

First discovery of hydrothermal vent with black smoker (Pika site) at the Southern Mariana Region and its properties

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The Southern Mariana Region has not been thoroughly studied about hydrothermal vent activity. Especially, active hydrothermal vent with black-smoker has not been discovered in this area. In this basalt-based arc system, a lot of minerals and reductive volcanic gases are provided from hydrothermal vents. Our main purposes in YK03-09 cruise were follows: 1) finding the thermophilic microbial ecosystem in the Mariana arc, and to reveal biological diversity and composition of the distinctive ecosystem; 2) investigating contents of hot water from vents, deposits, metamorphic compounds, and environmental factors in chemical/geological respects, and to know the interaction between biological activity and chemical/geological environment.

Referring to plume data got by Tow-yo of NOAA cruise (Feb. 2003) and the position information about white-smoker (Fryer site) discovered by submersible Jason of Hawaii university cruise (Apr.-May 2003), we carried out submersible surveys (D787 to D794) on the back-arc spreading ridge. As the result, two hydrothermal vent area (named Yamanaka site and Shitashima site) were newly discovered on the ridge, and also we confirmed the exact position of Fryer site. However, we could not find out any active hydrothermal vent with black-smoker in the back-arc spreading ridge (The highest temperature of hot water at the Fryer site was 110 deg C).

We carried out various samplings (hydrothermal hot water, ambient sea water, rocks, chimney, sediment, organisms, etc.) and microbiological incubation experiments at Fryer site during the dives, and also we monitored optical back scatter anomalies in the course of submersible descend and ascend (from D791 to D794) at the similar water depth where optical anomaly was detected during NOAA cruise. From the data, it was indicated the fact that large hydrothermal activity does not exist around our survey ridge area.

We changed dive point from D795. There are two major peaks of off-axis volcanoes in the east (about 3 miles SE from the ridge point). The mission of D795 was to check hydrothermal activity on these peaks by a single dive. At the descend to the southern peak small optical back scatter anomaly was observed at the water depth of 2,620 m. However, the southern peak pillow lavas were half covered by pelagic mud with no indication of hydrothermal activity. At the northern peak, however, we discovered an active hydrothermal vent at northern summit edge (Pika site). This is the world's first discovery of black smoker vent in South Mariana arc area. The black smoker vent was composed of more than eight small vents with sulfide chimneys several tens of centimeters tall. We carried out sampling (hydrothermal vent water, ambient sea water, rocks, organisms, filtrated organic matter) and set a transponder about 200 m east point from the black smoker.