Three dimensional resistivity structure around Amakusa to Minami-Shimabara aseismic zone

*Koki Aizawa[1], Kazunari Uchida[1], Yuko Tsukashima[1], Yuhei Yuasa[2], Dan Muramatsu[2], Yuto Yamamoto[2], Agnis Triahadini[2], Shiori Fujita, Tasuku Hashimoto[2], Keita Chiba[1], Satoru ANIYA[2], Kaori Tsukamoto[3], Yoshiko Teguri[3], Katsuaki Koike[4], Hisashi Asaue[4], Shinichi Takakura[5], Ryokei Yoshimura[6], Ken'ichi Yamazaki[6], Shintaro Komatsu[6], Takao Koyama[7], Hiroshi Ichihara[8], Tohru Yoshinaga[9]

1. Institute of Seismology and Volcanology, Faculty of Sciences, Kyushu University, 2. Department of Earth and Planetary Sciences, Graduate School of Science, Kyushu University, 3. Japan Meteorological Agency, 4. Graduate School of Engineering, Kyoto University, 5. National Institute of Advanced Industrial Science and Technology, 6. Disaster Prevention Research Institute, Kyoto University, 7. Earthquake Research Institute, The University of Tokyo, 8. Earthquake and Volcano Research Center Graduate School of Environmental Studies, Nagoya University, 9. Faculty of Engineering, Kumamoto University

In the upper crust of central Kyushu, a distinct aseismic zone exists enclosed by 20 to 30 km band-like active seismic activity. The aseismic zone stretches from Amakusa islands to southern part of Shimabara peninsula. One of the possible reasons for this kind of aseismic zone is the local high temperature that exceeds brittle-ductile transition around 400 ˚C. However, no remarkable geothermal activities exist on the aseismic zone, while the Quaternary volcanoes (Unzen, Kimpozan, and Akai), and the geothermal activities (e.g., Hinagu and Obama hot springs) exist outside of the aseismic zone. Because electric resistivity is sensitive to the presence of fluids, imaging resistivity structure of aseismic zone leads to know how fluids relate to the seismicity. To investigate the cause of the aseismic zone we conducted broad-band magnetotelluric (MT) surveys around the aseismic zone. Three-dimensional inversion by combining MT data of 110 sites on approximately 100 km x 100 km region shows a distinct high resistivity body that well corresponds to the shape of the aseismic region. We interpret the high resistivity body as an old solidified magma (plutons). The existence of pluton is consistent with the suggestion from the modeling of GNSS and seismic data (Yuasa et al., 2020). Because the pluton is so hard, it may not generate earthquakes at the central part on it, and also may impede the ascent of deep hot fluids, thereby volcanoes and geothermal zone are formed around the pluton. This idea is consistent with the suggestion from the other regions (e.g., Aizawa et al., 2014, Bedrosian et al., 2018).

Acknowledgments

We are greatly indebted to the land owners for their permission for field campaigns. The geomagnetic data used for the remote-reference processing were provided by the Kakioka Geomagnetic Observatory of JMA. This work is partly supported by Ministry of Education, Culture, Sports, Science and Technology of Japan under its Earthquake and Volcano Hazards Observation, and Research Program, and Earthquake Research Institute, the University of Tokyo under Joint Usage Program.

