Geology of the Smythii and Marginis region of the Moon: Using integrated remotely sensed data.

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Abstract. We characterized the diverse and complex geology of the eastern limb region of the Moon using a trio of remote-sensing data sets: Clementine, Lunar Prospector, and Apollo. On the basis of Clementine-derived iron and titanium maps we classify the highlands into low-iron (3-6 wt % FeO) and high-iron (6-9 wt % FeO) units. The association of the latter with basalt deposits west of Smythii basin suggests that the highland chemical variation is the result of mixing between basalt and highland lithologies. Mare Smythii and Mare Marginis soils are compositionally similar, containing moderate iron (15-18 wt % FeO) and titanium (2.5-3.5 wt % TiO_2). Smythii basin, in addition to the basalt deposits, contains an older, moderate-albedo plains unit. Our investigation reveals that the dark basin plains unit has a distinct albedo, chemistry, and surface texture and formed as a result of impact-mixing between highland and mare lithologies in approximately equal proportions. Clementine iron and maturity maps show that swirls along the northern margin of Mare Marginis have the same iron composition as the surrounding nonswirl material and indicate that the swirl material is bright because of its low agglutinate content. Gravity data for the eastern limb show high, positive Bouguer gravity anomalies for areas of thin basalt cover (e.g., Smythii basin and complex craters Joliot, Lomonosov, and Neper). We deduce that the uplift of dense mantle material is the primary (and mare basaltic fill the secondary) source for generating the concentration of mass beneath large craters and basins.