Geophysical Research Abstracts,
Vol. 11, EGU2009-6139, 2009
EGU General Assembly 2009

Trace element mobility at the slab-mantle interface: constraints from "hybrid" contact rocks in the Mt. Hochwart peridotite (Ulten Zone, Italy)

M. Marocchi (1), P. Tropper (2), V. Mair (3), G.M. Bargossi (1), and J. Hermann (4)

(1) Università di Bologna, Dipartimento di Scienze della Terra e Geologico-Ambientali, Bologna, Italy (marta.marocchi@unibo.it, +39 051 2094904), (2) Institute für Mineralogie und Petrologie, University of Innsbruck, Innrain 52 A-6020 Innsbruck, Austria, (3) Provincia Autonoma di Bolzano, Ufficio Geologia e prove materiali, Via Val dÉga 48, 39053 Cardano (Bolzano), Italy , (4) Research School of Earth Sciences, Australian National University, Mills Road, Canberra, ACT 0200 Australia

Subduction mélanges and hybrid rocks are considered, together with mafic rocks, metasediments and serpentinite as an important volatile-bearing portion of subducting slabs (cf. Spandler et al., 2008 and references therein; Miller et al., 2009). In particular, metasomatic rocks occurring in exhumed HP mélanges have recently attracted growing interest for two main reasons: i) metasomatic rocks forming at the interface between ultramafic and crustal rocks of subducting slabs constitute new bulk compositions which can affect the redistribution of major and trace elements and modify the composition of slab fluids moving to the mantle wedge and ii) these mineral assemblages, consisting mainly of hydrous phases can potentially store and transport water at great depth in subduction zones.

Ultramafic rocks belonging to the Hochwart peridotite (Ulten Zone, central-eastern Italian Alps) preserve a series of metasomatic mineral zones generated by infiltration of hydrous fluids/melts, which occurred at the gneiss-peridotite interface (Tumiati et al., 2007; Marocchi et al., 2009). The peridotite body of Mt. Hochwart represents an almost unique occurrence where subduction-related mantle metasomatism can be studied on an outcrop scale. The ultramafic body consists of metaperidotites exposed as a hectometre-size lens along a steep gully, associated to monomineralic zones that developed at the contact between the peridotite body and the garnet-bearing gneiss country rocks.

The formation of the metasomatic zones composed exclusively of hydrous phases involved extensive H2O-metasomatism as already documented for the Ulten peridotites (Scambelluri et al., 2006; Marocchi et al., 2007). Whole-rock geochemistry and trace element composition of hydrous phases (phlogopite and amphibole) in different metasomatic zones indicate mobility of many elements, including elements such as Ta, which are considered to have scarce mobility in fluids. Trace element composition of accessory minerals in the phlogopite-rich zone suggests that the trace element signature of subduction zone fluids may be fractionated in this zone. The progressive depletion in some trace elements (LREE and LILE) and enrichment in Li from the gneiss towards the peridotite suggests a strong influence of bulk composition on the trace element budget of hydrous minerals. Since these metasomatic zones can be representative of the processes occurring at the slab-mantle interface, we can infer that metasomatic reactions between slab-derived fluids and ultramafic mantle wedge will follow a specific series of reactions and create mineral zones similar to those observed in this study. Despite the mobility of many elements, in the trace element profiles for amphibole and phlogopite across the different zones, we observe a rapid decrease even of the "fluid mobile" element contents within the reaction zone. With the exception of Li, we assist to an abrupt decrease of most of trace element concentrations going towards the peridotite side contact. Thus, according to the present study, it is not likely that the "crustal trace element signature" (i.e. LILE and LREE-enriched) could be able to travel far into the mantle.

Our results further favour the evidence that the primary composition of subduction zone fluids reaching the source region of arc magmas is substantially modified by metasomatic reactions occurring in the mantle wedge. Furthermore, we underline that metasomatic rocks such as those observed at Mt. Hochwart are potentially able to transport H2O and other trace elements to greater depths in subduction zones.

References:

Marocchi M, Hermann J, Morten L (2007)-Lithos 99: 85-104.
Marocchi M, Mair V, Tropper P, Bargossi GM (2009)-Mineral Petrol, in press
Miller DP, Marschall RH, Schumacher JC (2009)- Lithos 107: 53-67.
Scambelluri M, Hermann J, Morten L, Rampone E (2006)- Contrib Mineral Petrol 151:372-394.
Spandler CJ, Hermann J, Faure K, Mavrogenes JA, Arculus RJ (2008)- Contrib Mineral Petrol 155: 181-198.
Tumiati S, Godard G, Martin S, Klőtzli U, Monticelli D (2007)- Lithos 94: 148-167.