LUNAR FARSIDE MARE DEPOSITS: LATEST GALILEO IMAGING
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New multispectral data (7-bands; 0.41-0.99 µm wavelength) were obtained for the
Moon by the Galileo spacecraft in December, 1990 [1]. These data were calibrated with
Earth-based spectral observations of well characterized sites containing mature mare soils
on the nearside to compare albedos, titanium contents (0.41/0.56 ratio), and mafic
absorption strengths (0.76/0.99 ratios) with previously uncharacterized mare basalts
located on the farside [2,3]. These data were processed and sub-pixel registered,
permitting for the first time the characterization of small mare patches on the farside.
The goal is to determine the compositions for these small mare pockets which extend from the
thinner crust of the western limb (thinned by the Procellarum basin impact?) through the
thicker farside crust to the thinner crust underlying mare pockets in the South Pole-Aitken
basin. These determinations should provide a better indication of the vertical and horizontal
heterogeneity of mare source zones on the Moon [4]. Small mare patches studied include
Gerard Q, Grimaldi/Riccioli, the units of the Crüger region, Schickard, Mendel-Rydberg,
and Apollo. For a discussion of volcanism associated with the Orientale basin, see Kadel
and Greeley, this issue.

Gerard Q. Gerard Q is an 18 km pre-Nectarian crater with a 7 km inner crater
containing an Eratosthenian/Imbrian mare patch [5]. SSI data suggest this unit is a low-
titanium basalt with a weak mafic absorption. However, the mare unit may have been
contaminated by crater ejecta, perhaps from the Orientale basin.

Grimaldi/Riccioli. The 430 km Grimaldi basin contains a 230 km ring filled
with an Eratosthenian/Imbrian-age mare unit [5]. SSI spectral data for Grimaldi show a
general E-W dichotomy. The NE and SE regions have spectral signatures indicative of
contamination by crater ejecta from Grimaldi B and of medium-titanium basalt with a weak
mafic absorption, respectively. In contrast, the NW and SW regions have spectral
signatures indicating medium-high-titanium basalts with weak mafic absorptions. We
suggest these results are evidence for multiple lava flows of different compositions in the
basin. SSI data indicate the mare unit in Riccioli consists of medium-high-titanium basalt,
slightly more Ti-rich than SW Grimaldi, with a weak mafic absorption. There is some
evidence of spectral variations possibly indicating multiple flows within Riccioli as well.

Crüger region. The Crüger region contains the 46 km diameter crater Crüger,
the dark feature Lacus Aestatis, and the 63 km diameter crater Rocca A, all of which
contain Eratosthenian/Imbrian-age mare units [5]. Previous studies have suggested that the
mare units in Crüger and Lacus Aestatis have an intermediate TiO2 abundance and that the
spectra of Crüger has a mafic signature indicative of a mafic mineral assemblage dominated
by high-Ca clinopyroxene [6]. SSI data show considerable variation among the units of
this region (Figure 1). The Crüger mare deposit ranges from medium- to medium-high-
titanium content with weak mafic absorption. The Rocca mare deposit has spectral
signatures indicating medium-titanium basalt with a weak mafic absorption. Mare units in
Lacus Aestatis show a wide range of Ti-content, from medium- to medium-high-titanium
basalts with weak mafic absorptions. We interpret these preliminary results to suggest a
wider range of mare compositions exist in the Crüger region than suggested by previous
studies.

Schickard. The 227 km diameter crater Schickard contains two mare patches (N
and S) separated by a unit of light plains material. SSI data indicate both patches consist of
low-titanium basalts with enhanced mafic absorptions relative to other western limb basalts.
Crater counts of the Schickard mare [7] suggest an age slightly younger than the Orientale
basin. A cratering model age indicating mare emplacement prior to resurfacing in the
neighboring Schiller-Zucchius basin further suggests that the Schickard mare may be part
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of a larger region of mare volcanism which includes materials underlying the Schiller-Zucchi plains to the south.

Mendel-Rydberg. The Mendel-Rydberg basin contains a small patch of dark, lightly cratered mare mapped as Eratosthenian/Imbian in age [8] located ~730 km SSW of the Orientale basin. Preliminary analysis of SSI spectral data for Mendel-Rydberg indicate a mare unit of wide ranging Ti-content, consisting of medium- to medium-high- to high-titanium basalts, all with weak mafic absorptions. These results may be an indication of multiple lava flows of different compositions within Mendel-Rydberg, but further analysis is needed before more definitive statements can be made.

Apollo. The 505 km diameter Apollo basin, located within the South Pole-Aitken basin, was one of the last regions observed by Galileo. Spectral data of two low albedo mare units (Figure 2) indicate a composition of medium-high- to high-titanium basalts with weak mafic absorptions. These units are slightly more Ti-rich than any of the limb basalts observed by the SSI. Hence, these mare units may have been associated with regional volcanism within the S.P.-Aitken basin during the Upper Imbrian.

Galileo SSI data suggest higher Ti-content mare units tend to occur in regions where crustal thinning due to the basin-forming process has occurred [7]. In contrast, lower Ti-content units tend to occur in regions of thicker crust over a longer time span [7]. Perhaps the excavation of the S.P.-Aitken basin resulted in a thinner crust and tapping of deeper magma source regions containing higher Ti-content basaltic magmas. Ongoing study includes determining the ages and compositions of all the mare patches scattered across the farside resolvable by Galileo data to determine if this pattern holds true. Future work includes application of a spectral mixing model to determine the range of effects from mixing of mare basalt with impact ejecta and agglutinate formation. These results will need to be related to petrologic models to better define the evolution of magmas within the lunar crust and the evolution of mare volcanism on the Moon.