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Pb isotopic compositions of Ryugu samples and carbonaceous chondrites

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The surface samples from a primitive carbonaceous asteroid Ryugu were successfully brought back by the Hayabusa2 spacecraft in 2020. The primary curation phase and subsequent initial analyses revealed that the Ryugu samples are similar to CI chondrites [1,2]. Here, we report preliminary results on the Pb isotopic compositions obtained from the Ryugu samples for their further characterization.

Four Ryugu samples [two samples from the first touchdown (A0106-0107) and two samples from the second touchdown (C0107-0108)] and three carbonaceous chondrites [Tagish Lake, Murchison, and Orgueil] were examined in this study. The Pb fractions were prepared using ion-exchange procedures following sample digestion [2], and unspiked and ^{207}Pb-^{204}Pb double-spiked samples prepared from a single dissolution were measured with TIMS (Triton plus) at Tokyo Tech.

The Pb isotopic data for Ryugu samples and carbonaceous chondrites from this study, as well as the literature data for Murchison and Allende bulk samples [3] and Allende matrix samples [4], form a straight array that closely passes through the primordial Pb compositions defined by troilites in iron meteorites [5,6] (Fig. 1). The Ryugu Pb isotopic compositions show variations but are indistinguishable between the samples from the first and second touchdown sites. They are less radiogenic than in most analyzed carbonaceous chondrites, indicating lower content of chondrule- or CAI-like refractory material depleted in moderately volatile elements. The y-intercept of the regression yields an age of 4577.9 ± 7.1 Ma, which is older than the age of Solar System formation (4567.3 ± 0.16 Ma [7]). As discussed in [4], this old age could be related to the presence of various components in chondrites with different ages and ^{238}U/^{235}U ratios.

This research was conducted by the teamwork of the Hayabusa2-initial-analysis chemistry team and the Hayabusa2-initial-analysis core.

References: [1] Yada et al. (2022) *Nat. Astron.*, 6, 214-220. [2] Yokoyama et al. (2022), *Science*, in review. [3] Bouvier et al. (2007) *GCA*, 71, 1583-1604. [4] Merle et al. (2020) *GCA*, 277, 1. [5] Blichert-Toft et al. (2010) *EPSL*, 300, 1-20. [6] Tatsumoto et al (1973) *Science*, 180, 1279-1283. [7] Connelly et al. (2012) *Science*, 338, 651-655. [8] Vermeesch (2018) *Geosci. Frontier.*, 9, 1479-1493.

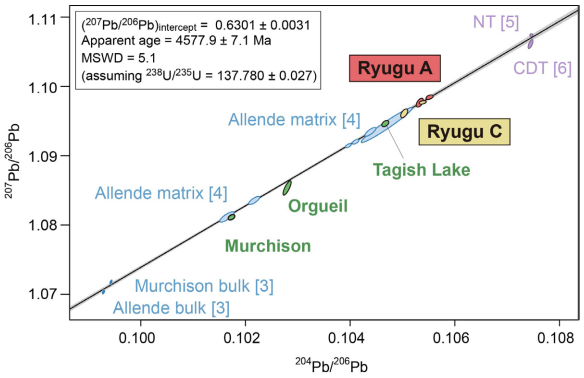

Fig. 1. ^{207}Pb/^{206}Pb-^{204}Pb/^{206}Pb isochron for Ryugu, carbonaceous chondrites [this study, 3], and Allende matrix [4]. Primordial Pb composition, assumed to be either Nantan troilite (NT [5]) or Canyon Diablo troilite (CDT [6]), was not included in the determination of isochron using IsoplotR [8]. Isochron age is reported at the 95% confidence level. The y-intercept age from the regression overlaps with the age from the slope of ^{207}Pb/^{204}Pb-^{206}Pb/^{204}Pb isochron within the errors.