Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.16589

# Origin of the volatile elements of primitive achondrites and iron meteorites revealed by zinc isotope anomalies

**LINRU FANG**[1], FRÉDÉRIC MOYNIER[1], MARINE PAQUET[1], EDITH KUBIK[1,2], JEAN-ALIX BARRAT[3,4] AND MARC CHAUSSIDON[5]

[1]Université de Paris, Institut de physique du globe de Paris, CNRS

[2]University of Bayreuth

[3]CNRS, IRD, Institut Français de Recherche pour l'Exploitation de la Mer, LEMAR, Univ Brest, France

[4]Institut Universitaire de France

[5]Université Paris Cité, Institut de physique du globe de Paris, CNRS

Presenting Author: lfang@ipgp.fr

Based on the isotopic anomalies of non-volatile elements such as Ti, Cr, Mo, and Ru, Solar System materials have been classified into two reservoirs: non-carbonaceous (NC) and carbonaceous (CC) [1,2]. Recently, isotopic anomalies of a moderately volatile element, Zn, have also been identified. Researchers have discovered that CC and NC chondrites form two distinct reservoirs [3,4], with CC having a positive $\varepsilon^{66}$Zn and NC having a negative $\varepsilon^{66}$Zn compared to the Earth ($\varepsilon^{66}$Zn=0). Here, $\varepsilon^{66}$Zn is the per ten thousand deviation of the $^{66}$Zn/$^{64}$Zn ratio normalized to the $^{68}$Zn/$^{64}$Zn ratio of 0.3856. These anomalies have been used to uncover the origin of the volatile elements of the Earth.

In this study, we report the mass-independent (as well as mass-dependent) Zn isotopic composition of primitive achondrites, iron meteorites, mesosiderites, and pallasites to evaluate the origin (CC vs NC) of their moderately volatile elements. Ungrouped primitive achondrites NWA6901 and NWA4587 have positive $\varepsilon^{66}$Zn, consistent with their affinity to CR chondrites as suggested by oxygen isotopes [5,6]. On the other hand, the acapulcoite, winonaite, brachinite, eucrite, diogenite and main group pallasite studied here have negative $\varepsilon^{66}$Zn, suggesting that these groups have volatile elements accreted from the NC reservoir.

In addition, we show that IID iron meteorites display positive $\varepsilon^{66}$Zn, indicating that their volatile elements originate from the CC reservoir, while IAB, IIIAB, IIE irons, and mesosiderites are derived from the NC reservoir, with negative $\varepsilon^{66}$Zn. Overall, our study contributes to a better understanding of the origin of the volatile elements in different types of meteorites and sheds light on the formation and evolution of the Solar System.

[1] Trinquier, Birk & Allegre (2007), *The Astrophysical Journal* 655(2), 1179-1185.

[2] Trinquier et al. (2009), *Science* 324(5925), 374-376.

[3] Savage, Moynier & Boyet (2022), *Icarus,* 115172.

[4] Steller et al. (2022), *Icarus* 386, 115171.

[5] Sanborn, Yin & Irving (2014), *LPS XLV*, 2032.

[6] Sanborn & Yin (2019), *LPS L*, 1498.