SHAPE FEATURES OF ITOKAWA REGOLITH PARTICLES COMPARED WITH LUNAR REGOLITH PARTICLES AND IMPACT EXPERIMENTS.

A. Tsuchiyama[1], T. Matsumoto[2], J. Matsuno[1], A. Shimada[1], T. Kadokawa[1], T. Sakurama[1], T. Nakano[3], K. Uesugi[4], M. Uesugi[2], T. Nakamura[5], T. Yada[2], Y. Karoji[2], K. Nishiizumi[6], A. Takeuchi[4], Y. Suzuki[4], T. Michikami[7], M. Arakawa[8], A. Nakamura[8], S. Hasegawa[2]. [1]Grad. Sch. Sci., Kyoto Univ. E-mail:atsuchi@kueps.kyoto-u.ac.jp. [2]ISAS/JAXA, [3]GSJ/AIST, [4]SPring-8/JASRI, [5]Grad. Sch. Sci., Tohoku Univ., [6]Space Sci. Lab., UC – Berkeley, [7]Fac. Engin., Kinki Univ., [8]Grad. Sch. Sci., Kobe Univ.

Introduction: 3D shapes of Itokawa regolith particles have been examined to understand their formation and evolution on Itokawa by comparing lunar regolith particles and fragments of impact experiments [1,2]. Based on the results (1) formation of regolith due to micrometeoroid impact and (2) mechanical abrasion probably due to seismic wave induced particle motion have been proposed. However, the numbers of particles of Itokawa (48 particles in [2]) and Moon and those in impact experiments might be statistically insufficient.

Experiments: In this study, we newly obtaied 3D shapes of Itokawa and lunar particles (Luna 16, 20, 24 and Apollo 11, 16 samples) by microtomography at SPring-8. 81 Itokawa particles including the data by [3] were examined. We also made new impact experiments with various conditions and their fragments were examined. Their shape distributions with respect to three-axis ratios (b/a *vs.* c/b: a>b>c) were compared.

Results and Discussion: Among the Itokawa particles, the shape distributions between Rooms-A and –B samples cannot be distinguished while angular particles seem to be slightly flatter than rounded particles, probably corresponding to the mechanical abrasion. The average axial ratios, a:b:c, are close to the silver ratio (1:1/√2:1/2).

In the impact experiments, average b/a ratio is close to the silver ratio (1:1/√2) while average c/b ratio varies (≤1:1/√2) depending on particle size and impact condition. Average a:b:c ratio for fragments comparable to Itokawa particles size concentrates on the silver ratio. This is consistent with Itokawa regolith particle formation due to impact but the impact condition cannot be restricted from the shape distribution.

The shape distributions of the lunar particles are distinguished from the Itokawa particles and the impact fragments. Those for fragments comparable to the Itokawa particle size are indistinguishable with each other irrespective of sampling sites. The lunar particles are more spherical (or equant) suggesting that they were abraded and/or fragmented by gardening in lunar regolith layers for longer durations than Itokawa.

References: [1] Tsuchiyama A. *et al.* 2011, *Science,* 333: 1125-1128. [2] Tsuchiyama A. *et al.* 2014, *Meteor. & Planet. Sci.* 49:172-187. [3] Meier M. M. M. et al. 2014, Abstract #1247. 45th Lunar & Planetary Science Conference.