Mn-Cr systematics of Juvinas revisited

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Juvinas is one of the two eucrites which displays an old Mn-Cr age [1]. As this age places an important chronological constraint on the accumulation history of the HED parent body, we have revisited the Cr isotope systematics of Juvinas using the analytical technique of Yamakawa et al. [2], which allows determination of high precision Cr isotope ratios without using the second-order fractionation correction [1].

In this study, we prepared a whole rock (WR) powder from a fragment of Juvinas weighing approximately 250mg. This WR powder was also used to retrieve chromite (Chr) by gently dissolving the silicates (Sil) using HF-HNO_3. In addition, we hand-picked eight fragments (FR) weighing >15mg from different parts of the Juvinas specimen for Cr isotope and EPMA analyses. All Cr isotope analysis were performed using the TRITON Plus at the National Museum of Nature and Science.

Our preliminary result shows that the ε^{54}Cr values of the WR, Sil, Chr, and FRs agree within the analytical uncertainty, yielding an average ε^{54}Cr value of -0.61 ±0.09. This value is in good agreement with the value reported by Trinquier et al. [3]. The ε^{53}Cr data, on the other hand, seem to be more complicated than result reported by Lugmair and Shukolyukov [1]. The ε^{53}Cr values of the Chr-WR-Sil fractions are well correlated with the $^{55}Mn/^{52}Cr$ ratios, defining an isochron whose slope corresponds to a $(^{53}Mn/^{55}Mn)_0$ of (1.2 ±0.7) x 10^{-7}. Using the U-Pb age and $(^{53}Mn/^{55}Mn)_0$ of D'Orbigny as an anchor [4, 5], this translates to an absolute age of 4546 ±4 Ma, an age significantly younger than that reported in [1]. The ε^{53}Cr values of the WR and FRs from this study and Trinquier et al. [6], on the other hand, show a considerable scatter. While these data generally plot along a reference line whose slope corresponds a $(^{53}Mn/^{55}Mn)_0$ of ~3 x 10^{-6}, the scatter extends beyond the analytical uncertainty, implying that the Mn-Cr systematics of Juvinas may be partially disturbed. A careful re-investigation of the Mn-Cr systematics, together with mineralogical characterization of important Cr bearing phases, is required to unravel the crystallization/thermal history of this meteorite.

References: [1] Lugmair and Shukolyukov (1998), GCA, 62, 2863. [2] Yamakawa et al. (2009), Anal. Chem., 81, 9787. [3] Trinquier et al. (2007), ApJ, 655, 1179. [4] Brennecka et al. (2012) PNAS, 109, 9299. [5] Yamashita et al. (2016), Goldschmidt Conf. Abstr. #3538. [6] Trinquier et al. (2008), GCA, 72, 5146.

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