

Thallium variations during high-pressure metamorphism

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Thallium (Tl) is a highly incompatible element which can be redistributed during various igneous and hydrothermal events, such as mineral dehydration and recrystallization and low-temperature hydrothermal alteration. These processes can remobilize Tl and induce substantial isotopic fractionation, particularly when working in conjunction with one another. Despite the strong influence these factors have in redefining Tl behavior, analyzing Tl geochemical variability in metamorphic regions, particularly related to subduction, where these processes play a major role, has only recently been undertaken. Here, we present new Tl concentration ([Tl]) and isotope composition data ($\epsilon^{205}\text{Tl}$) for metamorphic samples from the Schistes Lustrés Complex and the nearby Lago di Cignana exposure in the western Alps, Italy.

A suite of 18 metapelitic rocks, which exhibit peak P-T conditions of 300-550 °C and 1.5-3.0 GPa (similar to conditions experienced in most modern subduction zones) and with previous major and trace element, devolatilization, and stable isotope data, were analyzed [1,2]. During prograde metamorphism, [Tl] and $\epsilon^{205}\text{Tl}$ inversely correlate, with [Tl] decreasing and $\epsilon^{205}\text{Tl}$ increasing up to an inflection point before both reverse their behavior. We interpret this to be a consequence of fluid release resulting from the breakdown of, and resultant formation of new, Tl-bearing minerals such as chlorite and phengite, causing pronounced shifts in both [Tl] ([Tl]_{range}: ~100 to 1200 ppb) and $\epsilon^{205}\text{Tl}$ ($\epsilon^{205}\text{Tl}$ _{range}: ~-3.8 to +0.0). These data suggest that local or regional processes may significantly alter the Tl geochemical composition during subduction, highlighting the importance of constraining the systematic controls on Tl behavior at a range of scales, particularly for Earth's major reservoirs.

[1] G.E. Bebout et al. (2013), *Chemical Geology* 342, 1-20;

[2] J. Cook-Kollars et al. (2014), *Chemical Geology* 386, 31-48.