

Pre-eruptive magmatic processes leading to Aso-4 caldera-forming eruption

*Toshiaki Hasenaka¹, Kousuke Shiihara², ATSUSHI YASUDA³, Natsumi Hokanishi³, Yasushi Mori⁴

1. Center for Water Cycle, Marine Environment and Disaster management, Kumamoto University, 2. Graduate School of Science and Technology, Kumamoto University, 3. Earthquake Research Institute, University of Tokyo, 4. Kitakyushu Museum of Natural History and Human History

We measured compositions of plagioclase and pyroxenes and their melt inclusions from the precursory eruption products of 89 ka Aso-4 caldera-forming eruption. Aso-4 was the largest (VEI=7) of the four caldera-forming eruptions of Aso volcano, Kyushu island. Precursory eruptions include Omine pyroclastic cone and associated Takayubaru lava flows which erupted ca. 1,000 years before Aso-4, and Aso-ABCD tephra which erupted 9,000 years before Aso-4. Tephra units of Aso-A, B, C and D have no soils between the four, thus are considered as a series of continuous eruption.

Despite similar compositional trends observed in bulk rock chemistry, melt inclusions from Aso-ABCD tephra, those from Omine cone, and those from Aso-4 main eruptions show compositional trends distinct from all the others. Silica content of melt inclusions varies from 70-72 wt.% for Aso-ABCD, 67-70 wt.% for Omine, and 73-74 wt.% for the earliest subunit of Aso-4, followed by 71-74 wt.% for the next and voluminous subunit. Melt inclusions from Aso-ABCD tephra show similar composition to 123 ka Aso-3 tephra. Plagioclase also shows distinct compositions between Aso-ABCD, Omine, and Aso-4. Orthopyroxene and clinopyroxene often show a disequilibrium relationship in terms of Fe-Mg exchange.

When all the data are considered, a remnant of Aso-3 magma reservoir was possibly still active 9000 years before Aso-4 eruption. Magma reservoir for Omine was similar to Aso-4, however different compositional trend indicate a subsidiary reservoir to Aso-4 main one. Eruption of Aso-4 started from the top of most silica-rich part of a main reservoir, followed by mixing products of layers from a compositionally zoned large reservoir.

Keywords: Pre-eruptive magmatic processes, caldera-forming eruption, Aso volcano, Omine pyroclastic cone, Aso-ABCD tephra