CSEs in high pressure rocks from exhumed terranes

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Despite their geochemical and economic importance, very little work has focused on the behavior of subducted chalcophile and siderophile elements (CSE). Here we present the first survey of these elements in metasediments, metabasites, and hybrid mélange rocks from exhumed terranes worldwide. These samples represent greenschist- to eclogite-facies conditions. EPMA X-ray maps display significant Co, Ni, and As zoning in pyrite; however, no zoning was observed in pyrrhotite or chalcopyrite. *In situ* LA-ICP-MS analyses of sulfides reveal Co, Ni, Cu, Zn, As, Pb, and Cr at concentrations above 10 µg/g, whereas Ga, Ge, Mo, Ag, Cd, In, Sn, Sb, Tl, and Bi are typically below 1 µg/g. Pyrite is enriched in Co, As, Zn, and Cr relative to pyrrhotite and chalcopyrite, whereas pyrrhotite contains abundant Ni. Pyrite is also enriched in Cu relative to pyrrhotite.

Amphiboles and phyllosilicates were found to contain up to hunderds of µg/g of Ni, Cr, and Zn, and tens of µg/g of Co and Ga. In eclogites, Co in silicates mainly occurs in garnet, whereas Ni, Ga, and Zn occur in pyroxene. Both phases contain similar concentrations of Cr and Ge. Most silicates were found to have less than 1 µg/g of Cu; Cu in garnet was below detection, and As was below detection in all silicates.

Contrasting behavior of Co and Ni is displayed in hybrid mélange samples. Transects of pyrite in chlorite schists show no correlation between these two elements, consistent with the hightened fluid mobility of Co over Ni observed in hydrothermal ore deposits. In one glacophane-omphacite rock, Co and Ni are anti-correlated. This behavior may be explained by alternation between fluid-buffered conditions, in which cobalt is mobile, and rock-buffered conditions, in which reactions with silicates release Ni.

Matrix sulfides are absent in most eclogite-facies samples. Sulfide breakdown during subduction likely drives the release of As, Pb, and Cu into fluids that flux the overlying mantle, whereas both silicates and sulfides may contribute Co to these fluids. The elements Cr, Zn, Ga, and Ge likely persist into the eclogite facies, but may also be released during silicate dehydration.