Cr and O isotopes link IVA IRONS and LL CHONDRITES

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Swiss Government Excellence Scholarships

Introduction

- Combined Cr and O isotope data can identify a possible genetic link among an iron meteorite group representing the core and a stony meteorite group representing the differentiated or undifferentiated counterpart of a parent body or origin from a common reservoir.
- Genetic links using $\varepsilon^{54}Cr$ - $\Delta^{17}O$ have been proposed for:
  - IIIAB irons, main group pallasites and HEDs [1, 2]
  - IIE irons and H chondrites [3]
  - Eagle Station pallasite and CV chondrites [4]
  - IVA irons and L/LL ordinary chondrites [5].

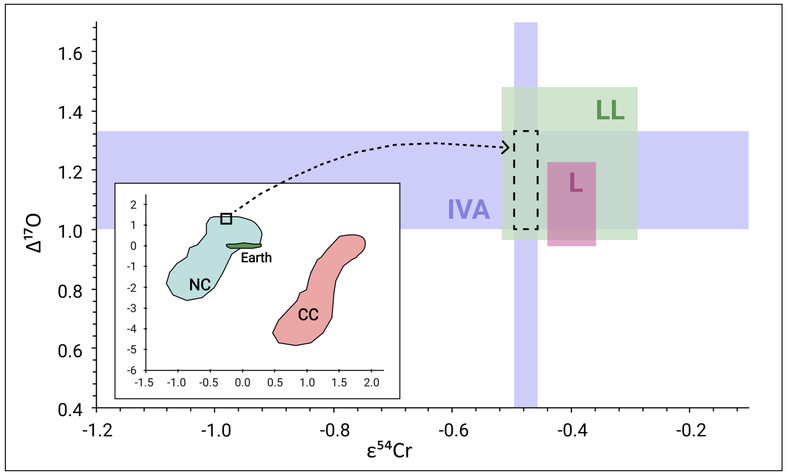
Objective

- $\varepsilon^{54}Cr$ values were obtained from *chromite* ($FeCr_2O_4$) or *daubréelite* ($FeCr_2S_4$) inclusions in IVA iron meteorites to evaluate association of IVA irons and L/LL chondrites.
- Why *chromite* and *daubréelite*?
  - main carrier phases of Cr in these meteorites.
  - low Fe/Cr ratios; no correction for spallogenic Cr [6].

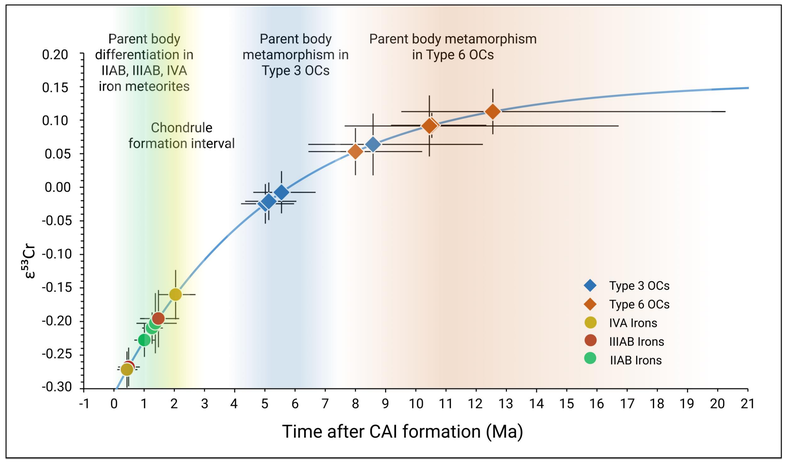
Samples and Methods:

IVA iron meteorite samples: Duchesne and Yanhuitlan.

- *Chromite* and *daubréelite* were analysed for Cr isotope compositions.
- $\Delta^{17}O$ data for IVA and L/LL and ^{54}Cr data for L/LL chondrites are compiled from the literature [7,8,9,10,11].



$\Delta^{17}O$ - $\varepsilon^{54}Cr$ diagram of IVA irons and LL/L ordinary chondrites.



Timeline of first 21 Myrs of the solar system formation showing parent body differentiation in IIAB, IIIAB and IVA irons and parent body metamorphism on OCs [14].

Results and Discussion:

- Combined $\varepsilon^{54}Cr$ vs. $\Delta^{17}O$ data for IVA irons show a clear overlap with the LL ordinary chondrites.
- Both LL chondrites and IVA irons are derived from a common isotope reservoir with the same O-Cr isotope composition and are therefore genetically related.
- This common reservoir existed within 1 Ma after the birth of the solar system as indicated by the early accretion and core formation of the iron meteorite parent bodies [12].
- The reservoir was also the source of planetesimal formation at least up to 3 Ma as indicated by the accretion of the ordinary chondrites parent bodies [13].
- This implies that planetesimal accretion within this reservoir spans an interval of at least 3 Ma and planetary accretion and differentiation was contemporaneous with chondrule formation.

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