Seismicity and 3D seismic velocity structure at the Kairei hydrothermal vent field near the Rodriguez Triple Junction in the Indian Ocean

Taiyu Mori[1], *Toshinori Sato[1], Hiroyoshi Takata[1], Yuki Imai[2], Yui Noguchi[1], Akihiro Kono[1], Tomoaki Yamada[3], Masanao Shinohara[3]

1. Graduate School of Science, Chiba University, 2. Faculty of Science, Chiba University, 3. Earthquake Research Institute, the University of Tokyo

1. Introduction

In the northern part of the first segment of the central Indian Ridge from the Rodriguez triple junction, the Kairei hydrothermal vent field exists and discharges hydrothermal fluid with rich hydrogen. Serpentinized peridotite and troctolites, and gabbroic rocks were discovered on the seafloor around the Kairei hydrothermal field. These rocks (originally situated at several kilometers beneath seafloor) exposed around the Kairei field may cause the rich hydrogen fluid. At the Kairei field, hydrogen-based various hydrothermal vent fauna 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. The areas at and around the Kairei hydrothermal vent field, the Hakuho Knoll and the Yokoniwa Rise, locate near the non-transform offset (NTO) between the first and second segments, and are regarded as an NTO massif. To investigate how the deep-seated rocks are uplifted and exposed onto seafloor, and the hydrothermal fluid circulates in subsurface, we conducted a seismic refraction/reflection survey and seismicity observation with ocean bottom seismometers (OBSs).

In JpGU 2016, we reported that a swarm of micro earthquakes exists at a location about 3-5 km northwest of the Kairei field and its depth is about 4-7 km. The focal mechanisms in the swarm are normal type. Another swarm exists at the first segment of the central Indian Ridge, and is divided into upper and lower parts, and both incline at about 60-70° toward west.

To determine more detailed 3D velocity structure and seismicity, we use TomoDD program (Zhang and Thurber, 2003). This presentation will show 3D velocity structure from artificial and natural sources and relocated hypocenter distributions.

2. Observation and methods

We conducted a seismic survey around the Kairei hydrothermal field from January 27 to March 19 in 2013 using S/V Yokosuka of Jamstec (YK13-01, YK13-03). We used 21 OBSs. We determined 3D velocity structure and hypocenter locations by TomoDD program. We obtained better resolution at deeper parts using natural sources.

3. Results

Seismic velocities under the Yokoniwa Rise and the Hakuho Knoll exceed about 6 km/s at depth of 1-2 km below seafloor. The high velocity area extends horizontally beneath the Yokoniwa Rise. A low velocity area locates under the ridge, and this suggests existence of magma. Seismicity shows swarms under the ridge at the northern part of the first segment and near the Kairei field. All of the swarms incline at about 60-70° toward west. This suggests that these fault system may form the NTO massif. The swarm near the Kairei vent field has very shallow events at the far side from the vent. This may imply a sea-water input area of the hydrothermal system.

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 Project, hydrothermal field, seismicity, crustal structure, NTO massif

