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Siderophile Element Mobility the Mantle Lithosphere

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Insights into the mobility of siderophile and chalcophile elements can be gleaned from in situ trace-element analyses of sulphide inclusions in eclogitic diamonds on the one hand and of sulphide minerals in eclogite xenoliths on the other. Palaeoproterozoic subduction at the western margin of the Slave craton, Canada, led to emplacement of gabbroic materials, deserpentinisation of underlying oceanic mantle and ensuing eclogitisation. During this process, sulphides grew or were recrystallised concomitant with encapuslation in diamond. They have coherent Re-Os isotope systematics and lie on a 1.9 Ga isochron. The concentrations of the highly siderophile elements (HSE) in these sulphide inclusions, which were protected from subsequent processes by their chemically inert host, attest to largely immobile behaviour during dehydration-induced metasomatism and metamorphism. This is interpreted to fingerprint a reducing and Cl-poor nature of the fluids involved in diamond growth.

By contrast, sulphide of the same composition and age occurring in eclogite xenoliths, similar to the source rocks of eclogitic diamonds, have been exposed to mantle metasomatic processes since their 1.9 Ga emplacement into the cratonic lithosphere. It is expected that such metasomatism led to introduction and/or remobilisation of siderophile and chalcophile elements. This is suggested by corrupted Re-Os isotope systematics of sulphide minerals in these samples, but the nature of the metasomatic fluid and effect on other chalcophile and siderophile elements has not yet been evaluated.

We are in the process of measuring trace element concentrations of sulphide minerals in these rocks by LAM ICPMS, with the aim to compare compositional signatures of sulphide minerals in eclogite xenoliths having disturbed Re-Os isotope systematics to primary sulphide grains included in diamond. We anticipate differences in siderophile and chalcophile element abundances and/or ratios that will afford insights into the nature and effects of mantle metasomatic agents that lead to redistribution of trace elements and disturbance of primary Re-Os isotope signatures.