Anomalously porous boulders on (162173) Ryugu as primordial materials from its parent body

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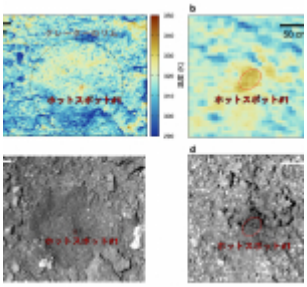

Press Release
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Abstract

Planetesimals—the initial stage of the planetary formation process—are considered to be initially very porous aggregates of dusts, and subsequent thermal and compaction processes reduce their porosity. The Hayabusa2 spacecraft found that boulders on the surface of asteroid (162173) Ryugu have an average porosity of 30–50%, higher than meteorites but lower than cometary nuclei, which are considered to be remnants of the original planetesimals. Here, using high-resolution thermal and optical imaging of Ryugu’s surface, we discovered, on the floor of fresh small craters (<20 m in diameter), boulders with reflectance (~0.015) lower than the Ryugu average and porosity >70%, which is as high as in cometary

bodies. The artificial crater formed by Hayabusa2's impact experiment is similar to these craters in size but does not have such high-porosity boulders. Thus, we argue that the observed high porosity is intrinsic and not created by subsequent impact comminution and/or cracking. We propose that these boulders are the least processed material on Ryugu and represent remnants of porous planetesimals that did not undergo a high degree of heating and compaction. Our multi-instrumental analysis suggests that fragments of the highly porous boulders are mixed within the surface regolith globally, implying that they might be captured within collected samples by touch-down operations.

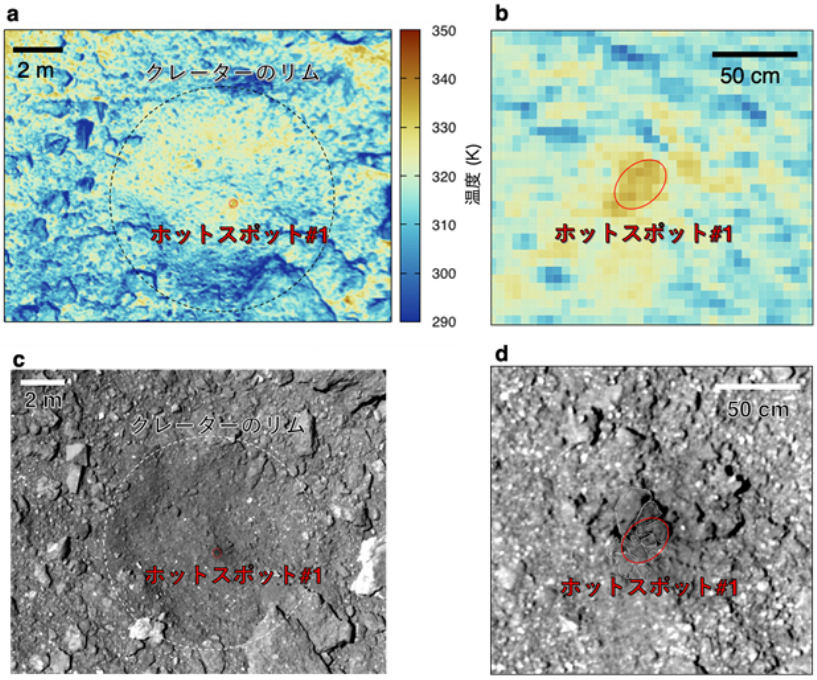

Figure: Hotspot HS1 within the ID126 crater.
Please see the following links for details.

- School of Science Press Release: https://www.s.u-tokyo.ac.jp/ja/press/2021/7400/
- URL: https://www.nature.com/articles/s41550-021-01371-7