Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.22887

The nucleosynthetic heritage of Bennu

MARIA SCHÖNBÄCHLER[1], MIRIAM RÜFENACHT[1], LARA A. E. MEYER[1], MATTIAS EK[1], KATARZYNA M. LISZEWSKA[1], MANUELA A. FEHR[1], JAN RENDER[2], QUINN R SHOLLENBERGER[2], JOSH WIMPENNY[2], GREG BRENNECKA[2], JESSICA J. BARNES[3], ANN N. NGUYEN[4], HAROLD C. CONNOLLY JR.[5] AND DANTE S. LAURETTA[3]

[1]ETH Zurich

[2]Lawrence Livermore National Laboratory

[3]Lunar and Planetary Laboratory, University of Arizona

[4]NASA Johnson Space Center

[5]Rowan University

Presenting Author: mariasc@ethz.ch

The OSIRIS-REx mission sampled the B-type asteroid Bennu and delivered 121.6 g of material to Earth in September 2023. Nucleosynthetic isotope variations are powerful tracers that can be used to establish relationships between different meteorite groups and the returned samples [1]. They can also constrain the samples' nucleosynthetic heritage, as well as mixing and reservoir formation in the protoplanetary disk [e.g.,2,3]. Nucleosynthetic variations reflect the heterogeneous distribution of isotopically distinct dust in the disk, and as such, they provide evidence for the formation of meteorite parent bodies from isotopically distinct dust reservoirs [e.g., 3]. They are thus also a means to identify exogenous clasts in Bennu materials.

Here, we report Ti and Fe isotope data obtained from Bennu samples and carbonaceous chondrites. We also present Ti isotope data for hand-picked matrix from CV and CR chondrites. An isotopic dataset was obtained on aggregate sample OREX-803015-100 consisting of particles typically <500 μm; therefore, its composition represents an average for Bennu materials. A 20.66 mg aliquot was dissolved at Washington University, St. Louis [4]. From this, 5 mg was analysed for Ti and Fe isotopes on a NeptunePlus MC-ICPMS at ETH Zurich; data from a separate aliquot, analysed at Lawrence Livermore National Laboratory, are reported in a companion abstract [5]. Our results demonstrate a close relationship of Bennu to CI and Ryugu samples and therefore a formation outside the snowline, as hypothesized by the mission [6]. Furthermore, the ^{50}Ti data from the CV and CR matrix fall consistently below the CI and Bennu values, indicating the presence of a uniform matrix mixed with ∼0.1–0.7% of refractory inclusions in CIs and Bennu.

Supported by NASA under Contract NNM10AA11C and Award NNH09ZDA007O.

References:

[1] Yokoyama et al. (2022) Science 379, eabn7850. [2] Mezger et al. (2020) Space Science Reviews 216, 27 [3] Rüfenacht et al. (2023) GCA 355, 110-125. [4] Koefoed et al. (2024) LPSC Abstract #2264. [5] Brennecka et al. (2024) this conference. [6] Lauretta et al. (2023) arXiv 2308.11794.