Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SVC53-01 Room:301A Time:May 21 09:00-09:15

Petrological significance of Takayubaru lava flow, a precursory event of Aso-4 caldera-forming pyroclastic eruption

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Contrasting type of eruption occurred close in space and time, in central Kyushu, 90,000 years ago. Omine pyroclastic cone and associated voluminous Takayubaru lava flow was formed just before Aso-4 caldera-forming eruption, 5 km west of caldera rim. The lava flow is 80-120 m thick, extends 9 km E-W, 4 km N-S, and has a volume of 2.0 km^3. It forms a flat plateau on which Aso-Kumamoto airport has been built. Aso-4 tephra overlies Takayubaru lava flow without recognizable soil formation. Reported K-Ar ages for Takayubaru and Aso-4 are nearly identical, also supporting a short interval time between the two.

We analyzed lava samples collected from the edge of Takayubaru lava flow and drilling core samples provided by Kumamoto River National Highway Office. We added scoriae collected from Omine cone and compared them with Aso-4 pyroclastic products in order to find changes in physical or chemical conditions leading to the contrasting eruption types.

All the analyzed samples were two-pyroxene andesite and dacite. They all include microphynocrsyt-size hornblende, varying from fresh to completely opacitized, suggesting a later crystallization event than phenocryst stage of pyroxene, plagioclase and opeque mineral crystallization. Most plagioclase phenocrysts show characteristic fractured texture, indicating melting along cleavage. Some of the groundmass shows inhomogeneous appearance. Silica content varies from 63 to 66 wt. % for lavas, and 61 to 66 wt. % for scoria samples, all of which are high-K. In contrast, Aso-4 pyroclastic products are bimodal. Mafic member contains basalt to basaltic andesite scoriae (49-56 wt. % SiO_2), whereas silisic member contains dacite pumice (65-72 wt.% SiO_2). Thus, our result shows that mafic magma did not erupt during the formation of Omine cone and associated Takayubaru lava flow, as opposed to a sequence of magmas erupted during Aso-4 event. Formation of hornblende, and decomposition of plagioclase suggest an important clue to physical changes that caused evacuation of felsic magma before Aso-4 eruption. Location of Omine cone on the active Futagawa fault suggests a possible precursory event including earthquakes caused by the fault movement.

Keywords: Takayubaru Lava, Omine volcano, Aso volcano, Aso-4 pyroclastic eruption, precursory event, Futagawa fault