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高圧実験から探る富士火山深部マグマ溜り
Deep magma chamber beneath Fuji volcano estimated from high-P experiments

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Fuji volcano, the largest in volume and eruption rate in Japan, is located at the center of Honshu, where North America, Eurasia and Philippine Sea plates meets. Because of the significance of Fuji volcano both in tectonic settings and potential of volcanic hazard (particularly after the M9 earthquake in 2011), precise knowledge on its magma plumbing system is essentially important. Very frequent LF-earthquakes occur at about 15 km beneath Fuji volcano (Ukawa 2007). Seismic tomography beneath Fuji volcano suggests the existence of large magma chamber below 20 km (Nakamichi, 2007). Fuji volcano has released only basalt ($>$750 km^3) which has narrow range of SiO_2 (SiO_2 = 49-53 wt.%) in the last 100,000 years. Some incompatible elements show more than a factor of 2 variations (Takahashi et al., 2003). Variation in incompatible elements may be due to some kind of magma fractionation process. Fujii (2007) proposed that the silica-non enrichment trend of Fuji volcano is explained by pyroxene dominate fractionation in the deep magma chamber. Primary purpose of this study is to reproduce the silica non-enrichment trend by high-P experiment and reveal PT conditions and water content of magma in the deep magma chamber.

Basalt scoria Tr-1 which represents the ?nal ejecta of Hoei eruption in AD1707, was adopted as a starting material. This is because 1) 0.7km^3 of magma was discharged by subplinian eruption within 2 weeks, 2) Basaltic Hoei scoria is homogeneous, apyric and representing melt composition. Internally heated Ar-gas pressure vessels (IHPV-5000 and IHPV-8600) at the Magma Factory, Tokyo Institute of Technology were used. The f_{O2} was controlled at NNO buffer.At 4 kbar (equivalent to the depth of LF earthquakes), experiments were carried out at temperatures of 1050, 1100 and 1150 C, with H_2O contents of 1.3, 2.7 and 4.7 wt.%, respectively. At 7 kbar (equivalent to the inferred depth of Fuji magma chamber by seismic tomography; around 25 km depth) experiments were carried out at temperatures of 1075, 1100 and 1125 C, and H_2O contents of 1.0, 1.1, 3.6 and 6.3 wt.%, respectively.

Quenched run products were analyzed with EPMA. Run products from 4 kbar experiments always include magnetite and melt composition shows silica enrichment trend (SiO_2 increases with increasing K_2O). In the phase diagram at 7 kbar, multiple saturation point of opx+cpx+pl+melt exists on the liquidus at around 1120 C, 3.5 wt.% H_2O, which is the likely condition of the top of the Fuji magma chamber at the time of Hoei eruption. Melt compositions at 7 kbar shows silica non-enrichment trend until magnetite starts crystallization. Vanadium partitions strongly into magnetite ($D_V{}^{mt/melt}$ is about 20 at the NNO buffer, Toplis et al., 2002) and therefore it is a good indicator of magnetite crystallization. Judging from high vanadium content in Fuji basalts, magnetite does not crystallize in the deeper magma chamber. Origin of the monotonous basalt magma production in Fuji volcano may be due to the absence of shallow level magma chamber. Because plate boundary exists at 3-5 km beneath Fuji volcano, shallow level magma chamber may be short-lived due to high-stress and large crustal deformation.

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