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Constraints on fluid-mineral partitioning of thallium during high-pressure metamorphism

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Trace element behavior in subduction zones can vary significantly, with some elements seemingly lost from slabs and sediments during forearc metamorphism, others apparently retained through forearcs and introduced to subarc mantle wedges to at least partly be recycled to the surface via arc volcanism, and some transiting to beyond subarcs into the deeper mantle. Furthermore, the controls on remobilization, including devolatilization, fluid-mineral partitioning, or concurrent metasomatism, are poorly quantified. Thallium (Tl) is no exception to this, owing its behavior in subduction zones to its largely incompatible nature, strong redox controls, and variable enrichment or depletion depending on subduction sediment sources. We obtained Tl concentrations ([Tl]) and Tl isotope data ($e^{205}Tl$) for mineral splits from samples of the HP/UHP Schistes Lustrés metasedimentary suite and the nearby coesite-bearing Lago di Cignana exposure in the western Alps, Italy with the hope of elucidating the behavior of Tl during prograde subduction-zone metamorphism.

Mineral separates from this suite, with units that experienced a range of peak *P-T* conditions of 300-550 °C and 1.5-3.0 GPa, were analyzed by ICP-MS. Sheet silicates, specifically phengite, are the dominant Tl host in the Schistes Lustrés, with higher-grade units (Finestre, Cignana) that lost an average of ~20% H_2O during prograde devolatilization having the highest phengite [Tl] of 1,200-2,000 ng/g. The available whole-rock [Tl] for this suite range from ~500-1,000 ng/g Tl, showing no systematic change with increasing grade. These data, when coupled with ongoing analyses of $e^{205}Tl$, will yield insight regarding the controls of Tl behavior in this setting, namely whether fluid-mineral partitioning impacts the likely Tl isotope compositions delivered to subarc mantle wedges via aqueous fluids or siliceous melts.