

## Hayabusa2 and the formation of the Solar System

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Explorations of small solar system bodies bring us direct and unique information about the formation and evolution of the Solar system. Asteroids may preserve accretion processes of planetesimals or pebbles, a sequence of destructive events induced by the gas-driven migration of giant planets, and hydrothermal processes on the parent bodies. After successful small-body missions like *Rosetta* to comet 67P/Churyumov-Gerasimenko, *Dawn* to Vesta and Ceres, and *New Horizons* to Pluto, two spacecraft *Hayabusa2* and *OSIRIS-REx* are now traveling to dark primitive asteroids. The *Hayabusa2* spacecraft journeys to a C-type near-earth asteroid (162173) Ryugu (1999 JU3) to conduct detailed remote sensing observations and return samples from the surface. The *Hayabusa2* spacecraft developed by Japan Aerospace Exploration Agency (JAXA) was successfully launched on 3 Dec. 2014 by the H-IIA Launch Vehicle and performed an Earth swing-by on 3 Dec. 2015 to set it on a course toward its target. The spacecraft will reach Ryugu in the summer of 2018, observe the asteroid for 18 months, and sample surface materials from up to three different locations. The samples will be delivered to the Earth in Nov.-Dec. 2020.

Ground-based observations have obtained a variety of optical reflectance spectra for Ryugu. Some reported the 0.7  $\mu\text{m}$  absorption feature and steep slope in the short wavelength region, suggesting hydrated minerals. Some others obtained very flat spectra. Such variety might reflect surface chemical inhomogeneity. Through deciphering memories recorded on the asteroid, *Hayabusa2* will increase our knowledge of the material mixing and transfer processes in the early solar system, mineral-water-organic interactions on planetesimals, and dynamical processes such as impact [1].

*Hayabusa2* carries a sampler and four onboard remote-sensing instruments: a multi-band optical imager (ONC-T), a laser altimeter (LIDAR), a near infrared spectrometer covering 3- $\mu\text{m}$  absorption band (NIRS3), and a thermal infrared imager (TIR). It also has three small rovers of MINERVA-II and a small lander MASCOT (Mobile Asteroid Surface Scout) developed by DLR in cooperation with CNES. Further, *Hayabusa2* has impact experiment devices, which consist of a small carry-on impactor (SCI) excavating underground materials and a deployable camera (DCAM3) to observe the ejecta curtain. The interdisciplinary research using the data from these onboard and lander's instruments and the analyses of returned samples is the key to the success of the mission.

[1] Tachibana et al. (2014) *Geochem. J.* 48, 571-587.

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