GEOLOGIC PROCESSES ON A SMALL ASTEROID ITOKAWA. N. Hirata[1], S. Abe[2], M. Ishiguro[3], K. Kitazato[4], R. Nakamura[5], H. Miyamoto[6], H. Demura[1], and M. Abe[7] [1]The University of Aizu, Ikki-machi, Aizu-Wakamatsu, Fukushima, 965-8580, Japan, [2]Institute of Astronomy, National Central University (NCU), Taiwan, [3]Department of Physics and Astronomy, Seoul National University, [4]Graduate School of Science, Kobe University, [5]National Institute of Advanced Industrial Science and Technology (AIST), [6]The University Museum, University of Tokyo, [7]The Institute of Space and Astronautical, Japan Aerospace Exploration Agency, Corresponding author's e-mail address: naru@u-aizu.ac.jp

Introduction: Itokawa is the smallest asteroid ever observed by a spacecraft [1]. In spite of its size, the surface of Itokawa shows a wide variety of both topographic and brightness features [1-4]. These features suggest that the asteroid underwent diverse geologic processes including impact cratering [3], seismic shaking, mass movement [4] and space weathering [5]. Recent extensive studies on Itokawa with Hayabusa observational data provide key pieces of evidence to obtain a comprehensive understanding on geologic processes on the surface of a small asteroid. Moreover, the understanding on surface processes will lead to gain a clear insight into an internal structure of Itokawa. It was suggested as a rubble-pile body, but the details are still unknown. Our goal is to present a new geological view of small asteroids.

Tool and Data: We developed a GIS-oriented software package to analyze multiple map data of an irregular-shaped body [6]. This tool can handle many kinds of data geographically associated onto a polygon shape model of an asteroid. A GIS (Geographical Information System)-oriented approach is very powerful to get a clear and comprehensive grasp on characteristics of the target body. Map data is a set of data that are associated with particular locations on the surface of the shape model (Fig. 1). The tool currently supports a set of scalar data associated with the polygon IDs. A slope angle map, a geopotential map, a near-infrared reflectance map [7] and a visible brightness map are now available [6] (Fig. 2).

Results and Discussions: Locations of brightness features in the visible band and near-infrared band are well consistent each other. As the surface brightness is regarded to depend on the degree of space weathering, this result means that an effect of space weathering uniformly appears on both the visible band and the near-infrared band. Comparing the shape model and the slope map, the less space weathered-regions correspond to edges/bulges of the global shape, rims of possible impact structures or steep regions. The last case was already pointed out in previous reports [2, 5]. The authors of them suggested that space weathered-regolith on steep slopes flows down by seismic shaking and the surface is kept fresh against space weathering. However, close-up views of Itokawa show that even a bulk rock surface is suffered with space weathering [4]. Accordingly, not only a removal of weathered regolith, but also some mechanism to create fresh surface are supposed to explain bright features on the steep slope. If a constituent of Itokawa is very weak, seismic shaking may break its surface. The very low density of Itokawa, which suggests a large macro porosity of the asteroid and/or a large micro porosity of its constituent, is consistent with this view. The edges/bulges are also regions where shaking power converges and creation of fresh surface may occur. These discussions imply that Itokawa is a pile of a few blocks of relatively large size and a layer of space weathered small boulders.

References: [1] Fujiwara A. et al. (2006) *Science*, 312, 1330-34. [2] Saito J. et al. (2006) *Science*, 312, 1341-44. [3] Hirata N. et al., (2008) *Icarus, Submitted.* [4] Miyamoto H. et al., (2007) *Science*, 316, 1011-1014. [5] Hiroi T. et al., (2006) *Nature*, 443, 56-58. [6] Hirata N. et al., (2008) *LPS XXXIX*, Abstract #1584. [7] Kitazato K. et al. (2008) *this volume*.

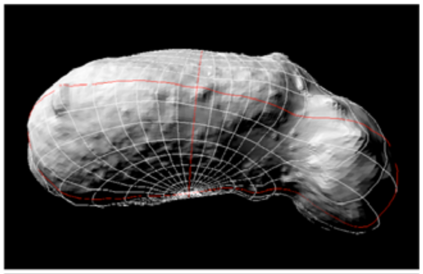

Fig. 1

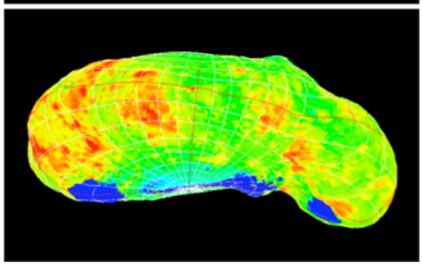

Fig. 2