Metastability and HP metamorphism at fluid deficient conditions, an example from the Bergen Arcs (Western Norway) *Poster*

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In the Lindæs Nappe, Bergen Arcs Western Norway, Precambrian granulites facies anorthosites (P<10 kbars, T=800°C) and their Caledonian eclogite (P<17 kbars, T=700°C) and amphibolite facies equivalents alternate on meter scale. It has recently been suggested by Camacho et al. (2005) that the granulite facies anorthosites, remained at low temperatures (350°C) and were only locally heated to 700°C and reacted to eclogites by spasmodic hot fluids. This is in contrast to previously published models (Austrheim 1987) where the fluid-triggered mineral reactions in a terrain that was at 700°C during the Caledonian Orogeny. In the latter model the dry granulites metastably survive the Caledonian HP/HT metamorphic event at 425 Ma.

In pristine granulites, occurring adjacent (less than 1 m distance) to the completely eclogitised parts, visible Caledonian metamorphism is very limited. Reactions are confined to local (15 m wide kyanite, zoisite, garnet and K-feldspar aggregates and feathery intergrowth of K-feldspar and zoisite growing on plagioclase-plagioclase grain boundaries. In addition 0.1 to 0.5 mm thick coronas are observed around spinel and corundum that is embedded in plagioclase (Fig. 1). During progressive reaction/fluid availability these reaction rims (coronas) become thicker and change their mineral assemblage from garnet, omphacite, kyanite to omphacite, amphibole, kyanite. In addition to these changes, plagioclase transforms to an increasing amount of fine-grained zoisite and phengite needles. The little H_2O needed to facilitate these transformations is provided from the breakdown of primary hydrous phases like scapolite and hornblende that are typically found in the granulites.

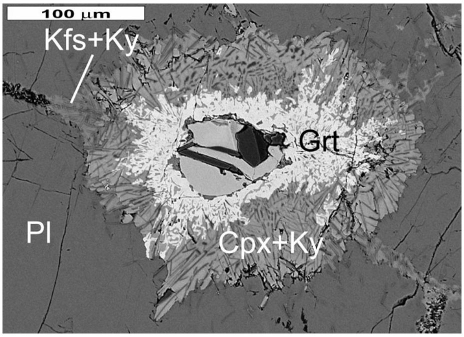

Figure 1: Eclogite facies garnet-omphacite-kyanite corona around spinel/corundum embedded in a plagioclase groundmass within an otherwise unreacted granulite facies anorthosite. The grain boundaries between plagioclase grains show tiny growth of K-feldspar and kyanite.

Based on the above described textural and chemical characteristics (e.g. the occurrence of omphacite and garnets rich in Alm and Grs component, distinctly different to the granulite facies mineral compositions), that can be observed in the most pristine granulites we suggest that these coronas and can be assigned to the Caledonian metamorphism. This in turn means that also the least reacted granulites record the same P–T conditions as are recorded in the adjacent eclogites but not the same fluid

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conditions. The little water needed to balance the zoisite formation on the micro scale can be balanced by the breakdown of hydrous primary phases (hornblende and scapolite). These 'granulite facies' anorthosites remained fluid deficient compared to their fully equilibrated eclogite facies equivalents. Fluid deficiency and meta-stability at metamorphic conditions as recorded by the nearby eclogites explain the observed close occurrence of granulites and eclogites.

The granulites from the eclogitised areas in the Lindæs Nappe contain sufficient amounts of fluid to record the high-pressure event on the microscale. However, these signs of metamorphism are easily miss-interpreted as of lower grade origin. Extending our observations to a completely dry bulk composition it is inferred that such a rock will miss all signs of the Caledonian metamorphism and that the first metamorphic mineral assemblage will first form when fluid is introduced.

References

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