

### A NEW ION-PROBE DETERMINATION OF $^{53}\text{Mn}/^{55}\text{Mn}$ IN D'ORBIGNY AND SAHARA 99555 USING MATRIX-MATCHED STANDARDS.

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**Introduction:** The developing chronology for the angrite meteorites shows that their parent body had a prolonged thermal history. New results show that the angrite meteorite series exhibit a spread of Pb-Pb ages as large as 7 Ma [1], but the time intervals measured with U-Pb do not match time intervals recorded by existing Mn-Cr ages [2]. When compared to Lewis Cliff 86010 (LEW), the older Pb-Pb ages of D'Orbigny and Sahara 99555 (SAH) imply that their  $^{53}\text{Mn}/^{55}\text{Mn}$  ratio should be around  $3.8 \times 10^{-6}$ , but so far the highest reported value is only  $3.24 \pm 0.04 \times 10^{-6}$  [3]. The discrepancy between these isotopic systems warrants investigation at the scale of mineral separates and, where possible, within individual crystals. We have determined new  $^{53}\text{Mn}/^{55}\text{Mn}$  isochrons for the D'Orbigny and SAH meteorites using Sensitive High-mass Resolution Ion Micro-Probe Reverse Geometry (SHRIMP-RG) which enables measurement of large surpluses of radiogenic  $^{53}\text{Cr}$  ( $^{53}\text{Cr}^*$ ) in major and accessory minerals and in crystal rims which have very low Cr concentrations.

**Method:**  $^{53}\text{Cr}/^{52}\text{Cr}$  and  $^{55}\text{Mn}/^{52}\text{Cr}$  were measured *in situ* in olivine, high-Ca fayalite and low-Ca kirschsteinite in chips of D'Orbigny and SAH. Suitable areas  $\sim 20 \mu\text{m}$  in diameter were sputtered using a 2 nA O<sup>+</sup> primary ion beam, with mass resolution  $m/\Delta m \sim 6000$  (10% peak height) to resolve molecular interferences. Three compositionally matched synthetic mineral standards were used to monitor instrumental mass-fractionation and to determine Mn-Cr relative sensitivity factors. This is necessary because the relative sensitivity for these elements changes considerably as a function of the bulk matrix composition [4].

**Results:**  $^{53}\text{Cr}/^{52}\text{Cr}$  and  $^{55}\text{Mn}/^{52}\text{Cr}$  are well correlated in Fe-Ca olivine, allowing isochrons to be calculated. Both D'Orbigny and SAH have  $^{53}\text{Mn}/^{55}\text{Mn}$  of approximately  $3.5 \times 10^{-6}$ , accurate to about 10%. This value is higher than a previous ion probe determination [5] and one thermal ionization mass spectrometry study [TIMS; 6], but agrees with the TIMS result of [3].

**Discussion:** The discrepancy between our result and those of [5] is likely due to changes in ionization potential for Mn and Cr in different sputtered matrices. Understanding the effects of using a glass vs. a mineral standard for determining relative sensitivity is crucial to interpreting ion-probe Mn-Cr ages and is being investigated.

The Mn-Cr age difference between formation of D'Orbigny and SAH on one hand, and LEW on the other, is about 5.5 Ma. This interval agrees with the highest previous TIMS determination of [3] and is close to the Pb-Pb age difference of 6 Ma [1]. The latter suggests that isotopic closure for both Cr and Pb diffusion occurred at nearly the same time within each sample.

**References:** [1] Amelin Y. and Irving A. J. 2007. Workshop on the Chronology of Meteorites and the Early Solar System. pp. 20-21. [2] Wadhwa M. et al. 2007. Workshop on the Chronology of Meteorites and the Early Solar System. pp. 173-174. [3] Glavin D. P. et al. 2004. *Meteoritics & Planetary Science* 39:693-700. [4] McKibbin S. J. et al. 2008. *This Meeting*. [5] Sugiura N. et al. 2005. *Earth Planets Space* 57:e13-e16. [6] Nyquist L. E. et al. 2003. Abstract #1388. 34th Lunar and Planetary Science Conference.