

Eruption style of phreatomagmatic eruption based on paleomagnetism and lithofacies -A case study of AD 886 Niijima eruption

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The AD 886 volcanic eruption of Mukaiyama volcano, Niijima was started phreatomagmatic eruption beneath shallow sea water and erupted Habushiura pyroclastic flow in the early stage. Habushiura pyroclastic-flow deposit is composed of several tens flow units which show various depositional lithofacies. As a result of field work, the flow units are mainly divided into characteristic tree type lithofacies, FR unit which is rich in fines and has grading structures and lamina structures, FD unit which is poor in fines and massive, and LPR unit which is composed of large pumice block. The FR units are continuous and distribute until the distal area. The FD units are not continuous and mainly deposited within 2 km from the vent. The LPR units are confirmed a few units within 2 km from the vent.

In this study, the emplacement temperatures of Habushiura pyroclastic-flow deposit are estimated by the paleomagnetic method to study the eruptional and depositional mechanism. 10 oriented lithic and pumice fragments were collected from each 14 flow unit (FR; 7 units, FD; 6 units, LPR; 1 unit). Remanent magnetizations of lithic fragments show a mixture of single and two stable characteristic remanent magnetizations (ChRM) as a result of progressive thermal demagnetization. The directions of single component magnetization and high-temperature component magnetization were scattered widely. The directions of low-temperature component magnetization with blocking temperature below 200 to 350 degree Celsius show coincident with the direction of the axial geomagnetic field in AD 886 suggesting that their emplacement temperatures are 200 to 350 degree Celsius. Remanent magnetizations of 4 or 5 pumice fragments from each FD unit and LPR unit have ChRM with blocking temperature below 200 to 300 degree Celsius and their directions show that they coincident with the direction of the axial geomagnetic field in AD 886, suggesting that their emplacement temperatures are 200 to 300 degree Celsius. While, pumice fragments in FR unit emplaced at ambient temperature because the directions of ChRM are scattered. In addition, the blocking temperatures of ChRM which coincident with the direction of the axial geomagnetic field at AD 886 for four samples collected from a large pumice fragment 1.2 m in diameter in the LPR unit are below 460 degree Celsius for inner part of samples and 300 degree Celsius for outer part of samples. It indicates that the core of the large pumice fragment emplaced at 460 degree Celsius. Remanent magnetizations above 300 degree Celsius of pumice fragments don't have ChRM and the remanent magnetization directions changed each demagnetization steps irregularly. To know this reason the reheating experiment was done. Two pumice fragments were reheated to 690 degree Celsius in the absence of magnetic field and cooled in the geomagnetic field in fixed for one sample and rolled irregularly for another sample to acquisition thermoremanent magnetization. Intensity of magnetization acquired in rolled sample is lower than another sample in fixed sample and shows the close to natural remanent magnetization before acquisition. Progressive thermal demagnetization shows that remanent magnetization of fixed sample have single component and remanent magnetization of rolled sample are changed the direction irregularly. It suggests that rolling pumice fragments acquired remanent magnetizations with different directions during transportation.

To conclude lithofacies and emplacement temperature, the FR units were formed by explosive eruption accompanied violent contact with water and the ejecta were cooled soon. FD units and LPR units were formed by relatively effusive eruption by a little contact with water and it was kept high temperature (200 to 300 degree Celsius). Lithic fragments were eroded at the vent area where are reheated by high-temperature magma, and then transported in pyroclastic flow and emplaced at 200 to 300 degree Celsius.