

## Origins of Cr-diopside in peridotite xenoliths

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The modal abundance of clinopyroxene (cpx) in mantle peridotite is a major factor in controlling the lithophile trace element budget of the lithospheric mantle. The abundance of cpx (along with garnet in some peridotites) strongly influences physical properties such as density. It is therefore critical to understand the origin and timing of cpx formation within mantle samples if we are to understand the potential temporal controls on the chemical and physical evolution of the continental lithosphere. We have investigated the possible origins of cpx in mantle xenoliths using detailed *in situ* Sr isotope and trace element analyses of individual cpx crystals (MicroMill and TIMS). We present results from Greenland, a craton with highly depleted lithosphere, where cpx is scarce, and Kimberley, Kaapvaal craton, where cpx is more abundant, along with other evidence of metasomatism. Greenland peridotites show remarkably homogenous Sr isotope values (0.703607 to 0.703672) with no isochronous relationship. Trace element concentrations show considerable variation but this does not correlate with the limited isotope variation or with textural characteristics. Cpx from Kimberley peridotites have much more radiogenic Sr isotopes. One sample we have studied in detail contains much more variable, non-isochronous Sr isotopes (0.70586 to 0.70412). This sample is also characterised by considerable variation in trace element abundances. Homogeneous isotopic compositions in some samples, coupled with varied trace element concentrations are inconsistent with long term enrichment or depletion implying that the majority of cpx is a recent metasomatic addition to the lithosphere. A global compilation of Sr isotope data for both on- and off-craton cpx mineral separates shows that the majority of cpx has a similar Sr isotope composition to OIB/MORB indicating that cpx is a metasomatic addition from a melt originating in the convecting mantle. In rarer cases where Sr isotope variation is marked, melt interacted with a more enriched component, possibly from an older event, in the lithosphere, or the cpx could have formed from a precursor mineral. However this is not representative of the majority of mantle cpx.

An important implication of these results is that the lithospheric mantle, contrary to common assumption, may not have been an incompatible element enriched reservoir throughout its history.

## New views about the composition of Mercury's core and its magnetic field origin

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According to previous models, the estimated oxygen fugacity, under which the core segregation of Mercury might take place, would be 3- 6 log units below the iron-wüstite buffer. Under such reducing conditions, the core of Mercury would contain several wt% of silicon, in addition to sulfur. The ternary Fe-S-Si has a vast immiscibility gap at low pressure, which might be closed after the core-mantle boundary of Mercury. This immiscibility gap raises the possibility that the mercurian core has a shell structure: (i) an outer layer of Fe-S-Si liquid, rich in S; (ii) a middle layer of Fe-Si-S liquid, rich in Si; and (iii) an inner core of solid Fe-Si metal; a fourth layer of homogeneous Fe-S-Si liquid could also be possible, depending on the exact depth at which the immiscibility gap closes. The Fe-S-rich outer layer could contain significant amount of uranium, which is not possible with the two other important heat-producing elements thorium and potassium. Heat from the decay of uranium could thus contribute significantly to the genesis of Mercury's magnetic field.