Final Report for: Remote Sensing Information Applied to Geological Study of Planets
Grant Number: NAG5-10401
PI: Carle M. Pieters
Dates: 2/1/01 to 1/31/04
Level: $40K/year

The Planetary Geology and Geophysics tasks under this grant have concentrated on the development and testing of tools for remote compositional analyses for the Moon and other airless bodies (especially asteroids). The grant has supported the PI and her students. Detailed analyses of space-weathering analogs were undertaken. Lunar research included development of models for regolith evolution and redistribution of materials across the Moon, with particular emphasis on the interior of South Pole-Aitken Basin. Lunar compositional analyses identified general rock types using Clementine data and mapped their distribution globally and locally based on the type of mafic mineralogy present (or lack thereof). Progress in these areas has been extensively discussed in the literature and in proposals submitted to the PGG program in 2003 and 2004. A summary of scientific publications resulting directly from the research supported by NAG5-10401 is presented below. Copies of any of these will be happily provided on request.

Clark, B. E., B. Hapke, C. M. Pieters, D. Britt, Asteroid Space Weathering and Regolith Evolution in *Asteroids III*, W. Bottke *et al.*, Eds, Univ. Arizona Press, Tucson, 585-599, 2002.

Hiroi, T., C. M. Pieters, F. Vilas, S. Sasaki, Y. Hamabe, and E. Kurahashi, Mystery of the 506.5 nm feature of reflectance spectra of Vesta and Vestoids; evidence for space weathering? *Earth, Planets and Space* 53; 11, Page 1071-1075, 2001.

Hiroi, T., M. E. Zolensky, and C. M. Pieters, The Tagish Lake Meteorite: A Possible Sample from a D-Type Asteroid, *Science,293,* pp. 2234-2236, 2001.

Hiroi, T., M. E. Zolensky, and C. M. Pieters, Discovery of the First D-Asteroid Spectral Counterpart: Tagish Lake Meteorite, *Lunar Planet. Sci. XXXII*, Houston, TX, CD-ROM, #1776, 2001.

Hiroi, T., L. V. Moroz, T. V. Shingareva, A. T. Basilevsky, and C. M. Pieters, Effects of Microsecond Pulse Laser Irradiation on VIS-NIR Reflectance Spectrum of Carbonaceous Chondrite Simulant: Implications for Martian Moons and Primitive Asteroids, *Lunar Planet. Sci. XXXIV,*CD-ROM, #1324, 2003.

Noble, S. K., and C. M. Pieters, Space Weathering Processes on Mercury, *Solar System Remote Sensing*, University of Pittsburg, PA, Abstract #4005. 2002.

Noble, S. K., C. M. Pieters, and L. P. Keller, The Optical Properties of Nanophase Iron: Investigation of a Space Weathering Analog, *Lunar Planet. Sci. XXXIV,*CD-ROM, #1172, 2003.

Noble, S. K., and C. M. Pieters, Space Weathering on Mercury: Implications for Remote Sensing, *Solar System Research,* vol. 37, issue 1, 31-35, 2003.

Petro, N. E., and C. M. Pieters, The Size and Location of the Transient Crater of the South Pole-Aitken Basin, *Lunar Planet. Sci. XXXIII,* CD-ROM, #1848, 2002.

Pieters, C. M., J. W. Head III, L. R. Gaddis, B. L. Jolliff, and M. Duke, Rock Types of South Pole-Aitken Basin and Extent of Basaltic Volcanism, *J. Geophys. Res.,106,*(E11), 28,001-28,022, 2001. [Identification of rock types]

Pieters, C. M., Give and Take Between Spa and Imbrium Basins, *Lunar Planet. Sci. XXXIII*, Houston, TX, CD-ROM, #1776, 2002.

Pieters, C. M., J. W. Head III, L. R. Gaddis, B. L. Jolliff, and M. Duke, The character and possible origin of "Olivine Hill" in South Pole-Aitken basin, *Lunar Planet. Sci. XXXII*, Houston, TX, CD-ROM, 1810, 2001.

Pieters, C. M., Mid-Infrared Reflectance Spectroscopy: Where are we, Where are we going, and Why?, *Mars Infrared Spectroscopy*, LPI #2015, 2002.

Pieters, C. M., Lunar Science Missions in Context of the Decadal Solar System Exploration Survey, *The Moon Beyond*, Taos, NM #3017, 2002.

Ueda, Y., T. Hiroi, C. M. Pieters, and M. Miyamoto, Changes of band I center and band II/band I area ratio in reflectance spectra of olivine-pyroxene mixtures due to the space weathering and grain size effects, *Lunar Planet. Sci. XXXIII*, LPI, Houston, TX, CD-ROM, #2023, 2002.

Ueda, Y., T. Hiroi, C. M. Pieters, and M. Miyamoto, Expanding the modified Gaussian model to include the space weathering effects: estimation of the weathering degrees of pulse-laser treated olivine samples, *Lunar Planet. Sci. XXXIII*, LPI, Houston, TX, CD-ROM, #1950, 2002.