Mechanism of myrmekite formation deduced from petrological evidence and steady-diffusion modeling:case of Okueyama granitic body

Takashi Yuguchi[1]; Tadao Nishiyama[2]

[1] Grad.school of sci.and tech.Kumamoto univ.; [2] Earth Sci.,Kumamoto Univ.

Myrmekite is a ubiquitous texture in metamorphic and granitic rocks, however, the genesis of myrmekite has been an enigma. It is not easy to investigate the formation of myrmekitic textures in metamorphic rocks in detail, because they have undergone deformation. This paper studies myrmekite in the Okueyama granitic body(OKG) which shows no evidence of later deformation.

The mechanism of myrmekite formation is examined based on two kinds of textures: one is myrmekite and the other is a reaction rim, both of which formed by sub-solidus reaction between plagioclase and K-feldspar in OKG. Myrmekite is an intergrowth texture consisting of vermicular quartz and sodic plagioclase, while the reaction rim texture occurs as an albite-rich rim in plagioclase free of vermicular quartz. Myrmekite is relatively rare in the granitic body, whereas the reaction rim occurs ubiquitously. There is a close relationship between myrmekite and the reaction rims as shown by a composite texture consisting of both zones. Myrmekite and the reaction rim formed during the deuteric coarsening stage(below 500^{o}C), and the extents of them are good indicators of constraining the model of magmatic cooling process for OKG(Yuguchi and Nishiyama, 2007).

The overall reactions for myrmekite formation and the reaction rim formation are derived from the lines of petrological evidence such as chemical compositions of two textures and the volume fraction of vermicular quartz in myrmekite(0.4 in maximum). The overall reactions for two textures imply that 1)myrmekite will form when some amounts of silica flows into the intergranular medium, 2)the reaction rim will form when the inflow of silica is smaller than that required for the myrmekite formation, and 3)the more the inflow of silica into the intergranular medium becomes, the more the volume fraction of vermicular quartz in myrmekite increases. Thus the difference between myrmekite formation and the reaction rim formation results from the amounts of silica inflow into the intergranular medium.

The steady-diffusion modeling(Johnson and Carlson,1990), based on each of overall reaction equations, defines the range of the ratio of phenomenological coefficients (L-ratios) and the boundary reactions during myrmekite formation and the reaction rim formation, respectively. The results show that the volume fraction of vermicular quartz in myrmekite depends on the combination of L_{AlAl}/L_{CaCa} and L_{AlAl}/L_{NaNa} and the inflow of silica into an intergranular medium between myrmekite and K-feldspar, that is, myrmekite with high volume fraction of vermicular quartz formed under condition of high values of L_{AlAl}/L_{CaCa} , L_{AlAl}/L_{NaNa} and silica inflow, and the formation of the reaction rim does not depend on the values of L_{AlAl}/L_{CaCa} , L_{AlAl}/L_{NaNa} , and L_{AlAl}/L_{SiSi} , but on the inflow of silica into an intergranular medium between plagioclase and K-feldspar.