

Geomagnetic field variations associated with enhanced volcanic activity at Kusatsu-Shirane volcano

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During the 2014 activity of Kusatsu-Shirane volcano, changes in the geomagnetic total intensity were observed by four proton precession magnetometers installed in the summit area. As a result of a careful treatment of the data, we found that those changes had occurred only for about three weeks in May, 2014. Using a simple differencing method from the data at Yatsugatake Magnetic Observatory of the University of Tokyo, we estimated that the amount of geomagnetic variations during that period was 1.1 nT at the maximum. The distribution of the estimated variations showed a spatial pattern suggesting demagnetization occurred at some depths beneath around the Yugama-Mizugama craters. The estimated changes in the geomagnetic total intensity were modeled by a magnetic dipole source under the assumption that the horizontal source location lies around the Mizugama crater. As a result, we found that a demagnetization source located at depths between 1000 and 1300 m below Mizugama crater satisfies the condition of the estimated changes in the geomagnetic total intensity. From several evidences of the enhanced volcanic activity such as a sudden increase of fumarolic temperature, and inflation of the ground, we infer that a sudden intrusion of the high-temperature volcanic fluids caused demagnetization of rocks beneath the Mizugama crater.

Keywords: Kusatsu-Shirane volcano, volcanic activity, geomagnetic field observation, thermal demagnetization, hydrothermal system