Geophysical Research Abstracts
Vol. 15, EGU2013-8053, 2013
EGU General Assembly 2013


# Estimated Rock Abundances at the Apollo and Luna Landing Sites

Karin E. Bauch (1), Harald Hiesinger (1), Julia Weinauer (1), Mark S. Robinson (2), and Frank Scholten (3)

(1) Westfälische Wilhelms-Universität Münster, Institut für Planetologie, Münster, Germany (karin.bauch@uni-muenster.de), (2) School of Earth & Space Exploration, Arizona State University, Tempe, USA, (3) DLR-Institut für Planetenforschung, Berlin, Germany

Diurnal temperature variations can be used to analyze the surface and subsurface thermophysical properties [1, 2]. These properties, namely the bulk density, heat capacity, and thermal conductivity, define the thermal inertia, which represents the ability of the surface and subsurface to conduct and store heat [2]. Materials with a low thermal inertia, such as dust and other fine grained materials, quickly respond to temperature changes, which results in a large temperature amplitude during a complete lunar cycle. Surfaces covered with high thermal inertia materials, e.g., rocks or bedrock, take more time to heat up during the day and reradiate the heat during night.

We derived maps of thermal inertia from LRO-Diviner nighttime temperature data [3]. This approach is similar to martian thermal inertia derivations, as described by Mellon et al. (2000) and Putzig et al. (2005) [2, 4]. In addition to studying thermal inertia, we also calculated the relative rock abundances of selected study areas; e.g., the Apollo and Luna Landing Sites. Due to the relatively large footprints of remote sensing data, anisothermal surfaces are observed within the field of view. Consequently, multiple thermal inertia units having variable temperatures are merged to a single observed temperature. However, because the brightness temperature is a function of wavelength, it increases with decreasing wavelength. This nonlinearity of the Planck radiance can be used to determine the rock concentration of the observed surfaces [e.g., 5-7]. Therefore, we used our model surface temperatures for different thermal inertia and rock abundances and compared these results to the LRO-Diviner temperature data at distinct wavelengths.

The areas investigated in this study are covered by units of low thermal inertia material with low rock abundances (<10%), the lunar regolith. However, units of high thermal inertia and increased rock abundances are associated with specific morphologic features. Impact craters show elevated rock abundances, especially at the central peak and the crater walls. However, with increasing age their thermal signature decreases as the regolith cover becomes thicker and/or rocks are fragmented by subsequent impacts. Other features with elevated rock abundances are rilles, such as Rimae Hadley, which has been investigated and imaged in detail during the Apollo 15 mission. Along the rille we determined rock abundances of up to 40%. The overall abundances of rocks determined in this study show good agreement with images obtained during the landing missions, as well as high-resolution images by the Lunar Reconnaissance Orbiter Narrow Angle Camera.

The results of this study will be used in preparation of the MERTIS experiment, which is part of the payload of ESA's BepiColombo Mission to Mercury. Among other objectives, this instrument will study the surface temperatures and thermal inertia of Mercury. Studying the lunar surface allows us to test and validate the thermal model in advance.

References:
[1] Urquhart, M.L. and Jakosky, B.M. (1997), *JGR 102*, 10,959-10,969. [2] Mellon, M.T. et al. (2000), *Icarus 148*, 437-455. [3] Bauch, K.E. et al. (2011), *LPSC XLII*, Abstract #2278. [4] Putzig, N.E. et al. (2005), *Icarus 173*, 325-341. [5] Christensen, P.R. (1986), *Icarus 68*, 217-238. [6] Golombek, M.P. et al. (2003), *JGR 108(E12)*, 8086. [7] Bandfield, J.L. et al. (2011), *JGR 116(E00H02)*.