Hayabusa-2 – sample return from a near-Earth C-type asteroid (2014-2020): Current status

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Hayabusa-2 is an asteroid exploration mission to return surface samples of a near-Earth C-type asteroid 1999 JU_3. Because asteroids are the evolved remnants of planetesimals that were the building blocks of planets, detailed observation by a spacecraft and analyses of return samples will provide direct evidence of planet formation and dynamical evolution of the solar system. Moreover, C-type asteroids are expected to preserve the most pristine materials in the solar system, an interacted mixture of minerals, ice, and organic matter. Space missions are the only way to obtain such pristine materials with geologic context and without terrestrial contamination. In order to understand the dynamical and chemical evolution of the solar system by investigating and sampling 1999 JU_3, Hayabusa-2 sets the following scientific objectives: (1) Thermal evolution from planetesimal to near-Earth asteroid, (2) Destruction and accumulation of rubble pile body, (3) Diversification of organics through interactions with minerals and water on planetesimal, and (4) Material circulation in the early solar system. The basic design of the spacecraft is the same as in the original Hayabusa, but many improvements will be made and new technology will be adopted. The on-board instruments necessary for the fulfillment of the scientific objectives are a laser altimeter (LIDAR), a multi-band camera (ONC-T), a near-infrared spectrometer (NIRS3), a thermal infrared imager (TIR) and a wide-angle camera (ONC-W). A small impactor (SCI) will also be aboard for an asteroid-scale impact experiment, which will make a crater of several meters in diameter. The sampler, of which concept and design are also the same as the original Hayabusa, has three projectiles for impact sampling and the sample container has three separate rooms inside for sampling at three different locations, one of which could be ejecta from the artificial impact to sample sub-surface materials.

Hayabusa-2 will be launched in late 2014, arrive on 1999 JU_3 in mid-2018, and fully investigate and sample the asteroid during its 18-month stay. The spacecraft will return to Earth with samples in December 2020. Preliminary integration tests of the spacecraft are now being made, and the current mission status will be presented at the meeting.

Geochemical discrimination of tsunami sediments in Tohoku and Shizuoka area, Japan

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Tsunami sediments from the stricken area

Geochemical studies of modern and past-tsunami sediments were performed to detect a tsunami invasion proxy. In this study, the modern tsunami sediments from the Pacific coast of Tohoku area, Japan (March.11th, 2011), have been analyzed by EDXRF and ICP-MS. In addition, past-tsunami sediments were also taken from the coastal area of Japan (Jogan, ca. 1100 BP; Yayoi, ca. 2000 BP; Sizuoka, ca. 3000 BP) in order to establish a novel method for the geochemical discrimination of invisible tsunami layers, such as mud and thin sand layers.

Na/Ti atomic ratios of tsunami sediment

Na/Ti and Si/Al atomic ratios in the tsunami sediments varied from 2.7 to 22.4 and from 1.7 to 13.6, respectively (Fig. 1). The Na/Ti ratios markedly increased up to ca. 7-22 in the tsunami layers from the northeast (Tohoku area) and middle Japan (Shizuoka prefecture). Our results show that the Na/Ti values are useful indicator of past-tsunami sediment layers.

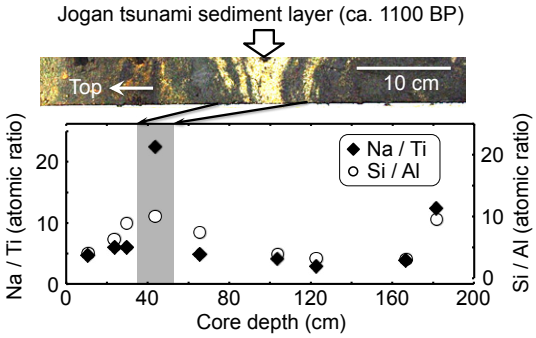

Figure 1: Na/Ti and Si/Al atomic ratios of tsunami sediments (Jogan, ca. 1100 BP) from Sendai plain in Tohoku area, Japan.

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