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Garnet and clinopyroxene pseudomorphs: example of local mass balance in the Caledonides of western Norway.

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The Precambrian granulite facies rocks of Lindås Nappe, Bergen Arcs, Caledonides of W.Norway are partially hydrated at amphibolites and eclogite facies conditions. The Lindås Nappe outcrop over an area of ca 1000 km^2 where relict granulite facies lenses make up only ca 10%. At Hillandsvatnet, garnetite displays sharp hydration fronts across which the granulite facies assemblage composed of garnet (70%) and clinopyroxene (30%) is replaced by an amphibolite facies mineralogy defined by chlorite, epidote and amphibole. This setting allows us to assess the mechanism of fluid transport through an initially low permeability rock and how this induces changes of texture and element transport.

The replacement of garnet and clinopyroxene is pseudomorphic so that the grain shapes of the garnet and clinopyroxene are preserved even if when they are completely replaced.

This requires that the reactive fluids must pass through the solid crystal grains and this can be achieved by an interface coupled dissolution-precipitation mechanism. Porosity generation is a key feature of this mechanism (Putnis and Austrheim 2012). The porosity is not only a consequence of reduction in solid molar volume but depends on the relative solubilities of parent and product phases in the reactive fluid. Putnis et al. 2007 and Xia et al. 2009 have shown that even in pseudomorphic reactions where the molar volume increases, porosity may still be generated by the reaction. This is fundamental in understanding the element mobility and the mass transfer in a low permeability rock even more when the bulk rock composition of these two rocks stay unchanged; except a gain in water during amphibolitisation. The textural evolution during the replacement of garnet by pargasite, epidote and chlorite and pyroxene by hornblende and quartz in our rock sample conforms to that expected by a coupled dissolution-precipitation mechanism. SEM and Microprobe analysis coupled with the software XMapTools V 1.06.1 .(Lanari *et al.*, 2014) were used to quantify the local mass transfer required during the replacement processes and to identify the importance of fluid in metamorphic reactions.

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