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Mineral carbonation of oceanic peridotite in the St. Paul's transform fault, equatorial Mid-Atlantic Ridge

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We examined submarine and serpentinite and mylonitic peridotite from St. Paul's Rocks archipelago (St. Paul's Transform Fault, equatorial Mid-Atlantic Ridge) to determine the interactions between these rocks and hydrothermal fluids. The samples were recovered from the southern and northern submarine flanks of the archipelago using human-occupied submersibles. Fluid-rock interactions caused the formation of serpentine-magnesite, serpentine-talc-magnesite-graphite, talc-magnesite-graphite, and magnesite-chlorite-apatite assemblages. Equilibrium thermodynamic constraints indicate that these assemblages were produced by interactions with fluids characterized by CO_2 concentrations that must have exceeded normal seawater by at least one order of magnitude. Such high concentrations and the association of magnesite with apatite in ultramafic rocks point to magmatic degassing of CO_2 as the underlying cause for mineral carbonation. While the flux of CO_2 at transform faults remains to be determined, our results indicate that oceanic transform faults can act as conduits for CO_2-rich hydrothermal fluids and that ultramafic rocks in transform fault systems are a potentially important sink for geologic CO_2. Considering that oceanic transform faults have not been accounted for as sources of geologic CO_2, previous studies may have underestimated the global flux of CO_2 from oceanic mantle to the oceans.