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Non-traditional stable isotope constraints on mantle mineralogical heterogeneity: past, present and future

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Recent studies of non-traditional stable isotope systems (e.g., Fe, Ni, Zn, Ti, Ca, Cr, V) have exploited variations in mineral- and redox-specific equilibrium fractionation effects to link observed variations to source mineralogy and processes, such as partial melting, magmatic differentiation, and the tectonic recycling of surface material [e.g., 1-4]. In this presentation, I will review some examples of how novel stable isotope systems, such as Fe, can be used to place constraints on the mineralogy and chemistry of the mantle source regions of ocean island basalts and Archean komatiites, and what the implications of these findings could be for the mineralogical and chemical evolution of the Earth's upper and lower mantle. I will also discuss recent studies exploiting quantitative combined phase equilibria and equilibrium melt isotope fractionation models [7-8] and the extent that these can be used to predict equilibrium stable isotope partitioning during upper mantle melting of enriched and depleted lithologies.

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