

$\Delta^{17}\text{O}-\epsilon^{54}\text{Cr}$ Systematics as a Forensic Tool for Investigating Isotopic Domains in the Early Solar System

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The widespread heterogeneity of the $\epsilon^{54}\text{Cr}$ isotopic composition in meteorites [e.g., 1] and its utility in meteorite classification [e.g., 2] has established this parameter as an increasingly robust forensic tool for investigating origins of planetary materials and their inter-relationships.

Comparison of the coupled $\Delta^{17}\text{O}-\epsilon^{54}\text{Cr}$ values within an individual sample to other meteorites (or class of meteorites) provides a powerful means to establish or refute an origin on a common parent body. Thus, we have recently reported high-precision Cr isotopic results for a range of ungrouped or anomalous meteorites [3-5] to investigate possible common origins with known meteorite groups, and to decipher the identity and evolution of their respective parent bodies.

We will illustrate this with three examples of the use of $\Delta^{17}\text{O}-\epsilon^{54}\text{Cr}$ systematics in investigating differentiation processes in the early Solar System. First, we will discuss the use of $\epsilon^{54}\text{Cr}$ in examining the possibility for a non-Vesta origin for the anomalous eucrites Ibitira, PCA 91007, Asuka 881394, Pasamonte, and NWA 1240, and the possibility of the current (or former) existence of multiple differentiated Vesta-like parent bodies. Second, we will review the increasing number of unique, previously unsampled differentiated bodies that are becoming more discernible using $\Delta^{17}\text{O}-\epsilon^{54}\text{Cr}$ systematics. For these ungrouped meteorites (NWA 7325, NWA 8054, and NWA 6704), the $\Delta^{17}\text{O}$ composition alone would provide uncertain relationships with other established meteorite groups. Finally, we will discuss the ability of $\epsilon^{54}\text{Cr}$ values to establish genetic connections between a newly discovered group of materials possessing highly metamorphosed and igneous textures and CR2 chondrites, with implications for possible differentiation on the CR parent body.

[1] Trinquier A. *et al* (2007) *ApJ*, **655**, 1179-1185 [2] Warren P. H. (2011) *EPSL*, **311**, 93-100 [3] Sanborn M. E. *et al* (2014) *45th LPSC*, A2018 [4] Sanborn M. E. *et al* (2013) *76th MetSoc*, A5220 [5] Sanborn M. E. *et al* (2014) *45th LPSC*, A2032