Chromites of ordinary chondrites: Chronological constraints by the initial Cr method and new oxygen isotope data

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Chronological studies indicate that the parent bodies of ordinary chondrites accreted shortly, ~3 $x10^6$ y, after the isolation of the solar nebula from the instellar medium. The following period of thermal metamorphism lasted for ~100 $x10^6$ y. However, the details of this evolution as well as the structure of the parent bodies of these first planetary objects are still debated. Is the parent body characterized by a layered structure with the most metamorphosed material in the center while less metamorphosed material is located at the outer zones? Or, do these bodies possess a rubble pile structure, implying that high and low temperature cooling occurred in different planetary environments?

We will present a systematic investigation with Mn/Cr systematics and oxygen isotopes on chromites that were separated from different classes (H-, L-, LL-) and types (4, 5, 6) of ordinary chondrites. Chromite formed during thermal metamorphism and this mineral phase is present in a low abundance (0.3-1.0 %) all classes et types of OCs.

New oxygen data (n=5) of are fully consistent with previous findings that LL and L chondrites exhibit the highest and that H chondrites showing the lowest $\Delta^{17}O$ values respectively [1].

We will discuss the new Cr data of chromites in an approach that is similar to the ‘Sr initial method’ that has been applied to phosphates [1,2]. Chromites are characterized by very low (< 0.01) Cr/Mn ratios. Therefore, their Cr isotopic composition does not change with time, it is “frozen in”. In consequence, the Cr composition measured today in chromites can directly be compared to the Cr isotopic evolution of the solar system. Assuming an initial solar system composition of Cr and an elemental Mn/Cr ratio similar to CIs (0.71), this evolution of the Cr isotopic composition can be traced over time and when an appropriate time anchor is used, the Cr isotopic composition can directly be transformed into absolute ages.

[1] Clayton et al. (1991) *GCA* **55**, 2317-2337; [2] Sanz et al. (1969), *EPSL* **7**, 33-43; [3] Podosek & Brannon (1991), *Meteoritics* **26**, 145-152.