

I. OUTLINE OF RESEARCH CRUISE

Eiichi Honza

This report, on marine geological and geophysical investigations in the Japan Sea, forms part of a five years research programme by the Geological Survey of Japan on the geology of the continental shelves and slopes around Japan using the research vessel HAKUREI-MARU.

The report is mainly concerned with the results from on-board observations by the scientific staff, but, some, results from analyses obtained after the cruise are also included.

The survey covers the eastern and central parts of the Japan Sea which includes the continental shelves along Honshu and southwestern Hokkaido, the Okushiri and Sado Ridges, the northeast Japan Basin, the Yamato Basin and Ridges, the Oki and Kita-Oki Ridges and the Oki Basin (Fig. I-1).

Scientific staff aboard HAKUREI-MARU consisted of six scientists from the Marine

Table I-1 Scientific staff on board

Name	Institute	Speciality
Eiichi HONZA	Marine Geol. Div., G.S.J.	chief scientist, geology
Masafumi INOUE	Technical Div., G.S.J.	geomorphology
Teruki MIYAZAKI	Marine Geol. Div., G.S.J.	geophysics
Makoto YUASA	Marine Geol. Div., G.S.J.	lithology
Kensaku TAMAKI	Marine Geol. Div., G.S.J.	structural geology
**Fumitoshi MURAKAMI	Marine Geol. Div., G.S.J.	geophysics
****Kiyokazu NISHIMURA	Marine Geol. Div., G.S.J.	geophysics
***Takashi MITSUNASHI	Fuel Div., G.S.J.	sedimentology
***Yasumoto SUZUKI	Fuel Div., G.S.J.	structural geology
*Kazuo OKAMOTO	Hiroshima Univ.	paleontology
*Michio KATO	Hiroshima Univ.	paleontology
*Masahiro KIDA	Nagoya Univ.	technical assistance
*Hiroshi NISHIYAMA	Nagoya Univ.	technical assistance
*Keiko MASUTANI	Tokyo Fisheries Univ.	technical assistance
*Tsutomu TERAJ	Tokyo Fisheries Univ.	technical assistance
**Hiroyuki SHIBUI	Tokyo Fisheries Univ.	technical assistance
**Yutaka UCHIYAMA	Tokyo Fisheries Univ.	technical assistance
**Takao KUROKI	Tokyo Fisheries Univ.	technical assistance
****Kazuo SASAGE	Tokyo Fisheries Univ.	technical assistance
****Hirohito SHIMAZU	Tokyo Fisheries Univ.	technical assistance
****Takayoshi HOSOKAWA	Tokyo Fisheries Univ.	technical assistance
****Eiichi FURUKAWA	Tokyo Fisheries Univ.	technical assistance
***Etsuo IWASAKI	Kanazawa Univ.	technical assistance

*Funabashi-Niigata

**Funabashi-Hakodate

***Niigata-Hakodate

****Niigata-Funabashi

*****Hakodate-Funabashi

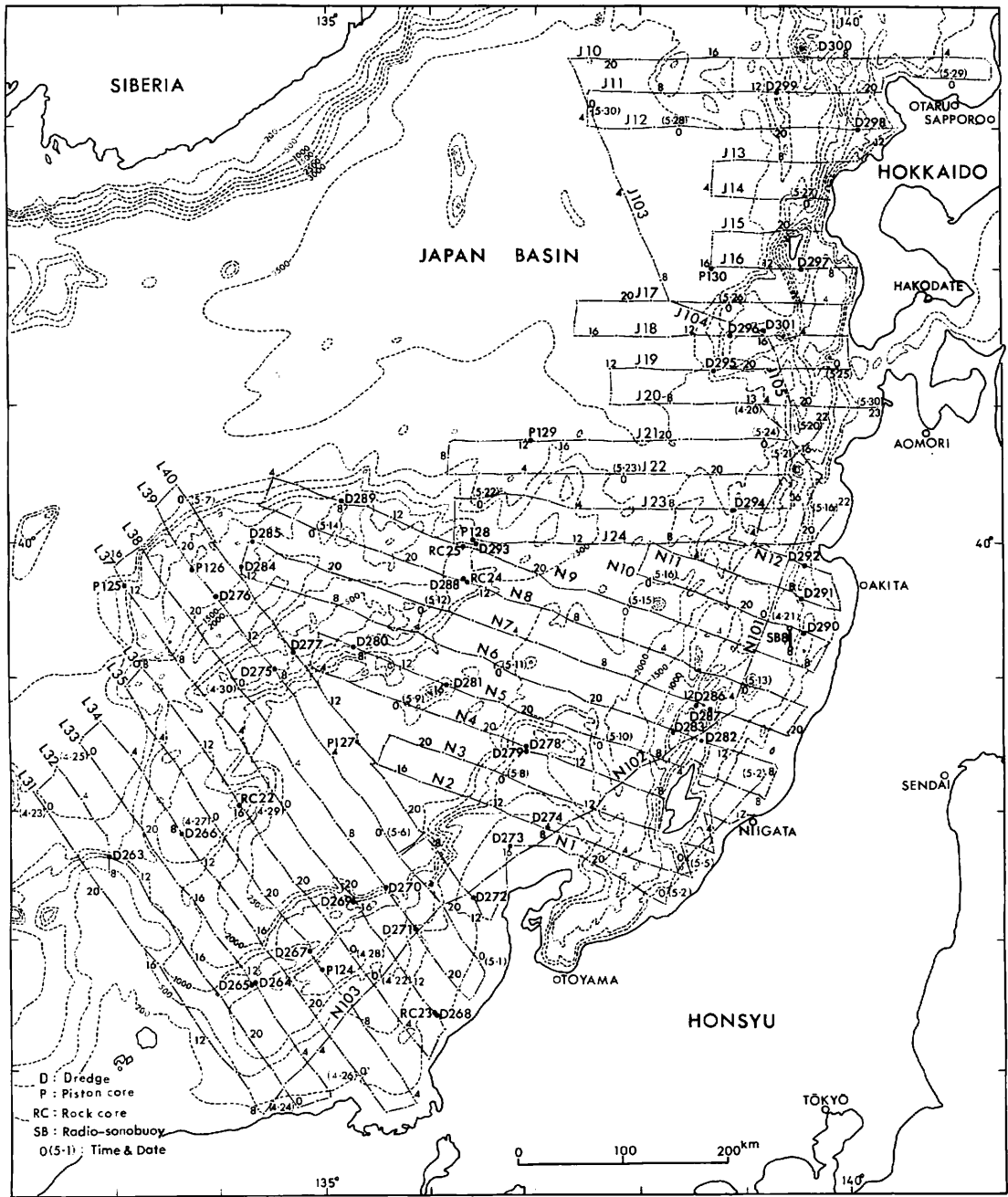


Fig. I-1 Surveyed area and track chart of the geological and geophysical surveys.

Geological Division, a technical official from the Technical Division, two scientists attached to the Fuel Division of the Geological Survey of Japan, two guest scientists from Hiroshima University, and twelve technical assistants who are post and undergraduate students from Nagoya, Kanazawa and Tokyo Fisheries Universities (Table I-1).

The ship left the Funabashi Port on the 18th April 1978 and surveyed the slope area of Japan Sea along the north Honshu, Oki Ridge Kita-Oki Bank, Oki Trough, southern Yamato Basin and southern Yamato Ridge for 15 days entering Niigata Port on 2nd of May. On the 4th of May, the ship left Niigata Port and surveyed the central part of Yamato Basin, Yamato Ridge and continental shelves along Tohoku region for 14 days, and entering Hakodate Port on 17th of May. Finally on the 20th of May the ship left Hakodate Port and surveyed the continental shelves and slopes around Tsugaru Strait and northeast Japan Basin for 14 days (Table I-2).

Table I-2 Schedule of the cruise

April 18th	Lv. the Port of Funabashi Geological and geophysical survey along the Honshu coast and in the Oki, Kita-Oki Ridges, Oki Basin and southern Yamato Basin.
May 2nd	Ar. at the Port of Niigata
May 4th	Lv. the Port of Niigata Geological and geophysical survey in the shelves of Tohoku, Okushiri and Sado Ridges, Yamato Basin and Yamato Ridges
May 17th	Ar. at the Port of Hakodate
May 20th	Lv. the Port of Hakodate Geological and geophysical survey on the shelves around Tsugaru Strait and northeastern Japan Sea
June 2nd	Ar. at the Port of Funabashi

Table I-3 Observation methods.

Cruising and positioning by NNSS, Loran C and Decca
<i>Geophysical methods</i>
Bathymetric survey by 12 kHz PDR
—Prospecting of bottom topography
Subbottom profiling by 3.5 kHz PDR
—Prospecting of sedimentary surficial layers and surficial structure
Continuous seismic profiling survey by air gun and sparker
—Prospecting of sedimentary layers and geological structure
Refraction measurements by sono-radio buoy
—Prospecting of sedimentary layers and geological structure
Magnetic survey by proton magnetometer
Gravity measurements by on-board gravimeter
—Auxiliary consideration of general geological structure
<i>Geological methods</i>
Bottom sampling by chain-bag and cylinder dredges
—Sampling of sediments and rocks
Bottom sampling by rock corer
—Sampling of sediments and rocks
Bottom sampling by piston corer with 6 m core-barrel
—Observation of vertical sequence of surficial sedimentary columns

Table I-4 Results of stationary

Station No.	Sample No.	Date	Time	Position		Depth (m)	Sampler
				Latitude	Longitude		
1077	D263	1978 April, 23	8: 37	37°38.5'N	132°56.0'E	1430	Chain-bag type and cylinder type dredges
			~ 9: 51	~ 37°38.1'N	~ 132°55.9'E	~ 1295	
1078	D264	April, 24	8: 38	36°38.4'N	134°20.0'E	645	ditto
			~ 9: 30	~ 36°38.6'N	~ 134°20.1'E	~ 516	
1079	D265	April, 24	10: 23	36°39.8'N	134°19.2'E	443	ditto
			~ 10: 58	~ 36°40.0'N	~ 134°19.5'E	~ 400	
1080	D266	April, 25	9: 22	37°49.1'N	133°37.3'E	642	ditto
			~ 10: 14	~ 37°48.8'N	~ 133°37.7'E	~ 600	
1081	D267	April, 26	12: 43	36°54.9'N	134°50.9'E	477	ditto
			~ 13: 16	~ 36°55.0'N	~ 134°51.0'E	~ 466	
1082	P124	"	14: 25 ~ 15: 26	36°47.3'N	134°57.5'E	1780	Piston corer
1083	RC22	1978 April, 27	15: 26 ~ 15: 59	38°01.8'N	134°11.6'E	557	Rock corer
1084	RC23	April, 28	8: 53 ~ 9: 07	36°25.1'N	136°03.2'E	135	ditto
1085	D268	"	9: 32	36°26.0'N	136°02.0'E	152	Chain-bag type and cylinder type dredges
			~ 9: 50	~ 36°26.0'N	~ 136°02.2'E	~ 145	

observations (compiled by M. YUASA)

Area and topography	Samples	Remarks
North off Oki Is. slope of bank.	Dark reddish brown silt (probably surface sediment), pale olive grey silt (glutinous), medium-grained sandstone and siltstone (shale).	Probably in situ sedimentary rocks.
Northeast off Oki Is., slope of Oki Bank.	Medium sand (and granule ?) bearing silt and rocks. rocks: mainly tuffaceous rock (i.e. tuffaceous sandstone, tuff breccia, acid tuff and tuffaceous conglomerate), and minor amount of rhyolite, diolite, granite and moonstone phenocryst bearing acid welded tuff.	Tuffaceous rocks are probably in situ.
ditto, uneven surface of top of Oki Bank.	Fine sand bearing silt, rubble of grassy andesite and rhyolite, pumice and minor pebbles (siliceous rock).	
NNE off Oki Is., slope near the top of Kita-Oki Bank.	Fine sand bearing grey silt, rocks and pebbles. rocks: mainly granitic rocks (quartz diolite, granite, quartz porphyry (marginal facies, five-grained)). pebble: pumice, siliceous rock, sedimentary rocks.	Granitic rocks are probably in situ.
Oki Bank, uppermost slope.	Olive grey fine~medium sand and pebbles (volcanic rock, granitic rock, conglomerate, sandstone, chert and metamorphic rock(?)).	
Oki Trough.	397 cm length, clay with 3 ash layers and a foraminifera layer.	Tention 1.8 t.
NNE off Oki Is., slope of Kita-Oki Bank.	120 cm length, sand and shell sand.	
Off Kaga City, top of Oguri (bank).	35 cm length, 0-26 cm shell fragment bearing olive grey sand. 26-35 cm grey sand	
ditto, upper slope.	Shell fragment bearing five~medium sand, many amount of shell fragment and coral, minor rocks and pebbles. rocks: conglomerate (in situ), hard sandstone, volcanic rock and volcanic breccia.	

Table I-4

Station No.	Sample No.	Date	Time	Position		Depth (m)	Sampler
				Latitude	Longitude		
1086	D269	"	17: 27	37°18.0'N	135°15.8'E	2200	ditto
			~ 18: 50	~ 37°17.8'N	~ 135°16.0'E	~ 2107	
1087	P125	April, 29	12: 54 ~ 14: 22	39°41.9'N	133°04.8'E	2725	Piston corer
1088	D270	April, 30	11: 54 ~ 13: 43	37°23.0'N ~ 37°23.0'N	135°34.6'E	2452 ~ 2230	Chain-bag type and cylinder type dredges
1089	D271	"	16: 54 ~ 17: 37	37°03.6'N ~ 37°03.6'N	135°52.5'E ~ 135°52.6'E	815 ~ 805	ditto
1090	D272	May, 1	10: 40 ~ 10: 58	37°20.2'N ~ 37°20.1'N	136°23.8'E ~ 136°24.0'E	143 ~ 145	ditto
1091	D273	"	15: 52 ~ 16: 15	37°44.0'N ~ 37°44.3'N	136°45.2'E ~ 135°45.1'E	100 ~ 100	Chain-bag type and cylinder type dredges
1092	D274	May, 5	8: 26 ~ 8: 52	37°52.3'N ~ 37°52.6'N	137°08.2'E ~ 137°08.0'E	153 ~ 139	ditto
1093	D275	May, 6	9: 28 ~ 10: 01	39°03.6'N ~ 39°03.8'N	134°30.8'E ~ 134°30.7'E	505 ~ 499	ditto
1094	D276	"	15: 05 ~ 16: 00	39°36.1'N ~ 39°36.5'N	133°57.5'E ~ 133°57.1'E	880 ~ 770	ditto
1095	P126	"	18: 18 ~ 18: 42	39°49.1'N	133°44.6'E	640	Piston corer

(Continued)

Area and topography	Samples	Remarks
Oki Bank, slope.	Dark brown silt (slightly glutinous) rocks and pebbles. rocks: shaly siltstone, semi-consolidated siltstone, hard shale-like dark brown siltstone.	In situ rocks.
Southwestern margin of Japan Basin bottom.	487 cm length, clay	
Eastern margin of Oki Bank, slope.	Dark grey silt, pale brownish grey silt and rocks. rocks: basaltic rock (some of them representing pillow structure) and acid tuff	In situ volcanics.
West off Noto Pen., continental slope.	Fine sand size grain bearing greyish olive silt, volcanic rock, hard shaly rock and pebbles (acid volcanic rock).	
ditto continental shelf.	Shell fragment bearing fine~medium sand, shell and shell fragment, rubble of basic~intermediate volcanic rock, and pebbles (granitic rock, rhyolite, etc.).	
North off Noto Pen., continental shelf.	Shell fragment bearing fine~medium sand, shell and shell fragment, rubble of basic~intermediate volcanic rock, block of calcareous matter and pebbles.	
ditto.	Shell fragments and granule bearing medium~coarse sand, shell and shell fragments, many amount of pebble~boulder of finegrained and fossil (mollusca and plant) bearing sandstone, and minor pebble of andesite.	Sandstone is nearly in situ.
Central part of Yamato Bank, slope.	Well-sorted fine sand and pebbles (pumice, chert, rhyolite, andesite and scoria).	
Kita-Yamato Bank, slope.	Fine sand bearing silt, rubble (volcanic breccia, 6 cm × 4 cm × 4 cm), and pebbles (sandstone, chert, qz-porphyry, volcanic breccia, etc.)	
ditto.	370 cm length, medium and very coarse sand containing granitic pebble.	

Table I-4

Station No.	Sample No.	Date	Time	Position		Depth (m)	Sampler
				Latitude	Longitude		
1096	D277	May, 7	8: 15	39°12.5'N	134°40.6'E	424	Chain-bag type and cylinder type dredges
			~ 8: 51	~ 39°12.5'N	~ 134°40.9'E	~ 392	
1097	P127	"	14: 34	38°31.4'N	135°17.4'E	3012	Piston corer
			~ 15: 44				
1098	D278	May, 8	15: 16	38°28.0'N	136°56.3'E	526	Chain-bag type and cylinder type dredges
			~ 15: 50	~ 38°28.1'N	~ 136°56.1'E	~ 526	
1099	D279	"	16: 23	38°27.6'N	136°54.8'E	563	ditto
			~ 17: 13	~ 38°27.3'N	~ 136°55.4'E	~ 602	
1100	D280	May, 9	8: 54	39°13.2'N	135°16.0'E	755	ditto
			~ 9: 55	~ 39°13.0'N	~ 135°16.0'E	~ 780	
1101	D281	"	14: 35	38°57.2'N	136°08.6'E	2630	ditto
			~ 16: 28	~ 38°57.2'N	~ 136°07.7'E	~ 2560	
1102	D282	May, 10	13: 16	38°31.7'N	138°35.7'E	136	ditto
			~ 13: 34	~ 38°31.6'N	~ 138°35.9'E	~ 137	
1103	D283	"	15: 39	38°36.3'N	138°19.8'E	107	ditto
			~ 15: 52	~ 38°36.4'N	~ 138°20.0'E	~ 100	
1104	D284	May, 11	13: 07	39°48.8'N	134°11.7'E	873	ditto
			~ 13: 51	~ 39°49.3'N	~ 134°11.8'E	~ 855	
1105	D285	"	15:45	40°00.7'N	134°18.9'E	745	ditto
			~ 16: 37	~ 40°00.3'N	~ 134°19.5'E	~ 650	
1106	D286	May, 12	13: 00	38°48.1'N	138°32.6'E	445	Chain-bag type and cylinder type dredges
			~ 13: 34	~ 38°47.0'N	~ 138°32.8'E	~ 325	
1107	D278	"	14: 55	38°45.5'N	138°40.2'E	137	ditto
			~ 15: 55	~ 38°45.6'N	~ 138°40.1'E	~ 139	

(Continued)

Area and topography	Samples	Remarks
Yamato Bank, slope.	Rocks: volcanic breccia, tuff breccia, andesite and hornfels Pebbles: welded tuff and siltstone	In situ. Cylinder type dredge was lost.
Yamato Basin.	560 cm length, clay with ash layers.	
North off Noto Pen., continental slope.	Fine sand bearing silt and rubble (pumice and dolerite).	
ditto.	Silt bearing fine sand, fine sand bearing silt (glutinous), boulder (glassy andesite, andesite), cobble (rhyolite, porphyrite) and pebble (welded tuff, porphyrite, pumice, chert, sandstone).	
Southeastern part of Yamato Bank, slope of high.	Fine sand, boulder~pebble (granitic rock, andesite, rhyolite, sandstone, hornfels, etc.).	
Eastern part of Yamato Seamount, slope.	Reddish brown silt, siltstone and pebble (volcanic rock, pumice).	
North off Sado Island, island shelf.	Well-sorted fine sand, calcareous siltstone, calcareous sandstone, pyrite nodule, sand pype and pebbles.	In situ rocks.
North off Sado Island, Hyotan-Guri (Bank).	Granule bearing coarse shell sand, rock fragment, altered volcanic conglomerate and pebble (volcanic rock).	
Northeastern part of Kita-Yamato Bank, slope.	Brownish grey silt containing foraminifera (surface), grey silt containing foraminifera, rock fragment (volcanic conglomerate (altered), pumice), and pebble.	
ditto.	Fine sand, pebble (gneiss, sandstone, acid volcanic rock, tuff breccia, cherty rock etc.) and small amount of rock fragment (basic~intermediate volcanic rock).	
North off Sado Is., Mukai-se (bank), slope.	Fine sand bearing silt and rubbles (tuff breccia, lapilli tuff, tuff and pumice).	
ditto top flat surface of Mukai-se (bank).	Shell fragment bearing medium sand, boulder~pebble (andesite, dacite altered rhyolite, siliceous siltstone, sandstone, diatomite, scoria, tuff breccia).	

Table I-4

Station No.	Sample No.	Date	Time	Position		Depth (m)	Sampler
				Latitude	Longitude		
1108	RC24	May, 13	13: 53 ~ 15: 13	39°42.7'N	136°21.2'E	2155	Rock corer
1109	D288	"	15: 32 ~ 17: 00	39°43.4'N ~ 39°43.4'N	136°19.3'E ~ 136°18.5'E	1695 ~ 1583	Chain-bag type and cylinder type dredges
1110	D289	May, 14	8: 28 ~ 9: 42	40°17.0'N ~ 40°16.7'N	135°09.1'E ~ 135°09.4'E	1621 ~ 1416	ditto
1111	RC25	"	15: 55 ~ 16: 33	39°58.8'N	136°19.0'E	1653	Rock corer
1112	D290	May, 15	11: 11 ~ 11: 29	39°18.7'N ~ 39°18.6'N	139°36.1'E ~ 139°36.3'E	136 ~ 135	Chain-bag type and cylinder type dredges
1113	SB8	"	13: 40 ~ 17: 01	39°22.1'N ~ 39°12.1'N 39°12.4'N ~ 39°20.2'N	139°26.6'E ~ 139°20.6'E 139°20.5'E ~ 139°27.5'E		Sono-buoy
1114	D291	May, 16	9: 02 ~ 9: 45	39°36.2'N ~ 39°36.0'N	139°31.8'E ~ 139°31.8'E	360 ~ 319	Chain-bag type and cylinder type dredges
1115	D292	"	14: 54 ~ 15: 12	39°51.2'N ~ 39°51.3'N	139°34.7'E ~ 139°34.5'E	115 ~ 110	ditto
1116	P128	May, 21	17: 01 ~ 17: 55	40°01.0'N	136°23.9'E	1835	Piston corer
1117	D293	"	18: 16 ~ 19: 51	40°00.0'N ~ 39°59.7'N	136°26.0'E ~ 136°26.1'E	1794 ~ 1790	Chain-bag type and cylinder type dredges
1118	D294	May, 22	11: 11 ~ 13: 04	40°14.9'N ~ 40°14.8'N	138°52.4'E ~ 138°53.2'E	2760 ~ 2195	ditto

(Continued)

Area and topography	Samples	Remarks
Eastern part of Yamato Bank, slope.	211 cm length, silt, siltstone and ash.	2.1 t.
ditto.	Dark brown silt (surface), glutinous grey silt, rubble (dacite) andesite (siltstone) and pebble (granite, acid volcanic rock).	
Northern part of Nishi-Takuyo Bank, slope.	Brown silt, rocks (fine-grained leucocratic granite, medium-grained granite, porphyry, andesite) and pebble (granite, qz-porphyry).	In situ granite.
Northeastern part of Yamato Bank, slope.	21 cm length, silt	
North off Tobishima Is., island shelf.	Fine sand, shell, shell fragments, rocks and pebbles. Rocks: siltstone, tuffaceous siltstone Pebbles: pumice, andesite, barite nodule, siliceous siltstone.	In situ rocks.
Mogami Trough.		
South of Shin-guri (bank), slope of a small bank.	Olive grey silt (slightly glutinous) rock fragment (tuffaceous conglomerate, soft siltstone, hard silt~sandstone) and pebble (pumice).	Rock fragments may be in situ.
Oga-Mukose (bank), slope.	Illsorted fine~medium sand containing granule, shell, shellfragment and silt, boulder (dacite), and rock fragment (siltstone and sandstone).	Rock fragments may be in situ.
Eastern part of Yamato Bank.	551 cm length, clay and ash layers.	
ditto.	Dark brown silt (surface), glutinous silt (light brown and dark olive) and granule (rhyolite, pumice, andesite).	
Off Oga Pen., slope of a high.	Medium sand containing granule, siltstone and andesite.	Siltstone may be in situ.

Table 1-4

Station No.	Sample No.	Date	Time	Position		Depth (m)	Sampler
				Latitude	Longitude		
1119	P129	May, 23	13: 13 ~ 14: 21	40°44.7'N	136°56.3'E	3230	Piston corer
1120	D295	May, 24	16: 26 ~ 18: 22	41°14.8'N ~ 41°14.6'N	138°40.7'E ~ 138°41.3'E	3120 ~ 3090	Chain-bag type and cylinder type dredges
1121	D296	May, 25	7: 54 ~ 10: 08	41°30.6'N ~ 41°30.5'N	138°49.6'E ~ 138°31.7'E	2308 ~ 2160	ditto
1122	D297	May, 26	10: 03 ~ 10: 26	41°59.7'N ~ 41°59.7'N	139°31.0'E ~ 139°30.8'E	110 ~ 105	ditto
1123	P130	"	14: 35 ~ 15: 55	41°59.9'N	138°40.1'E	3700	Piston corer
1124	D298	May, 27	15: 14 ~ 16: 30	42°59.7'N ~ 42°59.7'N	140°02.6'E ~ 140°03.6'E	1213 ~ 825	Chain-bag type and cylinder type dredges
1125	D299	May, 28	13: 19 ~ 15: 36	43°15.0'N ~ 43°15.2'N	139°18.8'E ~ 139°17.9'E	3350 ~ 2935	ditto
1126	D300	May, 29	10: 55 ~ 11: 57	43°33.1'N ~ 43°33.5'N	139°31.6'E ~ 139°32.0'E	1208 ~ 1010	ditto ditto
1127	D301	May, 30	14: 17 ~ 15: 30	41°32.9'N ~ 41°32.8'N	139°09.0'E ~ 139°09.1'E	1040 ~ 1030	ditto

Routine seismic and magnetic profiling surveys were carried out with Bolt type airguns and a proton magnetometer both of which were towed from the ship's stern. 3.5 kHz echo sounders and an on-board gravity meter were used to obtain bottom and sub-bottom information. Refraction measurements were carried out by sono-buoy. Dredge, rock coring and piston coring sites were selected to ascertain and correlate the seismic profiling results of the material which outcropped at seabed (Table I-3). Several dredge and rock coring sites were selected for a lithological study of the ridges and seven piston coring sites were selected to study the sedimentology of certain basins.

The ships position was ascertained by the use of NNSS, Loran C and Decca equipment. Decca stations on land do not cover the whole of the surveyed area, but are available in the northern part of Japan Sea. The ship covered a total distance of 9143.4 nautical miles

(Continued)

Area and topography	Samples	Remarks
Southeastern part of Japan Basin, a small high.	520 length, clay and ash layers.	
Southwest off Oshima-Oshima Is., slope of Matsumae Plateau.	Brown clay (upper) and dark grey clayey silt (lower).	
West off Oshima-Oshima Is., slope of Matsumae Plateau.	Brown clay and pumice.	ditto.
South off Okushiri Is., upper slope of Okushiri Spur.	Shell fragment bearing medium sand, pebble cobble (siltstone and andesite) and shell fragment.	
West off Okushiri Is., Japan Basin.	510 cm length, clay and ash layer.	
Southern part of Iwanai Bank, slope.	Dark olive grey silt and light brown~ olive grey siltstone.	In situ siltstone.
West off Shakotan Pen., slope of Okushiri Ridge.	No sample.	
Shiribeshi Seamount, slope.	Fine sand bearing silt, pebble (sandy siltstone and volcanic rock) and granule (volcanic rock).	
West off Oshima-Oshima, slope of a high on the Matsumae Plateau.	Fine sand bearing silt.	A half of sand is iron sand.

during 46 days. The results of the stationary observations are summarized in Table I-4.

I wish to acknowledge Mr. D.F. NASH of Shin Nishi-Nihon Oil Co. for his assistance in editing.