Geophysical Research Abstracts
Vol. 15, EGU2013-394, 2013
EGU General Assembly 2013
© Author(s) 2013. CC Attribution 3.0 License.

Evolution History of Asteroid Itokawa Based on Block Distribution Analysis

Sara Mazrouei (1,2), Michael Daly (1), Olivier Barnouin (3), and Carolyn Ernst (3)

(1) The Centre for Research in Earth and Space Science, York University, Toronto, Canada, (2) European Space Agency/ ESTEC, Noordwijk, The Netherlands (sara.mazrouei@esa.int), (3) The Johns Hopkins University Applied Physics Laboratory, Laurel, USA

This work investigates trends in the global and regional distribution of blocks on asteroid 25143 Itokawa in order to discover new findings to better understand the history of this asteroid. Itokawa is a near-Earth object, and the first asteroid that was targeted for a sample return mission. Trends in block population provide new insights in regards to Itokawa's current appearance following the disruption of a possible parent body, and how its surface might have changed since then. Here blocks are defined as rocks or features with distinctive positive relief that are larger than a few meters in size.

The size and distribution of blocks are measured by mapping the outline of the blocks using the Small Body Mapping Tool (SBMT) created by the Johns Hopkins University Applied Physics Laboratory [1]. The SBMT allows the user to overlap correctly geo-located Hayabusa images [2] onto the Itokawa shape model.

This study provides additional inferences on the original disruption and subsequent re-accretion of Itokawa's "head" and "body" from block analyses. A new approach is taken by analyzing the population of blocks with respect to latitude for both Itokawa's current state, and a hypothetical elliptical body.

Itokawa currently rotates approximately about its maximum moment of inertia, which is expected due to conservation of momentum and minimum energy arguments. After the possible disruption of the parent body of Itokawa, the "body" of Itokawa would have tended to a similar rotation. The shape of this body is made by removing the head of Itokawa and applying a semispherical cap. Using the method of [3] inertial properties of this object are calculated. With the assumption that this object had settled to its stable rotational axis, it is found that the pole axis could have been tilted about 13º away from the current axis in the direction opposite the head, equivalent to a 33 meter change in the center of mass.

The results of this study provide means to test the hypothesis of whether or not Itokawa is a contact binary.

References:

[1] E. G. Kahn, et al. A tool for the visualization of small body data. In LPSC XLII, 2011.

[2] A. Fujiwara, et al. The rubble-pile asteroid Itokawa as observed by Hayabusa. Science, 312(5778):1330–1334, June 2006.

[3] A. F. Cheng, et al. Small-scale topography of 433 Eros from laser altimetry and imaging. Icarus, 155(1):51–74, 2002