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Topographic Analysis of the Proposed Landing Area of Sinus Iridum

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Abstract

The Chinese first lunar lander/rover Chang'E-3 is planned to land on the Sinus Iridum landing area in 2013. Using the Chang'E-2 CCD image data, we analyzed the topographic features of the proposed landing area.

1. Introduction

In 2013, Chang'E-3 will head for the proposed landing area of Sinus Iridum(Fig 1), which is chosen by the scientific group of China's Lunar Exploration Project (CLEP) based on the global comparison research using Chang'E-1 datasets—including CCD image[1], results of IIM data[2,3], the global DEM data[4], and other lunar data. Chang'E-2 stereo camera has obtained data of both 7m (coverage 100%) and 1.5m (coverage 71%) resolution for the area [5]. The data of Chang'E-2 could help us get a preliminary understanding of the topography of the area.

After receiving the original data, procedures including radiometric correction, geometric correction, photometric correction, photogrammetric and mosaic mapping are operated to generate the Sinus Iridum 7m resolution basemap, and 3 kinds of data geometrically based on the basemap: a)32 obit-photos of 1.5m resolution; b) 30m DEM; c)4m obit-DEM. Based on these data, we studied the regional topographic features, measured the crater diameter and depth, extracted the crater coordinates, and statistically analyzed the distribution of the terrain units.

2. Topographic Analysis

Sinus Iridum is a plain of basaltic lava that forms a northwestern extension to the Mare Imbrium. The analysis of DEM data (30m) shows that the maximum height of this area is -2481m and the minimum is -3437m, the average is -2991m, and the RMS is 135m. The slope analysis (scale 90m) shows that the slope of most area in Sinus Iridum is within 10° (particularly, 10.6% of the area have a slope of 0°), and the average slope is 2.218°, and the RMS is 3.16°. There are several valleys and rimaes mostly with an extension from north to south in this area and no mountain like landforms.

CE-2's high resolution images (1.5m) show that there are densely distributed small craters and scattered groups of boulders which are the main threats to the soft landing. We detect and morphologically measure 17706 complete craters for their depth, diameter, rim height, and slope of the crater wall, as shown in Table 1. The statistical results showed that: more than 97% of the crater depth/diameter ratio is less than 1:10; more than 93% of the rim height/ diameter ratio of less than 1:20; most crater walls are flat: more than 94% of the crater wall has a slope less than 10°. The landing area is generally flat terrain, without large complex impact craters, but there are individual fresh craters with steep edge.

3. The Distribution of Craters

Based on the CE-2 image and DEM data, we identified all the craters larger than 100m. The crater density is shown in fig 2.

The analysis of the crater data shows that this area is densely covered by a great quantity of craters small than 1000m. In average, there are 53.4 craters (>200m) in 10km×10km area, 64.6 craters (>100m) in 5km×5km area, and roughly 20 craters (>50m) in 1km×1km area. Generally, the smaller the diameter is, the more craters there are. The actual relevance of the crater size and density remained to be solved. The craters are few and scattered around the biggest crater -crater Laplace A. The reason may be the ejecta from this large crater filled in many small craters. We are still working on the Sinus Iridum landing area, including the distribution of boulders, small scale slope analysis, DEM and DOM of higher resolution, etc.

Acknowledgements

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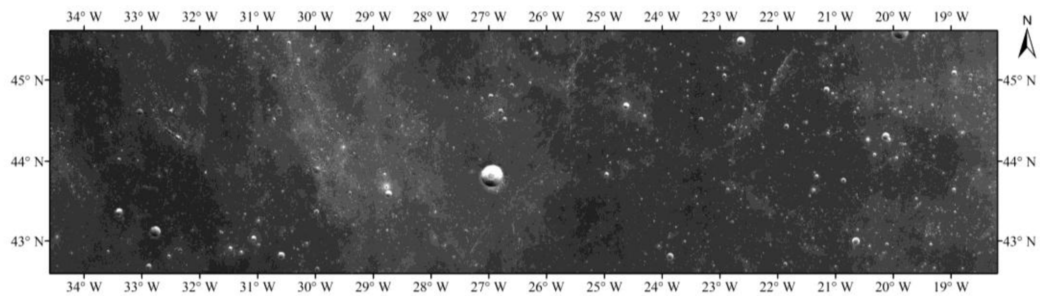

Figure 1: The CE-2 CCD image mosaic of the proposed landing area.

Table 1: The morphological statistics of craters measurements (total 17706).

Diameter /depth	count	proportion	rim height/diameter	count	proportion	Slope of the crater wall	count	proportion
>0.20	1	0.003%	>0.10	35	0.20%	>20	35	0.20%
0.18~0.20	4	0.02%	0.09~0.10	33	0.19%	18~20	56	0.32%
0.16~0.18	4	0.02%	0.08~0.09	68	0.38%	16~18	118	0.67%
0.14~0.16	22	0.12%	0.07~0.08	122	0.69%	14~16	268	1.51%
0.12~0.14	105	0.59%	0.06~0.07	298	1.68%	12~14	574	3.24%
0.10~0.12	328	1.85%	0.05~0.06	665	3.76%	10~12	1139	6.43%
0.08~0.10	1026	5.79%	0.04~0.05	1604	9.06%	8~10	2360	13.33%
0.06~0.08	2965	16.75%	0.03~0.04	3845	21.72%	6~8	4607	26.02%
0.04~0.06	7190	40.61%	0.02~0.03	6266	35.39%	4~6	6561	37.06%
0.02~0.04	6019	33.99%	0.01~0.02	4379	24.73%	2~4	1986	11.22%
<0.02	42	0.23%	<0.01	391	2.21%	<2	2	0.01%

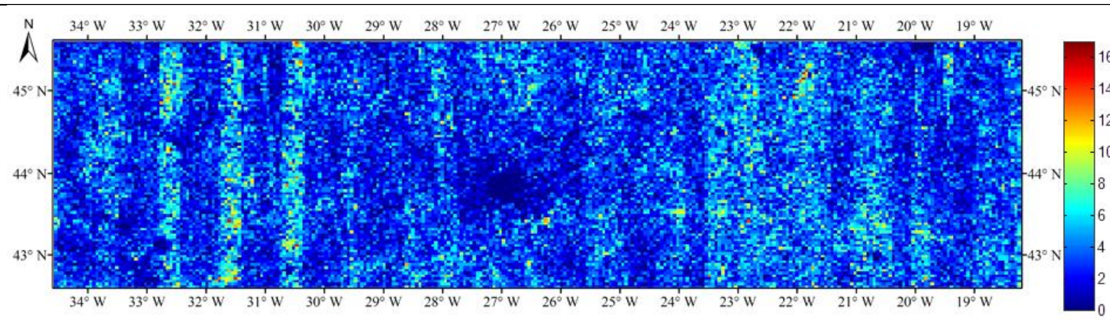

Figure 2: The crater density of the proposed landing area.