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Investigating migration of CO_2-bearing fluids into peridotites at a subduction plate boundary: the case study of listvenites series at OmanDP Site BT1 (Wadi Mansah, Oman Ophiolite)

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Mass transfer of carbon transported by hydrothermal fluids in subduction zones is one of the major mechanisms for carbon cycling. One case study is found in the Semail Ophiolite (OmanDP Site BT1), where listvenites (quartz-carbonate assemblages) – serpentinites series testify for extensive carbonation of mantle rocks by the ingress of reactive CO_2-bearing fluids at the base of the ophiolite. We investigate the sequence of fluid input using petrographical observations and in-situ geochemical analyses of carbonates and serpentines (EPMA, LA-HR-ICPMS).

The carbonates present in listvenites and serpentinites comprise mostly magnesite with variable iron contents (FeO: 0.03-27.89 wt%). Magnesite is trace elements depleted (Yb: 0.01-0.88 x C1-chondrite) except for fluid mobile elements (e.g., Ba, U, Pb and Sr): they have compositions similar to the precursor serpentine. We identified 5 generations of carbonate-bearing veins cutting through both listvenites and serpentinites. The first generation is composed of serpentine that was partially or totally replaced by dolomite or magnesite fibres evidencing incipient carbonation of serpentinite. In listvenites, serpentine was replaced by quartz but the vein morphology can still be recognized. The second generation is composed of magnesite having the same composition as matrix-forming magnesite suggesting contemporaneous fluid transport and crystallization. The third vein generation is less frequent, being composed by « en échelon » tabular dolomite. The fourth vein generation is composed by an assemblage of quartz and carbonates (magnesite and/or dolomite). The last vein generation is composed by thick dolomite veins, crosscutting all previously described ones. Preliminary trace element data suggest variable trace element contents and fractionation from one generation of vein to the other with, for example, Yb ranging from 0.001 to 1.5 x C1-chondrite, (Ce/Yb) from 0.004 to 6 x C1-chondrite and (U/Th) from 0.5 to 2121 x PM. We discuss the origin of these geochemical variations in relation to the mineralogy of the veins and to the possible sources of the likely multiple ingresses of CO_2-bearing reactive fluids that triggered carbonates formation.