
In December 1992 the Galileo spacecraft passed through the Earth-Moon system for its final gravity assist to Jupiter. The SSI camera obtained several 6-color mosaics of the lunar north polar region and the sunlit nearside and eastern limb at ~1.3 km/pixel. Initial analyses have concentrated on the north polar areas to assess the composition of the crust in that region. Shown in the attached figures are representative 6-color calibrated SSI spectra (typically 5x5 pixels). Photometric corrections have not yet been applied, and all spectra are scaled to unity at 0.56 μm. The data were first calibrated relative to MS2, a standard area in Mare Serenitatis (18.7°N, 21.5°E), and the top four plots of highlands, highland craters, maria, and mare craters are displayed relative to MS2. SSI spectra of areas measured with telescopic data (mare MT1/MS2 and mare crater MSA/MS2) agree well with previous data, confirming that the calibration procedures and SSI data are spectrally accurate. The bottom three plots of craters/sun have been calibrated to reflectance using previously obtained telescopic spectra of Apollo 16/MS2 (shown with Highlards/MS2) and laboratory spectra of mature Apollo 16 soil (shown for reference with the Highland Craters/Sun). Although some variations in these spectra mimic previously observed spectra of lunar terrains (1, 2, 3, 4), several characteristics are unusual. Familiar and unfamiliar properties are observed in these northern latitudes and both types merit further investigation in their geologic context.

Highlands & Plains. To a first order the highlands and northern bright plains have characteristics similar to those of Apollo 16 soils implying a distinctly feldspathic and low iron composition. Extensive areas of plains around large northern Copernican craters such as Anaxagoras and Thales, however, have clearly been affected by the impact event (extending to four crater diameters from the rim). The spectral properties of these plains (Goldschmidt and Thales west) are peculiar in that they are not directly comparable to those of immature highland soils at small highland craters. Although these distinctive plains properties are clearly a cratering related effect (compare Thales west to nearby Thales shadow), it is currently not known whether they are due to compositional or physical effects.

Maria and Mare Craters. SSI properties of mare materials are discussed by (6). In the north polar region extensive areas of Mare Frigoris exhibit properties similar to those studied previously (4, 7), with the lowTi basalts more comparable to those of Luna 24 than those of Apollo 12. The Gartner DHC ejecta exhibits properties comparable to western intermediate Ti basalts (4). One mare crater at the easternmost edge of Frigoris (bottom plot) is unusual. Its brightness suggests a high feldspathic content, whereas it clearly has a 1 μm band center at wavelengths long even for maria, suggesting an unusual mineralogy.

Highland Craters. Several small non-mare craters exhibit abundant mafic minerals. These craters exhibit great diversity in the strength and character of the ferrous 1 μm absorption, suggesting a range of mineral compositions, some of which may approach gabbroic compositions (e.g. Piton B and Cr [Neisco-Kane]). The high spatial resolution SSI data show that spectral contrast increases dramatically with spatial resolution for small features of freshly exposed material. Although mare craters have not yet been fully evaluated, the strongest lunar 1 μm band observed remotely to date is associated with a small unnamed crater in the Fra Mauro Formation (5) south of Anaxagoras (Cr #3). Compare the 2x2 pixel spectrum (corresponding to an area <3 km in diameter) to the 4x4 pixel spectrum (~6km).
COMPOSITIONAL DIVERSITY C. M. Pieters et al.

Highlands-Plains/MS2

- Ap16B/MS2 (Tele)
- Goldschmidt Plains
- Gartner Plains
- Thales shadow
- Thales west plains

Maria/MS2

- MS2/MS2
- M. Frigoris A

Highland Craters/MS2

- Piton B/MS2
- Cr #3 [4x4]
- Cr #1
- Cr #2
- Cr near Schwabe
- Cr [Neiso-Kane]

Mare Craters/MS2

- MSA/MS2 Lm4
- sbCr Frig C/MS2
- sbCr Frig W/MS2

Highland Craters/Sun & Ap16

Northern Craters

Wavelength (µm)