MAGMATIC CHROMIAN SPINEL IN METABASITE FROM THE LATIMOJONG MOUNTAINS, SULAWESI, INDONESIA

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In metavolcanic rocks of the Latimojong Mountains, central Sulawesi, Indonesia, chromian spinel spans a wide compositional range in Cr/(Cr+Al). Spinel occurs in the matrix of metamorphic silicates (Chl+Act+Pmp) and as inclusions in magmatic clinopyroxene phenocrysts (Fig. 1). Two types of chromian spinel are observed in metabasites and volcaniclastic rocks, including (i) high-Al chromite (100xCr/(Cr+Al) = 40 – 60) and (ii) high-Cr chromite (100xCr/(Cr+Al) > 70). The values for 100xFe/(Mg+Fe) range from 32 to 52, and TiO_2 concentrations vary from 0.1 to 1.7 wt.%.
Based on the spinel compositions obtained from electron microprobe (EMPA) analyses, it is inferred that the Cr-rich chromites within mafic metavolcanic rocks are derived from a suprasubduction zone (SSZ) environment, whereas Al-rich chromite formed in a mid-ocean ridge (MORB) setting (ZHOU & ROBINSON, 1997). The chromian spinels may have originated from different tectonic settings that were later amalgamated in one region. These results are confirmed by analysis of clinopyroxene showing that parent magmas were generated in IAB and MORB environments. The Cl-chondrite normalized REE patterns of metabasite and volcaniclastic rocks are flat, similar to MORB.
Alternatively, chromian spinel may have crystallized from a single batch of magma, but at different stages of fractional crystallization. Growing clinopyroxene phenocrysts in a MORB-type melt trapped floating chromite crystals that developed through time to progressively more-Al depleted compositions and forming chromite of higher #Cr. In the example illustrated below, Al-rich chromite may have been trapped in the clinopyroxene rim by turbulent magma movement where cumulus material has been brought up from deeper parts of the chamber (Fig. 1).

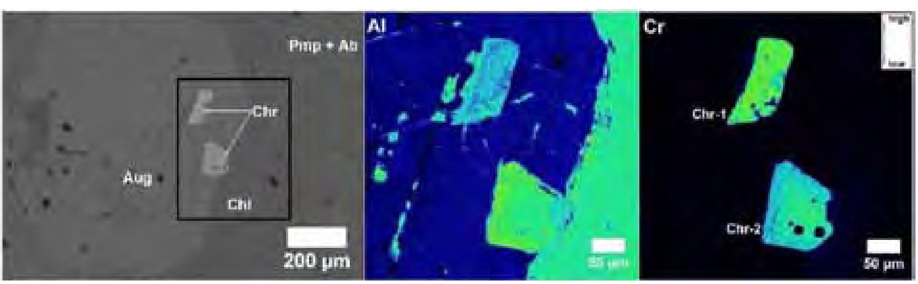

Figure 1. Quantitative element map of chromian spinel hosted by clinopyroxene in metabasite. Area on the left image is enlarged in the Al and Cr element maps. Chr-1 has 13 wt% Al_2O_3, 0.14 wt% TiO_2, 51 wt% Cr_2O_3; Cr# of 73; in contrast, Chr-2 has 18.5 wt% Al_2O_3, 0.7 wt% TiO_2, 38.9 wt% Cr_2O_3, Cr# of 59.

ZHOU, M.-F., ROBINSON, P.T. (1997): Econ Geol, 92, 259-262.