

The initial deposit of the 1707 eruption of Fuji volcano, Japan

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The 1707 (Hoei) eruption is one of the few large-scale explosive eruptions at Fuji volcano. The eruption is considered to be important for preparation of hazard map and evacuation planning because of the damage of widespread fallout tephra. The eruptive history of the 1707 eruption has been studied based on distal fallout deposits and abundant historical records, and an eruption model starting from dacitic magma eruption and magma plumbing system have been discussed (e.g. Fujii, 2007). In recent years, the author's research has revealed that Mt. Hoei is a pyroclastic cone formed by the accumulation of volcanic ejecta, and it has become necessary to re-examine the sequence of the 1707 eruption (Baba et al., in press). We conducted a geological survey within 2-20 km east of the crater to investigate the eruptive events of the early stage of the 1707 eruption. As a result, we found that the black to dark-gray pyroclastic layer, which is located directly below the fallout white pumice layer (e.g., Ho-Ia: Miyaji, 1984) and have been reported such as black soil layer (e.g., S24-10: Uesugi, 2003), may be the initial phase of the 1707 eruption.

The black to dark-gray pyroclastic layer is composed of black to dark-gray volcanic ash and volcanic lapilli such as red to black scoriae and accessory materials. A small amount of light brown pumice (2-5 mm) and gabbro fragments (several centimeters) are also present. At the top and bottom of the pyroclastic layer, reddish brown volcanic ash layer with a thickness of about 5 mm can be seen. The black scoriae are well vesiculated and glassy. The black scoria and its fine-grained fragments, black to dark-gray volcanic ash, are considered to be the essential material. The results of EDS and EPMA analyses of the glassy part of the black scoria and the light brown pumice are within the chemical composition range of basaltic fragments (Ho-III and IV) and white pumice (Ho-Ia) in the 1707 fallout deposit, respectively.

The black to dark-gray pyroclastic layer is enriched in organic materials such as carbonized wood, and contains sclerotium grains in the area above 900 m asl. From the ¹⁴C age results of the carbonized wood and sclerotium grains, the stratigraphic position of the pyroclastic layer just below the Ho-Ia, and the chemical composition of the pyroclastic materials, the pyroclastic layer is considered to be the initial stage of the 1707 eruption. The upper surface of the pyroclastic layer is almost horizontal, while the base is wavy and covers the lower brown volcanic ash soil layer. This pyroclastic layer can be found Gotemba parking lot (~13 cm thick), 4.5 km east of the 1707 crater, and to Subashiri roadside station, 10.5 km east of the crater (~35 cm thick), but not eastward of the village of Omika, 17 km east of the crater. The results of grain-size distribution show a median grain size between -0.22 and 0.93 phi and a sorting coefficient between 1.96 and 3.01 phi. Because the thickness of the layer is not proportional to the distance from the source crater and the layer is deposited in troughs, the pyroclastic layer is considered to be flowing deposits such as pyroclastic flows rather than fallout deposits. In the lake sediments of Lake Yamanaka (YA-1), located about 15 km northeast of the 1707 crater, this layer is about 2 cm thick, suggesting that it diffused over a wide area.

Based on descriptions in historical documents, it is estimated that earthquakes continued from the night of Dec.15, 1707, and eruptions began at around 10 a.m. on the following day, Dec.16. According to Koyama (2009), although the reliability of the eruption events and times described in the historical records is still an issue, there are records such as "black clouds came out and covered the whole sky from

all directions" in Ikido, Oyama town at around 8 a.m. on Dec.16, and "stones and debris came down from the west, and there were many tremors and thunderstorms, and the sky and earth were all in darkness" in Yamanoshiri, Gotemba city. Since the villages of Ikido and Yamanoshiri are more than 17 km away from the 1707 crater, and the distribution of pyroclastic layers has not been confirmed yet, it is highly likely that this is an eyewitness account of how the eastern foot of Fuji volcano, including the village of Subashiri, was swallowed by pyroclastic flow deposits.

Our findings suggest that the black to dark-gray pyroclastic layer is a product of the 1707 eruption and that basaltic magma was erupted in the initial stage. We propose that the pyroclastic layer should be called Ho-Zero because it is directly covered by the Ho-Ia in the early stage of the eruption.

Keywords: Fuji volcano, 1707 eruption, initial deposit, hazard map