Formation process of the Omine pyroclastic cone in Niijima Island, Japan

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On the Niijima Island, rhyolitic eruption started in 886 with generation of the Habushiura pyroclastic density current deposits followed by the growth of the Omine pyroclastic cone and the emplacement of the Mukaiyama lava. Sedimentary structures, emplacement temperatures and ash morphology indicate the Habushiura pyroclastic density current deposits were generated by shallow marine phreatomagmatic eruption (Nakaoka and Suzuki-Kamata, 2015). In this study, we discuss the eruption style and development of the Omine pyroclastic cone with sedimentary features of the deposits and paleomagnetism of the essential rock fragments.

The Habushiura pyroclastic density current deposits constitute a plateau rising over 100 m above sea level and the Omine pyroclastic cone rises 200 m above the plateau with a basal diameter of 2.7 km, without any indication of significant time break between the Omine pyroclastic cone such as weathered zone and structural disconformity. The summit is relatively flat being covered with the Mukaiyama lava but at least, five craters are confirmed in the eastern half.

The eruption products contain block-sized to lapilli-sized poorly to moderately vesicular fragments and blocky to platy ash particles of biotite rhyolite with minor accidental fragments. Juvenile fragments contain elongate vesicles but have a bulk density of 1.6–1.7 g/cm^3, larger than 0.8–1.3 g/cm^3 for the Habushiura pyroclastic density current. These clasts are accumulated in the cone commonly to form massive, poor sorted beds abundant in ash with a thickness of several 10 cm to 120 cm thick.

Upon thermal demagnetization, magnetization direction of the juvenile fragments becomes stable and parallel to the direction of the Earth’ s magnetic field of that time below 350-400 degree C. This implies that the juvenile fragments were emplaced below 350-400 degree C and magnetized while being cooled to the ambient temperature, consistent with that block-sized juvenile fragments have prismatic cracks and are occasionally disintegrated along the cracks.

These results collectively suggest that the Omine tuff cones are composed of the pyroclastic density current deposits produced by explosive interaction between the hot lava and external water or gravitational collapse of lava. The Habushiura pyroclastic density current deposits are also interpreted as the products of explosive interaction between the hot lava and external water but its emplacement temperature is below 300 degree C as estimated also by thermal demagnetization (Nakaoka and Suzuki-Kamata, 2015). This perhaps reflects lesser extent contribution of the ambient water to the eruption of Omine pyroclastic cone. Pyroclasts, however, could accumulate to build a pyroclastic cone but exceptionally where wet in direct contact with water vapor (Aranda-Gomez and Luhr, 1996; Kano and Takarada, 2007).

