Oral | Symbol S (Solid Earth Sciences) | S-CG Complex & General

[S-CG61_2AM2]Petrology, Mineralogy and Resource Geology

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Fri. May 2, 2014 11:00 AM - 12:45 PM 311 (3F)
We widely invite presentations in the fields of petrology, mineralogy and resource geology. Especially description of minerals and rocks, investigation of their origin and evolution by field investigation and/or laboratory experiments, and development of new methods are accepted.

12:15 PM - 12:30 PM

[SCG61-P13_PG]Phase relation in ternary feldspar system at high temperature

3-min talk in an oral session
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Keywords:ternary feldspar, phase relation, high temperature experiment

During cooling of rocks or by change of chemical composition of feldspar, feldspar transforms to other polymorphs and forms various micro-textures. Observing micro-textures of feldspar is a useful approach to give a constraint to the thermal history of the rock. It has been known that the feldspars in ultrahigh-temperature (UHT) metamorphic rocks have ternary feldspar (Tfs) composition and those have the various and complex microtextures. However, the occurrence and the formation process of micro-textures in Tfs had not been studied in detail and they could not be interpreted by the widely used phase diagram with 2nd-order C2/m-C-1 phase transition at high temperature. And furthermore, although many experimental studies were performed, with respected to the phase relation on the plagioclase feldspar and alkali feldspar systems, the detailed experiments for the phase relations in the An-Ab-Or ternary feldspar system were restricted and its phase relations still remain ambiguous. Due to the high crystallization temperature of ternary feldspar (Tfs), Tfs would preserve the information about thermal history in more detail than those recorded on alkali feldspars and plagioclase feldspars. Previous thermodynamic studies on the C2/m - C-1 phase transition (Kroll et al., 1980; Salje et al.1985, Carpenter, 1988) were carried out using the in situ powder X-ray experiments on pure Ab compositions. Due to the spatial resolution of analytical instruments, they missed the formation of the micro-texture on C2/m - C-1 phase transition. In this study, high temperature and high pressure experiments were carried out to decide the phase relation at high temperature including the phase relation between the C2/m and the C-1 in the An-Ab-Or ternary feldspar system at 1100 - 1300C and 10 kbar. We reveal the formation process of complex micro-textures of Tfs in UHT metamorphic rock by the present phase diagram. We employed mixture of powdered lamellae-free oligoclase and sanidine crystal as starting materials. Bulk composition of starting materials was prepared by varying ratio of oligoclase and sanidine. We focused whether micro-textures derived from the C2/m - C-1 phase transition were formed or not. Experimental products were observed using field emission scanning electron microscopy (FE-SEM, JEOL JSM-7001F) and annular dark-field scanning transmission electron microscopy (ADF-STEM, JEOL

JEM-2100F) to observe micro-textures.Exsolution lamellae by a compositional gap between the C2/m and the C-1 which has near (010) interface, were observed in the run products synthesized at 1100 - 1200C. This result strongly suggests that the C2/m - C-1 transition is the first order phase transition. Moreover, the glass phase was observed in run products synthesized at 1250 - 1300C. From these experimental results, we propose the phase diagram on the Olg (An25Ab75) -Or pseudo-binary. Napier Complex in northern Enderby Land, East Antarctica is one of the most famous regional ultrahigh-temperature (UHT) metamorphic terranes in the world. Although Tfs in Napier Complex has the complex microtextures (e.g., Harley 1985; Sheraton et al. 1987; Hokada, 2001), the occurrence and the formation process of micro-textures in Tfs have not been understood in detail. By the phase diagram obtained in the study, the formation process of Tfs in the felsic gneiss and the micro-texture in Tfs were revealed as following process. At first heterogeneous distribution of Olg, Tfs, and myrmekite-like textures were result of melting of the felsic gneiss and following crystallization. And then, the peak metamorphic temperature is estimated to be at least 1200 - 1250C. At the cooling process, the complex exsolution textures of Tfs are composed of (010) coarse lamellae derived from C2/m - C-1 first order phase transition and (-901) fine lamellae derived from spinodal decomposition.