

Seismic structure and seismicity at the southern Mariana Trough with hydrothermal activities

Toshinori Sato^{1*}, Mariko Mizuno¹, Hiroyoshi Takata¹, Tomoaki Yamada², Takehi Isse², Kimihiro Mochizuki², Masanao Shinohara²

¹Graduate School of Science, Chiba University, ²Earthquake Research Institute, University of Tokyo

1. Introduction

The Southern Mariana Trough back-arc spreading system shows asymmetry spreading, and has high relief at spreading axes, which infers abundant melt supply. Furthermore, five hydrothermal vents that extrude different water contents, exist within 5 km near the spreading axis. To investigate upper mantle structure, crustal structure and hypocenter distribution provide important constraint on following four main points to understand the back-arc spreading system; 1) imaging melt delivery to the spreading axis and off axis seamount including volcanic arc, 2) production and character of the crust, 3) relationship between melt supply and crustal formation, and 4) pathway and heat source for hydrothermal circulation with related to its formation.

2. Observation and analysis method

We conducted a seismic reflection/refraction survey and seismicity observation at the hydrothermal area in the Southern Mariana Trough from August to November in 2010. We used 9 ocean bottom seismometers, an air gun (GI gun) and a single channel streamer cable. We took 7 parallel lines and 7 perpendicular lines to the spreading center. Line length was 15 km each, and line interval was 2.5 km.

In analysis of refraction data, we firstly made 2D cross sections of survey lines A1, A4, A7, B1, B4 and B7 using the progressive model developing method (Sato and Kennett, GJI, 2000). Then we made 3D initial models and conducted 3D inversion using FAST (Zelt and Barton, JGR, 1998).

3. Results

In refraction analysis, we used more than 9000 P-wave arrivals (hand picked). In 3D inversion, RMS was reduced from 120 ms (initial model) to 30 ms (after 10 iterations). The result of 3D inversion shows low velocity at the central part of the spreading ridge and high velocity under the off axis seamount. The high velocity under the off axis seamount suggests thick layer 3 and past magma intrusion from the mantle. The reflection survey shows that some reflectors exist under the hydrothermal area. From seismicity observation, we obtained very low seismicity at the hydrothermal area in the 3 month's observation. This suggests that hydrothermal activities are not related to tectonic stresses.

Acknowledgements

We thank the captain and the crew of R/V Yokosuka of Jamstec for their support. This work was supported by JSPS KAKENHI Grant Number 20109002.

Keywords: TAIGA, hydrothermal area, crustal structure, Mariana trough