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Letter

Very low solubility of rutile in H_2O at high pressure and temperature, and its implications for Ti mobility in subduction zones

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Abstract

The solubility of rutile in H_2O has been measured at 1000–1100 °C, 1–2 GPa. The data indicate that solubility is very low over the investigated range, with a maximum of 4.7 millimol/kg H_2O at 1100 °C, 2 GPa. The data were fit with the equation $\log m_{Ti} = 4.892 - 10470/T + 0.1923P$, where m_{Ti} is Ti molality, T is in Kelvins, and P in GPa. When compared to previous results, the new data indicate substantially lower solubility, opposite pressure dependence, and thermodynamic properties of the reaction rutile = $TiO_{2,aq}$ that are now consistent with other oxide hydrolysis reactions. Calculations of Ti transport during mantle metasomatism by H_2O in subduction zone environments predict much lower Ti mobility at all conditions. These results offer strong support for models of Ti retention in eclogites during slab devolatilization, and require that examples of significant Ti mass transfer be explained by complexing agents in solution, most likely aluminosilicate complexes.