UHT metamorphism of felsic gneiss

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Felsic orthogneiss is a common constituent in granulite-facies terrane. Because of its relatively simple mineral assemblage which being stable over wide P-T range, felsic gneiss has been thought as not so useful for discussing the metamorphic conditions and processes. Geochemical characteristics of felsic orthogneiss can be used for evaluating the original magmas. It is, however, not always easy to assess the effect of compositional modification, even if minor, during the high-grade metamorphism. This study aims to discuss the UHT metamorphic processes including the chemical behavior controlled by fluid and/or partial melting based on the chemical composition and texture of feldspars in felsic orthogneiss from the Napier Complex, Antarctica.

Six orthogneiss samples used in this study have mineral assmblages of Opx+Qtz+Fsp(+Cpx) with minor Zrn, Ilm, Mt and Ap. Feldspars show antiperthitic or mesoperthitic exsolution textures. Pre-exsolution one-phase compositions, which can be indicative of peak metamorphism, of these feldspars have been estimated using the method described in [1]. Exsolutuion lamellae are commonly restricted in core-mantle of the feldspar grains, and the lamella-free area is developed in the rim. Thus, the pre-exsolution one-phase compositions have been recovered for (a) the lamella-bearing core, and for (b) the feldspar whole-grain. Three 'tonalitic' samples give the feldspar core (an:ab:or=20-28:53-56:17-28) and whole grain (an:ab:or=24-29:58-63:13) compositions, and other three 'granodioritic' samples show core (an:ab:or=15-17:37-48:36-48) and whole grain (an:ab:or=18-20:45-56:24-37) relations. According to feldspar solvus model proposed by [2], the estimated pre-exsolution feldspar core compositions were stable over >950-1100°C, and whole grain compositions were at >900-1050°C. The compositional differences between feldspar core and whole grain are considered to results from one (or some) of the following possibilities: 1) Feldspar core-rim chemical variation is a sort of compositional zoning, and the orthoclase-poor (lamella-free) rim post-dated the core. 2) Whole grain had been once homogeneous at the metamorphic peak, and the drop of orthoclase content has been controled by the element diffusion toward the rim during cooling. 3) Later fluid infiltration might have played a role in the partial removal of K_2O component in the feldspar rim. 4) Feldspar grains may have been precipitated from partial melt, and the change of feldspar composition is subject to the coexisiting melt.

References

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