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Discovering the timing of fluid-rock interactions in serpentinized systems

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Serpentinized ultramafic rocks have long eluded reliable direct dating because of their overall low concentration of radiogenic elements and lack of common mineral chronometers. However, understanding the timing and rates of fluid-rock interactions in serpentinites can help inform geodynamic models that invoke serpentinization of faults, biologic models that use the generation of H_2 to fuel microbial communities, chemical models that quantify fluid-mobile element cycling through serpentinite subduction, and climate models that incorporate CO_2 sequestration in ultramafic systems. Across all systems, knowing when elements are mobile and when key hydrothermal mineral reactions occur are crucial constraints. Recent applications of (U-Th)/He and U-isotope chronometry in serpentinized systems reveal a complex history of fluid-alteration in serpentinites on land and the seafloor. In both areas, we discover evidence for mineral growth and fluid-rock interactions younger than previously thought. Although we still do not understand the full complexity in either system, these results point to the propensity for serpentinized systems to continue to experience fluid-rock interactions under evolving conditions for millions of years.