Aeromagnetic survey over Unzen volcano

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We conducted helicopter-borne magnetic surveys over Unzen Volcano, southwestern Japan on September 18, 2002 in order to investigate the subsurface structure of Unzen graben and the cooling process of the lava dome formed in the latest eruption spanning between 1991 and 1995.

Unzen volcano started a phreatic eruption in November, 1990 at summit craters after a quiescence of 198 years. After intensive ash ejection in February 1991, a lave dome appeared at the eastern neighbor of the previous peak of Mt. Fugen in May, 1991.The lava dome, named Heiseishinzan, gradually grew on the eastern flank of Mt. Fugen and yielded frequent pyroclastic flows until the surface activity ended in 1995.

The survey consists of three flights of 1 hour for each. The first flight covers an area over Futsu, Chijiwa, and Kanahama faults, the major normal faults that form Unzen graben system. The second and the third flights cover the summit area of Unzen volcano with spiral trajectories at altitudes of 1000 and 500 ft, respectively. The spacing between the survey lines is about 500 m. Geomagnetic total field was recorded by an optical pumping magnetometer (GEOMETRICS) and an Overhauser proton magnetometer (GEM) installed in and over the sensor bird, which is suspended with a wire of 20 m long under the airframe. The sampling intervals of these magnetometers are 0.1 sec and 0.5 sec, respectively. While real time navigation was achieved by a portable GPS receiver with a PC monitor, precise positioning data of the sensor bird was obtained by the differential GPS technique with a time resolution of 1 sec.

Diurnal magnetic variations of extra-terrestrial origin were removed by subtracting the total field data recorded at a temporal station nearby. As a next step, we estimated the effect of surface topography using a statistical correlation method (Grauch, 1987) in order to model a deeper magnetic structure. In the present study, we propose a plausible model of magnetic structure beneath Unzen volcano.

Main features of the magnetic map are positive anomalies on the summit area of the volcano (Heiseishinzan lava dome and Mt. Fugen) and a negative anomaly on Unzen hot-spring area.