

## **Siderophile volatile element fractionation in the solar nebula**

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The decoupling of refractory from volatile element inventories of chondrites is explicable if chondrites represent mixtures of thermally processed volatile element-depleted refractory material with variable proportions of volatile-rich material, typically located in matrix. CI chondrite-normalized bulk chondrite patterns suggest that the volatile element-rich component in some carbonaceous chondrite (CC) groups has roughly CI chondrite-like ratios of many siderophile volatile elements (SVE), although absolute concentrations are lower than in CI chondrites. In ordinary chondrites (OC), the relative depletion of SVE may decrease with element volatility, or may be constant. Enstatite chondrites (EC) tend to be most complex with an abundance peak near Au, As and K and depletion of more volatile elements. Recent isotope dilution-ICPMS concentration data of a range of SVE in bulk chondrites and their components have refined this picture. For instance, Te in reduced chondrites of the EC and OC classes is systematically depleted compared to other elements of similar volatility and tends to show siderophile behavior in components. In contrast, carbonaceous chondrites show CI chondritic Se/Te and mostly chalcophile behavior of Te in components, consistent with calculated condensation temperatures for solar gas compositions. The different behavior of Te reflects its changing volatility (coupled to siderophile *vs.* chalcophile behavior) in the EC and OC formation environments, compared to CC and average solar gas. Thus, S-Se-Te ratios, in combination with other tracers are a useful tool to assess the reduced or oxidized nature and volatile element composition of planetary building materials. The behavior of other SVE (e.g., Cu, Ag, In, Cd, Zn) in different groups of chondrites is broadly consistent with calculations of condensation temperatures in solar gas. However, some OC and EC display ‘anomalous’ behavior, notably of Ag, In and Cd, which has been attributed to changes in volatility during heating processes on the parent bodies. These elements may be particularly vulnerable to losses during highly energetic planetary accretion events (e.g. giant impacts), as indicated by data on lunar rocks.