Goldschmidt 2021 Abstract
https://doi.org/10.7185/gold2021.5076

Probing the cerium stable isotopic dynamics of terrestrial and extraterrestrial rocks

HAMED POURKHORSANDI[1], VINCIANE DEBAILLE[2], JEROEN DE JONG[3], ROSALIND ARMYTAGE[4] AND SOPHIE DECRÉE[5]

[1]Université Libre de Bruxelles (ULB)
[2]Université Libre de Bruxelles
[3]Université Libre de Bruxelles, DSTE, CP160/02
[4]Jacobs/NASA
[5]Royal Belgian Institute of Natural Sciences
Presenting Author: hpkhorsandi@gmail.com

Probing the cerium stable isotopic dynamics of terrestrial and extraterrestrial rocks

Hamed Pourkhorsandi[a], Vinciane Debaille[a], Jeroen de Jong[a], Rosalind M.G. Armytage[a,b], and Sophie Decrée[c]

[a]Laboratoire G-Time, ULB, Belgium; [b]Jacobs/JETS, NASA JSC, USA; [c]RBINS, Belgium

E-mail: hamed.pourkhorsandi@ulb.ac.be

The systematics of REE and their radiogenic isotopes are among the main sources of information about the age, origin and formation of terrestrial and extraterrestrial rocks and their parent bodies [1]. Cerium is the most abundant REE. It has four main stable isotopes and the focus so far has been on ^{138}Ce, a β-decay product of ^{138}La [2]. Despite their higher abundance, very little data exist on the distribution of stable ^{140,142}Ce (calculated as $^{142}\delta$Ce) in the solar system [3-5].

This study aims to (i) investigate the relationship between Ce elemental abundance with $^{142}\delta$Ce, (ii) characterize the effects of magmatic petrogenesis and thermal metamorphism on $^{142}\delta$Ce, and (iii) report the $^{142}\delta$Ce composition of the inner solar nebula, based on the analysis of terrestrial rocks and ordinary and enstatite chondrites.

Analytical methodology is described in [6]. $^{142}\delta$Ce data of terrestrial igneous reference materials show a relatively homogenous composition between different materials. This indicates lack of magmatic fractionation and/or Ce concentration effects on $^{142}\delta$Ce composition. On the other hand, REE ore samples tend to show slightly lighter average $^{142}\delta$Ce composition than the common igneous rocks and will require more scrutiny.

Our selected chondritic meteorites cover a range of solar nebula conditions, from highly reduced EH to highly oxidized LL, and encompassing all petrologic types from 3 to 6. Our $^{142}\delta$Ce data show a relatively homogeneous composition between the average value of chondrites and terrestrial igneous samples, except some having lighter or heavier $^{142}\delta$Ce compositions without any relationship with their chemical or petrologic types. These observations imply lack of ^{140,142}Ce fractionation during thermal metamorphism, fO_2 difference, and between these chondrites and analysed terrestrial samples.

References: [1] DePaolo (1998) *Neodymium Isotopic Geochemistry*, 261pp. [2] Bellot+ (2015) *GCA* 168, 261-279. [3] Nakada+ (2013) *GCA*, 103, 49-62. [4] Nakada+ (2016) *GCA*, 181, 89-100. [5] Nakada+ (2019) *Geochemical Journal*, 53, 293-304. [6] Pourkhorsandi+ (2021) *Talanta*, 224, 121877.