INVESTIGATION OF MATERIAL FROM REINER AND CAVALERIUS CRATERS IN THE REINER GAMMA LUNAR REGION

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Abstract EPSC2026-59ECP

1. INTRODUCTION

The robotic Lunar Vertex mission [1, 2] will study the Reiner Gamma magnetic anomaly and swirl at the surface of the Moon. The Reiner Gamma swirl is a curvilinear albedo feature that is co-located with a magnetic anomaly, both of unknown origin. The scientific community is studying Reiner Gamma in the fields of plasma physics, magnetism, and geology, each having potentially played a role at some point on the evolution of the Reiner Gamma formation dating back to ~2.9 Ga [3].

Our research focuses on geology. The intriguing layout of two complex craters: Cavalerius and Reiner, in the vicinity of Reiner Gamma suggests they have potentially played a role in resurfacing the swirl via ballistic sedimentation of their ejecta. Hood [4] identify a cluster of craters near the eye of Reiner Gamma swirl and extrapolate to the distance pass through the center of Cavalerius crater (Figure 1.). The important tracks near Reiner crater and directional to Reiner Gamma swirl are traceable with topographical numerical model. We investigating entire tracks resulting of these two impacts.

2. OBJECTIVES

Our main objective is to determine whether fresh material from surrounding complex craters could have been deposited on the Reiner Gamma magnetic anomaly after its formation.

Specifics objectives are to :

(1) identify the material ejected from Cavalerius and Reiner craters at a fine spatial scale,

(2) study the similarity between the material found on the Reiner Gamma magnetic anomaly and that of the complex craters.

3. METHOD

Step 1. Geomorphological map

We delimitated the barycenter and rim crest of each complex crater with the newly developed MorphoPy python code [5]. The proximal ejecta is identified by the Melosh formula [6] which assumed one radius after the rim crest. The presence of the topographic features : lineaments and V-shaped patterns, radially surroundings complex craters, representative of discontinuous ejecta, is extracted by using SLDEM2015 with ArcGIS pro and ENVI 6.1 tools.

Step 2. Delineation of sampling area

We calculated the ejecta thickness for Cavalerius and Reiner craters by using a power-law relationship that states that ejecta thickness decreases with distance from the rim crest (Housen's formula [7] for calculating thickness of Cavalerius ejecta and Sharpton [8] for Reiner).

For each complex crater, we identify small craters located on the ejecta blanket based on two characteristics: visible rays on the surface surrounding the crater by using OMAT data, and crater depth that does not exceed the bottom of the ejecta blanket of the complex craters. We used the formula of Basilevsky (1976) that stipulate for a fresh crater, the depth is representative of 1/3 of the crater diameter. Diameter apparent is measured with WACs/NACs images.

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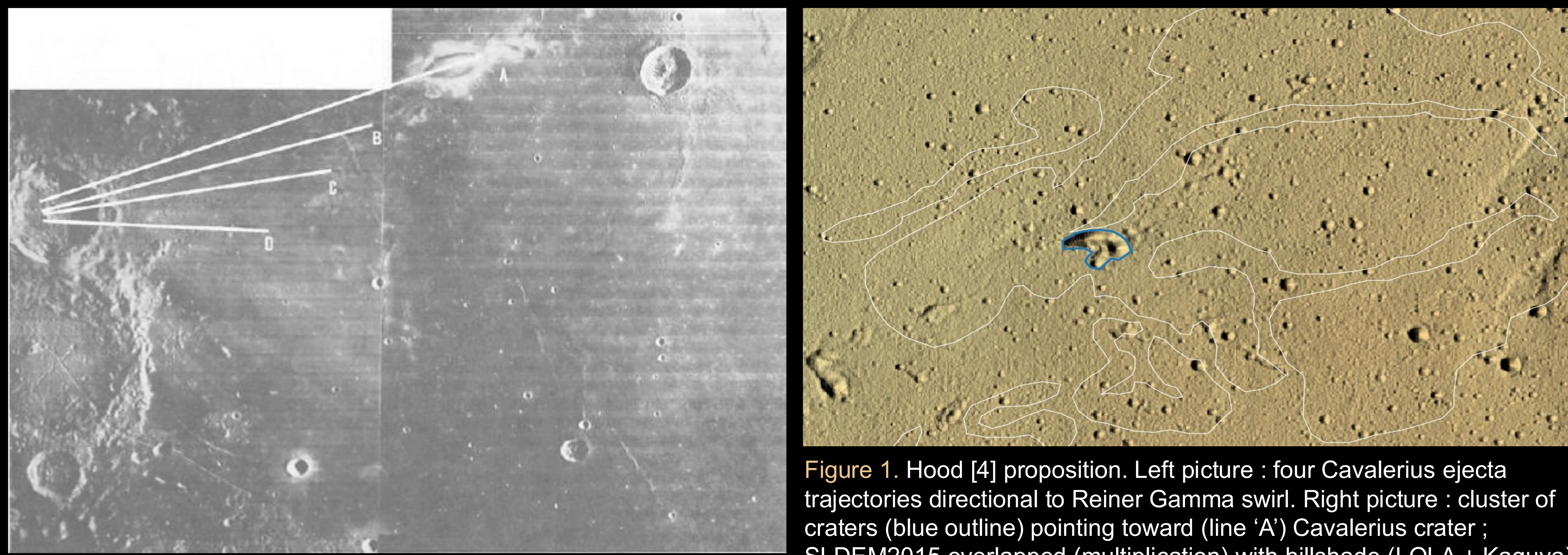

Figure 1. Hood [4] proposition. Left picture : four Cavalerius ejecta trajectories directional to Reiner Gamma swirl. Right picture : cluster of craters (blue outline) pointing toward (line 'A') Cavalerius crater ; SLDEM2015 overlapped (multiplication) with hillshade (LOLA + Kaguya).

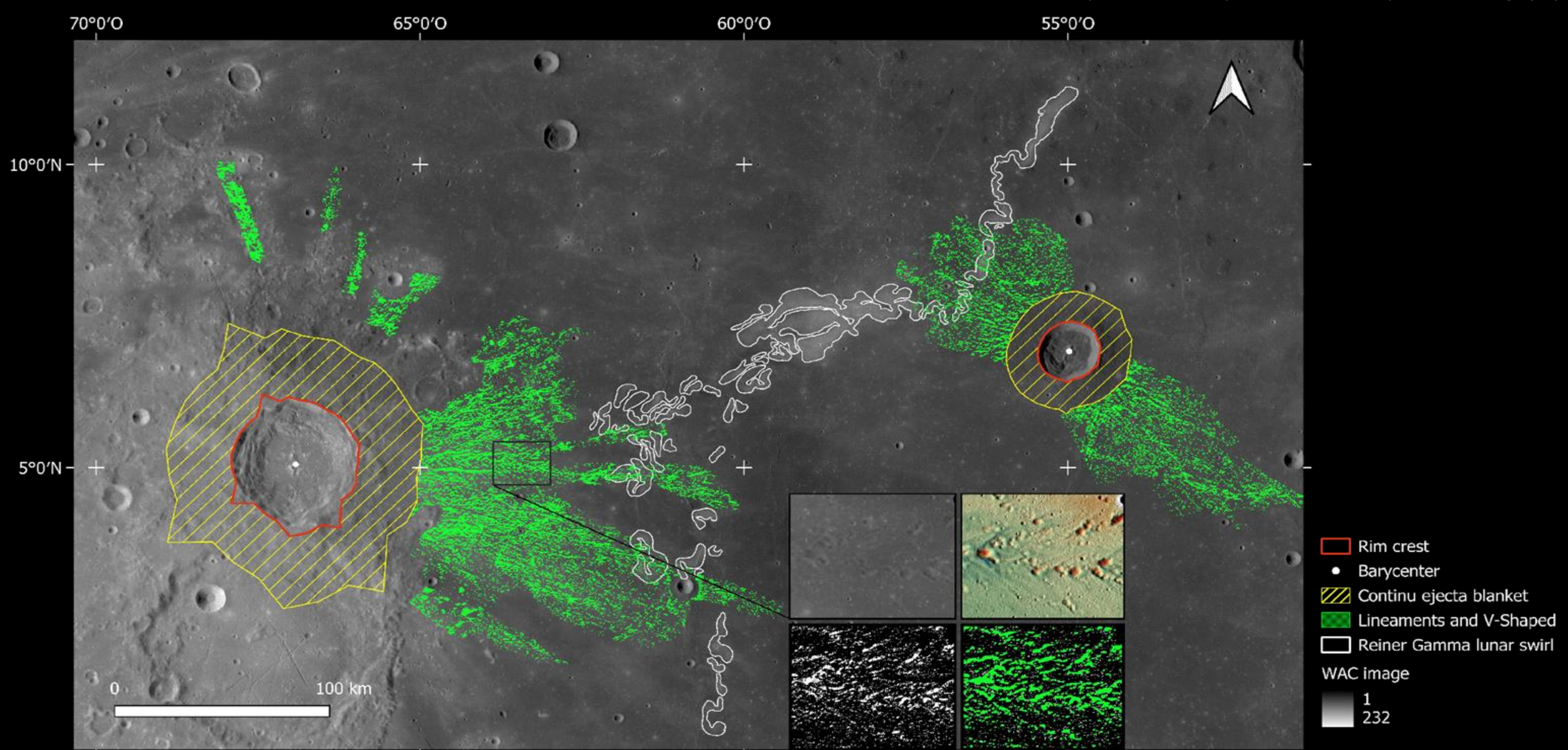

Figure 2. Geomorphological map of Cavalerius and Reiner craters and their surroundings. Three boxes representative of the ENVI treatment (top right and those at the bottom), with the aim of highlighting lineaments and V-shaped. The image in the box at the top left shows a close-up of the region.

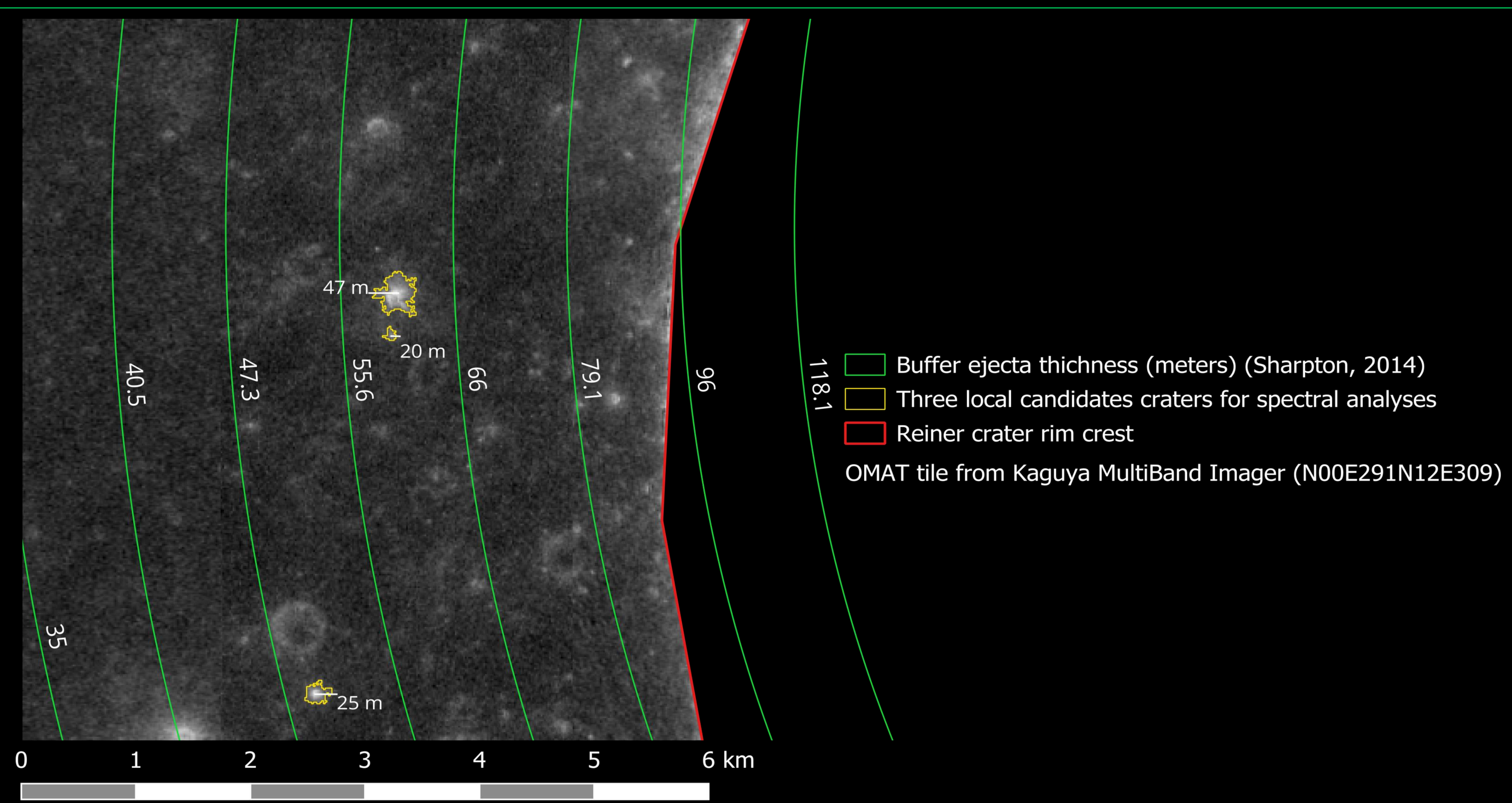

Figure 3. Local west region of Reiner crater surrounding of his ejecta thickness and presence of craters candidate will support the multi- and hyper-spectral analyses.

4. RESULTS

Figure 2. shows the geomorphological map of Cavalerius and Reiner craters and their surroundings : barycenter, rim crest, continuous ejecta cover, and lineaments and V-shaped patterns. Notable fact : the lineaments and V-shaped patterns does not reach the cluster of craters identify by Hood (1979).

Figure 3. shows local example of the thickness of ejecta of Reiner crater and three candidate craters, with high OMAT value and whose depth does not reach the bottom of the Reiner ejecta field and will support the multi- and hyper-spectral analyses. The number of craters candidate for Reiner is 46 and for Cavalerius is 63.

5. DISCUSSION AND CONCLUSION

The main part of the Reiner Gamma swirl, the eye of Reiner Gamma swirl, isn't cover by lineaments or V-shaped patterns.

Step 3. Mineralogical composition analyses

The identified candidate craters at step 2. will support the multi- and hyper-spectral analyses which aims to compare the mineral composition of each site (complex craters ejecta versus swirl surface) and to identify any correlations between the compositions.

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