

Seismic structure and seismicity survey at the Kairei hydrothermal vent field in the Indian Ocean

SATO, Toshinori^{1*} ; TAKATA, Hiroyoshi¹ ; IMAI, Yuki² ; NOGUCHI, Yui¹ ; KOUNO, Akihiro¹ ; YAMADA, Tomoaki³ ; SHINOHARA, Masanao³

¹Graduate School of Science, Chiba Univ., ²Dep. Science, Chiba Univ., ³ERI, Univ. Tokyo

1. Introduction

In the first segment of the central Indian Ridge from the Rodriguez triple junction, the Kairei hydrothermal vent field exists and extrudes hydrothermal fluid with richer hydrogen content compared to other hydrothermal vents in the world. Around the Kairei hydrothermal field, serpentinized peridotite and troctolites, and gabbroic rocks were discovered. These deep-seated rocks exposed around the Kairei field may cause the enrichment of H₂ in the Kairei fluids. At the Kairei field, a hydrogen-based subsurface microbial ecosystem and various hydrothermal vent macrofauna were found. In the TAIGA Project (Trans-crustal Advection and In situ reaction of Global sub-seafloor Aquifer), this area is a representative field of TAIGA of hydrogen. To investigate how the deep-seated rocks (originally situated at several kilometers below seafloor) are uplifted and exposed onto seafloor, and the hydrothermal fluids circulate in subsurface, we conducted a seismic refraction/reflection survey and seismicity observation with ocean bottom seismometers (OBSs).

2. Observation

We conducted a seismic survey around the Kairei hydrothermal field from January 27 to March 19 in 2013 using S/V Yokosuka of Jamstec. We used 21 OBSs, an air gun (GI gun) and a single channel streamer cable. Deployed intervals of OBSs are about 7.5 km, and 2 km near the Kairei field. Survey lines are 5 lines NNW-SSE direction parallel to the ridge axis, 5 lines E-W direction, and 5 lines NNE-SSW direction. Line lengths are from 7 km to 30 km. In addition, we conducted other 5 lines pass around the point just above the Kairei hydrothermal field and the Yokoniwa Rise. The air gun was a GI gun with 355 cu. in. (5.5 l), and the shot interval was 40 s (about 100 m).

3. Results

From seismicity observation, we found many micro earthquakes in this area. A swarm of micro earthquakes exists at a location about 1 km northwest of the Kairei field. The swarm has a NNW-SSE strike, parallel to the ridge axis. The depth of the swarm is very shallow (~4 km from seafloor). This swarm may be related to the hydrothermal activities of the Kairei field. At the first segment of the central Indian Ridge, many micro earthquakes occurred. The depth of these events is deeper than that of the swarm near the Kairei field.

Acknowledgements

We thank the captain and the crew of S/V Yokosuka of Jamstec for their support. This work was supported by Grant-in-Aid for Scientific Research on Innovative Areas of the Ministry of Education, Culture, Sports, Science and Technology (Grant Number 20109002, TAIGA project).

Keywords: TAIGA, hydrothermal area, seismicity, Triple junction in the Indian Ocean