Current Status of Hayabusa2 Landing Site Deliberation

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Hayabusa2 is scheduled to arrive at the C-type asteroid 162173 Ryugu on July 2018. During its 18-month stay, Hayabusa2 will sample surface materials at three different locations on the asteroid (Yoshikawa et al., 2014). To maximize the scientific gains of Hayabusa2 mission, it is important to select the landing sites from scientific aspects that are derived from integration of remote sensing data obtained by on-board instruments, ONC, NIRS3, TIR, LIDAR, and MASCOT, and laboratory experiment data obtained by using meteorites and simulant of asteroidal materials. Therefore, the Interdisciplinary Science Team which draws the general picture of a scientific scenario of Hayabusa2 (Kobayashi et al., 2014) newly organized four working groups in 2014. The main purpose of these WGs is to select the best landing site by integrating remote sensing data and meteoritical knowledge, and is to expand planetary science into new research fields via the WG process.
Meteorite WG: The primary purpose of this WG is to identify the surface of Ryugu with one of the meteorite groups. Previous studies show that many carbonaceous chondrites are petrologically heterogeneous in a mm-cm scale. Meter-scale observation of the entire surface obtained by Hayabusa2 would contribute to understand the formation history of C-type asteroids including asteroid Ryugu. In order to constrain the meteorite group using the remote sensing data, petrologic variations observed in different meteorite groups and those within a group are being discussed. Brecciation, secondary alteration, and space weathering effects on the asteroid surface are also considered in collaboration with the other WGs.
Secondary alteration WG: We have proposed the following 3 candidates as scientifically valuable samples on Ryugu; (1) major components, (2) primitive materials (here after, 'primitive materials' are supposed to be materials that were experienced the least secondary alteration on the asteroid), and (3) others (e.g. exotic material). Firstly, we discussed the detailed spectral characteristics for identification of the primitive materials on the asteroidal surface using data acquired by the on-board instruments. Reflectance spectra of the primitive materials should show low albedo, no/weak 0.7 and 1 um absorptions suggesting presence of hydrous minerals and anhydrous silicate respectively, and a clear absorption-band at 3 um caused by presence of hydrous phases. However, the spectral features of asteroids are complex since they depend on several parameters. Further accumulation of reflectance spectra for various groups of meteorites will be required. The other candidates will be examined as well.
Volatiles WG: Searching organic compounds from the asteroid surface is one of the significant goals of Hayabusa2. In particular, organic carbon contents could be an indicator for a primitive asteroid. For example, the contents of insoluble organic matter (IOM) and total organic carbon (TOC) from CM, CR, and Tagish Lake chondrites negatively correlate with the albedo features at the wavelength of 0.55 and 0.39 um in their reflectance spectra (Hiroi et al., 2016), respectively. These correlations appear to be related to the aqueous alteration degrees. TOC values are superficially higher in the aqueously altered chondrites. To be more accurate, we propose that the albedos are the better indicator reflecting the ratio of IOM to soluble organic matter (SOM).

Further laboratory experiments must be carried out in order to evaluate the degrees of thermal metamorphism and space weathering.
Grain size WG: The possible methods for determination of the asteroidal surface condition have been organized so far. We continue discussion about the surface condition determination by integrating data from several on-board instruments. In addition, the influence of grain sizes on spectral feature will be evaluated.

Keywords: Hayabusa2, Interdisciplinary Science Team, landing site

