Origin of siderophile element fractionations in components of unequilibrated ordinary chondrites

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Abundances of the highly siderophile elements (HSE: platinum group elements, Re and Au), Fe, Ni, Co, Te, Se and S in physically separated components of unequilibrated ordinary chondrites have been studied to constrain physicochemical processes in their nebular formation regions.

Different types of HSE abundance patterns have been observed in components of ordinary chondrites: 1) CI chondritic HSE patterns, 2) abundance patterns that show depletions and enrichments of Pd and Au, but unfractionated refractory HSE, 3) depletions of Re, Os, Ir and Ru compared to other HSE and CI chondrites. Magnetic components of a LL3.6 chondrite show higher HSE/Ni compared to magnetic components of L3.05 and H3.3 chondrites. Tellurium is depleted in most components compared to CI normalized HSE, Se and S abundances.

The differences in siderophile element abundance patterns in the components likely were caused by heterogeneity of metal- and sulfide-rich dust precursors of ordinary chondrites, partial loss of refractory HSE carrier phases before equilibration of HSE with Fe-Ni metal alloys, volatility, metal-silicate-sulfide partitioning, and in some cases (petrologic type > 3.5), partitioning during kamacite-taenite exsolution. The correlation of Te with Ir and Pd suggests that the depletion of Te is most likely associated with the high temperature history of the metal precursors during chondrule formation or prior to it. The data also indicates differences in the volatility and geochemical behaviour of Te in the formation region of ordinary chondrites compared to carbonaceous chondrites.