DANGER IN INTERPRETING THE 2-MICRON BAND OF REFLECTANCE SPECTRA OF SMALL ASTEROIDS: A LESSON FROM HAYABUSA/NIRS DATA OF ITOKAWA.

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Introduction: Visible and near-infrared reflectance spectra have been often used in interpreting the surface mineralogy of asteroids. Especially, the 1 and 2 μm absorption bands are mainly indicative of the chemical compositions and relative abundances of pyroxenes and olivine. However, the interpretation of the apparent position and relative strength of the 2 μm band has many problems, which we present here based on different observations of the asteroid 25143 Itokawa.

Distance Dependency of Itokawa's 2-μm Band: It is clear from close observations by the Near-Infrared Spectrometer (NIRS) onboard Hayabusa spacecraft in October and November 2005 that Itokawa consists of a space-weathered LL5 or 6 chondrite material [1, 2, 3]. However, Itokawa's reflectance spectra taken by the same NIRS at a farther distance in September 2005 show somewhat different properties of the 2 μm band. Because all laboratory measurements of LL chondrite samples are performed using a small, uniform sample, observations which should be compared with them are those made at higher spatial resolutions (the highest resolution of NIRS observation was in the centimeter scale). This can cause serious misinterpretation of its surface mineralogy if one blindly uses the traditional band center and strength parameters based on any ground-based observation.

Possible Causes: Itokawa (and probably many other small asteroids) has a highly diverse physical property over it surface: from large and small boulders to regolith because of its low gravity and young surface age. Therefore, when its surface is observed as a whole or with low spatial resolution, the data would contain many different physical units even if the composition may be uniform. This is very different from typical laboratory measurements of meteorites, wherein each sample is measured as a chip or powder with a centimeter-scale field of view. There is not proven validity in applying a traditional 2-μm band characterization technique to a mixture of different physical forms of the same meteorite. In addition, space weathering which exists on Itokawa [1] causes weakening of the 1 and 2 μm band in a disproportionate manner [4], thus changing their band area ratio.

Summary: In this presentation, we will try to address whether the distance dependency of Itokawa's 2-μm band could be explained by those two possible causes.

References: [1] Hiroi T. et al. 2006. *Nature* 443:56-58. [2] Ishiguro M. et al. 2007. *Meteoritics & Planetary Science* 42:1791-1800. [3] Hiroi T. et al. 2007. Abstract #1048. 38th Lunar & Planetary Science Conference. [4] Ueda Y. et al. 2002. Abstract #2023. 33rd Lunar & Planetary Science Conference.