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# Mg-K-Fe fluid producing mineral reactions, metasomatism and microfabric development during formation of nodular sillimanite-gneiss in the middle crust

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The Proterozoic gneisses of the Bamble lithotectonic domain (south Norway) underwent intense scapolitisation caused by K- and Mg-rich fluids and extensive albitisation with formation of numerous ore deposits.

By detailed studies of mineral reaction fabrics we document release of the chemical active Mg, K and Fe-components forming the metasomatic fluid: Breakdown of biotite to muscovite releases K, Mg, Fe, Si and $H_2O$. As reaction products tiny Fe-oxide needles are present in the transforming rock. $H_2O$ is reacting with K-feldspar to produce additional amounts of white mica and quartz. During a subsequent reaction muscovite is replaced to sillimanite again releasing quartz and a K-rich fluid. The reactions form the peculiar sillimanite-nodular quartzite, but also well-foliated sillimanite-mica gneiss.

Optical and EBSD microfabric studies reveal a shape preferred orientation for quartz, but despite of a pronounced foliation, quartz does not show a crystallographic preferred orientation. A crystallographic preferred orientation is present for mica and sillimanite. Coarse micas show sutured boundaries to quartz, implying low nucleation rates, no crystallographic or surface-energy control during growth and no obvious crystallographic relationship to quartz.

Our study illustrates the transformation of a quartzofeldspatic lithology into sillimanite-bearing quartzite. The mineral replacement and deformation show ongoing metamorphic reactions during deformation. The microfabric data indicates reaction at non-isostatic stress condition. The deduced mineral replacement reactions document a source of K-, Mg- and Fe-rich metasomatic fluids necessary to cause the pervasive scapolitisation and Fe-deposition in the area. The mineral reactions and deformation produce rocks with a new mineralogy and structure; an increased understanding of these processes is important for the modelling of crustal building and geological history.