Geophysical Research Abstracts
Vol. 19, EGU2017-1081-1, 2017
EGU General Assembly 2017

Redistribution of iron and titanium in subduction zones: insights from high-pressure serpentinites

Rosalind Crossley, Katy Evans, Steven Reddy, and Gregory Lester

The Institute of Geoscience Research (TIGeR), Department of Applied Geology, Curtin University, Perth, Australia (rosalind.crossley@postgrad.curtin.edu.au)

The redox state, quantity and composition of subduction zone fluids influence the transport and precipitation of elements including those which are redox-sensitive, of economic importance such as Cu, Au and Ag, and those considered to be immobile, which include Fe^{3+}. However, subduction zone fluids remain poorly understood. The redox state of Fe in high-pressure ultramafic rocks, which host a significant proportion of Fe^{3+}, can be used to provide an insight into Fe cycling and constrain the composition of subduction zone fluids.

In this work, a combination of the study of oxide and silicate mineral textures, interpretation of mineral parageneses, mineral composition data, and the whole rock geochemistry of high-pressure retrogressed ultramafic rocks from the Zermatt-Saas Zone constrains the distribution of iron and titanium, and oxidation state of iron, to provide constraints on fluids at depth in subduction zones. Oxide minerals host the bulk of the iron, particularly Fe^{3+}. The increase in mode of magnetite during initial retrogression is most consistent with oxidation of existing iron within the samples during the infiltration of an oxidising fluid since it is difficult to reconcile addition of Fe^{3+} with the known limited solubility of this species. These fluids may be sourced from hybrid samples and/or serpentinites at greater depths. However, high Ti contents are not typical of serpentinites and additionally cannot be accounted for by simple mixing of a depleted mantle protolith with the nearby Allalin gabbro. Titanium-rich samples are suggested to result from fluid-facilitated hybridisation of gabbro and serpentinite protoliths prior to peak metamorphism, and provides the tantalising possibility that Ti, an element generally perceived as immobile, has been added to the rock during this process. If Ti addition has occurred, then the introduction of Fe^{3+}, also generally considered to be immobile, cannot be disregarded. Aluminosilicate complexing could provide a transport vector for Ti where this mechanism of Ti transport is consistent with the Al-rich nature of the sample.