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高圧実験と斑晶メルト包有物に基づく三宅島火山大船戸期のマグマ供給系
Magma plumbing system in Ofunato stage of Miyakejima volcano based on high-pressure experiments and melt inclusion study

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Miyakejima is an active volcanic island located about 200 km south of Tokyo in Izu-Mariana arc. Forecasting future eruptions of Miyakejima is important, and precise knowledge on its magma pluming system is essential. Tsukui et al. (2001) divided the volcanic activity of the last 10000 years into four stages: 10000-7000 (Ofunato Stage), 4000-2500 (Tsubota Stage), 2500 y.B.P to AD1154 (Oyama Stage) since AD1469 (Shinmio Stage). Products of the Ofunato stage are basalts and they are relatively primitive. On the other hand, products in Tsubota Stage are andesites and those in the later three stages are mixed products of basalt and andesite. To understand the evolution of the magma plumbing system, first I reconstruct the simple magma chamber in Ofunato Stage by high-pressure experiments and also analyzed major elements and volatile contents in melt inclusions of phenocrysts of products in Ofunato stage in order to confirm experimental results.

OFS scoriae, which are one of the least fractionated Miyakejima basalt in Ofunato stage, were used. Phenocrysts of OFS are only plagioclase (10.9 vol.%) and olivine (0.7 vol.%). Core composition of plagioclase phenocrysts is 90 to 96 % An. Core composition of olivine phenocrysts is 78 to 82% Fo. Fig,1 shows melt composition of OFS, composition of melt inclusions (MIs) in olivine and plagioclase phenocrysts and bulk composition of eruptive products in the last 10,000 years. The chemical composition of the melt inclusions in olivine were corrected for post entrapment crystallization by adding a host olivine component up to the composition which satisfies olivine˜melt equilibrium, KD = 0.30.

Most compositions of MIs in olivine were plotted near the melt composition of OFS (gray circles in Fig.1) indicating that melt of OFS is in equilibrium with phenocrysts of olivine. Small numbers of MIs in olivine was more primitive than the other, therefore low-evolved magma may have mixed. MIs in plagioclase were not corrected for post entrapment crystallization so that their compositions are scattered (gray squares in Fig. 1)

Experiments were performed in the temperature ranges of 1050-1200C at 1.0, 1.5, 2.0, 2.5kbar using IHPV at the Magma Factory, Tokyo Tech. Based on the experimental results (phase relation, mineral composition) and petrology of OFS (modal composition and core compositions of phenocrysts), magma chamber in Ofunato Stage was reconstructed. The magma chamber was located at 5˜6km depth (˜1.5kbar) and water-rich (˜3 wt.%) basalt magma crystallized olivine and calcic plagioclase (which is the typical phenocryst assemblage throughout Ofunato Stage) at ˜1100C under NNO-buffer. Estimated depth of OFS magma chamber (ca. ˜7000 YBP) is equal to that of the shallow magma chamber in 2000 eruption (Saito et al. 2005, 2010). Accordingly, it is suggested that magma chamber survived through time in spite of two caldera forming stages.

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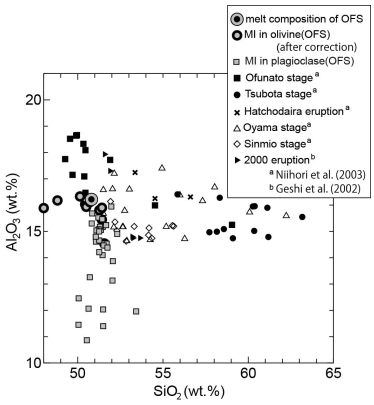

Fig.1
Composition of melt inclusions (MIs)(this study) and OFS melt. Bulk rock compositions by previous workers (Niihori et al. 2003 and Geshi et al. 2002) are also plotted.