Geophysical Research Abstracts
Vol. 20, EGU2018-6267-3, 2018
EGU General Assembly 2018

The variation of plagioclase aspect ratio in alkaline dolerite bodies in Atsumi district, northeastern Japan

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To clarify the cooling rate of magma body is important in considering the timescale of magmatic processes such as mass transportation or compaction. Recently, Holness (2014) found that there is a negative correlation between the average aspect ratio of plagioclase and the crystallization time in five sills and a lava lake of relatively similar chemical composition (tholeiitic basalt-basaltic andesite; e.g. the 130m-thick Portal Peak sill has SiO_2 of 52.4-54.8 wt%, MgO of 3.1-6.6 wt% and Na_2O+K_2O of 2.8-3.3 wt%; Hergt 1989) and showed that the aspect ratio of plagioclase has the potential to become a speedometer in magmatic intrusives. However, the influence of magma composition on the variation of plagioclase aspect ratio has not been much discussed in the paper. Therefore, in order to inspect it, we conducted petrography, X-ray fluorescence analysis for whole-rock chemistry, the measurement of the plagioclase aspect ratio and the calculation of the crystallization time on two alkaline basalt bodies in Atsumi area, northern Japan (the 130 m-thick Kayaoka alkali dolerite sheet and a 6.3 m-thick intrusive body in Hakusan Island; Kushiro 1964, Tamiya et al. 2010). Also we compared stratigraphic variation between average aspect ratio of plagioclase and bulk rock composition in Kayaoka sheet in order to investigate relationship between average aspect ratio of plagioclase and magmatic process. As a result, the following results were obtained for plagioclase from the two intrusive bodies: (1) The average aspect ratios (major axis length / minor axis length) are about 3.8-5.6 and 6.4-9.8 for the Kayaoka sheet and the intrusive body in Hakusan Island, respectively. (2) There is a negative correlation between the average aspect ratios and the calculated crystallization times in the two bodies, except for the marginal regions of the igneous bodies. (3) In the Kayaoka sheet, the average aspect ratio increases from the central part towards the top and bottom but decreases again only in the lowermost few meters. (4) Bulk rock composition in Kayaoka sheet has SiO_2 of 49.6-51.5 wt%, MgO of 6.3-9.5 wt% and Na_2O+K_2O of 3.7-5.8 wt%.The features of (2) and (3) are the same as those reported in Holness (2014). However, compared between sills of comparable thickness, the plagioclase aspect ratios in alkaline basalt body are significantly larger than those in tholeiite basalt body in Holness (2014). This may be owing to the influence of magma viscosity on diffusion coefficient.