

資 料

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Status of the Marine Geological Activities of the Geological Survey of Japan (1978)

MARINE GEOLOGY DEPARTMENT, GEOLOGICAL SURVEY OF JAPAN

Since the establishment of the Marine Geology Department and the launching of the R/V Hakurei-Marū (1821 G.T.) both in 1974, the Marine Geology Department consisting of the three sections of Marine Geology, Marine Mineral Resources, and Marine Geophysics has been actively conducting various research projects with considerable results, and grown as one of the leading organizations of marine geological researches in Japan.

Its research activities include two major projects by using the R/V Hakurei-Marū, *Marine geological investigations on continental shelves and slopes around Japan* and *Investigations on deep sea manganese nodules in the Central Pacific Basin*. Her cruise program during 1977-1978 and the survey methods applied are shown in Table 1 and Table 2, respectively. The results of studies are published both as two series of *Cruise Report* and *Marine Geology Map* and as many individual papers on various journals. Table 3-1 and Table 3-2 show the published issues of the two series.

The department has been concerned with two other projects, *Marine geological investigations on polluted sediments* and *Preliminary investigations on marine sand and gravel resources on offshore areas*, by using chartered smaller vessels. Also, it has been contributing to a wide range of by-lateral and multi-lateral international cooperations in the fields of marine geology and mineral resources in various ways.

Table 1 Hakurei-Marū cruises by GSJ in 1977 and 1978.

GH 77-1 Cruise	January 12—March 12, 1977 (Ch. Sci.: T. Moritani) Central Pacific Basin, for manganese nodule deposits research.
GH 77-2 Cruise	April 19—May 28, 1977 (Ch. Sci.: E. Honza) The Sea of Japan off southwest Japan and around the Oki Islands, for geological mapping (1: 1,000,000 and 1: 200,000).
GH 77-3-1 Cruise	June 14—July 9, 1977 (Ch. Sci.: E. Honza) The Sea of Okhotsk and the Sea of Japan off Hokkaido, for geological mapping (1: 1,000,000).
GH 77-3-2 Cruise	July 10—August 6, 1977 (Ch. Sci.: E. Inoue) Off Nishi-Tsugaru in the Sea of Japan, for sedimentological mapping (1: 200,000).
GH 77-3-3 Cruise	August 6—August 12, 1977 (Ch. Sci.: J. Chujo) The Sea of Japan of the Pacific, for technical training of foreign students and supplementary research of geological mapping.
GH 78-1 Cruise	January 7—March 7, 1978 (Ch. Sci.: T. Moritani) Central Pacific Basin, for manganese nodule deposits research.
GH 78-2 Cruise	April 18—June 2, 1978 (Ch. Sci.: E. Honza) Central part of the Sea of Japan, for geological mapping (1: 1,000,000).
GH 78-3 Cruise	June 13—July 4, 1978 (Ch. Sci.: E. Inoue) Around the Oki Islands in the Sea of Japan, for geological mapping (1: 200,000).
GH 78-4 Cruise	July 12—August 12, 1978 (Ch. Sci.: E. Inoue) Off Abashiri in the Okhotsk Sea, for sedimentological mapping (1: 200,000).
GH 79-1 Cruise (scheduled)	January 13—March 13, 1979 (Ch. Sci.: A. Mizuno) Central Pacific Basin, for manganese nodule deposits research.

Table 2 Method of marine geology investigation aboard R/V Hakurei-Marui.

Methods	Projects	Investigation around the Japanese Islands	Manganese nodule investigation
Positioning		NNSS, Decca, Loran C/A	NNSS
Geophysical methods			
Gravity measurement		On-board gravity meter	On-board gravity meter
Magnetic measurement		Proton magnetometer	Proton magnetometer
Depth sounding/topography		Precision depth recorder (12 kHz PDR)	Precision depth recorder (12 kHz PDR)
Continuous seismic reflection profiling		Air gun, sparker	Air gun
Seismic refraction		Sono-radio buoy	Sono-radio buoy
Sediment profiling		3.5 kHz PDR (subbottom profiler)	3.5 kHz PDR (subbottom profiler)
Side looking survey		Side scan sonar	
Geological methods			
Sediment sampling		Smith-McIntyre grab, piston corer, and gravity corer	Okean 70 grab, free fall grab, box sampler, piston corer, and free fall corer
Rock sampling		Submerged rock drill, dredge, and rock corer	Dredge, rock corer
Sea bottom observation		Deep sea camera	Deep sea camera, free fall camera, and deep sea television
Others			
Water sampling and measurement		Water sampler with grab	Water sampler (Nansen bottle) STD
On-board instrumental analysis		X-ray diffractometer, X-ray fluorescence spectrometer, radiography instrument, and others	

Table 3-1 Main publications concerning marine geology and marine mineral resources from GSJ
—Cruise Report Series—.

<p>The <i>Cruise Report</i> is published on each cruise of the R/V Hakurei-Marui. Each report is edited by the chief scientist (and co-chief scientist) and comprizes many papers contributed by on-board and non-on-board scientists concerned.</p>	
No. 1	Deep Sea Mineral Resources Investigations in Northwest Pacific, November-December 1972. 42 pp. (1974)
No. 2	Goto-nada Sea and Tsushima Strait Investigations, Northwestern Kyushu, 1972-1973. 68 pp. (1975)
No. 3	Sagami-nada Sea Investigations, April-May 1974, GH 74-1 and -2 Cruises. 58 pp. (1975)
No. 4	Deep Sea Mineral Resources Investigation in the Eastern Central Pacific Basin, August-October 1974 (GH 74-5 Cruise). 103 pp. (1975)
No. 5	Izu-Ogasawara (Bonin) Arc and Trench Investigations, June and October-November 1974, GH 74-3 and -6 Cruises. 68 pp. (1976)
No. 6	Ryukyu Island (Nansei-Shoto) Arc, GH 75-1 and 75-5 Cruises, January-February and July-August 1975. 81 pp. (1976)
No. 7	Geological Investigation of Japan and Southern Kurile Trench and Slope Areas, GH 76-2 Cruise, April-June 1976. 127 pp. (1977)
No. 8	Deep Sea Mineral Resources Investigation in the Central-eastern Part of Central Pacific Basin, January-March 1976 (GH 76-1 Cruise). 217 pp. (1977)
No. 9	Investigations of the Continental Margin of Southwest Japan, June-July 1975 (GH 75-4 Cruise). 88 pp. (1978)
No. 10	Geological Investigations in the Northern Margin of the Okinawa Trough and the Western Margin of the Japan Sea, April-May 1977 (GH 77-2 Cruise). 79 pp. (1978)
No. 11	Geological Investigation of the Okhotsk and Japan Seas off Hokkaido, June-July 1977 (GH 77-3 Cruise). 72 pp. (1978)

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Table 3-2 Main publications concerning marine geology and marine mineral resources from GSJ
—Marine Geology Map Series—.

The *Marine Geology Map Series* include two types of maps. *Marine Geological Map* issue consists usually of geological map, magnetic anomaly map, and gravity anomaly map. *Sedimentological Map* issue consists of granulometric map, coarse fraction composition map, and others.

No. 1	Submarine Geological Map around Koshikijima Islands 1: 200,000 (1975)
No. 2	Bottom Sediment Map, Tsushima & Goto Islands Area 1: 200,000 (1975)
No. 3	Submarine Geological Map of Sagami-Nada Sea and Its Vicinity 1: 200,000 (1976)
No. 4	Sedimentological Map of Sagami-Nada Sea and Its Vicinity 1: 200,000 (1976)
No. 5	Marine Geological Map of the South of Kii Strait 1: 200,000 (1976)
No. 6	Sedimentological Map of the South of Kii Strait 1: 200,000 (1976)
No. 7	Geological Map around Ryukyu Arc 1: 1,000,000 (1977)
No. 8	Geological Map off Outer Zone of Southwest Japan 1: 1,000,000 (1977)
No. 9	Sedimentological Map of Offing of Hachinohe 1: 200,000 (1978)
No. 10	Geological Map off Hachinohe 1: 200,000 (1978)
No. 11	Geological Map of the Japan and Kuril Trenches and the Adjacent Areas 1: 1,000,000 (1978)

Marine geological investigations on continental shelves and slopes around Japan

(First five year project, F.Y. 1974-1978)

This project aims at mapping both subbottom geology and bottom sediments of the areas around the Japanese Islands, with resulting publications of geological reconnaissance maps on a scale of 1: 1,000,000 for extensive areas, and also both of detailed geological and sedimentological maps on a scale of 1: 200,000 for selected offshore areas (Fig. 1).

The reconnaissance studies have been concentrated in the Pacific Ocean side areas during 1974-1976, and then extended to the areas of the Sea of Japan and the Okhotsk during 1977-1978. Through these works, we have obtained a lot of geological and geophysical data concerning the tracks at intervals of about fifteen nautical miles over the entire areas around the Japanese Islands, except the Izu-Ogasawara Ridge area which is left for the cruises during 1979 (Fig. 2). Three issues of reconnaissance geological map which covers the whole areas of the Pacific continental margin have been published until now.

The detailed studies have been done so far with considerable accumulations of the geological, sedimentological and geophysical data for some shelf and upper slope areas such as off western Kyushu, off Kii Peninsula, off South Kwanto, off Hachinohe, off Nishitsugaru, around the Oki Islands, and off Abashiri. Tracks and sampling sites are densely spaced on each area, at intervals of about two to three nautical miles. We have published the geological and sedimentological maps of the areas of off Kii Peninsula, off South Kwanto, off Hachinohe, and off western Kyushu.

As a note on the bottom sampling technique, in addition to the conventional methods of dredge and rock corer, a small type submerged rock drill (MD300PT) capable to obtain a maximum 75 cm long rock core has been developed in 1975 and used in some sites for the detailed mapping survey on a scale of 1: 200,000 (Fig. 3-a). Recently, a larger rock drill (MD500H) was additionally developed to obtain longer rock core at deeper water. Being capable to take 6 m long rock core at a maximum

depth of 500 m, it has a fully automatic battery drive system as well as the MD300PT (Fig. 3-6) (Inoue et al., Preprints, The 5th Intern. Ocean Dev. Conf., September 1978, Tokyo). The machine was put to practical use with success during GH 78-3 Cruise in 1978.

The second phase five year project on marine geological investigation around Japan is now planned. It will be concerned with marine geology and geophysics of the entire Izu-Ogasawara Ridge to make a reconnaissance geological map in F.Y. 1979. Also, it will cover the Pacific shelves and upper slopes of Honshu to provide geological and sedimentological maps (1: 200,000) since F.Y. 1980 through 1984.

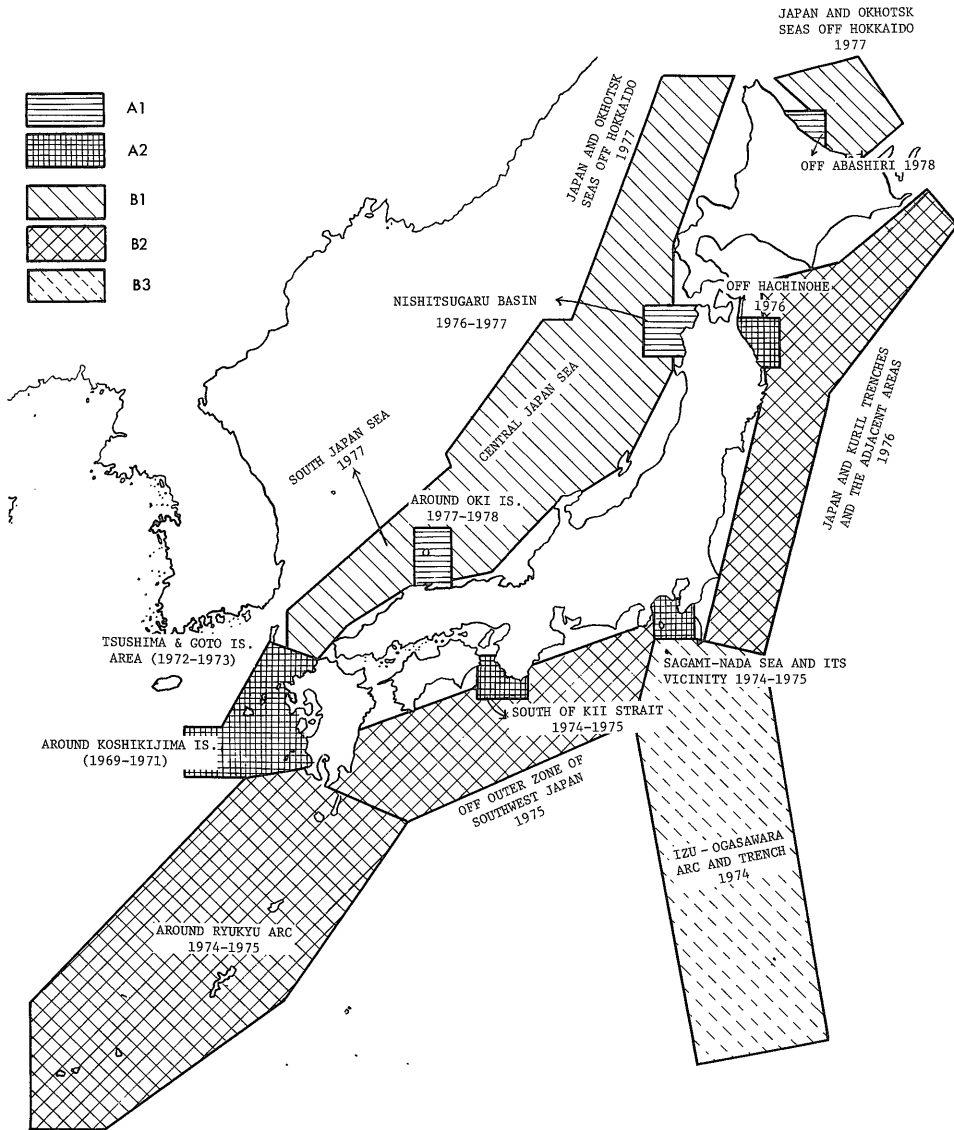


Fig. 1 Five year program (1974-1978) of the geological and sedimentological research around the Japanese Islands.

A1: surveyed area	} on a scale of	B1: Surveyed area	} on a scale of
A2: Area of map published		B2: Area of map published	
	1: 200,000		1: 1,000,000
		B3: Preliminarily surveyed area	

Investigations on deep sea manganese nodules in the Central Pacific Basin

(Five year project, F.Y. 1974–1978)

This project aims at clarifying manganese nodule genesis in relation to topography, sedimentology, and other geologic factors as a basic information for their exploration and exploitation.

The main objective area has been Central Pacific Basin since 1974. Four cruises of the Hakurei-Maru during 1974–1978 have covered an extensive area of ca. 2,000 km × ca. 500 km, which extends from siliceous ooze zone south to red clay zone north (Fig. 4).

Through these works the geological, sedimentological, and geophysical data of the Central Pacific

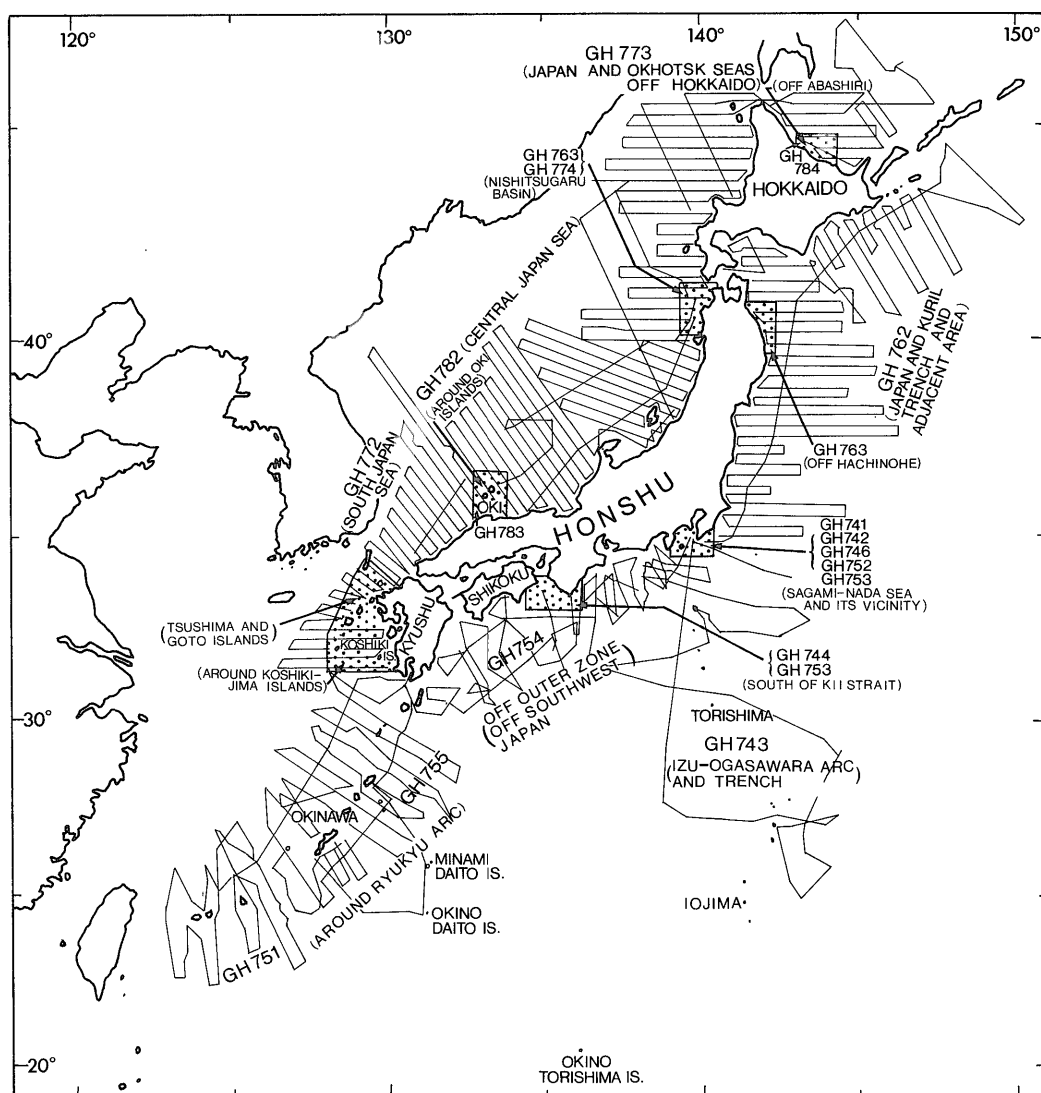


Fig. 2 Surveyed areas and geophysical track lines around the Japanese Islands (1974–1978). Dotted area: surveyed areas for geologic and sedimentologic maps (scale=1: 200,000) since 1969 onward.

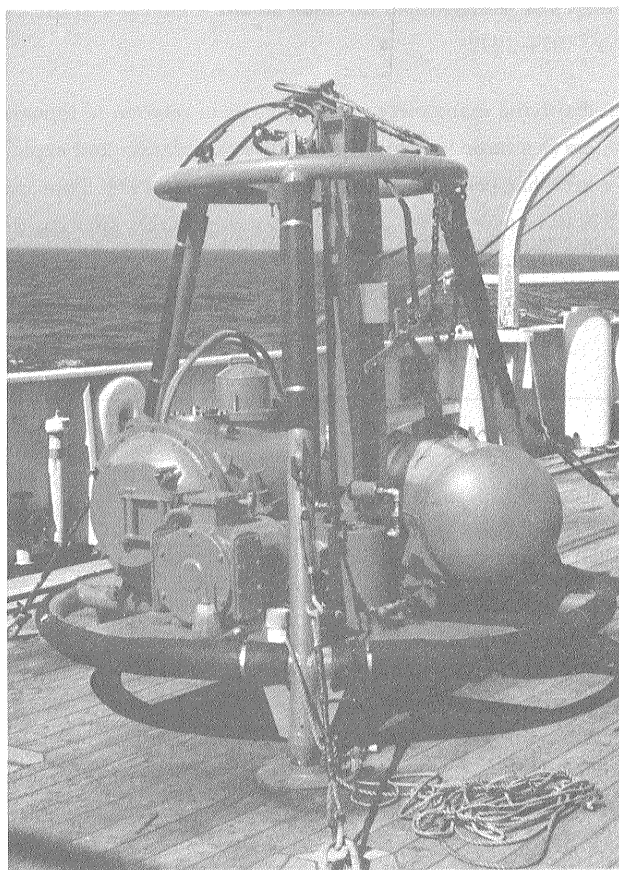


Fig. 3-a Small type submerged rock drill (MD300PT).

Basin have been accumulated, and also abundance of manganese nodules and their mineralogical and chemical compositions have been clarified, particularly in relation to nodule morphology, submarine topography, and acoustic stratigraphy. The nodule abundance and sediment types in the area, as a part of the results, are shown in Fig. 5. However, they show the overall tendencies interpreted from the field data on the widely spaced survey lines (Fig. 6) and sampling sites (Fig. 5). More detailed surveys with densely spaced samplings and geophysical measurements are necessary concerning some selected areas in further studies.

Some preliminary syntheses of the studies (F.Y. 1974–1978) were presented in the 5th Intern. Ocean Dev. Conf., September 1978, Tokyo by Mizuno and Moritani. The detailed data have been published in two issues of Cruise Report (No. 4 and No. 8) and also in other individual papers on various journals.

In F.Y. 1978, the GH 79-1 Cruise is scheduled in the north-eastern part of the Central Pacific Basin during January–March 1979 as the final cruise of the present successive year project.

The next five year project of the deep sea mineral resources investigation (F.Y. 1979–1984), in planning, will longitudinally cover the axial part of the Central Pacific Basin with a transect from southeast of Wake to west of Tahiti. It will contribute to the problems on the genesis of manganese

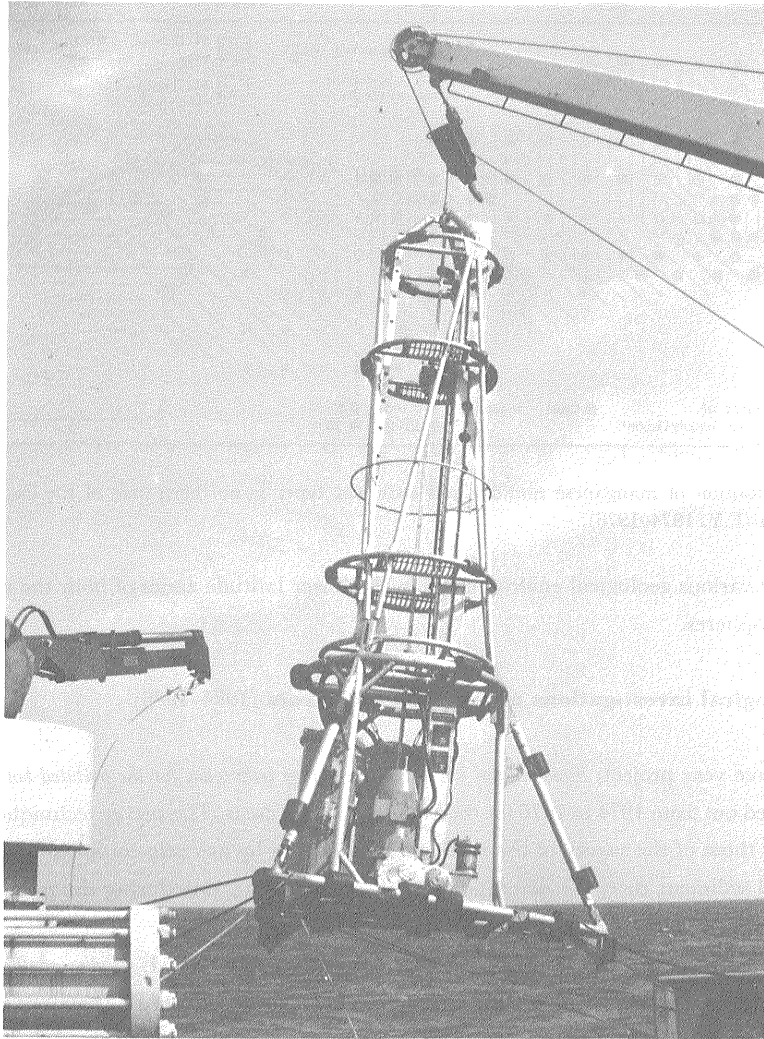


Fig. 3-b Large type submerged rock drill (MD500H).

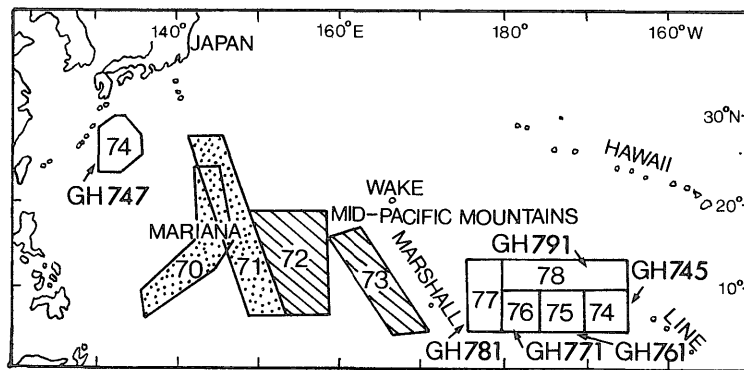


Fig. 4 Research areas for manganese nodule deposits by the Geological Survey of Japan (F.Y. 1970-1978).

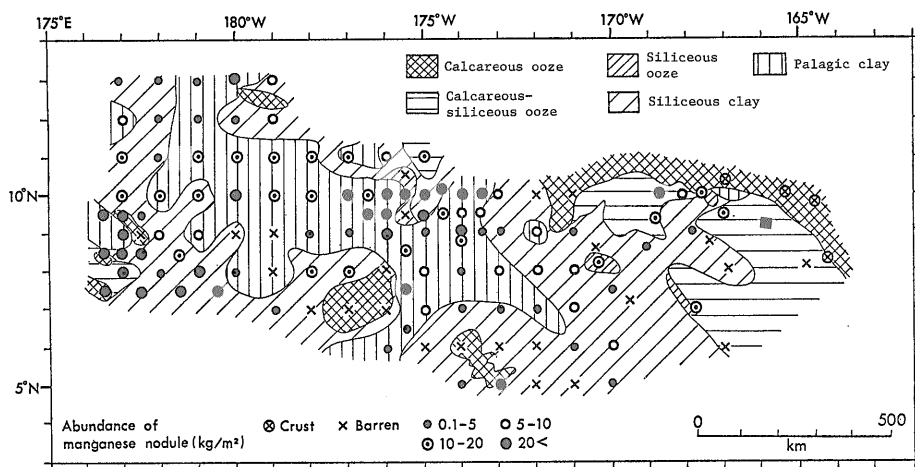


Fig. 5 Distribution of manganese nodules and sediment types in northern part of the Central Pacific Basin (F.Y. 1974-1978).

nodules under various geological environments in the lower latitude zones of both the northern and southern hemispheres.

Marine geological investigations on polluted sediments (1974-1976)

The first three year project, *Fundamental studies on the survey techniques for the polluted bottom sediments*, has been carried out from 1974 to 1976 for the Seto Inland Sea areas. The survey techniques developed have included those of the survey of the sediment distribution by acoustic equipments, the sampling of undisturbed sediment core, the determination of sedimentation rate during the past 100 years by ^{210}Pb dating method, etc.

As an extending work of the former project, a new three year project, *Studies on the accumulation mechanism of the polluted bottom sediments (1977-1979)*, has been initiated in 1977. It aims at clarifying the origin of sediments and historical changes of the sedimentary environments through the studies of distribution of sediments relevant to changes in their thickness, sea bottom topography, suspended materials, and physical and chemical properties of the sediments.

Three types of representative model fields of bay areas have been selected for this project from subarctic, temperate, and subtropical zones along the Japanese Islands. In 1977 two areas of Shibushi Bay and Suruga Bay were studied, and in 1978 Funaka Bay and Toyama Bay are now being studied.

Investigations on marine sand and gravel resources on offshore areas

This project has been conducted since 1975 to provide marine mineralogical data to the near future prospects of offshore marine sand and gravel resources in shallow water at depths of tens-of-meters. The on-board survey methods consist mainly of depth sounding, bottom observation by means of marine bottom photography and side scan sonar, subbottom profiling using a boomar equipment and bottom sampling by a Smith-McIntyre grab.

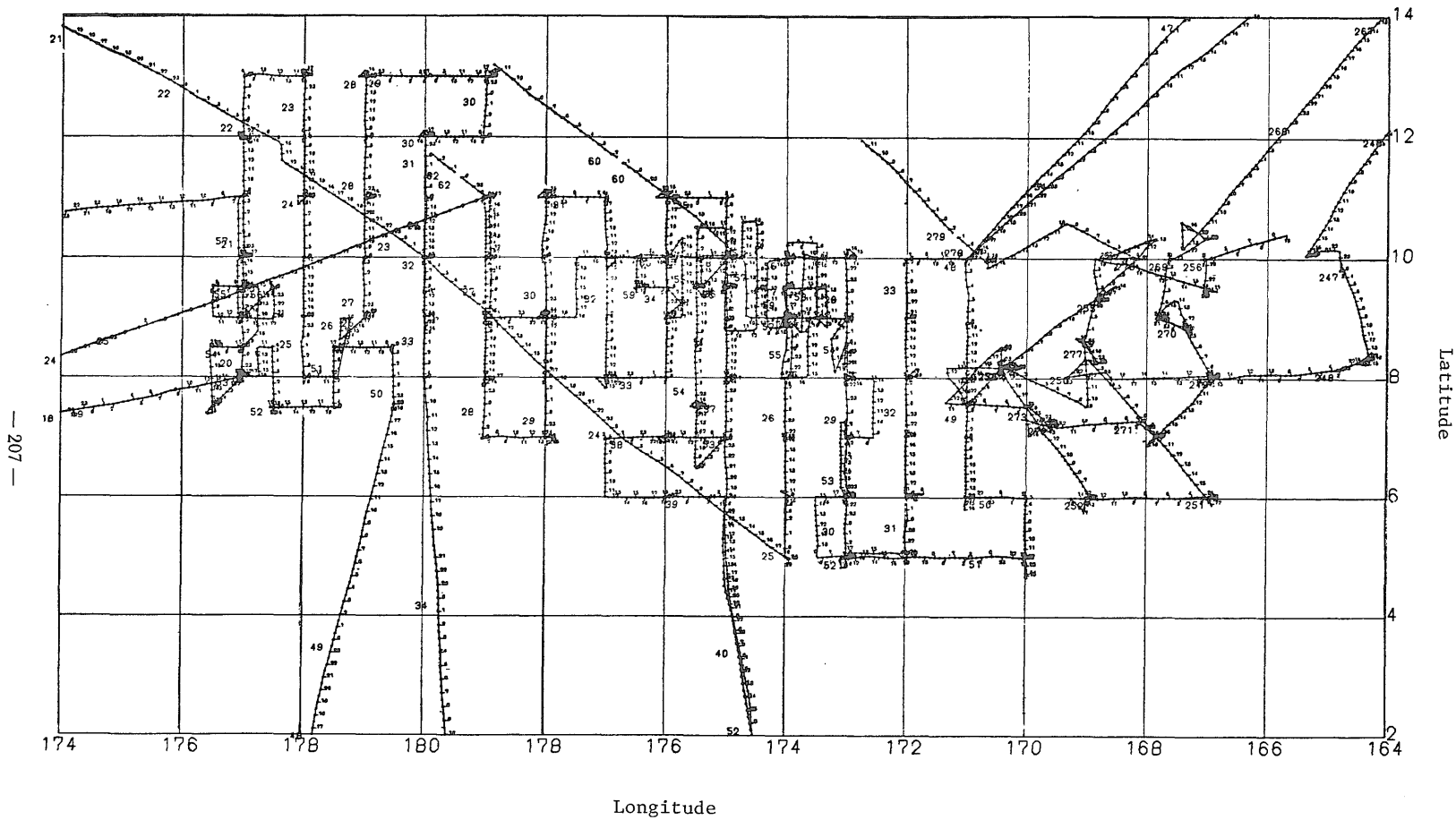


Fig. 6 Geophysical track lines in the Central Pacific (1974-1978).

The areas already surveyed are off the northern coast of Kyushu (1975), off the western coast of Kyushu (1976), and off the western coast of Okinawa Island (1977). It has been concluded through these works that promising sand and gravel deposits tend to be developed on 40–50 m submarine terraces in many parts of those areas, although the detailed distribution considerably varies, depending on topographic condition and supplying condition of calcareous remains.

The work in 1978 is scheduled for the Seto Inland Sea during November 1978.

International cooperations

International cooperations in the fields of marine geology and marine mineral resources have been active in many ways year by year.

1) The bilateral governmental programs have contributed to the information exchanges of the scientific progress on the subjects, and the exchange of scientists is expected to be realized in near future.

In this category, there are included the activities of the Marine Geology Panel on the U.S.–Japan Cooperative Program in Natural Resources (UJNR) covering a wide range of field of marine geology including manganese nodules, and the cooperative programs on manganese nodule research under both the Japan–France Agreement on Cooperation in Science and Technology and the Japan–Federal Republic of Germany Agreement on Cooperation in Science and Technology. Also in other related field, some staffs have contributed as the members to the activities of Marine Mining Panel and Sea Bottom Survey Panel under the U.S.–Japan Cooperative Program in Natural Resources.

2) The training on-board the R/V Hakurei-Marū for scientists has been carried out during some parts of Hakurei-Marū cruises around the Japanese Islands every year.

3) Also, several scientists and trainees from developing countries have occasionally participated in the Hakurei-Marū cruises both around Japan and in the Central Pacific for joint research work or on-board training: these include the scientists from Fiji, the Republic of Korea, Thailand, Turkey, and Western Samoa.

4) Two geologists of the Marine Geology Department joined in the Glomar Challenger IPOD Cruises, Leg 57 and Leg 58, in the western Pacific during the fall of 1977 to the beginning of 1978.

5) The department is also contributing to the activities of CCOP and CCOP/SOPAC through participation of the special adviser in the meeting or participation of scientist in the survey cruise.

地質調査所における海洋地質調査研究の現状 (1978)

地質調査所海洋地質部

地質調査所海洋地質部のおもな研究は、白嶺丸による「日本周辺大陸棚海底地質総合研究」、「深海底鉍物資源探査に関する基礎的研究」、その他の調査船による汚染底質に関する研究、大陸棚域の骨材資源に関する研究である。また、二国間、多国間の海洋地質・鉍物資源に関する国際協力がさまざまな形で行われている。それらの概況、成果を紹介した。