Salt Lake City '97
Annual-Meeting Abstracts

Abs. No. 51421

SURFACE COMPOS1TION OF THE GALILEAN SATELLITES FROM GALILEO NEAR INFRARED MAPPING SPECTROSCOPY

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The Galileo Near Infrared Mapping Spectrometer (NIMS) is currently obtaining spectral maps of Jupiter's moons in the wavelength range 0.7 to 5.2 microns. This spectral region is rich with absorption features which can be used to determine the composition and spatial distribution of minerals on the satellite surfaces. Among the icy Galilean satellites, Callisto shows the least amount of water ice, covering about 10 % of the surface in patchy concentrations. Most of the surface is covered with unidentified (as yet) dark minerals. The exposed ice is often associated with impact craters, implying that the darker material exists as a blanket over more pure ice. Non-ice spectral features at 3.88, 4.03, 4.25, and 4.57 microns are present in Callisto's spectra, each with different spatial distributions. Possible materials causing the 4.25 micron feature include carbon dioxide and hydroxylated silicates. Sulfur dioxide, tholins, S-H, Si-H, and deuterated constituents are candidates for the other features. There is evidence for the presence of hydrated minerals, based on water band shifts and shapes. Ganymede's surface exhibits water absorption bands, largely due to ice but hydrates are also present. A dark component is present, but with a smaller proportion compared to Callisto. Some of the non-ice features seen in Callisto's spectra are also present on Ganymede. The purest ice is found to be associated with craters; the Osiris ejects blanket shows ice grain sizes of approximately 100 microns. Band depth maps at weak water bands show that relatively large ice grains are equatorially distributed while the depths of the stronger bands indicate that the total amount of ice cover is greater in the polar regions, suggesting poleward transport. Water is the dominant molecule covering Europa's surface, occuring as ice but also as a hydrate. The trailing side shows high concentrations of this hydrous mineral, whose identification is not yet established. The depths of water bands are greatest at high latitudes, likely due to higher purity ice. Grain sizes there are about 250 microns, Spectra of the leading side also show more pure ice, with grain sizes of approximately 50 microns. Sulfur dioxide frost or ice covers lo's surface, except in hot volcanic areas. Large grains (approximately 500 microns in diameter) occur in the equatorial region of Colchis Regio, while concentrations of smaller grains (200 microns) are found at high latitudes. A fine-grained frost covering is pervasive.

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