IRON ISOTOPE COMPOSITION OF ALLENDE MATRIX, CAIs AND CHONDRULES.
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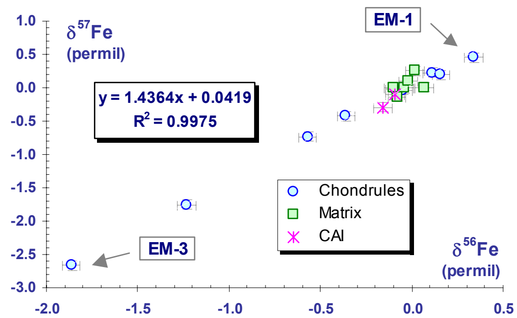
Introduction: We have studied the petrography and Fe-isotope composition of: (1) 9 chondrules, (2) 6 matrix aliquots and (3) 2 CAIs from Allende (CV3). A range of textural-chemical chondrule types are represented, allowing us to examine the Fe-isotope signature in material with different thermal histories. Analytical procedures are detailed elsewhere [1,2,3]

Fe-isotope Fractionation: The overall variation in δ^{56}Fe is 2.24‰ and in δ^{57}Fe is 3.16‰. EM-1 (non-porphyritic chondrule) is most isotopically heavy and EM-3 (porphyritic chondrule) is most isotopically light, with all other measurements falling on a mass fractionation line between these two end-members.



Discussion: The Fe-isotope composition of Allende matrix aliquots are very similar, possibly indicating isotopic equilibration of matrix components. Chondrules are in isotopic disequilibrium with matrix. The Fe fractionation of Allende chondrules is less than that expected if they had experienced extensive open system evaporation [4]. The largest chondrules are most isotopically heavy and light, and smaller chondrules fall closer to matrix compositions. Thus, larger chondrules better preserve Fe-isotope compositions, but smaller chondrules may be more susceptible to metasomatic induced isotopic exchange. CAI Fe-isotope compositions are similar to, or slightly lighter than the matrix signature. Thus, iron contained within CAIs may have derived from the matrix, as pristine CAIs contain little/no iron. The Fe metasomatism is not associated with significant Fe-isotopic fractionation.

Porphyritic and non-porphyritic chondrules have differing thermal histories, being produced by incomplete melting and total melting respectively. However, Fe-isotope fractionation does not appear to vary systematically with texture. Nor is systematic variation observed with respect to bulk composition or metal content. We conclude that chondrule Fe-isotopic signatures represent that of the precursor material. Melting history may also influence the Fe-isotopic signature, with the isotopically heaviest signatures deriving from the most melting events. Further analyses will develop these theories further.

References: [1] Mullane et al. (2001) LPS XXXII, Abs. #1545. [2] Mullane et al. (2002) In: Plasma Source Mass Spec., Royal Soc. Chem. (in press). [3] Mullane et al. (2002) Met. Plan. Sci. 37, 105 Abs. [4] Alexander C.M.O'D. & Wang J. (2001) Met. Plan. Sci. 36, 419-428.