Moderately volatile element behavior during accretion

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The volatilities of moderately volatile elements (Pb, Cd, Zn, Cu, Cl, Br etc) during the accretion, melting, vaporisation and re-condensation processes which took place on asteroids and protoplanets are usually approximated by their condensation temperatures from a reduced solar gas. Abundances in silicate Earth correlate weakly with condensation temperature, however, suggesting other processes were involved in setting MVE abundances. We recently determined experimentally the vaporisation behavior of 13 elements (Ag,Bi,Cd,Cr,Cu,Ga,Ge,In,Pb,Sb,Sn,Tl,Zn) from molten basalt at 1 atm pressure and a range of oxygen fugacities [1] . The elemental abundances in silicate Earth correlate closely with volatilities from melt at conditions close to Fe-FeO (IW). We have added Cl and Br to our experiments and are able to compare their volatilities to those elements previously studied. We find the fO2 dependence of volatility is dramatically different but that in the fO2 range close to IW, halogen volatility is low, similar to that of Zn. This is consistent with recent measurements of halogen abundances in CI chondrites [2] which indicate relative abundances similar to Zn and In in silicate Earth. The results are consistent with the hypothesis that moderately volatile elements were added to Earth in bodies which had undergone episodes of melting and vaporisation.

1.Norris, C.A. & B.J. Wood, Nature, 2017. **549** p. 507-+.
2.Clay, P.L., et al., Nature, 2017. **551**(7682): p. 614-+.