

**REPORT ON THE COOPERATIVE STUDY PROJECT
ON THE DEEPSEA MINERAL RESOURCES
IN
SELECTED OFFSHORE AREAS OF THE SOPAC REGION
(VOLUME 1-1)
SEA AREA OF THE NIUE**

MARCH 2004

**JAPAN INTERNATIONAL COOPERATION AGENCY
JAPAN OIL, GAS AND METALS NATIONAL CORPORATION**

MPN
CR(3)
04-088

PREFACE

In response to a request by the South Pacific Applied Geoscience Commission (SOPAC), the Government of Japan has undertaken marine geological and other studies for the understanding of the mineral resources potential of the deep-sea bottom in the offshore regions of SOPAC member countries. Implementation of the survey has been consigned to the Japan International Cooperation Agency (JICA). Considering the technical nature of geological and mineral prospecting studies, JICA commissioned the Metal Mining Agency of Japan (MMAJ) to execute the survey.

The survey is undertaken as the three-year Stage II Phase 2 Program started from the fiscal year 2003. This is the first year of the program, and the survey area is set within the Exclusive Economic Zone (EEZ) of Niue.

The MMAJ dispatched the Hakurei Maru No.2, a research vessel designed for investigating deep-sea mineral resources, to the survey area from November 8 to December 5 (survey period: November 17, 2003 to November 23, 2003), successfully completing the survey as planned with the cooperation of the Government of Niue.

It is a pleasure to record our deep gratitude to all persons concerned, particularly to the staff of the SOPAC Secretariat, the Government of Niue, as well as the Japanese Ministry of Foreign Affairs, the Ministry of Economy, Trade and Industry, the Japanese Embassy in the Republic of Fiji, and the Japanese Embassy in New Zealand.

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ABSTRACT

The survey of this year is the first year of Stage II Phase 2 Program started from the year 2003, and the survey was carried out for the understanding of manganese nodule resources potential within the Exclusive Economic Zone (EEZ) of Niue covering the area of approximately 605,000k m².

The survey area, including the Island of Niue at the center, occupies southwestern part of the Samoa Basin and northern part of the Southwest Pacific Basin, both of which are 5,000m to 5,600m deep, and its western edge is bounded by the Tonga Trench of 8,000m deep. The period of survey cruise was from November 8 to December 5 (survey period: November 17, 2003 to November 23, 2003).

Manganese nodule sampling by Free-Fall Grab (FG) and Spade Corer (SC) was carried out for the 12 stations, at a total of 36 sampling points (12 stations × 3 sampling points), and in addition to this, sampling of manganese crust was conducted at two sampling stations. Concurrently with the sampling, photographs of the seafloor were taken and characteristics of bottom sediments of the seafloor and occurrence of manganese nodules were studied for the assessment of abundance of manganese nodules. During moving from one sampling station to another, acoustic surveys such as Sub-Bottom Profiler (SBP) survey, Multi Narrow-Beam Echo Sounder (MBES) survey, were conducted, and bathymetric maps and information of sea-bottom sediments were compiled, and regional assessment on the abundance of manganese nodules was conducted by the Multi Frequency Exploration System (MFES). In addition to these, an environmental survey was conducted as a baseline study to understand environmental situation of present day for future evaluation of potential mining impacts on the deep-sea environment.

The water depth of the survey area is about 5,000m deep. In the north part of the area the SBP type with acoustically opaque layer on the uppermost horizon is predominant, suggesting scarce distribution of unconsolidated sediments. The south of the area, on the other hand, is dominated by the SBP type consisting of thin acoustically opaque top layer underlain by transparent layer, and the uppermost acoustically opaque layer is suggested to indicate compact unconsolidated sediments of several tens of meters thick. In accordance with SBP survey, the results of MBES survey show that the north area is dominantly represented by dark color on the MBES image, suggesting that the seafloor surface is occupied by hard material.

All of the bottom sediments samples collected by FG and SC are insoluble brown clay with comparatively abundant volcanoclastic grains. According to microfossil study

of the sediments, the deposition of the sediments is assumed to have started before Miocene time and continues up to present. The area is assumed to have been laid under tropical to subtropical climatic condition, same as present, since 500,000 years ago.

Among the FG sampling at twelve stations, manganese nodule was collected only at one station (03506 station, 3 FG sampling points), and the abundance of manganese nodules was calculated to be 1.02kg/m² as the average of 3 sampling points (sampling point FG01: 1.25 kg/m², FG02: 0.69 kg/m², FG03: 1.13 kg/m²). At the 03504 station, manganese nodules were not collected by FG but the existence of them was confirmed by the sea-bottom photographs and the abundance was estimated from the photographs to be 8 to 10 kg/m². An additional sampling by Arm Dredge (AD) (03509), conducted at the same location as 03504 to confirm the manganese nodules revealed by the sea-bottom photograph, resulted in collecting 157.7kg of pebbly manganese nodules of 2 to 4cm across and 2.4kg of manganese crust. Manganese crust of approximately 9kg was collected by another AD sampling (03511) conducted at the slope of seamount in the south of the area.

The chemical compositions of manganese nodules are slightly different between the Plain Province (average abundance, Co: 0.36%; Ni: 0.41%; Cu: 0.24%) and the Hilly Province (Co: 0.69%; Ni:0.25%; Cu:0.07%). The former resembles the chemical composition of hydrogenous manganese nodule (s-type) reported from the Central Pacific Basin. The latter, on the other hand, resembles that of manganese crust collected on the slope of the sea mountain in the south part, further similar to that of typical cobalt-rich manganese crust of the Northwest Pacific, and this suggests a close genetic relation between manganese nodules of the Hilly Province and cobalt-rich manganese crust.

As the results of this survey, the abundance of manganese nodules of the sea area is assumed to be low, however, a finding of manganese crust collected around the sea mountains in the south of the area warrants a further survey in the seamount area for assessing the potentiality of manganese crust resources.

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