DUST ENRICHMENT: LESS THAN MEETS THE EYE.

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Introduction: Total evaporation of a dust-enriched region is often called upon to provide a solar nebular environment of high enough f_{O2} at high temperature to account for the near-ubiquitous presence of FeO in chondrites. Unless the dust contains substantial water, however, this mechanism is of limited efficacy.

Results: Equilibrium condensation calculations were done with the VAPORS code [1] on systems enriched by 10^4x in dry chondritic (OC) dust [2], but otherwise solar in composition. A total pressure of 10^{-3} bar ensured that the condensation sequence in a cooling gas is MELTS liquid [3], olivine, FeNi metal, sp+opx. Log f_{O2} falls from IW at 2200K to IW-1.5 by 1950K (Fig. 1) due to consumption by condensing silicate melt of the free oxygen that was released by high-T vaporization of the dust [2]. Olivine Fa_6 coexists with melt containing 19 wt% FeO at 1950K. Over the next 500K of cooling, X_{Fa} rises to only 0.17 as reduction lowers the oxidized fraction of the total iron by 27% (Fig. 2), causing FeO in the liquid to plunge to 5 wt%. If the dust contains just 5 wt% H_2O, reduction is more subdued, as a smaller fraction of the free oxygen recondenses, keeping f_{O2} higher, IW-1.2 to -1.0 until T reaches 1450K, where X_{Fa}=0.29 and the melt contains 14 wt% FeO. Massive enrichment in anhydrous dust thus yields only transient oxidizing conditions, and condensates so formed will show obvious signs of reduction with falling T.

References: [1] Ebel D.S. & Grossman L. 2000. *GCA* 64:339-366. [2] Fedkin A.V. & Grossman L. 2006. *MESS II*, 279-294. [3] Ghiorso M.S. & Sack R.O. 1995. *CMP* 119:197-212.