75	
Calcareous clay	(I)DPs	8.9	75	
Calcareous ooze*	DPs	10.0	75	Southern upper slope of "12°N–177°W Rise"; 3.5 kHz trs. ly. 5 m thick.
Calcareous ooze	—	0	35	
not collected	DPs	1.2	75	
Calcareous ooze	V	(10.5)		Rough at the western upper slope of "12°N–177°W Rise"; seismic reflection Unit I little developed; 3.5 kHz trs. ly. not present.
Calcareous ooze	DPs	7.2	80	
Calcareous ooze	V	2.2	90	