PD Interview

Program Director Interview

Shoichi Ishii

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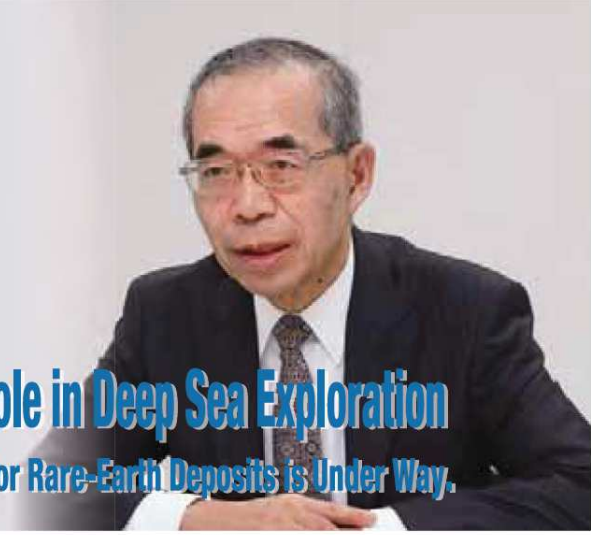

Japan Is the Only Country That Can Take a Leading Role in Deep Sea Exploration

Currently, the Development of the Exploration/Production Technology for Rare-Earth Deposits is Under Way.

In the Japanese Exclusive Economic Zone (EEZ), the existence of a variety of marine resources has been confirmed. In this program, the exploration of a 6,000 m deep seafloor containing rare-earth elements (REEs) and the development of production technology are under way. I interviewed PD Shoichi Ishii about this difficult and ambitious challenge.

Q: I want you to tell us about your enthusiasm toward this program.

PD: **The Japanese EEZ is the sixth largest EEZ in the world in terms of area. When you consider depth, the cubic volume is fourth in the world, and I think that Japan, as a maritime nation, should examine the conditions of the deep sea and confirm the amount of deposits and the maritime environment.**

"The sea at a depth of 6,000m is a world of extreme environment."

Q: What sort of world is the deep sea at 6,000 m?

PD: The pressure at 6,000 m is 600 kilogram per 1 cm^2. The temperature is close to 0°C. It is completely dark.

Since the radio waves that are used on land do not transmit in the sea, we rely on acoustic communication. This is an extreme world where laser beams cannot reach.

Q: Edokko Mark 1 (free-fall-type deep-sea probe) confirmed the existence of fish.

PD: A variety of creatures such as macrouridae, crustaceans, and microorganisms live at the depth of 6,000 m and protecting the environment is an important issue in our activities.

"REEs are essential for higher-performance EVs"

Q: Please tell us about the usefulness of rare-earth elements and rare metals.

PD: In the 2020s, neodymium and dysprosium will be necessary for high-performance magnets to be used in the motors of electric vehicles (EVs), and cerium is necessary for catalysts related to exhaust gasses. In addition, yttrium and gallium are used for LED lights.

Of course, rare-earth elements and rare metals are not only used in automobiles, but also in many other products, such as television sets, digital cameras, and smartphones, and are essential for higher-performance machinery.

Now, China produces around 80% of the worlds rare-earth elements and has more than 40% of deposits. In this context, it is important to confirm the size of the researves of rare-earth elements in the Japanese EEZ.

In this program, we mainly explore the Minamitorishima area, which is reported to be a sea area with high concentrations of rare-earth elements.

"Introduction of deep-sea AUV and realization of a deep-sea terminal"

Q: I hear that for exploration, deep sea Autonomous Underwater Vehicles (AUVs) and a deep sea terminal system will be introduced.

PD: Currently, we are obtaining data collected in acoustic survey conducted by a research vessel at the depth of 6,000 m.

In addition to this, from next year (2020), **deep sea AUVs,** also called underwater robots, **will be deployed in array to conduct a high-resolution acoustic survey close to the seafloor. Through an analysis of acoustic images, the marine mineral resource deposits and the potential site will be mapped, which I think will lead to cracking, sampling and lifting of the rare-earth elements.**

Moreover, we are currently developing a system that can be recharged at a deep sea terminal system and can thus continue a survey for about five days. We are also developing a 6,000 m-long pipe, which is necessary for lifting the cracked deposits.

With respect to technology for cracking, sampling and lifting of rare-earth elements, we have already used a power grab sampler to recover 3 m^2 of high-concentration rare-earth elements from the sea area being surveyed. This is the first time that this amount of these elements has been sampled. It is an order of magnitude greater than the amount obtained by core sampling with a piston

corer (a core sampling machine capable of sampling down to 20 m beneath the seafloor). This has enabled us to make a detailed analysis of the viscosity density and other properties of deposits.

"Features a close relationship between the participating government ministries agencies and R&D institutions"

Q: As a stand-out feature of SIP, emphasis is put on cooperation among the government ministries and agencies and the coordination among government, industry and academic entities.

PD: That's right. Starting from July this year (2019), the Ministry of Foreign Affairs joined, and with the cooperation of nine government ministries and agencies, many R&D institutions have become involved and a Promotion Committee was formed. This committee includes Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Japan Oil, Gas and Metals National Corporation (JOGMEC), the National Institute of Advanced Industrial Science and Technology (AIST), and the National Institute of Maritime, Port and Aviation Technology (MPAT). I believe that this demonstrates a very wide range of cooperation, which has not been seen in other programs.

More than one year has already passed since the second phase began, but the cooperation of the nine government ministries and agencies and the collaboration among the R&D institutions has been very close and swift, which is characteristic of this program. I believe that this way of advancing the program will make the speed of the 5-year second phase even faster, with more fruitful results.

"The outcome of this program blooms multilaterally."

Q: Lastly, please tell us about your ideas on the future of Japan as a maritime nation.

PD: **In the second phase, we are focusing on mineral resources such as rare-earth elements, rare metals, cobalt and manganese. If this really is economically efficient, I believe that it will be very encouraging to the industry of Japan.**

For example, regarding oil, there is the issue of the Straits of Hormuz. Even if a similar issue emerges for rare-earth elements/rare metals, we will have a sense of security if we are able to obtain a stable supply within the country.

In addition, I think that beginning with this program, when we work toward the investigation of the maritime environment, mapping a wide swath of seafloor, and then work toward the effective utilization of seafloor, it will lead to the outcomes of this program blooming multilaterally.

Figure 01: Manganese nodules, as well as rare-earth deposits, were confirmed in the surveyed sea area.

Figure 02: Rare-earth deposits. Include rare-earth elements in high concentration.

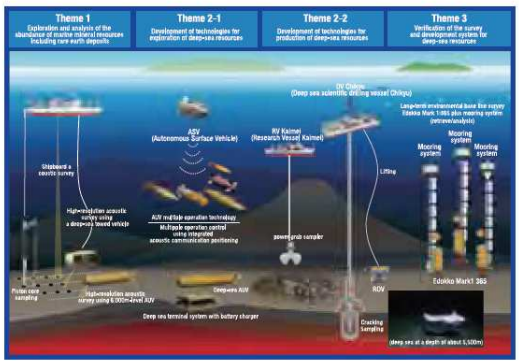

Figure 03: Outline of each theme