



Oxygen isotopes in garnet and accessory minerals to constrain fluids in subducted crust

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Fluids are considered a fundamental agent for chemical exchanges between different rock types in the subduction system. Constraints on the sources and pathways of subduction fluids thus provide crucial information to reconstruct subduction processes. Garnet and U-Pb accessory minerals constitute some of the most robust and ubiquitous minerals in subducted crust and can preserve multiple growth zones that track the metamorphic evolution of the sample they are hosted in. Microbeam investigation of the chemical (major and trace elements) and isotopic composition (oxygen and U-Pb) of garnet and accessory minerals is used to track significant fluid-rock interaction at different stages of the subduction system. This approach requires consideration of the diffusivity of oxygen isotopes particularly in garnet, which has been investigated experimentally.

The nature of the protolith and ocean floor alteration is preserved in relict accessory phases within eclogites that have been fully modified at HP conditions (e.g. Monviso and Dora Maira units in the Western Alps). Minerals in the lawsonite-blueschists of the Tavsanli zone in Turkey record pervasive fluid exchange between mafic and sedimentary blocks at the early stage of subduction. High pressure shear zones and lithological boundaries show evidence of intense fluid metasomatism at depth along discontinuities in Monviso and Corsica. In the UHP oceanic crust of the Zermatt-Saas Zone, garnet oxygen isotopes and tourmaline boron isotopes indicate multistage fluid infiltration during prograde metamorphism. Localized exchanges of aqueous fluids are also observed in the subducted continental crust of the Sesia-Lanzo Zone. In most cases analyses of distinct mineral zones enable identification of multiple pulses of fluids during the rock evolution.