

Chemical reaction processes bridge between asteroid Ryugu and early evolution of Earth

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JAXA's Hayabusa2 has arrived at asteroid Ryugu and is uncovering many new aspects of the primitive asteroid, such as extremely low albedo ($4.5 \pm 0.1\%$), flat spectra (Cb type), young resurfacing age ($< 10^6$ yr for the top 1 m layer), high boulder number density (x2 of Itokawa) and low abundance of hydrated minerals. These pieces of information is very importance for understanding the early evolution of inner solar system and Earth's surface environment. In particular, what happens upon hypervelocity impacts of such bodies is important for understading the atmospheric chemistry of early Earth. In this study, we review atmospheric entry processes, high-temperature chemistry processes, and discuss the implications of recent results on asteroid missions, such as Hayabusa2 and OSIRIS-REx, for Earth's early evolution.

Keywords: Asteroid missions, Hypervelocity impacts, Impact vapor clouds, Atmospheric entry physics