TEXTURAL EVOLUTION OF THE PYROXENE-SPINEL SYMPLECTITE FROM THE HOROMAN PERIDOTITE COMPLEX, HOKKAIDO, JAPAN

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ABSTRACT

The Horoman peridotite contains pyroxene-spinel symplectites, which are thought to be after garnet (Takahashi and Arai, 1989). The symplectite consists of clinopyroxene, orthopyroxene and spinel and typically occurs in spinel lherzolite lithologies. Examination of the bulk composition of the symplectite reveals that their composition is well expressed in terms of mixtures of pyropic garnet and forsterite components. Although the mineral and bulk chemical compositions of the symplectite are rather constant among studied samples, their texture is variable in terms of grain size, grain shape and spatial relationships among the constituent minerals. We tried to quantitatively characterize these textural features and variations by means of SEM observations combined with digital image analysis aided with a personal computer. In particular, spatial correlations among minerals were measured using the method of Morishita and Obata (1995). Based on the scale parameters defined from the spatial correlations, a hypothesis on the structural evolution of the symplectite is proposed as follows.

The primary garnet was first transformed into a single phased, highly-aluminous pyroxene, which was thermodynamically metastable. Subsequently this aluminous pyroxene started to be decomposed into two-phase mixtures of Ca-rich and Ca-poor pyroxenes. The pyroxene domain structure continues to grow as time goes. At some time during the coarsening of the pyroxene composites, Al-Cr spinel started to nucleate preferentially on the grain boundaries of the two pyroxenes and rapidly grew along the grain boundaries. The excess Al and Cr that was desolved in the pyroxenes reacted with the forsterite component supplied by diffusion from the surroundings to form the Al-Cr spinel. Since the appearance of the spinel and the establishment of phase equilibrium in spinel lherzolite facies, the texture continued to evolve. The pyroxene domain structure continued to grow, while spinel grains became more spherical to minimize the surface energy without significantly changing their positions, resulting in a gradual loss of spatial correlations between the spinel and the two-pyroxene grain boundaries. The proposed evolutionary scheme well explains the textural diversity observed among the Horoman symplectites.

REFERENCES

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