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Exsolution textures in alkali feldspar from the Ohgi tonalite

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Electron petrographic study of exsolution textures is performed on alkali feldspar in porphyritic granitic rocks from the Ohgi tonalite, which is one of the Late Cretaceous-Paleogene granitoids in the San' yo zone, Southwest Japan, distributed between Kyoto and Shiga Prefecture. Alkali feldspar occurs as subhedral to anhedral prismatic crystals (ca. 200 um in long) in matrix of the orthopyroxene-bearing porphyritic granitic rocks described by Takaya et al. (2009). Most of the crystals are partially or wholly altered. The unaltered alkali feldspar whose the chemical composition is $Or_{57-71}Ab_{24-38}An_{1.8-3.1}Cn_{0.4-3.4}$ containing up to 1.8 wt % in BaO displays the chemical zoning in Cn component; the composition in core is high, toward the margin Cn content decreases and rim is almost free in Cn. Various exsolution textures can be observed in the crystals in accordance with the chemical zoning in Cn component.

The core part is clearly composed of several parts on the basis of the textural feature; one characterized by the presence of the relatively-coarse exsolution lamellar intergrowth and the other by the fine exsolution lamellar intergrowth with no coarse lamellae. TEM observation of the coarse intergrowth (bulk composition: $Or_{58-61}Ab_{34-37}An_{2.1-2.5}Cn_{2.9-3.3}$) reveals that the interface between lamellae is linear and sharp, and the periodicity of the intergrowth is irregular, the fact of which implies that the coarse intergrowth was formed due to nucleation and growth mechanism. In the fine lamellar intergrowth (bulk composition: $Or_{57}Ab_{38}An_{2.2}Cn_{2.6}$), in contrast, the interface between lamellae is sharp and wavy, and the periodicity of the intergrowth is regular, suggesting that the fine intergrowth was formed by proceeding with spinodal decomposition mechanism. In the rim, on the other hand, the apparently-homogeneous regions can be occasionally observed in addition to the coarse lamellar intergrowth. TEM observation in this region (bulk composition: $Or_{62}Ab_{36}An_{1.9}Cn_{0.5}$) was clarified to be a presence of the fine lamellar intergrowth whose texture is similar to that of the fine lamellae in the core, that is, the fine lamellar intergrowth in the Cn-poor rim suggests to be formed by spinodal decomposition.

These electron petrographic observations reveal that two distinct exsolution textures, each of which was formed by the different mechanisms (nucleation and growth and spinodal decomposition), are coexisting in a single crystal of alkali feldspar, which can be explained by a small difference in the Or component (almost same Cn) even by a simple cooling process. Furthermore, it is suggested that Or-rich limb in spinodal curve shifts to Or-poor side by increasing with Cn content because the bulk composition of the lamellar intergrowth formed by spinodal decomposition is Or-richer at low Cn content in comparison with high Cn content. This present tendency is concordant with that suggested by Lagache and Catel (1992) and Viswanathan (1992).

Keywords: alkali feldspar, exsolution texture, spinodal decomposition, nucleation and growth, celsian, Ohgi tonalite