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Reexamination of phases of feldspars at high temperature and pressure.

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The feldspar is common rock forming mineral composed by $CaAl_2Si_2O_8$(An)-$NaAlSi_3O_8$(Ab)-$KAlSi_3O_8$(Or). Although the chemical composition of feldspar is commonly in plagioclase (An-Ab) or alkali-feldspar (Ab-Or), the ternary composition (An-Ab-Or) is possible composition and these ternary feldspars have unique textures in the case of ultra high temperature metamorphism, such as Napier Complex. We researches the micro-textures of the ternary feldspars in the felsic gneiss (TH97012006, hereafter shortened to 12006) from Mt. Riiser-Larsen in Napier Complex, East Antarctica and revealed the formation process. But it became apparent that the chemical compositions did not agree with tielines of the geothermometer-model (Fuhrman et al., 1988) and some micro-textures were not explained by coherent elastic boundary model (Cahn, 1962; Willaime et al., 1974). Therefore, Kodama et al. (2010) suggested that the coherent elastic exsolution model used by Fuhrman et al. (1988) would not be explained the texture observed in this study and the phase transition from high temperature to low temperature phase were first order.

Therefore, we focus on the behavior of chemical composition in the high to low temperature phase transition at near $An_{30}Ab_{70}$ composition and run the high temperature and the high pressure experiments of ternary feldspars using piston cylinder apparatus to determine the order of the phase transition because there is discontinuity of chemical composition and volume when first-order transition occurs, on the other hand, there is no discontinuity of chemical composition or volume when second-order transition occurs. Scanning electron microscope and energy-dispersive X-ray spectroscopy were used to observe the textures and determine chemical composition of the feldspars obtained from the experiments. Transmission electron microscope was used to observe the microtextures and determine the space group of the feldspars. We observed the discontinuity of chemical composition as characteristic of the first-order transition is observed in an oligoclase experimented at 1300C, 10kbar for 24 hours and this result suggested that the phase transition between high and low temperature phase had the first order.

Keywords: ternary feldspar, high temperature and pressure experiment, ultra high temperature metamorphism