Automatic sampling system of eruptive materials for active volcanoes

Taketo Shimano[1]

[1] Fuji-Tokoha Univ.

Ultimate goal for understanding volcanic eruptions would be predicting all aspects of eruptions. There are two types of complexities; diversity in types and time evolution pattern of eruptions. For the diversity in eruption types, we know now that explosive eruptions are resulted from insufficient degassing whereas effusive eruptions are from sufficient degassing, even if the magma for both types are the same at depths. However, we are still unsure about the processes that control the difference among respective eruption types like Hawaiian, Strombolian, etc. In terms of predictability, prediction of an eruption a few days before its beginning has been successful sometimes (eg. the 2000 eruption at Usu volcano), as a consequence of thick accumulation of knowledge about the volcano by many observational approaches. But at most volcanoes including these lucky cases, it is still very difficult to predict the sequence, or time evolution, of the eruption. Thus, it is important, for understanding the mechanism which generates the diversity of eruption, to obtain detail description of eruptions as time series of quantitative data.

We are now developing automatic sampling system of eruptive materials (bombs, lithics, essential; ASSEMBLE). The system consists of two sub-systems; sampling system and observation system. Main purpose of the sampling system is to collect eruptive materials automatically at dangerous localities during eruption, and we developed automatic ash sampler that collects 30 samples in one cycle with a time interval that we can preset. The observation system consists of some cameras with three targets; vent condition, in-situ condition of ash deposition, and plume height (VIP), because information of these targets is fundamental for interpreting data of the eruptive products. Since most characteristic phenomena occur at active vents, observation of surface manifestations like jets and thermal activities are very important information to characterize the event. As deposition of volcanic materials is not a simple phenomenon. For instance, reworked deposit may form during interval between active stages. Deposition rate at a certain location may not be constant throughout one stage. Thus, to confirm the depositional condition of the automatically sampled materials, camera is set near the sampling machine. Plume height is one of a few fundamental data that relate both theory and observation in terms of dynamics and energetics at least for Plinian eruptions; plume height is a function of heat release rate, or eruption rate of magma. So it would be easier way to compare new observation of different eruption types with the Plinian cases for understanding the mechanism. As a whole system, we are going to relate surface observation and eruptive materials in higher time precision than before, and give constraints on the explosion and heat transfer mechanisms of eruptions. We are now testing the system at active volcanoes in Japan.