Paleomagnetic study of Pumice fall deposit of the 1783 eruption of Asama-Maekake volcano

*Tatsuo Kanamaru[1], Kuniyuki Furukawa[2]

1. Department of Earth and Environmental Sciences, College of Humanities & Sciences, Nihon University, 2. Faculty of Business Administration, Aichi University

Thermal history of volcanic ejecta can be detected by paleomagnetic techniques by taking oriented samples from outcrops. The method of estimating emplacement temperature of pyroclastic density current deposit by contribution of diverse blocking temperature distribution is representative example. Cooling history of pyroclastic fall deposit should contain several volcanic processes from vent to deposition. However, it is commonly believed that pumices erupted during a Plinian eruption would cool rapidly in the cold troposphere immediately after the eruption. On the other hand, a historical drawing depicting the turmoil in Karuizawa town, located approximately 12 km southeast of the Asama-Maekake volcano during the 1783 eruption, suggests that red-hot pumice could have fallen in the area at that time. Paleomagnetic studies enable us to determine whether hot pumice really fell around the volcano during the eruption. However, in general, because of too small size of pumices and too fragileness of outcrops to use tripod orientater, it is difficult to collect oriented samples for paleomagnetic studies of pumice fall deposits. As a result, studies of this type are not often reported. In this study, we collected oriented pumice samples of various sizes (ranging from 2-10 cm in long axis) 4.4 km east of the vent for paleomagnetic investigations. We overcame the challenges posed by the samples' diverse grain size and fragility using a newly-invented orientation technique that with a crossed-line laser marking device. Stepwise thermal demagnetization indicates that, for most samples, with some exceptions, the lower temperature components of characteristic remanent magnetizations are 240-450 degrees Celsius. The smallest sample has the lowest temperature component, indicating a grain size effect on cooling before settling on the ground. Most of the samples show two or more components indicating fluctuation when settling and/or compaction during cooling. The presence of high temperature components also suggests that they were much hotter than those estimated from the low temperature components. Overall, the directions of the lower temperature components were somewhat scattered but were plot lower hemisphere in stereographic projection. Additionally, the average value did not concentrate at paleo-geomagnetic direction of 18th century. Our paleomagnetic results, mentioned above probably indicate that the pumice grains sustained surprisingly high temperature when falling and that it was accumulated as cooling. Although direct comparison may not accurately represent the natural phenomena because the distance from the vent to Karuizawa town is approximately three times farther than our sampling point, there is a possibility that the pumices depicted in the historical drawing was hot.

Keywords: Asama-Maekake volcano, Asama volcano, Maekake volcano, paleomagnetism, pumice fall deposit, emplacement temperature

