

Surface exposure history of asteroid Bennu based on cosmogenic radionuclides in OSIRIS-Rex samples.

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The surface of asteroid Bennu changes over time because of impacts, mass movement, and particle ejections [1-4]. The OSIRIS-REx samples were collected from a 20-m-diameter crater on Bennu called Hokioi. One of the driving hypotheses of the mission is that Hokioi is part of a population of small (<25 m) craters that are less than 0.1 Myr old and contain relatively unweathered material [1,4]. Our goal is to understand the recent surface exposure history of Bennu, utilizing radionuclides (¹⁰Be, ²⁶Al, ³⁶Cl, ⁴¹Ca) produced by both galactic and solar cosmic rays. We received ~12 mg of aggregate sample OREX-803014-0. We picked five of the larger particles with masses ranging from 0.24 to 0.68 mg. We dissolved each particle, along with 0.15 mg Be and 1.0 mg Cl carrier, in HF/HNO₃ mixture, and did the same for the remaining aggregate sample of 9.8 mg. After dissolution, we took a small aliquot for chemical analysis, added 0.7 mg of Al carrier, and separated Be, Al, and Cl for analysis of cosmogenic ¹⁰Be, ²⁶Al, and ³⁶Cl by accelerator mass spectrometry [5]. Preliminary ²⁶Al results show concentrations of 21–27 dpm/kg for the Bennu samples, with an average of 22.5 ± 0.6 dpm/kg for the five particles and 21.1 ± 0.7 dpm/kg for the remaining aggregate. These values are close to the expected ²⁶Al saturation values of 25–30 dpm/kg for the top 1 m of Bennu's regolith, suggesting a minimum exposure age of 1.5–2.0 Myr near the surface. Our initial Bennu results also resemble those found for Ryugu samples [6,7]; thus, we can hypothesize that the two asteroids have had similar surface exposure histories.

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