

High precision stable chromium isotopes in meteorites

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The stable isotopic compositions of meteorites have been widely studied to constrain early processes in the solar nebula and planetary accretion and differentiation processes such as core formation (e.g., [1]). It has been proposed that stable chromium isotopes could be fractionated during core formation [2] on the basis that chondrites appear to be isotopically lighter than the Bulk Silicate Earth (BSE). More recently, it was proposed that the stable Cr isotopic difference between chondrites and BSE is due to heterogeneity in the solar system [3].

Here we report high precision stable Cr isotopic compositions for 19 meteorites (chondrites and achondrites). The external precision of these measurements is about 15ppm, which is almost 4 times better than previous studies. Samples were analysed for both unspiked and double-spiked aliquots and corrections made for nucleosynthetic anomalies to determine mass dependent variations.

The $\delta^{53}\text{Cr}$ values for carbonaceous chondrites range from -0.13 to -0.07 which is more variable than for ordinary chondrites (-0.14 to -0.11). Enstatite chondrites are isotopically heavier than ordinary chondrites and these small variations within our dataset could be due to redox conditions and heterogeneity in the early solar system. HEDs and Martian meteorites are characterised by more variability with a good correlation between Cr concentration and $\delta^{53}\text{Cr}$, which may reflect magmatic processes.

The chondrites analysed in this study have isotopic compositions that are similar to that of BSE, in contrast to findings of other studies [2] [3]. Isotopic fractionation between metal and silicate at high temperature was also studied using piston cylinder experiments. Both silicate and metal fractions were analysed for their Cr isotopic compositions. There is no isotopic difference between these phases. These new results suggest that there was no Cr isotopic fractionation during core formation on Earth.

[1] Armytage et al. 2011, *GCA* [2] Moynier et al. 2011, *Science* [3] Schiller et al. 2014, *JAAS*.