GRAIN SIZE DISTRIBUTION AND BULK DENSITY OF PUMICES FROM 1257 AD SAMALAS ERUPTION PYROCLASTIC FALL DEPOSITS

*Alutsyah Luthfian[1], Atsushi Toramaru[1], Yasuo Miyabuchi[2]

1. Department of Earth and Planetary Sciences, Graduate School of Sciences, Kyushu University, Nishi-ku, 744, Motooka, Fukuoka 819-0395, Japan, 2. Faculty of Advanced Science and Technology, Kumamoto University, Kurokami 2-40-1, Chuo-ku, Kumamoto 860-8555, Japan

Samalas Caldera is a 6-km diameter crater, located near the Rinjani volcano in Lombok Island, Indonesia. The caldera was formed by the collapse of Samalas Volcano in ca. 1257 AD. The 1257 Samalas eruption sent out 170 megatons of sulphur dioxide (Vidal et al., 2016), which caused the worldwide climate disturbance for four years after the eruption (Alloway et al., 2017). The volume of erupted tephra was estimated to be 33–40 km3 dense-rock equivalent (Vidal et al., 2015). Vidal et al. (2018) also had analyzed the geochemistry of rocks from Samalas –Rinjani volcanic system. From the geochemical analysis, they conclude that the magma feeding the volcanic system has evolved from high alumina basalts to the trachydacite via fractional crystallization. The evolution process happened during the last 12,000 years before the 1257 eruption.
Previous researches on 1257 Samalas Caldera-forming eruption highlighted the social, geochronological and geochemical aspects of the event, with little emphasis on its physical aspect. Assessing the physical aspects of 1257 Samalas Eruption helps us getting a more complete picture on how the event proceeds through the time. Vidal et al. (2015) has estimated the plume height and mass discharge rate of various phases in 1257 Samalas eruption. In the present study, we try to assess the physical aspects of the 1257 Samalas eruption using grain size distribution (GSD) and pumice bulk density data. Samples were collected in pyroclastic fall deposits of the 1257 Samalas tephra at two localities, locality 1 and locality 5. Locality 1 is located 25 km northwest of the Samalas Caldera, and locality 5 is about 32 km southwest the Samalas Caldera.
In both localities 1 and 5, we found the general stratigraphy consistent with the results by Vidal et al. (2015) description, except for the early stage of fall units, P1-PF and P2-PF1. Vidal et al. (2015) could distinguish the P1-PF and P2-PF1 by means of grading structure and qualitative lithic content. According to Vidal et al. (2015), the P1-PF is reversely graded and "shows enrichment in lithic clasts towards the top", and P2-PF1 is normally graded and has abundant lithic clasts. However, our field observation in locality 1 and 5 failed to see such grading structure in P1-PF and P2-PF1 layer. We also observed that the lithic content remains constant throughout P1-PF and P2-PF1 there. Thus, we propose P1-PF and P2-PF1 to be combined into one "first pumice fall" layer. P1-PF and P2-PF1 corresponds to the lower and upper part of our "first pumice fall" layer, respectively.
In locality 1, we analyzed the "first pumice fall" GSD using samples taken from eight sublayers spaced around 2 cm. In locality 5, we took samples from five sublayers spaced around 15 cm to construct the "first pumice fall" GSD. The GSD of the first pumice fall in locality 1 shows that the median grain size (Mdϕ) decreases until the middle part of the layer, then increases upward. The GSDs of the second and third pumice fall layer (P2-PF2 and P3-PF1 layer of Vidal et al. (2015), respectively) also show the upward increment in Mdϕ values. In the locality 5, GSDs of the first and second pumice fall layer show decreasing Mdϕ value upward. The sorting coefficient ($\sigma\phi$) of all pyroclastic fall deposits in first and fifth localities range from 0.54 to 0.86.
After the results of pyroclastic fall's GSD analysis, we selected pumices with length between 4 mm and 8 mm for bulk density measurement. We selected 229 pumices from locality 1 and 40 pumices from locality 5. Our data shows that, in the similar size range, average pumice density increases from second pumice

fall toward the fourth pumice fall (P3-PF2 layer of Vidal et al. (2015)). In the "first pumice fall" layer, the pumice density decreases toward the top. We consider that the decreasing density in the "first pumice fall" is caused by the segregation effect during settling in the atmosphere.

Keywords: Samalas Caldera, grain size distribution, bulk density

