Solar initial $^{92}Nb/^{93}Nb$ deduced from U-Pb dated achondrites

T. IIZUKA[1], Y.-J. LAI[2], W. AKRAM[2], Y. AMELIN[3] AND M. SCHÖNBÄCHLER[2]

[1]DEPS, University of Tokyo (iizuka@eps.s.u-tokyo.ac.jp)
[2]IGP, ETH Zürich, 8092 Zürich, Switzerland
[3]RSES, Australian National University

The short-lived radionuclide ^{92}Nb decays to ^{92}Zr with a half-life of 36 Ma. Because Nb and Zr can fractionate from each other during partial melting of the mantle, the Nb-Zr system can potentially place chronological constraints on early planetary silicate differentiation. This application requires the initial abundance of ^{92}Nb (or $^{92}Nb/^{93}Nb$) and its homogeneity in the solar system to be unambiguously defined. Yet previously reported initial $^{92}Nb/^{93}Nb$ values range from ~10^{-5} to >10^{-3} [1-6], and remain to be further constrained. All but one of the previous studies estimated the initial $^{92}Nb/^{93}Nb$ using Zr isotope data for single phases with fractionated Nb/Zr in meteorites such as zircons and CAIs, assuming that their source materials and bulk chondrites possessed identical initial $^{92}Nb/^{93}Nb$ and Zr isotopic compositions [1-5]. To evaluate the homogeneity of the initial ^{92}Nb abundance, however, it is desirable to define internal mineral isochrons for meteorites with known absolute ages. Although Schönbächler et al. [6] applied the internal isochron approach to the chondrite Estacado and the mesosiderite Vaca Muerta, these meteorites include components of different origins and their absolute formation ages are not precisely constrained.

Here we present Nb-Zr data for mineral fractions from four "monomict" meteorites, which originate from distinct parent bodies and whose U-Pb ages were precisely determined: the angrite NWA 4590 (4557.9 ± 0.3 Ma [7]), the eucrite Agoult (4554.5 ± 2.0 Ma [8]) and the ungrouped achondrites Ibitira (4556.8 ± 0.6 Ma [9]) and A-881394 (4566.8 ± 0.3 Ma [10]). The Nb-Zr data for all studied achondrites define internal isochrons, with slopes corresponding to initial $^{92}Nb/^{93}Nb$ ratios of 2.5–5.3 x 10^{-5} at the time of the solar system formation. We are still in the process of determining Zr isotopic ratios in coarse (~80 μm) zircon grains from the eucrite Agoult [8]. The solar initial $^{92}Nb/^{93}Nb$ will be more precisely determined by integrating the zircon data into the internal isochron. Nevertheless, our data indicate the homogeneous distribution of ^{92}Nb among the source regions of the studied achondrites at the order of ~10^{-5} for the solar initial $^{92}Nb/^{93}Nb$ ratio.

[1] Harper (1996) *ApJ* **466**, 437. [2] Sanloup et al. (2000) *EPSL* **184**, 75. [3] Yin et al. (2000) *ApJ* **536**, L49. [4] Münker et al. (2000) *Science* **289**, 1538. [5] Hirata (2001) *Chem. Geol.* **176**, 323. [6] Schönbächler et al. (2002) *Science* **295**, 1705. [7] Amelin et al. (2011) *LPSC* 1682. [8] Iizuka et al. (2015) *EPSL* **409**, 182. [9] Iizuka et al. (2014) *GCA* **132**, 259. [10] Koefoed et al. (2015) *LPSC* 1842.