

**Zn isotopes in chondrites, chondrules and matrix: Origin of the volatile element depletion in chondrites**

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Planetary materials are characterized by specific abundances of moderately volatile lithophile elements, with volatile element depletions observed in differentiated bodies and most chondrite groups when compared to CI chondrites [1]. The origin of this volatile element depletions is, however, still debated. Stable isotope compositions of moderately volatile elements can be used to trace the origin of volatile element abundance variations among planetary materials.

Zinc is a moderately volatile element with a 50% condensation temperature of  $\sim 730$  K [2]. The Zn isotopic composition of terrestrial igneous rocks is very limited in range and clustered within  $0.2 < \delta^{66}\text{Zn} < 0.4$  [3], where  $\delta^{66}\text{Zn}$  is the permil deviation of the  $^{66}\text{Zn}/^{64}\text{Zn}$  ratio from the JMC-Lyon standard. The only exceptions are significantly volatile-depleted samples, including the Moon and terrestrial impact rocks, which display heavy Zn isotope compositions possibly indicating Zn isotope fractionation during evaporation [4, 5]. Luck et al. [6] found a negative correlation between  $\delta^{66}\text{Zn}$  and  $1/\text{Zn}$  among CV, CM, CO, and CI chondrites, opposite to what is expected if evaporation was the cause of Zn abundance variations between chondrite groups. This finding, however, suggests that the volatile element variability in chondrites was caused by nebula processes.

We have analyzed the Zn isotopic composition of an extended range of carbonaceous chondrites: CI (3), CM (4), CO (5), CV (4), CR (1), and 4 CK will be measured next. All analyzed bulk samples define a negative correlation in a  $\delta^{66}\text{Zn}$  vs  $\text{Mg}/\text{Zn}$  or  $\text{Ca}/\text{Zn}$  plot, which further confirms that Zn abundance variations between carbonaceous chondrites is not due to evaporation but rather due to nebula processes.

In addition, we will present chondrules and matrix data for both Allende (CV) and Mokoia (CV) to test for isotopic complementarity between chondritic components.

**References:** [1] O'Neill, H. S. C. & Palme, H. 2008. Collisional erosion and the non-chondritic composition of the terrestrial planets. *Phil. Trans. R. Soc. A* **366**, 4205-4238. [2] Lodders, K. 2003. Solar System abundances and condensation temperatures of the elements. *Astrophys. J.* **591**, 1220-1247. [3] Chen, H., et al. 2013. Zinc isotope fractionation during magmatic differentiation and the isotopic composition of the bulk Earth. *Earth Planet. Sci. Lett.* **369-370**, 34-42. [4] Moynier, F. et al. 2009. Isotopic fractionation of zinc in tektites. *Earth Planet. Sci. Lett.* **277**, 482-489. [5] Day, J. & Moynier, F. 2014. Evaporative fractionation of volatile stable isotopes and their bearing on the origin of the Moon. *Phil. Trans. R. Soc. A* **372**, 20130259, doi:10.1098/rsta.2013.0259. [6] Luck, J. M., et al. 2005. Zn and Cu isotopic variations in chondrites and iron meteorites: Early solar nebula reservoirs and parent-body processes. *Geochim. Cosmochim. Acta* **69**, 5351-5363.