REVISITING THE HOLLOWS OF GUSEV – PRELIMINARY RESULTS. J. Saraiva[1], P. Pina[1] and L. Bandeira[1], [1]CERENA/IST, Lisboa, Portugal (jose.saraiva@ist.utl.pt).

Introduction: Understanding the nature and distribution of small (<100 m in diameter) craters on Mars is far from being a closed matter [1-3]. In fact, the data on small craters is still rather sparse. It is easy to observe the fact that there are areas of the Martian surface that are full of small craters, while others are almost devoid of them, but this tells us little about their origin and age. However, gathering data on their distribution and appearance can provide clues about their relations with similar-sized craters, illuminating the spiny question of a common (secondary) origin vs. a " true" (i. e. primary) status, while also denouncing the possible role of far-away primaries in creating an increased density of small secondary craters in certain areas [4, 5]. In recent years, the HiRISE camera opened up a new window into the details of the Martian surface. Craters only a few meters in diameter became visually detectable, and one single image can contain several hundred thousand of them. Counting all of these features is a daunting task, and a sampling approach, if correctly devised (accomodating geological information) and applied seems more envisionable.

Area of study: The area traversed by the MER Spirit in Gusev crater [6] shows a complex population of small craters. To study this, we selected an HiRISE image, specifically PSP-009174-1650 (Figure 1) and manually identified craters (in a GIS environment, using cratertools [7]) in an area covering a few kms north (Figure 2) and south to the path of Spirit, while classifying each of them into categories, according to their apparent state of conservationn. This is a subjective decision, but based on previous observations. There are in the area many small round features filled with fine wind-carried sediments and presenting a smooth surface, termed hollows in previous studies [8], and mostly thought of as secondaries. However, scattered among them some fresh-looking craters of diverse dimension can be found. If these are also secondaries, they result from a more recent event. There are also many examples of intermediate stage craters, not yet filled by sediments, but clearly affected by erosion and with rims that look far from fresh.

Some distinct units have been mapped in the area [9], including ejecta blankets of some large (in context) craters such as Bonneville, Missoula and Lahontan. By studying the numbers and appearances of the small craters in those areas, we plan to see if they have a discernible effect on the population of small craters, and to what distance does it persist (if present).

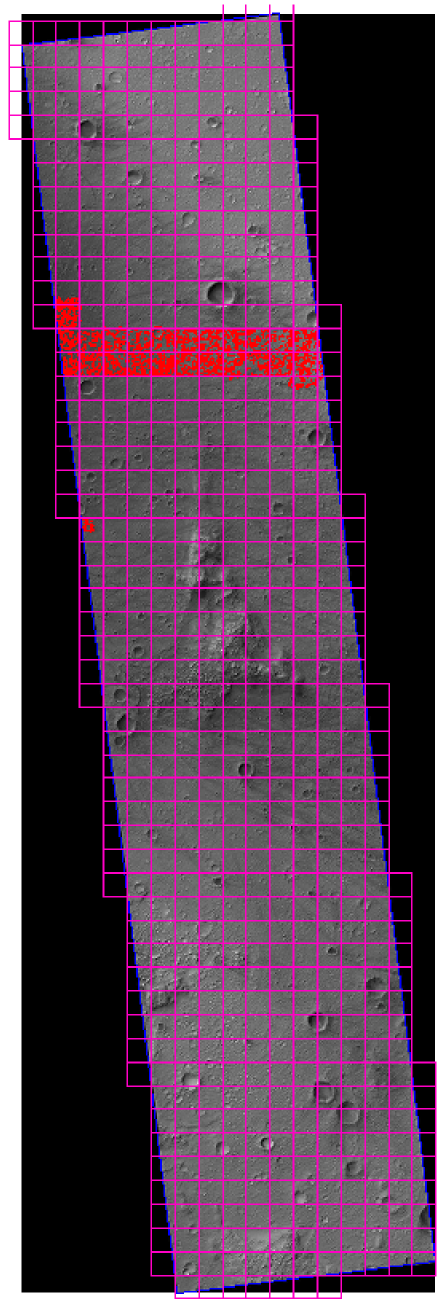

Figure 1 – HiRISE image PSP-009174-1650 with superposed 500x500 m grid and currently identified small craters [image: NASA/JPL/University of Arizona].

Results: Up to this moment, 6090 craters have been identified in the area studied, corresponding to a surface of a little more than 5.5 km^2. An example of the work carried out can be seen in Figure 3.

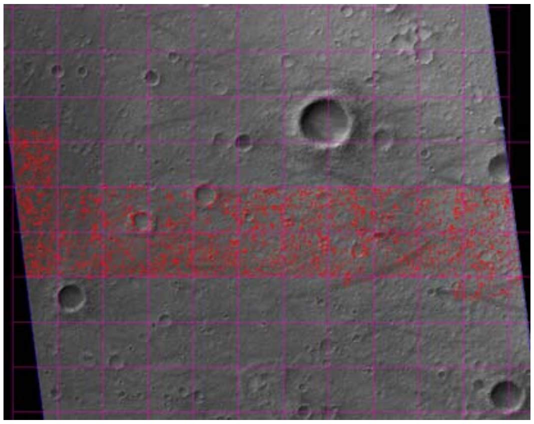

Figure 2 – Detail of image from Figure 1, showing work in progress in an E-W area approximately 5 km north of Spirit trajectory.

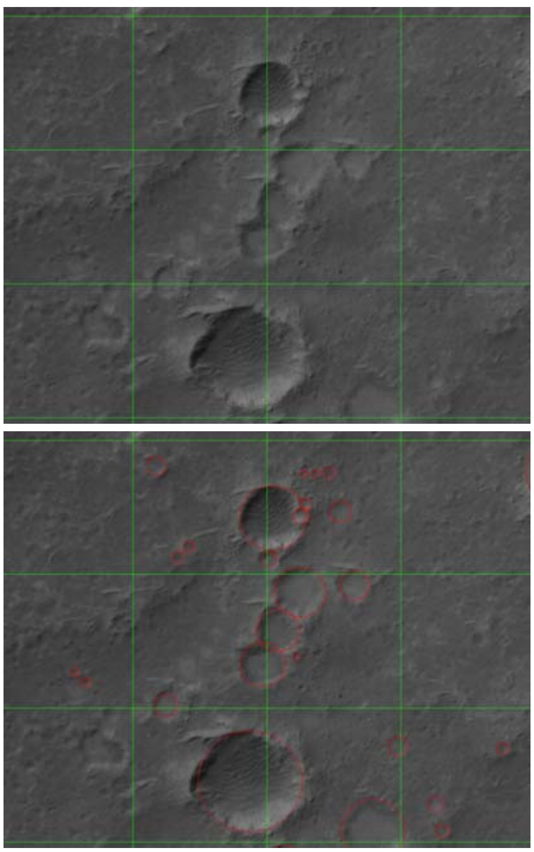

Figure 3 – A small part of the area currently under study, showing craters and their detection; the dimensions of the green grid are 50x50 m.

The smallest crater detected so far is only 1.2 m in diameter, corresponding to 5 to 6 pixels in the HiRISE image; questions can be raised about the limit of visual detection in these images, and efforts are in place to try to be as objective as possible about this. The largest crater identified in the same area is around 240 m in diameter. The distribution of sizes of these craters can be seen in Figure 4, and shows the expected shape, with numbers growing in the lower limit. A finer analysis, which will take into account the categorization of craters, will ensue.

Future work: This work marks only the beginning of a more ambitious project to collect data on the distribution of small craters on different parts of the Martian surface. Difficulties posed by the small dimensions of the features have been identified, and measures have been devised to guarantee the accuracy of the detections. The full appraisal and interpretation of the results will have to take into consideration local geological context and regional distribution of larger impacts. On the way to this goal, many issues will be looked into, for instance the multiscale characterization of crater morphology, and alternate ways to consider crater densities (especially when talking about very small craters) and distribution patterns. Other questions, as yet unidentified, will undoubtedly arise and be tackled along the development of this research.

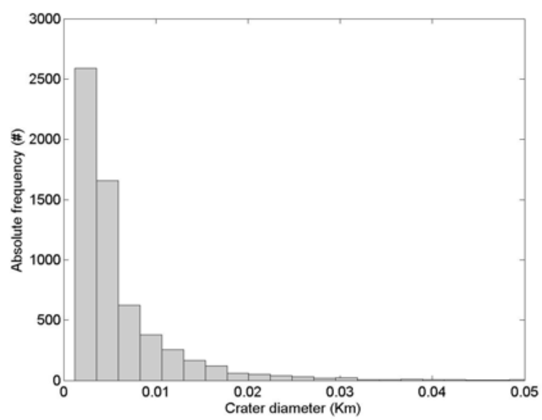

Figure 4 – Histogram of crater diameters currently identified in the area studied.

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