Minor and trace element abundance of Cr-spinel from forearc mantle and abyssal peridotites.

FABIO STERN[1]*, KEIKO HATTORI[1], BENOIT SAUMUR[1] AND SIMON JACKSON[2]

[1]University of Ottawa, Department of Earth Sciences
fster095@uottawa.ca (* presenting author)
khattori@uottawa.ca,
bmsaumur@gmail.com

[2] Natural Resources Canada, Geological Survey of Canada
Simon.Jackson@NRCan-RNCan.gc.ca

We examined chemical compositions of Cr-spinel in forearc mantle peridotites from the Marianas, Himalayas, Bay of Island Ophiolite Complex (BOIC) in Newfoundland and the northern ultramafic belt in Dominican Republic. The origin of the Himalayan peridotites is similar to that of the Mariana samples; both represent refractory peridotites in a mature stage of subduction zones whereas BOIC and Dominican Republic samples represent an infant stage of subduction zones. To characterize the spinel compositions from forearc mantle peridotites, spinel in abyssal peridotites from Dominican Republic was also examined.

Cr-spinel is commonly rimmed by magnetite, but the cores of Cr-spinel have low YFe3+ (<0.10) and similar compositions among different grains in individual samples. Therefore, the cores are considered to be primary. Cr-spinel grains contain high Cr# in the Himalayas (0.60-0.76) and Marianas (0.68-0.73) compared to those from the BOIC (0.40-0.64) and Dominican Republic (0.20-0.39 in abyssal peridotites; 0.47-0.66 in forearc mantle peridotites).

Nickel concentration in Cr-spinel from all locations range from 276 to 2166 ppm; showing a broad positive correlation with Mg#, confirming their coherent behaviour in the mantle. High Ni contents (887–2166 ppm) are found in spinel in abyssal peridotites from Dominican Republic and low contents (317-470 ppm) are found in forearc mantle peridotites from the Himalayas. The correlation suggests that S was low in all locations during partial melting.

The Cr-spinels in all samples have significant amounts of Co (272-777 ppm), with an average of 405 ppm. Cobalt has a strong inverse correlation with Mg# and a positive correlation with Cr#. Co contents are low (295-367 ppm) in abyssal peridotites from Dominican Republic and high (574-777 ppm) in forearc mantle peridotites from the Himalayas, suggesting that Co is compatible in spinel in the mantle during partial melting.

Manganese has the widest range of concentration among the minor elements from 938 to 5535 ppm. It shows a positive correlation with Fe2+ suggesting Mn also resides in the octahedral site. Cr-spinel in abyssal peridotites from Dominican Republic shows low Mn contents (938–1446 ppm) whereas the Himalayan Cr-spinel shows high contents (2432-5535 ppm).

Our data document very large variations in minor and trace element abundances in spinel compared to major elements; some elements, such as Ti and Ni, show variations greater than one order of magnitude, and the trace and minor element abundances provide distinct geochemical signatures reflecting tectonic settings of the host rocks.