Effect of core merging on the sulfur, selenium, and tellurium contents of the Earth's mantle

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It is widely accepted that the final assembly of Earth was dominated by major impacts. Potentially, this mode of accretion could have created a chemical disequilibrium situation (Rubie et al. 2011). If impactors were differentiated in silicate and metal, the two components could have separated physically from each other upon impact. Silicate material would have been absorbed by the silicate Earth while cores larger than several kilometers in diameter (Dahl & Stevenson 2010) would have travelled straight through Earth's mantle and merged with Earth's core. We are equilibrating ultramafic silicate melts with Fe-S melts in sintered MgO capsules, at P-T-fO_2 conditions and metal/S atomic ratios reasonable for metal-silicate segregation on differentiated planetesimals. Aim is to search for chemical signatures in the mantle that could be diagnostic of core merging. Our first partitioning data suggest that the composition of the silicate Earth would have reacted quite sensitively to core merging, notably with respect to the abundances and ratios of S, Se, and Te. Depending on the amount of material added by late impacts, selective absorption of silicate material from planetesimals by the silicate Earth could have imposed S-Se-Te concentrations significantly above those observed in Earth's mantle. The S/Te and Se/Te ratios would be quite removed from the chondritic ratios.

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