Geophysical Research Abstracts
Vol. 19, EGU2017-8699-1, 2017
EGU General Assembly 2017

Carbonation of Peridotite by CO_2-rich Fluids: Insights from Listvenites in the Advocate Ophiolite (Newfoundland)

Manuel Menzel (1), Carlos J. Garrido (1), Claudio Marchesi (1,3), Vicente López Sánchez Vizcaíno (1,2), Károly Hidas (1), Monica P. Escayola (4), and Bjørn Jamtveit (5)

(1) Instituto Andaluz de Ciencias de la Tierra (IACT), CSIC-Universidad de Granada, Avenida de las Palmeras 4, 18100 Armilla (Granada), Spain (manuel.menzel@csic.es), (3) Dpto. de Mineralogía y Petrología, Facultad de Ciencias, Universidad de Granada, Avenida Fuentenueva s/n, 18002 Granada, Spain, (2) Dpto. de Geología, Universidad de Jaén, Escuela Politécnica Superior, 23700 Linares, Spain, (4) IDEAN Instituto de Estudios Andinos "Don Pablo Groeber", National Scientific and Technical Research Council, Buenos Aires, Argentina, (5) Physics of Geological Processes (PGP), Department of Geosciences, University of Oslo, Blindern, 0316 Oslo, Norway

Listvenites are the result of a sequence of reactions of CO_2-rich hydrothermal fluids with serpentinite that forms magnesite-quartz rocks in the last reaction step. Listvenites are natural analogues for carbon sequestration by mineral carbonation, fixing large quantities of carbon in relatively small, confined zones of intense reactive fluid flux within serpentinite. The association of listvenite (magnesite-quartz), soapstone (talc-magnesite) and carbonated serpentinite in the mantle section of the Advocate ophiolite complex in Newfoundland (Canada) is an ideal natural example to study the carbonation of serpentinites because the reaction progress is recorded by the differently carbonated assemblages. The Advocate listvenites crop out in a 20-30 m wide zone that can be followed for about 1 km, surrounded by serpentinite and harzburgite. Quartz and magnesite veins are widespread in the central listvenite domain. This mobilization of silica into a vein network is reflected in a depletion of silica in the most carbonated lithologies, whereas most other major elements remain unchanged over a wide range of CO_2-contents. Notably, there is a sharp decrease in bulk rock Fe^{3+}/Fe_{total} from 0.65 – 0.8 in lizardite-chrysotile serpentinites to 0.1 – 0.3 in talc-magnesite rocks and listvenites. High Cr and Ni contents and preserved red-brown Cr-spinel in the carbonated lithologies demonstrate the mantle peridotites provenance of the listvenites. The presence of thin veins of Cr-mica (fuchsite) suggests that Cr was mobilized to some degree. Fine dispersed magnetite trails in magnesite trace serpentine pseudomorphs after olivine, indicating that no deformation occurred in some domains during the carbonation, while deformation was concentrated in talc-rich lithologies. The rheological contrasts of serpentinites, soapstones and listvenites and, in consequence, the formation of veins in response to shear- or extensional fractures may result in a re-opening of pathways for the influx of very CO_2-rich fluids that are needed for the formation of listvenites. Carbonated mantle rocks like the Advocate listvenites may represent the best accessible natural analogue for carbonation of serpentinites through bend faulting at the outer rise of trenches, since hydrothermal fluids in those systems may become more CO_2-rich due to percolation through overlying sediments, thus allowing for localized intense carbonation.

Funding: We acknowledge funding from the People programme (Marie Curie Actions - ITN) of the European Union FP7 under REA Grant Agreement n°608001.