Volcanomagnetic effect observed at Kuchierabujima Volcano

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1. Introduction

Phreatic eruptions had been repeatedly occurred at intervals of several to a few tens years around Shindake crater of Kuchierabujima Volcano since the oldest historic eruption in 1841. Recently, eruption activity ceased after the latest fissure eruption in 1980. However, swam activities were observed in 1996 and in 1999 just beneath the crater, which worried that the volcanic activity would reactivate in the near future. In this context, various geophysical and geochemical researches were conducted as the Joint Observation Campaign of Kuchierabujima Volcano in the fiscal year of 2000. We installed three overhauser magnetometers at the summit area and the geomagnetic total intensities have been recording at 5 minutes intervals since August 2000 (Kanda et al., 2001). The objective of this study is to detect the heat supply, which is high temperature enough to decrease magnetization of rocks, to the preparation area of phreatic explosion. In this paper, we will present some results from the total geomagnetic field observation over two years and discuss the thermal state of the shallow part of Kuchierabujima Volcano.

2. Volcanomagnetic variation

Geomagnetic total intensities observed at the south of Shindake crater have shown decreasing tendency since the spring season in 2001. In general, the observed geomagnetic total intensity in the volcanic circumstances involves variations of various origins, so that we have to extract volcanomagnetic one. Three components geomagnetic fields recorded at Kakioka geomagnetic observatory (JMA) were used as the reference data together with the local total intensity to eliminate the stationary components from time series of site differencing data by application of a prediction filter. As a result, it was revealed that decrease of the total intensity begun in April or May 2001 at a site (C1) just south of Shindake crater, subsequently at other site (B1) located at about 1km south of Shindake. Change at B1 reached to about the same amount as that of C1 not later than the middle of October 2001. After cease of the change for about a month, the total intensities at both sites resumed decreasing at nearly the same rate. If these changes in total intensities result from the change in the subsurface thermal state, the mechanism should be thermal demagnetization of rocks. It is certain that the demagnetization begun around the underground of Shindake crater. When we consider the locations of the demagnetization and the sites that show decreasing tendency, usual interpretation by an equivalent magnetic dipole is difficult to explain the amount of changes for both sites. Instead, laterally extended demagnetization area should be considered. Although interpretation is limited to qualitative one by now, we will construct a quantitative model in time and space on the basis of temperature dependences of rock samples and magnetic structure inferred from an aeromagnetic survey conducted on January 31, 2001 (Utsugi et al., 2002).

References

Kanda et al. (2001): Monitoring geomagnetic total intensity using satellite telecommunication at Kuchierabujima volcano, Annual. Disas. Prev. Res. Inst., Vol.44 B-1, pp.327-332.

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