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Water transport during metamorphic vein formation: the role of reaction-induced pressure buildup during serpentinization

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At slow-spreading ridges, the extension is accommodated both by an exhumation of mantle rocks and a magmatic input. The heat released during the crystallization of the magmas is evacuated through the hydrothermal circulation transporting high-temperature fluids up to mantle rocks which can be hydrated through a serpentinization reaction. At the millimetre scale, water transport is also accommodated by advection in the highly permeable fracture network typically found in serpentinized peridotites. This high permeability is the consequence of fracturing processes related to lithospheric scale deformation, thermal contraction or a pressure build-up associated with the positive volume increase occurring during the reaction. If the relationship between pressure increase and fracturing has been studied in details, the impact of this pressure increases on the fluid flow is still unclear. Therefore, we used existing data on the texture and composition of serpentine veins (mm to μm scale) found in peridotites to identify the physical processes involved in the transport of water during the reaction. A finite difference model was then developed to investigate the couplings between pressure increase and fluid flow at the scale of the vein. This model will allow us to probe the influence on the reaction of parameters such as the kinetics of the reaction, the geometry and the texture of the veins, the amount of the volume increase, or the external forces.