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LROC IMAGING OF THE CHANG'E 3 LANDING SITE

M. S. Robinson[a, *], J. B. Plescia[b], R. V. Wagner[a], and J. Oberst[c]

[a]Arizona State University, Tempe, AZ, USA - (robinson@ser.asu.edu)
[b]The Johns Hopkins University, Applied Physics Laboratory, Laurel, MD, USA
[c] Technical University Berlin (TUB), Strasse des 17. Juni 135, 10623 Berlin, Germany

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ABSTRACT:

Chang'e 3, the third mission in China's Lunar Exploration Program (Zheng et al., 2008; Laxmann, 2012), was launched on 6 December 2013 and landed on 14 December 2013. Chang'e 3 includes a lander and a rover (Yutu, or Jade Rabbit). High-resolution descent imaging acquired by the lander made identification of the landing site from pre-existing Lunar Reconnaissance Orbiter Camera (LROC) Narrow Angle Camera (NAC) images relatively easy and the landing site was located in near real time. Here we describe the landing area as seen in LROC images, report precise lander coordinates, and report future imaging opportunities.

The Lunar Reconnaissance Orbiter (LRO) first passed over the landing site on 24 December. At this time LROC began to acquire a sequence of 6 NAC image pairs over 36 hours. A near vertical view was acquired on 25 December 03:52:49 UT, when LRO was at an altitude of ~150 km; the pixel size was 1.60 m. Given the relatively small size of the Chang'e 3 lander (body 2.5 m across; leg diameter 4.8 m), confident identification of the vehicle within a NAC image is potentially problematic; however, a comparison of LROC images taken before and after the landing provided confirmation of the presence of the lander and rover. The rover was about 30 m to the south of the lander when imaged by LROC on 25 December.

The landing site is in the northwest portion of Mare Imbrium at 44.1213°N, 340.4885°E (Robinson, 2013), at an elevation of -2640 m. The vehicle set down on a relatively flat area with few blocks, 60 m east of the rim of a 450 m diameter impact crater ("CE3" crater) that is 40 m deep (shadow measure). During the formation of the CE3 crater, basalt was excavated from depths of perhaps 50 meters or more, thus the lander is sitting on the ejecta from deep within the crater, and can sample deeper basalt layers. As the rover moves away from the CE3 crater it will, in a geologic sense, be ascending up and out of the crater (ejecta from the original surface lies one to two crater radii from the rim (Melosh, 1989)) revealing any vertical changes in mare composition (stratigraphy). The surface around the lander consists of Eratosthenian-aged (3.0 Gy) mare basalts (Hiesinger et al., 2010), deformed by a large-scale north-south trending wrinkle ridge and lies to the south (10-km) of a contact with an older Imbrian-aged basalt (3.5 Gy (Hiesinger et al., 2010)). Lunar mare basalts are divided into two main spectral types: "red" and "blue" (Pieters et al., 1978). The presence of ilmenite ($FeTiO_3$) results in lower reflectance and a "less-red" (or "blue") color. The landing site is on a blue mare (higher titanium).

LRO will pass over the Chang'e 3 site about every 28 days, each time with unique solar illumination conditions allowing for detailed study of the photometric properties of local materials. Additionally, NAC stereo imaging is planned that will enable topographic mapping of the area at 5 m scales.

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* Corresponding author