Fate of volatiles in the deep mantle and the light elements in the Core

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High-Pressure Geochemistry is one of the most important fields to elucidate the formation and evolution processes of the Earth. Volatile elements can be transported into the deep mantle by slab subduction. Hydrogen may be transported as far as the bottom of the lower mantle by hydrous phases such as H-phase δ solid solution due to collapse of the stagnant slabs into the lower mantle [1]. Carbon is also transported into the lower mantle by carbonates in the slabs. We confirmed that the reaction of magnesite and silica produces the potential source of super-deep diamond and higher fO_2 regions at the base of the lower mantle [2]. The density of magmas containing volatiles suggest that the magmas are denser than surrounding solid mantle in two depths, i.e. the base of the upper mantle [3] and the core-mantle boundary region [4]. Dehydration melting could produce dense magmas at the base of the lower mantle due to a steep temperature gradient at the core-mantle boundary.

Volatiles and other light elements are considered to be included in the Earth's core. Partitioning of these elements between solid and liquid metals and the sound velocity measurements of iron-light elements alloys by using Inelastic X-ray scattering (IXS) combined with double-sided laser heating DAC [5] revealed that the inner core is enriched in silicon with minor sulphur without oxygen, whereas the outer core is enriched in sulphur. Oxygen may not be a major light element in the core.

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