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Hayabusa: Scientific Investigations through In-situ Measurements and Initial Sample Analyses

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The Hayabusa (MUSES-C) spacecraft was launched in May 2003 to conduct sample return from (25143) Itokawa, an S(IV)-type near Earth asteroid (NEA) of approximately 600 x 300 x 270 m in size [1]. After the Earth swing-by in May 2004, the spacecraft is currently cruising in the interplanetary space and will arrive the NEA in early September. First the spacecraft will conduct global mapping with the multi-color optical camera, the near-IR spectrometer, the X-ray fluorescence spectrometer, and the LIDAR for two months. Then the sampling sites will be chosen and up to three "touch-and-go" samplings will be attempted [2]. Prior to the first touch down, a hopping rover will be deployed to investigate asteroidal surfaces.
After the satellite and dust band search, initial observations will concentrate on physical and compositional characterizations of Itokawa. Once the heterogeneity (or homogeneity) of the surface is determined, high latitude observations for the limited locations with high interests will be carried out. Such areas may include ponds, boulders, regolith landslides, peaks of the semi-major axis, etc. in the view of both scientific premises and engineering safety as sampling locations. Also several topics of integrated sciences among the multiple instruments will be studied such as space weathering effect which may explain the difference between the ordinary chondrites spectra and that of the S-type asteroids, regolith thickness estimate, crater chronology including the embedded craters, implication of the internal structure from geological features and polarimetric imaging of the asteroid surface roughness.
In June 2007, the return capsule will be retrieved at the Australian desert. Prior to detailed analyses by qualified researchers in the world, general characteristics of the samples will be studied by the initial analysis team [3]. In this phase, the cross calibration data for the in-situ instruments will be produced first and then 15% of the samples will be analyzed in various means to yield size distribution, micro-structure, bulk composition, mineralogy, absolute dating, organic contents, etc.

Keywords: MUSES-C; Hayabusa; asteroids; NEAs; sample return; microgravity; space weathering; crater chronology; absolute dating

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