Isotopic considerations on the evolution of the Early Protoplanetary Inner Disk : consequences for the origin and composition of the Earth

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The Enstatite chondrite-Earth multi-elemental isotopic identity implies a large-scale equilibrium, involving the parent materials of the terrestrial planets and of the E chondrites' parent body. Such large-scale equilibrium conditions existed only in the Early Protoplanetary Inner Disk (EPID). From the Sun, CI and Enstatite Chondrites, and terrestrial isotopic characteristics, we deduce the chemical evolution of EPID. That chemical evolution results from a dual loss, in volatile elements due to the temperature increase, and in refractory elements by a rapid centripetal drift of solids, during a high temperature episode, before the establishment of stable planetesimal orbits.

In this scenario EPID loses ~50% of its residual refractory mass to the proto-sun in a few thousand years. By a thermodynamical modeling of gas-solid equilibrium we determine the average composition of the material that accreted to form the terrestrial planets and calculate the resulting Bulk Earth, Core and Mantle compositions. The Earth's Core contains 8.6% light elements (5.3% Si, 1.5%O,1.8% S). The primitive lower mantle was significantly enriched in Fe, Ni and Si and depleted in Mg, Al, Na, K Ca, U, Th and Rare Earth Elements.

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