Effects of K2O content of magma on the crystallization differentiation trend

Reiko Makiyama[1], Takeru Yanagi[2]

[1] Earth and Planetary Sci., Kyushu Univ., [2] Earth and Planetary Sci., Kyushu Univ

There are two differentiation trends in the non-alkalic igneous rocks series: iron-enrichment is of tholeiitic and iron-depletion is of calk-alkalic trend, respectively (Miyashiro, 1974). From previous experiments, FeO* contents of melt increase until magnetite crystallization which produces SiO2-enrichiment and FeO*-depletion. It is possible to be regarded as the melt composition before magnetite crystallization is of tholeiitic and after that is of calk-alkalic trend.

Miyashiro (1974) referred to the relation of K2O content of volcanic rocks in arcs with the thickness of the underlying crust. Summarized experimental data, a liquid with higher contents of K2O crystallized magnetite at higher temperature and melt fraction. In this study, to investigate the relation of K2O content and compositional changes, the crystallization trends of primary basaltic compositions with different K2O contents were calculated under 1 atm and the constant oxygen fugacity using Ghiorso and Sack (1995). The calculation results in SiO2 v.s. FeO*, FeO*/MgO-SiO2, MgO-FeO*-(Na2O + K2O) and SiO2 v.s. CaO & (Na2O + K2O) diagrams showed that melt compositions with more K2O content shifted from tholeiitic to calk-alkalic trends because the promortion of magnetite crystallization by K2O results in less FeO* and rapid SiO2 enrichment. The calculations suggest that the primary basalts with more K2O content tend to have the melt compositions of more calk-alkalic trends in the same crystallization condition.