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Editorial to Topical Volume on: Hayabusa2: Revealing the Evolution of C-Type Asteroid Ryugu

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We all remember the exciting night in June, 2010 when the Hayabusa mission returned to Earth with the first sample of extra-terrestrial material from an asteroid, the asteroid 25143 Itokawa. Four and half years after that night, in December 2014, Hayabusa2, started its journey to the asteroid 162173 Ryugu. The success of the Hayabusa mission and the experience gained were the basis for the new even more ambitious mission Hayabusa2.

Asteroids are the "time capsules" of the solar system. They are the treasuries containing the 4.6 billion year history of the solar system. Hence, they strongly attract the planetary community in spite of their small fraction of the total mass of the solar system. As further proof of this, in September 2016 Hayabusa2 was joined by OSIRIS-Rex heading toward asteroid 101955 Bennu. While Itokawa is the familiar lithologic S-type asteroid, Ryugu is a C-type, considered to be more primordial, allowing us to approach closer to the beginning of the solar system.

Hayabusa2 observations will be performed upon arrival at Ryugu in 2018. It will survey the surface features, touchdown on the asteroid, form an artificial crater by shooting an impactor and sample materials both on and under the surface. In 2020 Hayabusa2 returns to Earth and releases the re-entry capsule carrying the material from Ryugu. On Hayabusa2 a 10-kg compact landing package, MASCOT, is included. MASCOT is to land on Ryugu and observe in the more detail the surface characteristics. The in-situ observations of the surface will complement the results from the global remote-sensing observation by the mother ship and the analysis of the sampled material.

Ryugu is expected to contain organic and/or hydrated minerals. These observations by Hayabusa2 are anticipated to provide answers not only about the structure and composition

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of Ryugu itself but also about more fundamental questions: What are the primitive materials of the solar system? How have they evolved to the present?

The significance of the Hayabusa2 project is not limited to the planetary science. State of the art technologies were developed for the Hayabusa2 project based on the experience of Hayabusa. The engineering for the long cruise in space, the touchdown on the low-gravity body, the sampling of the materials, the formation of a crater by the impactor and the re-entry into the Earth's atmosphere have been advanced for the mission of Hayabusa2.

We are delighted to have the opportunity to edit this special volume of papers about the scientific objectives and characteristics of the instruments on Hayabusa2 and MASCOT. The first four papers (Kameda et al., Mizuno et al., Yamada et al., and Senshu et al.) are on the optical navigation camera and laser altimeter, which are the instruments used for scientific observation as well as the touchdown navigation. The next two papers (Sawada et al. and Okazaki et al.) describe the technique to sample the material which was changed from that on first Hayabusa. The plan and devices to form the crater on Ryugu and observe the result are written in five papers (Ogawa et al., Sawada et al., Saiki et al., Arakawa et al. and Ishibashi et al.). The optical characteristics of the Ryugu surface are observed by the thermal infrared camera and near infrared spectrometer, which are described by four papers (Arai et al., Okada et al., Takita et al. and Iwata et al.). Ho et al. overviews MASCOT and its functions. The four installed instruments (camera, IR imaging spectrometer, radiometer and magnetometer) are described respectively in the papers by Jaumann et al., Bibring et al., Grott et al. and Hercik et al.

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