

Cruise Summary

1. Cruise Information

- Cruise ID: YK13-11
- Name of vessel: R/V Yokosuka
- Title of the cruise: YK13-11 SHINKAI6500/RV YOKOSUKA
- Chief scientist [Affiliation]: Shinji Tsuchida [JAMSTEC]

- Representative of the Science Party [Affiliation]: Shinji Tsuchida [JAMSTEC]
Kei Shiomi[JAXA]
- Title of proposal:
 - Comparative studies of biology, geology, and geochemistry on subducting seamounts in the Louisville Seamount and active volcanoes in the Kermadec Arc.
 - Global sea surface pCO₂ observation: Estimation of carbon budget between Ocean-Atmosphere by GOSAT data
- Cruise period: 24th October – 2nd November 2013
- Ports of call: Nuku'alofa, Tonga – Auckland, New Zealand
- Research area: Kermadec, South Pacific

2. Overview of the Observation

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1. Objectives of the survey of the Kermadec Trench

The oceanic structure around New Zealand, a country in the southern hemisphere, is similar to the one around Japan. There are areas where seamount chains stretch over several thousand kilometers. In this survey, jointly with the National Institute of Water and Atmospheric Research of New Zealand, JAMSTEC has studied organisms living in an area where two large seamount chains meet.

One of the large seamount chains surveyed is the Louisville Seamount Chain - a chain of over 70 seamounts stretching over about 4,300 kilometers from north-east to south-west of New Zealand. Seamounts in this area were formed around the South Pole, and some 70 millions of years later, they will subduct into the Kermadec Trench. Thus, in geological times those seamount will soon disappear. The Tonga-Kermadec Arc is located just across the trench with a series of volcanically active seamounts. There is an area where hot water loaded with sulfur and acids spews out of cracks in the seabed. Although the area is too deep (below 200-meter depth) for most of marine species to survive, those populations of

several species can be found, like around coral reefs. Those organisms rely on bacteria for energy. The bacteria produce energy from hydrogen sulfide and methane contained in the hot water.

In such a very unique environment where the disappearing seamount chain and the volcanically-active seamount chain lie over the trench axis, this survey was conducted to determine if there is any difference in ecosystems between the two seamount chains and, if any, where the difference comes from. For the first time in the world, JAMSTEC observed the seafloor in this area, using the manned research submersible SHINKAI 6500. JAMSTEC tried to collect data as well as samples of deep-sea species, using high-definition cameras and various measuring instruments. Based on the biological distribution data and the genetic information, JAMSTEC plans to unravel the biodiversity patterns of evolution in unique environments.

2. Outline (see the attached map)

- (1) The Louisville Seamount Chain at depths of 1,200 – 2,800 meters and the northern Kermadec Arc at depths of 400 – 800 meters

Period: October 26 to 30, 2013

Details:

- i) Topographic and geological survey in and around the Louisville Seamount Chain and the northern Kermadec Arc at depths of 300 – 5,000 meters.
 - Survey was conducted during dives of SHINKAI 6500.
 - Survey was conducted, using the “DEEP TOW” camera system.
 - Outcrops were observed and rock samples were obtained, using SHINKAI 6500.
 - Data on the submarine topography, gravity, and magnetism were measured, using instruments on the vessel.
- ii) Ecosystem and biodiversity monitoring in the Louisville Seamount Chain and the northern Kermadec Arc at depths of 300 – 5,000 meters.
 - Visual observation was conducted from SHINKAI 6500 to study depth distribution of fauna.
 - During the survey deep-sea animals were collected using a slurp gun (suction sampler), manipulators, and core samplers.
 - Environmental variables of habitats were measured, including water depth, water temperature, salinity, dissolved oxygen level, and hydrogen sulfide level.
 - Distribution of deep-sea fauna was investigated, using the “DEEP TOW” camera

system.

3. Summary of research achievements

- (1) A detailed bathymetric chart of the area around the Osbourne , Canopus, and Hinepuia Seamounts were drawn, as there was little topographic data available. The Osbourn Seamount is located at the west end of the Louisville Seamount Chain, while the Hinepuia Seamount is located in the northern Kermadec Arc.
- (2) The seafloor was observed at the Louisville Seamount Chain for the first time in the world. Many animals were found, including sponges, corals, lobsters, crabs, sea cucumbers, sea urchins, starfish, and fish. Some of the species were successfully sampled.
- (3) At the Hinepuia Seamount located in the northern Kermadec Arc, a new hydrothermal vent field was discovered for the first time. Vent-associated communities including *Bathymodiolus* mussels, *Symphurus* flat fish, and other species were found there. These observations are important in understanding the continuity and evolution of biological communities in the area.

Geological features were observed and rock samples were obtained. This made it possible to compare volcanic zones between the northern Kermadec Arc and the Louisville Seamount Chain.