

Volatile element depletion in early-formed planetesimals

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In terrestrial planets, there is evidence that the depletion in volatile elements is a function of radial distance from the Sun since the Earth is more depleted in volatiles than Mars. The picture is more obscured if one considers the asteroid belt where objects of variable degrees of volatile element depletions are observed. Models for the abundance in volatile elements in planetary materials predict lower volatile element abundances near the Sun. Rapid cooling of the disk also suggests that volatile element depletion should be an early feature. High precision Rb-Sr in eucrites (presumably from Vesta) and angrites (Hans et al. 2013) indicates that Rb depletion took place in the first Ma after the formation of CAI. This shows that these parent bodies probably formed within 1 AU since the condensation temperature of Rb (800°C) is reached within 10^5 years at 1 AU, while the accretion timescale of these objects is in the first 1-2 Ma after CAI. Thus, the early Rb depletion in eucrites and angrites provides evidence that these objects formed in the terrestrial planet region rather than the asteroid belt and that they were ejected there late.