

Origin of a huge boulder 'Yoshinodai' on asteroid Itokawa

Shinsuke Abe[1]; Masanao Abe[2]; Yasuhiko Takagi[3]; Kouhei Kitazato[2]; Takahiro Hiroi[4]; Masateru Ishiguro[5]; Naru Hirata[1]; Ryosuke Nakamura[6]; Akiko Nakamura[7]; Sho Sasaki[8]; Tadashi Mukai[9]; Akira Fujiwara[10]

[1] Kobe University; [2] ISAS/JAXA; [3] Toho Gakuen University; [4] Geological Sci., Brown Univ; [5] UH; [6] AIST; [7] Grad. Sch. of Sci. and Tech., Kobe Univ.; [8] Mizusawa Obs., Nat'l Astron. Obs. Japan; [9] Earth and Planetary System Sciences, Kobe Univ; [10] ISAS

<http://harbor.scitec.kobe-u.ac.jp/~avell/>

HAYABUSA (MUSES-C), launched on May 9, 2003, is the first Japanese asteroid mission. It will also be the first mission ever to collect samples from the surface of an asteroid. Through a combination of surface imagery, topography, spectrography, and sample science, Hayabusa will uncover the origin and evolution of the asteroid Itokawa as well as reveal what the connection might be between meteorites collected on Earth and their origins. These data should provide tremendous insights into the birth of meteorites and how our solar system has evolved. It may even provide new information on how the Earth may have first formed.

Close-up views of the asteroid Itokawa obtained as the HAYABUSA spacecraft approached the asteroids show the presence of an enormous flat and huge boulder. Named 'Yoshino-dai', after tableland as well as the address of Institute of Space and Astronautical Sciences (ISAS) which built Hayabusa, both the onboard Asteroid Multi-band Imaging Camera (AMICA) and the Laser Range Finder (LIDAR) show that this rock rises ~17 m above the surface and is 22 by 50 m in width. This boulder is one of many that are strewn all over the surface of Itokawa.

We are trying to address several key questions pertaining to the origin and evolution of Yoshinodai in particular:

Where does this boulder come from?

Is it a fragment that re-accreted onto Itokawa after a catastrophic disruption from a parent body?

Or is it the result of the formation of one of the craters on Itokawa?

Could Yoshinodai be a stronger remnant, in a region where most of the other surface material is soft and has somehow been eroded away maybe by impact gardening leaving behind this towering mesa?

And how about the fissures seen on the surface of this boulder?

How were they generated?

To date, the NIRS (Near-Infrared Spectrometer) and the LIDAR (Laser Detection and Ranging) sensors onboard HAYABUSA have obtained over 100,000 spectra and 1,000,000 laser detections of the equatorial region of Itokawa, including the Yoshinodai area. The NIRS data contains spectral information from 800 to 2100 nm, which can be used to determine the mineralogy of the asteroid. Preliminary analyses of these spectra indicate that Itokawa's composition is consistent with an assemblage containing olivine and pyroxene minerals. In addition, detailed topographic data of the asteroid surface provided by the LIDAR laser shows evidence for some variation in elevation across Itokawa. Moreover, AMICA optical color images and NIRS spectra of both top and side of Yoshinodai were obtained.

Possible origins of Itokawa's surface features, such as the Yoshinodai area, and details concerning the evolutionary history of the asteroid will be discussed by means of NIRS, AMICA, and LIDAR data onboard Hayabusa.