

New knowledge of eruptive sequence in Heian eruption of Towada volcano

HIROI, Yoshimi^{1*} ; MIYAMOTO, Tsuyoshi²

¹Grad.Sci.Tohoku Univ., ²CNEAS.,Tohoku Univ.

1. Introduction

Heian eruption is the latest activity at Towada volcano, in Heian period (eruptive episode A : Hayakawa,1985). This eruption has been started from Nakanoumi caldera lake (Kudo,2010) filled with lake water, and repeated magmatic and phreatomagmatic eruption alternately. The details of the eruptive sequence have already been shown by Hiroi and Miyamoto (2010), however, we got and report new knowledge about the activity of first plinian phase and the occurrence mechanism of large pyroclastic flow unit.

2. Ash layers within unit OYU-1

The first plinian pumice fall unit OYU-1 has a SW dispersal axis and it achieves 50km farther. OYU-1 in distal shows very well sorting and uniform grain size distribution , but we found plural outcrops that OYU-1 accompanies with fine ash layers within 12km from source vent. Two kinds of ashes are observed, one is a beige colored ash in the lower part of OYU-1. The thickness is about 1-8 cm, and dispersal area is SW-SSE. Others are gray colored ashes and intercalated in the upper part of OYU-1. Their thicknesses are about 1-3 cm, and each dispersal area is SW-SSW.

All of ashes are intercalated in pumice layer, and the boundary between pumice layer and ash one is almost clear. Because OYU-1 without ash layers in distal shows uniform grain size distribution, the extent of these ashes deposit is limited in narrow area if their ash had been accumulated during the plinian column formation. The clear boundaries between pumice and ash suggest that ash layers are not fall deposit accumulated for a long period, but flow deposit piled in a very short time. Ash layers can be found not only a valley, but the little highland such as a mountain ridge line. This feature of distribution shows that they are regarded as surge deposit.

Because the ashes intercalated with pumice layer in OYU-1 indicate the feature of density current, they are intra-plinian flow. As one of their origin these ashes are derived from small-scale density current by the partial column collapse. The dispersal area of the ashes is limited adjacent to source vent and just only the direction of dispersal axis. This tendency of distribution seems that it corresponds with the direction of strong wind of 22[m/s] blew.

On the other hand, the source vent within a caldera lake and the fine grain features of ashes indicate a possibility that ash layers are phreatomagmatic base-surge deposit. In that case the occurrence of magma-water explosion might be caused by satisfying a condition of magma-water ratio partially or temporarily on the surface of eruption column. Unit OYU-2, overlying OYU-1 pumice fall directly, is phreatomagmatic base-surge deposit. Thus these ash layers may be a precursor phenomenon of eruptive style transition.

3. Distribution and draining style of KPf

Kemanai Pyroclastic flow is the climax deposit of Heian eruption, the total volume is estimated about 5km³(Hayakawa,1985). KPf distributes only the south area of Towada caldera, except for Oirase River to east direction. The Towada caldera rim is lowest at southwest edge (630m above sea level). The highest outcrop of KPf on caldera rim is located in 760m. In spite of adjacent to the source vent KPf cannot be shown on Mt. Akaiwa(785m) on the south caldera rim. These distribution features suggest that KPf flew out over the lower part of caldera rim. KPf deposit has been regarded that it occurred by plinian column collapse of preceded unit OYU-3 (Matsu-ura et al.,2007,etc.). But the column collapse type pyroclastic flow can be accumulated in high-altitude, KPf seems to be piled on only lower portion. Thus KPf is not occurred by column collapse, but derived by currents over the lower caldera wall. This conclusion agrees with the new eruptive sequence by Hiroi and Miyamoto(2010), that the unit just before KPf is not plinian pumice fall OYU-3, but phreatomagmatic base-surge unit OYU-4 without higher eruption column.

Keywords: Towada volcano, Heian eruption, intra-plinian flow, Soufriere-type pyroclastic flow