AD 1895 phreatic explosion products of the Zao volcano, NE Japan

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The Goshikidake (ca. 0.1 km^3) situated in the Umanose caldera (ca. 30 ka, 1.7 km in diameter) is a small pyroclastic cone. The crater lake Okama is in the western side of the Goshikidake. The Okama erupted at AD 1895, which caused a series of phreatic explosions. The erupted products are well preserved, however any volcanologic researches concerning the eruption phenomena have not been performed, except for the documentation of Kochibe (1896). By clarifying the geologic characteristics of these deposits, coupled with the documentation, we are trying to reveal the nature of this activity, which would provide useful information on preparing future coming eruptions. By the documentation, the explosions took place in Feb. 15-20, Aug. 22 and Sept. 27-28. On Sept. 27 and 28 the eruption of AD 1985 reached the climax. Eruption column were witnessed and probably small cone was formed during this event. Scoria (ca. 30cm in diameter) which ejected from the Okama crater on Sept. 28 reached to the outside of Umanose caldera.

The phreatic explosion products extended over an area with a diameter of 2 km. These are recognized as stratified layers composed of gray colored ash with various amounts of andesite, altered lithic fragment and scoria. The products are best preserved at the southwestern rim of the Okama crater, with the total thickness of ca. 5 m. At this outcrop, we divided the products into five layers (1 to 5). All the layers are observable in the vicinity of the Okama crater, although the thickness of these layers vary, tending thinner toward the topographic high. Layer 1 (ca. 6 cm in thickness) consists of mainly gray colored fine ash and well sorted. Scorious (less than ca. 5 cm in diameter) blocks showing bomb-sag structure. Layer 2 (ca. 5 cm) is composed of light gray colored ash which is coarser than the gray colored ash of layer 1. Rarely observed clasts are altered lithic fragments (less than ca. 8 mm). The upper and lower surfaces of the layer 2 show wavy structure. Layer 3 (ca. 25 cm) consists of massive tuff breccia with gray andesite, altered lithic fragments and scoria (less than ca. 4 mm) in gray colored ash matrix. Samples of layer 2 and 3 come in the overlapping area of the fall and surge fields in sorting vs. median diameter diagram. These features show layer 2 and 3 would be deposited from relatively diluted pyroclastic density current. Layer 4 (ca. 65 cm) and 5 (ca. 3 m) consist of massive tuff breccia with gray andesite, altered lithic fragments and scoria (less than ca. 25 cm) set in pale gray (layer 4) or dark gray (layer 5) colored ash matrix. The larger lithic fragments are sparsely distributed, except for the clast-enriched upper part of layer 5. The lithic fragments tend to be elongated laterally. The layers 4 and 5 are poorly sorted. In sorting vs. median diameter diagram, samples of layers 4 and 5 are plotted in flow or overlapping area of surge and flow fields. These data are suggesting layer 4 and 5 would be mostly deposited from higher concentration pyroclastic density current.

The AD 1895 phreatic explosion products are also recognized in places outside of the Umanose caldera, with their thickness of ca. 10 cm and 3cm at ca. 0.7 km and 1.4 km distance from the crater, respectively, and can not be divided into sub-layers. The layers consist of tuff breccia with gray andesite, altered lithic fragments and scoria (less than ca. 8 mm) in light gray colored ash matrix. Within ca. 1 km from the crater, the products show reverse grading and poorly sorted, and large ballistic lithic fragments showing sag structure are sometimes observed. No ballistic lithic fragments are recognized in the 1895 ejecta at localities of more than 1 km away from the crater.

It is probable that most of the layers, at least layer 3 to 5, were formed at the climax phase, and the products outside of the caldera are distal facies of layer 5.