Number density of blocks on asteroid 25143 Itokawa and a comparison with the estimated one by a model based on impact experiments

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The Hayabusa spacecraft arrived at the asteroid 25143 Itokawa in summer 2005. The images taken by the spacecraft indicated that Itokawa is covered with numerous blocks. The purpose of this paper is to examine the origin of blocks on the surface of Itokawa, by comparing the observed number of blocks with the calculated values by a model based on impact cratering experiments. The size and the location of the blocks were investigated on PC screens. Here we define blocks as both apparently rootless rocks and distinctive positive relief. The number of blocks larger than 5m is roughly 500. Since the surface area of Itokawa is 0.393 km^2, the cumulative number of blocks larger than 5m per unit area is more than 10^3 (km^-2), that is larger than the finding for near-Earth S-type asteroid Eros by more than a magnitude. Before the arrival of the spacecraft to Itokawa, we estimated the number of blocks with larger than 1m by model based on the experimental data. However, since there is a large discrepancy between the previous estimation and the observed data, we reconsider the size of the source crater of the blocks and the material strength of Itokawa. The diameter of the observed maximum crater is about 100m, which is less than the half of the previously expected diameter. As a parameter, the material strengths of Itokawa are considered within the ranges of 0.1-10MPa. The results show that the estimated number of blocks is still very small compared with the observed data. These results probably mean that it is difficult to produce as many blocks on the surface as were observed considering only impact cratering as the source; it is likely that the blocks of Itokawa were originated from other process.