Nb-Zr systematics of rutiles from mesosiderites

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Mesosiderites and iron meteorites are notoriously difficult to date because of their limited mineralogy. The ^{92}Nb-^{92}Zr decay system ($T_{1/2}$ = 37 Myr) may provide a means to address this gap for samples, which contain rutile. The Nb-Zr decay system is a viable chronometer to constrain the evolution of planetary materials in the early solar system (e.g., [1]). Among the characterized minerals in meteorites, rutile displays the high Nb/Zr ratios with large ^{92}Zr excesses [2, 3] and is therefore ideally suited for Nb-Zr chronometry. In this study, we aim to develop an analytical method to determine Nb-Zr ages of meteoritic rutiles.

Occurrence and chemical composition of rutiles in the Vaca Muerta and Estherville mesosiderites were examined using SEM and EPMA at National Institute of Polar Research (Japan). Rutile grains were hand-picked after dissolving the silicate part of the mesosiderites in a concentrated HNO_3-HF mixture. Subsequently, the grains were dissolved in concentrated HNO_3-HF using Parr® bombs. Terrestrial rutiles and a synthetic TiO_2 powder (NIST SRM 154c) were also processed to validate the method. The analytical procedure of measuring ^{93}Nb/^{90}Zr ratios and Zr isotope compositions followed [1, 4]. The Zr isotope analysis was performed using a Thermo Finnigan Neptune Plus MC-ICPMS coupled with an Aridus II introduction system at ETH Zurich.

The EPMA analysis of rutiles yielded concentrations of ~400 ppm Zr and ~1200 ppm Nb in Vaca Muerta and ~1700 ppm Zr and ~300 ppm Nb in Estherville. Thus, the ^{93}Nb/^{90}Zr ratios of the rutiles considerably vary from 0.3–6. The terrestrial rutile and synthetic TiO_2 samples yielded Zr isotope ratios identical to the bracketed Zr standard, NIST 3169. This demonstrates that our method yields accurate high-precision Zr isotope measurements of meteoritic rutiles using MC-ICPMS. In addition, we will also present new Nb-Zr data of rutiles separated from mesosiderites and discuss their implications for the chronology.

[1] Iizuka *et al.* (2016) *EPSL* **439,** 172–181. [2] Harper (1996) *Astrophys. J.* **466**, 437–456. [3] Yin *et al.* (2000) *Astrophys. J.* **536**, L49–L53. [4] Schönbächler *et al.* (2004) *Analyst.* **129**, 32–37.