MARE BASALTS IN THE ORIENTALE BASIN: GALILEO MULTISPECTRAL OBSERVATIONS; S. D. Kadel and R. Greeley, Department of Geology, Arizona State University, Tempe, Arizona 85287

The Galileo flyby of the Moon in 1990 [1] provided the opportunity to obtain multispectral data for mare deposits in the Orientale basin. Spectral reflectance data, at five wavelengths ranging from 0.41 to 0.99 μm, derived from the Galileo camera (SSI) were calibrated with well-characterized mare sites on the lunar nearside, such as MH0 [2], to allow comparison and extension of titanium content, albedo, and mafic absorption strength classification to mare units in the Orientale basin. The 0.41/0.56 μm and 0.76/0.99 μm spectral reflectance ratios indicate titanium and mafic mineral content, respectively, of mature mare soils [3]. Spectral data (Figure 1) for Mare Orientale indicate that the lower albedo southern and northwestern units have medium-high titanium contents and weak mafic absorptions, whereas the unit in west-central Mare Orientale is a medium titanium basalt with a weak mafic absorption. In addition, there is a slightly enhanced mafic signature in extreme northwestern Mare Orientale, and evidence of contamination of northeastern Mare Orientale with highland ejecta from crater Maunder. Lacus Veris and Lacus Autumni have been observed telescopically [4,5], and characterized as low titanium basalts. Galileo data (Figure 2) suggest that Lacus Veris is composed of medium titanium basalt with a weak mafic absorption, whereas Lacus Autumni ranges from medium titanium (south) to medium-high titanium basalt (north), also with a weak mafic absorption. All mare units within the Orientale basin (Figure 3) have relatively higher albedos than most nearside mare units, perhaps as a result of the uniformly lower mafic mineral contents suggested by analysis of the Galileo data.

Recent crater counts [6] indicate that mare volcanism lasted at least 0.85 Ga in the Orientale basin - from 3.70 Ga in south-central Mare Orientale to 2.85 Ga in Lacus Autumni. In addition, at least two episodes of mare volcanism (3.70 and 3.45 Ga) are indicated in Mare Orientale, with the younger, less areally extensive units having lower albedos and slightly higher titanium contents. Subsequent emplacement of mare units in Lacus Veris (3.50 Ga) and Lacus Autumni (2.85 Ga) was of somewhat less titanium-rich basalts, with titanium content generally decreasing with time and distance from the basin center (an exception being the northernmost mare patch in Lacus Autumni). This may reflect a larger amount of crustal contamination of the magmas that produced these units as they rose along concentric ring faults from a source under the center of the basin. The generally weaker mafic absorptions of the Lacus Veris and Lacus Autumni units may be a further indication of such contamination. Future analysis of the Galileo multispectral data will focus on finer scale correlation of spectral and age units, as well as the effects of spectral mixing of adjacent mare units of different compositions, in order to better determine the compositional evolution of the mare basalts of the Orientale basin.
Figure 3. Galileo albedo (0.56 μm) image of Orientale basin superimposed on shaded airbrush relief map.