Silicon Isotopic Compositions of Metaperidotites from the Franciscan Complex- Implications for the Si Isotope Fractionation during Subduction Dehydration

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Silicon is the third most abundant element of the bulk Earth, and a major element in both crust and mantle. There are large Si isotopic fractionations during low-temperature environments (e.g., chemical weathering, siliceous precipitation), while the Si isotopic variation is relatively limited in high-temperature processes. Therefore, subducted crustal materials with large Si isotopic variation might produce Si isotope heterogeneity in the mantle, which made Si isotopes a potential tool to trace crustal recycling.

Knowledge on the behavior of Si isotopes during subduction processes is the prerequisite for applying Si isotopes as a tracer for crustal recycling. During subduction dehydration, fluids released from subducting slab have a great influence on the geochemical behavior of elements and isotopes in the overlying mantle wedge. The well-characterized metaperidotites from the Franciscan Complex of California have experienced a serie of mineral reactions due to Si-rich fluid metasomatism, including serpentinization, talcification, and tremolitization occurred successively in these mantle wedge peridotites. They are suitable samples to investigate the behavior of Si isotopes during fluid-rock reaction along the slab-mantle interface, and to constrain the Si isotopic compositions of the fluids and residual slab after metamorphic dehydration.

All samples exhibit a relatively homogeneous δ^{30}Si values ranging from -0.39‰ to -0.26‰, with an average of -0.32 ± 0.08‰ (2SD, n =15). This observation suggests that the Si isotopic composition of mantle wedge peridotites would not be modified significantly during metasomatism by slab-derived Si-rich fluids. Mass balance calculation indicates that dehydration during subduction may not significantly change the Si isotopic compositions of the residual subducting slab.