

Precursory activity and evolution of the 2011 eruption of Shinmoe-dake in Kirishima volcano-insights from ash samples

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After a precursory phreatic stage (2008 to 2010), the 2011 Shinmoe-dake eruption entered a phreatomagmatic stage on January 19, a sub-Plinian and lava accumulation stage at the end of January, a vulcanian stage in February-April, and a second phreatomagmatic stage in June-August. We examined ash samples from all the stages (Suzuki et al., in review for EPS, as of February, 2013). Component ratio, bulk composition, and particle size of the samples helped us define the eruptive stages. The juvenile particles were first found in the January 19 sample as pumice (8 vol%) and were consistently present as scoria and pumice particles thereafter (generally -50 vol%, decreasing in weaker events). The January 19 pumice has water-quench texture. After the lava accumulation, particles of that lava origin came to account for 30-70 vol% of the ash. The second phreatomagmatic stage is proposed because of fine ash and long eruption period. The SiO₂ contents of bulk ash are lower in post-January 19, 2011 eruptions, reflecting lower average SiO₂ contents in 2011 ejecta than in past ejecta. The free-crystal assemblages were two pyroxenes + plagioclase + Fe-Ti oxides until 2010; olivine joined the assemblage in 2011, when juvenile ash was erupted. This change is consistent with the absence or smaller sizes of olivine phenocrysts in past ejecta forming the volcanic edifice.

Aside from these scientific results, we also emphasize the importance of continuous observation of ash samples, for monitoring ongoing eruptive activity and forecasting activity change. As far as we know, ash characterization was the only method which detected the change of eruptive activity before the sub-Plinian event in the 2011 eruption; first detection of juvenile material in the January 19 sample showed that magma was rising to shallow depth. The continuous ash sample observation starting from a period of low activity (August 2008-June 2010 in the Shinmoe-dake 2011 case) helps us detect appearance of juvenile material.

Keywords: Volcanic ash, Shinmoe-dake, bulk ash composition, component ratio, particle size distribution