Cooling process of the Okueyama granitic body deduced from the extents of sub-solidus reactions. Okueyama, Kyushu, Japan

Takashi Yuguchi[1]; Tadao Nishiyama[2]

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

We examined extents of sub-solidus reactions during cooling process of a granitic body, the Okueyama granitic body (OKG), central Kyushu, Japan. The aim of the study is to quantify a difference in cooling duration according to the depth within a single magma chamber by studying the variation of the extents of subsolidus reactions such as myrmekite formation and exsolution in feldspar (perthite formation). OKG offers a good example for the study, because it represents a zoned pluton of which mineralogy and chemistry have been well studied (Takahashi,1986).

Sub-solidus reactions

We observed systematic increments of the extents of sub-solidus reactions according to the altitude, corresponding to the depth within the magma chamber. We found (1)The mean width of myrmekite between plagioclase and K-feldspar changes from 10 μm at the roof to 100 μm at 950 m below the roof, (2)the mean width of albite lamellar in perthite ranges from 10 μm at the roof to 230 μm at 950 m below the roof, (3)the volume fraction of the lamellar varies from 0.013 at the roof to 0.278 at 950 m below the roof, and (4)the mean spacing between neighboring lamellars changes from 35 μm at the roof to 138 μm at 950 m below the roof.

(1)-(4) increase systematically downward from the roof boundary of the pluton, but never show any systematic changes horizontally from the wall boundary. Hornblende - plagioclase geothermometer (Blundy and Holland,1990)gives about 710°C for core compositions and about 610°C for rim compositions. The temperature interval will give the condition for the sub-solidus reactions under which diffusion is effective.

Cooling process

Above observations imply that OKG was cooled effectively and gradually from the roof. We estimated the duration of cooling from 710°C to 610°C by using the mean spacing of neighboring albite lamellars in perthite. The characteristic diffusion length equation $Dt/L2 = 0.5$(Brady and Yund,1983) gives 50 yrs at the roof and 800 yrs at 950 m below the roof with a systematic downward increment.