Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.24111

Bulk Elemental Composition of Aggregate Material from Asteroid Bennu

PIERS KOEFOED[1], KUN WANG[1], CONEL M. O'D. ALEXANDER[2], JEAN-ALIX BARRAT[3], PIERRE HAENECOUR[4], JESSICA J. BARNES[4], ANN N. NGUYEN[5], HAROLD C. CONNOLLY JR.[6,7,8] AND DANTE S. LAURETTA[4]

[1]Washington University in St. Louis
[2]Carnegie Institution for Science
[3]CNRS, IRD, Institut Français de Recherche pour l'Exploitation de la Mer, LEMAR, Univ Brest, France
[4]Lunar and Planetary Laboratory, University of Arizona
[5]NASA Johnson Space Center
[6]Rowan University
[7]University of Arizona
[8]American Museum of Natural History

Presenting Author: piers.koefoed@wustl.edu

On September 24, 2023, NASA's OSIRIS-REx mission returned pristine carbonaceous material from asteroid Bennu. One key aspect required to understand this returned material is to establish its bulk chemical composition. This is primarily due to each chondrite group having a distinct elemental composition, which is important both as a classification tool and for establishing the connections between the different chondrite groups. As the carbonaceous and non-carbonaceous chondrites are thought to have formed in the inner and outer protoplanetary disk, respectively, measuring the bulk elemental composition of Bennu material will help test the mission hypothesis that "*Bennu's parent body formed beyond the snow line by accretion of material in the protoplanetary disk*" [1]. In addition, two further mission hypotheses — paraphrased as *Bennu's bulk elemental composition reflects that of its parent asteroid and is similar to the composition of the Sun* and *Bennu's dominant lithologies are comparable in composition to the most aqueously altered carbonaceous chondrites* [1] — can be directly tested by bulk elemental analyses.

Elemental analyses were undertaken on sample OREX-803015-0, a 20.66 mg aggregate sourced from inside the sample collector. All analyses were conducted using an iCAP Q ICP-MS. Overall, all 54 elements analyzed for the Bennu aggregate sample show similar abundances to those of the average CI chondrite [2,3], and thus the solar photosphere composition and some of the most aqueously altered carbonaceous chondrites. The elemental data also show that Bennu is indeed a carbonaceous asteroid that formed beyond the snow line by accretion of material in the protoplanetary disk. This Bennu aggregate sample appears similar in elemental composition to samples of asteroid Ryugu, yet without the small refractory element enrichments seen in Ryugu [4,5].

Supported by NASA under Contract NNM10AA11C. We Also thank financial support from McDonnell Center for the Space Sciences and NASA OSIRIS-REx Sample Analysis Participating Scientist Program (grant #80NSSC22K1689).

[1] Lauretta D.S. et al. (2023) *arXiv* 2308.11794. [2] Lodders K. (2003) *APJ, 591*, 1220-1247. [3] Barrat J.A. (2012) *GCA, 83*, 79-92. [4] Nakamura E. et al. (2022) *Japan Acad. Ser. B, 98*, 227-282. [5] Yokoyama T. et al. (2023) *Science, 379*, eabn7850.