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Fluid-mediated mass transfer between mafic and ultramafic rocks in subduction zones: Insights from the high-pressure Voltri Massif (Ligurian Alps, Italy)

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Exhumed high-pressure rocks offer the most direct way to constrain fluid-mediated mass transfer processes in subduction zones, however, accurate interpretation of these rocks requires distinguishing the high-pressure metasomatic processes in subduction zones from inherited oceanic signatures prior to subduction. This study investigates the formation of a metasomatic reaction zone in the Voltri Massif to understand the fluid-mediated mass transfer between juxtaposed mafic (metamorphosed oxide gabbro) and ultramafic (serpentinites) rocks at high *P-T* conditions by integrating phase petrology, petrophysical properties, bulk-rock and mineral chemistry, and Sr isotopes with thermodynamic phase equilibria and reaction path models. Trace elements and Sr isotope constraints suggest that the serpentinites and oxide gabbro formed in an oceanic setting. The reaction zone recorded diffusive and advective mass transfer processes that occurred over a range of *P-T* conditions, forming a variety of hydrous metasomatic assemblages with strongly fractionated bulk-rock trace-element characteristics. We discuss the importance of fluids that interacted with serpentinites in Mg-metasomatism and oxidation of mafic rocks. We speculate that fluid-rock interactions can transform dense, nominally anhydrous crustal blocks into buoyant, hydrous metasomatic rocks, which could subsequently rise as diapirs from the slab to the overlying mantle into the source regions of arc magmas.