



## The Aqueous Solubility Of Rhodochrosite In Subduction Zones

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Carbon is transported to the deep Earth predominantly by the subduction of carbonate minerals. These represent the most stable and abundant carbon bearing solids down to depths of at least 200 km (6 GPa) [1]. While high pressure-temperature (P-T) experiments extend the stability of carbonates in different structures to depths of at least 2,500 km (>100 GPa) [2,3], the enhanced solubility of carbonates in high P-T aqueous fluids [4,5] instead advocates for their efficient recycling back to the atmosphere through dissolution in slab fluids, transfer to the mantle wedge and consequent volcanic outgassing [6–9]. Here, we have determined the aqueous solubility of rhodochrosite ( $\text{MnCO}_3$ ) at subduction zone conditions (<8 GPa, <500°C).  $\text{Mn}^{2+}$  ion concentrations have been measured by synchrotron X-ray fluorescence (SXRF) spectroscopy coupled with the diamond anvil cell (DAC) at the European Synchrotron Radiation Facility. Complementary aqueous carbonate speciation data have been collected by Raman spectroscopy coupled with the DAC at the University of Cambridge. Together, both methods give a full picture of the aqueous geochemistry of the fluids in equilibrium with carbonates, directly at the high P-T conditions characteristic of subduction zones and the overlying mantle wedge.

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