

Multiple partial melting events in the contact aureole of the Reinfjord ultramafic complex, Seiland Igneous Province, Northern Norway

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The Reinfjord ultramafic complex is one of the largest layered peridotite and gabbro plutons in the Seiland Igneous Province. The ultramafic rocks have been emplaced in the lower part of the Sørøy Succession of Kalak nappe complex and developed a distinct contact aureole in the gneissic country rocks. The protoliths of the contact metamorphic rocks include psammite and semipelite, which had deposited as shallow-marine sediment on the Baltica continental margin of the Iapetus Ocean. Mineral compositions, microtexture features, and pseudosection modeling demonstrate a complex metamorphic history for the Reinfjord meta-sediments. Zn-rich hercynite, corundum and sillimanite inclusions in garnet porphyroblasts suggest an early staurolite-bearing assemblage that had formed prior to the contact metamorphic event.

The presence of two generations of former melt has been identified using the Cathodoluminescence microscopy. Two generations of melt, now present as Qtz, Pl and Kfs, can be related to biotite dehydration melting and partial re-melting of the first crystallized melt, respectively. Two garnet generations are recognized: Large garnet porphyroblasts could be a peritectic product phase formed by incongruent melting of biotite. In contrast, garnet overgrowths might have been generated by reaction of the first garnet generation and the later granitic melt. Retrograde hydrous reactions are indicated by biotite-replacing garnet, muscovite formed by water-rich melt crystallization and rare cordierite pseudomorphs.

In conclusion, peak contact metamorphism has been achieved with the assemblage Grt + Opx + Sil + Pl + Kfs + Qtz + melt formed by biotite dehydration melting at 800-850 °C, 4.5-5.0 kbar, which was then overprinted by the solidification of hydrous melt at a late cooling stage. The subsequent metamorphism event represented by melt films along the grain boundaries of large Qtz, Kfs, and Pl crystals and the second garnet generation, might have taken place in the melting field of hydrous granite at 800 °C, 7.0-7.5 kbar. The above two metamorphic events correspond to the Proterozoic intrusion of ultramafic complex and the Caledonian collision-related thrusting.