



The length scale of eclogitization in dolerite of the Hustad igneous complex in the northernmost UHP domain of the Western Gneiss Region in Norway

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The collision of the continents Baltica and Laurentia around 425 Ma ago resulted in the formation of the Caledonian Orogen. The western margin of the Proterozoic basement rocks of Baltica experienced ultrahigh-pressure metamorphism. Part of this western margin of Baltica is now exposed in the Western Gneiss Region (WGR) of Norway. Local occurrences of micro-diamond indicate that pressures reached up to 4 GPa. Within 12 kilometer distance of the Svartberget micro-diamond locality dolerites crosscutting the Proterozoic Hustad igneous body preserve primary igneous assemblages that did not record pressures higher than 1.5-1.6 GPa. No structural evidence of a major tectonic contact that can explain this pressure difference between the two has been recognized. In the dolerite the metamorphic overprint is only present as rims of garnet and secondary clinopyroxene.

Determining the pressure (P) - temperature (T) history of exhumed metamorphic rocks is fundamental to the understanding of orogenic processes. Thermodynamic calculations based on experimentally calibrated mineral reactions provide a tool to obtain P-T information of rocks from their mineralogy, mineral-chemistry and bulk-rock chemistry. The geological significance of such calculations is currently under discussion due to conflicting P-T results, as well as disequilibrium assemblages and textures observed in rocks from the same outcrop and even in the same thin section.

The scale at which rocks reach equilibrium depends on the length scale of diffusion which in turn depends on temperature. For each system under consideration there is a critical temperature below which equilibrium for the complete system is not reached on geological time scales. This thermal closure may occur when cooling during exhumation is too fast compared to the speed of chemical diffusion.

Alternatively, rock mechanics may play a key role in the kinetics of mineral reactions. If the viscosity of the rocks is high, volume producing mineral reactions may not have enough space to proceed on the geological time scale. This mechanical closure depends on the viscosity of rocks which also varies with temperature. However the length scale at which equilibrium will be reached is different. In this study the thermal versus mechanical length scale of equilibrium is evaluated for the partly eclogitized dolerites of the Hustad igneous complex in the WGR.