



Respective role of diffusion and pressure variation for reaction zone formation at a lithological interface

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At lithological interfaces, rocks of different composition are in contact leading to chemical exchanges and the development of reaction zones. Diffusion of species from one lithology to another has been modelled in details in such context but the change in density resulting from the formation of new mineralogical phases is generally not taken into account. However, this change may have strong consequences on the evolution of fluid pressure and porosity, two parameters which play a key role for deformation, fluid flow and thermodynamic equilibrium. To determine the role of density change for reaction zone formation, we developed a numerical model coupling reaction, deformation and fluid flow in a system where components can diffuse from one lithology to another. We apply this modelling to a reaction zone in Alpine Corsica formed at a contact between serpentinite and marble. At the marble contact, wollastonite and carbonaceous matter are found instead of calcite and quartz in the marble, suggesting decarbonation. At the serpentinite contact, a ferric garnet (andradite) and diopside are found. These mineralogical observations indicate reaction at low oxygen fugacity probably in the presence of the dihydrogen formed during the reaction of andradite formation at the expense of ferrous iron in serpentine. The respective increase in density of 25 % and 7 % in the bulk rock and in the garnet minerals suggest strong variations in fluid pressure and porosity during the reaction. Thermodynamic calculations show that pressure increase can stabilize wollastonite at the expense of calcite and quartz. We modelled both diffusion a dihydrogen and fluid pressure variations to determine the main triggering process for reaction zone formation.