Stratigraphic variation in characteristics of pyroclastic deposits in the 2011 subplinian eruptions of Shinmoedake volcano

Yu Iriyama[1], Atsushi Toramaru[1], Tetsuo Yamamoto[2]

[1]Kyushu University, Japan, [2]Hokkaido University, Japan

E-mail: iriyama.yu.808@s.kyushu-u.ac.jp

In general, a stratigraphic variation in characteristics of size distributions of pyroclastic deposits may reflect temporal behavior of eruption intensity. However, there is no quantitatively established methodology to link the stratigraphic variation and the temporal behavior of eruption intensity because of the complex coupling of several processes: eruption column dynamics, fallout process, and sedimentation. In case of old eruption's deposits, there is no detail such as accurate eruption evolution because they were not monitored at that time, and erosion process disguises the original stratigraphic variation. Fortunately, we have a chance, namely three subplinian phases of the 2011 Sinmoedake eruption, Kirishima volcanos, which promise the minimum influence of loss of fine materials. Furthermore different sources of observations concerning the eruption evolution by satellite images can be available in order to give additional constraints. This opportunity allows us to observe original stratigraphic variations of pyroclastic deposits and to compare our results and the other observations.

We collected samples at three localities, Takachihogawara (Tg; about 2 km far from vent), Miike elementary school (Mk; about 7.5 km far from vent), and Natsuo elementary school (Nt; about 11 km far from vent). In order to observe the temporal change of deposits, we divided the whole deposit into several to ten layers in sampling. We conducted grain size analysis for each layers by using sieves and the statistical analysis for obtained grain size distribution based on Inman (1952). As a result, characteristics of stratigraphic variation of grain size distribution in terms of median or mean show two peaks at Tg and Mk, and one peak at Nt. At all localities, peak positions of median or mean in the whole deposits are almost same, but totally these values shift finer with distance from the vent. Values of variance are nearly same at any distance and stratigraphic height.

Assuming that a single plinian eruption makes a single peak of median or mean of grain size distribution, analyzed deposits correspond to two subplinian eruptions. Together with isopach data by AIST (The National Institute of Advanced Industrial Science and Technology) and satellite image (Meteorological Agency), we conclude that the pyroclastic deposits at the sampling localities correspond to two plinian eruptions of 26th (16:10-18:35) and 27th (02:10-04:40). Furthermore the variation of a single eruption is also observed; first the values of median and mean become coarser, and then they become finer.

To explain the stratigraphic variation of grain size distribution of pyroclastic deposits, we formulate a model which relates the size distribution function as function of height at deposits, to initial size distribution and sorting process during settling. We will consider the cause of variation of median or mean and the relationship with eruption column dynamics and transportation in future.