Molybdenum behavior during high-pressure metamorphism

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Subduction is a fundamental process for recycling Earth materials, but major questions still remain regarding how well crustal material is efficiently recycled as opposed to polluting the deeper mantle. Several new, non-traditional stable isotope systems have recently been implemented in subduction zone settings in an attempt to elucidate to what extent surface materials may be transferred to volcanic arcs. One such system of particular interest is molybdenum (Mo) as there are noted differences between the Mo isotopic compositions of subducting material and resultant arc rocks in many locations. Here, we present new Mo concentration and isotope composition data ($\delta^{98}Mo_{NIST3134}$) for metamorphic samples from the Schistes Lustrés Complex and the nearby Lago di Cignana exposure in the western Alps, Italy.

Eighteen metapelitic samples from this region were analyzed, which exhibit peak P-T conditions of 300-550 °C and 1.5-3.0 GPa. Molybdenum concentrations here range from 0.1 to 1.2 ppm and exhibit two distinct phases of remobilization during prograde metamorphism. Likewise, $\delta^{98}Mo_{NIST3134}$ values for the samples presented here range from -2.17 to +0.76 per mil and also underwent two distinct shifts in isotopic composition during prograde metamorphism. Although these samples did undergo devolatilization and dehydration, there is no correlation between $\delta^{98}Mo_{NIST3134}$ and fluid-mobile elements (e.g., Ba/Th, Ce/Pb, Mo/Ce). Instead, these geochemical variations in Mo behavior may be reflections of protolith heterogeneity or re-equilibration with an external fluid.