Three-dimensional resistivity structure and volcanic activity of Iwo-yama, Kirishima volcanoes, Japan

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In Iwo-yama, Kirishima volcanoes, some anomalous phenomena have observed since 2013 (e.g. increase of earthquakes since 2013, occasional volcanic tremors since 2014, appearance of fumaroles, ground inflation since 2015, and small eruption in 2017), and all suggest volcanic unrest. In this study, we combined the high-resolution 3-D resistivity structure by broadband magnetotelluric (MT) survey with precise hypocenter relocation. MT data were collected in 2015, 2016 and 2017 around Iwo-yama, and the MT response functions (0.002~3000 s) of total 43 sites were estimated. To relocate hypocenters, we employed the double difference method (Waldhauser and Ellsworth, 2000) by using the velocity structure from active seismic survey (Tomatsu et al., 1997). The result shows that the shallow earthquakes (at a depth of 1 km to 3 km) occur beneath an electrically conductive layer (at a depth of -0.8 km to 1 km) that is interpreted as a hydrothermally altered clay-dominated layer. Moreover pressure source detected by precise leveling survey (Morita et al., JpGU 2018) is also located on the base of this conductive layer. It means that volcanic fluids capped beneath the low-permeable clay layer triggered the earthquakes and ground deformation since 2013. Probably, this is the first study that the location of a clay layer corresponds to hypocenters not only in the vertical direction but also in horizontal direction. So we suggest that the cap structure of electric conductive clay layer controls the entire shallow volcanic activity in Iwo-yama.

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