Development of automatic volcanic ash sampler - Application to Suwanosejima Volcano -

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Fine ash particles are often produced at early stages of volcanic eruptions. By using electron probe microanalyzer (EPMA) or secondary electron microscope (SEM), we are now technically able to derive relevant information for predicting subsequent eruptive activity from these tiny products of eruptions (eg. Hatae et al., 1996). However, because of their small volume and of short duration of these events, most fine ash particles are scattered away in the air and are rarely preserved as detectable deposit in geological time scale in the distal area from craters. It must be useful if such ash particles as precursors are sampled correctly and investigated readily before catastrophic eruptions.

On the other hand, there are some active volcanoes in Japan that emit ash particles continuously for years, such as Sakurajima and Suwanosejima Volcanoes since 1950's. Although only a small amount of ash is emitted at each event in such activities, total mass of the product is comparable to those of some giant eruptions in historical age. For instance, although Sakurajima Volcano emit ash particles only in the order of 10^4 tons per event, the total mass of ash emitted during recent 50 years of activity amounts up to 10^8 tons, which is comparable to those of giant eruptions in 1914 and 1946. As significant part of these fine ash particles are considered to be essential materials, investigation of these ash samples must serve us many important evidences about evolution of magmatic system beneath the volcano. In addition, by combining with phenomenological observation and with geophysical data during events, we should obtain many constraints on the relationship between eruptive phenomena and magmatic conditions at depths. These constraints must be useful for modeling and understanding ascent mechanism of magma in conduit, and dynamics of eruption cloud for such small scale eruptions.

So far, however, there have been few studies that discussed these subjects by continuous sampling of ash particles because of the danger in the proximal area and of the inconvenience in logistics in these fields. In such view points, we now started development of automatic ash sampler such that we can obtain ash samples readily and continuously with accurate time of sampling. We are developing the sampler putting emphasis on following three points; (1) automatic sampling at correct time, (2) compactness with light and small body as well as long term sampling, and (3) durability to ash and rain. In order to satisfy these requirements, we assembled mechanical sliding slit above sample cases (30 pieces) powered by DC motor, and controlled by digital timer (Model-02).

We set the sampler on October 17, 2003, at the summit of Suwanosejima Volcano. This is because Suwanosejima is the most active in Japan in recent few years with successive ash emission every month (more active than Sakurajima), and that we had already sampled ash particles in the deposit by hand soon after the event and investigated thin sections of them by EPMA and SEM (Shimano, 2003). Although there are some troubles yet because of hard condition at the summit, it will be a powerful instrument for volcanology, and thus we are now modifying the sampler putting emphasis on the full-water & ash proof, and simplification of mechanical parts.