メルト包有物から推定する桜島火山のマグマ溜まり深度

Depth of pre-eruptive magma reservoir of Sakurajima Volcano estimated from melt inclusions

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To interprete magmatic processes of the ongoing Vulcanian explosions and to forecast possible future activity in Sakurajima Volcano, determining pre-eruptive magmatic conditions of the historic eruptions, especially depths of the magma reservoirs, is crucial. We therefore analyzed volatile contents and major element compositions of melt inclusions (MIs) and their host phenocrysts in the three historic Plinian eruptions (1471 A.D., 1779 A.D., and 1914 A.D.) and recent Vulcanian eruptions (1955-present).
The water contents of 110 MIs were analyzed with a FT-IR micro-reflectance spectroscopy (Yasuda, 2014). Most of the pyroxene-hosted melt inclusions (MIs) were dacitic to rhyolitic (SiO_2 = 65-72 wt.%) and gradually shifted to mafic compositions with time as observed for bulk rock compositions after the 1471 eruption (Uto et al., 2005; Nakagawa et al., 2011). The water contents of the MIs in the three historic Plinian eruptions have similar frequency distributions ranging from 1.2 to 3.5 wt.%. More than 95% of the data were within 1.2-2.9 wt.%. By contrast, those of melt inclusions in the recent Vulcanian ejecta were less than 2.3 wt.%. The lower maximum water content of the erupted materials of the Vulcanian explosions compared to those of the Plinian eruptions are interpreted as a result of degassing before quenching upon eruption. The MIs containing up to 40 ppm CO_2 were rarely found (Sato et al., 2012, JpGU), but most of the MIs did not contain detectable CO_2 content. The saturation pressure for the water content of 1.2-2.9 wt.% was calculated at 15-73 MPa, which corresponds to the depth of 0.6-3.1 km assuming that density of the upper crust is 2400 kg/m^3. The depth of the shallowest magma reservoir estimated from the geodetic observations on the present Vulcanian explosions are located at a depth of 4 km beneath the Minamidake summit (Iguchi et al., 2013), which is deeper than the depth ranges for most of the MIs (0.6-3.1 km) and in accordance with the maximum depth (4.1 km, corresponding to 3.5 wt% H_2O). Considering the erupted volumes of these Plinian eruptions (0.3-0.8 km^3 for the Plinian eruptions and 0.8-2.0 km^3 including lava flows in DRE, Kobayashi et al., 2013), the obtained depth range (2.5 km) may be largely explained by the difference in the position of the magma reservoir.

キーワード：桜島火山、マグマ溜まり、メルト包有物、含水量
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