MERGE OF FIVE PREVIOUS CATALOGUES INTO THE GROUND TRUTH CATALOGUE AND REGISTRATION BASED ON MOLA DATA WITH THEMIS-DIR, MDIM AND MOC DATA-SETS.

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Summary: With merge was completed the integration with Barlow, Rodionova, Boyce, Kuzmin and the catalogue from our previous work. The resulting Ground Truth (GT) catalogue with 57633 craters was registered, using MOLA data as bases, with THEMIS-DIR, MDIM and MOC data-sets.

Introduction: The Framework for Evaluation of Crater Detection Algorithms (FECDA) was recently proposed as an initial step for solving the problem of objective evaluation of CDAs [1]. The FECDA includes the GT catalogue (locations and sizes of known craters) with 17582 craters, wherein each one is aligned with 1/64° MOLA data and confirmed with catalogues *B* [2] (from N.G. Barlow et al.) and *R* [3] (from J.F. Rodionova et al.). Recent cross-analysis-based improvements of the GT catalogue [4] resulted with the new updated GT catalogue with 18711 craters and following candidates for inclusion in the GT catalogue: (1) 559 large not-registered craters from the catalogue *R* (with $r > \sim 4.622$ km), (2) 4752 large not-registered craters from the catalogue *B* (with $r > \sim 4.622$ km); and (3) 18793 small not-registered craters from the catalogue *B* (with $r < \sim 4.622$ km). In this work, all these candidates for inclusion were processed for the purpose of the extension of the GT catalogue. Following this, catalogue *C* [5] (from J.M. Boyce et al.), catalogue *K* [5] (from R.O. Kuzmin et al.), and catalogue *N* [6] (from our previous work, which contains 22044 craters) were used for additional extensions of the GT catalogue.

Methods: Previously not registered craters from the catalogues *B* and *R* were directly merged into the GT catalogue without need for preprocessing, because all concerns and questionably cases had been already solved in the previous work [1, 4]. The catalogues *C* and *K* were processed in two steps: (1) self-evaluation was performed in order to eliminate duplicates; and (2) they were merged into the GT catalogue similarly as the catalogues *B* and *R* in the previous step. The large number of craters from the catalogues *C* and *K* had already been registered in the GT catalogue. In each such case only the name of the existing crater in the GT catalogue was extended with the reference to the crater from the catalogue of origin. In the case of catalogue *N*, which contains only coordinates and radiuses, all craters already contained in the GT catalogue were deleted first to simplify the integration process.

Results: Representative cases of the results of the completed merge with the catalogues *B*, *R*, *C*, *K* and *N* are shown in Fig. 1. Merging remaining craters from the catalogues *B* and *R*, the GT catalogue was extended with 23433 new craters. After that, the catalogue *C* with 2268 craters was processed and the GT catalogue was extended with 282 new craters. Interestingly, during this work we found out that, as shown in Fig. 1, THEMIS image provides evidence that at least one of the discovered quasi-circular depressions [7] indeed is a crater. The newer version of the catalogue *C* with 6047 craters [8] was unfortunately not used because it was not available at the time of this work. Using the same approach for the catalogue *K* with 24877 craters, the GT catalogue was extended with 14981 new craters. The 347 remaining craters from the catalogue *N* were sent to the second author of this catalogue for review. With 225 confirmed as craters the GT catalogue was additionally extended. During the final check (using crater names) of the consistency of the GT catalogue, we noticed that Ston crater was still not included. We added it to the GT catalogue to outline its openness for additional extensions in the future.

Conclusion: The resulting GT catalogue contains 57633 craters. Accordingly, it is currently the most complete catalogue that can be used for the FECDA. All craters from the resulting GT catalogue were additionally registered, using 1/128° MOLA data as bases, with 1/256° THEMIS-DIR, 1/256° MDIM and 1/256° MOC data-sets. Thanks to that, the GT catalogue can also be used with these additional subsystems.

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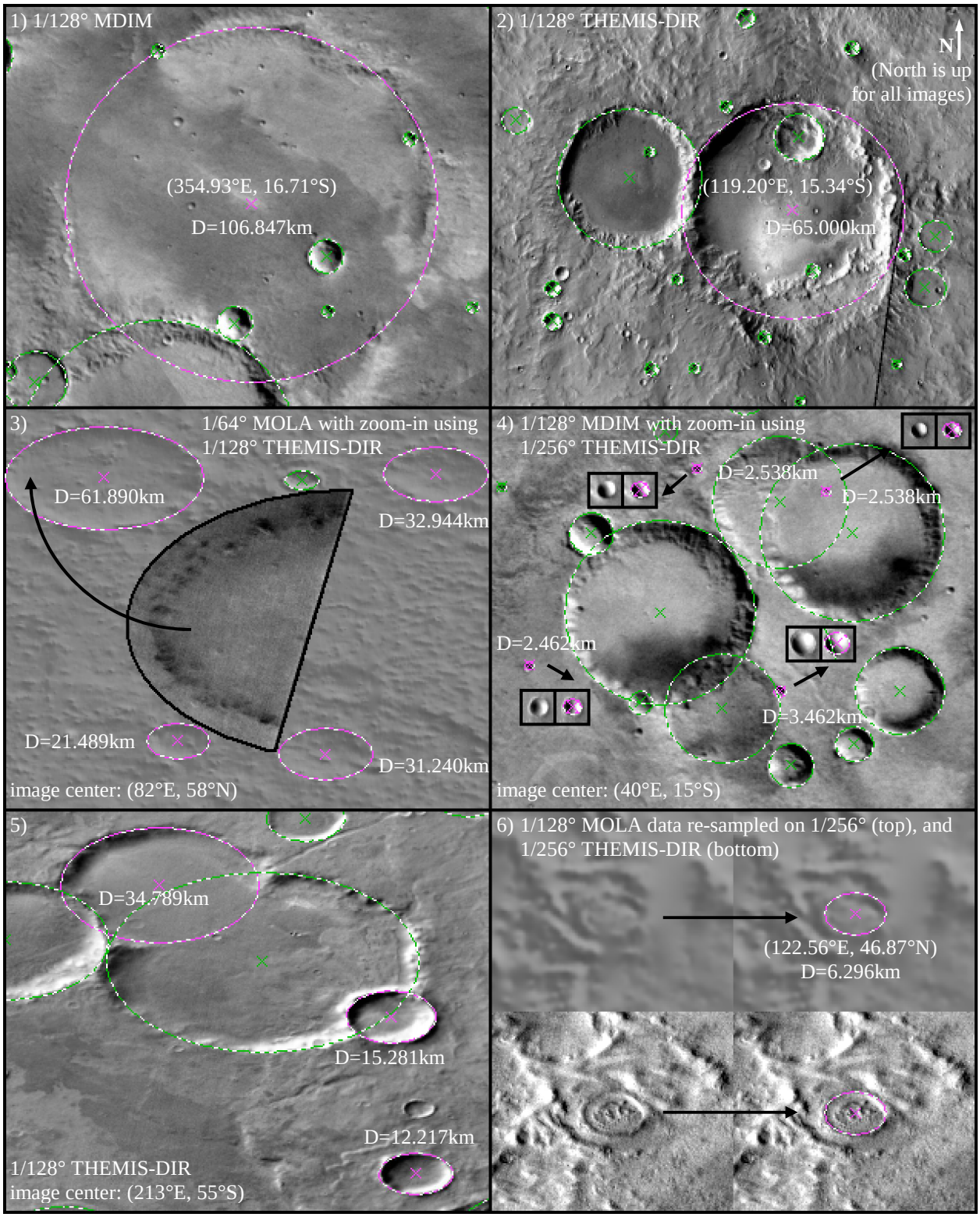

Figure 1: Contributions (T=top, B=bottom, L=left, R=right; names of all following craters ends with Y2007S) from following catalogues: (1) Barlow, S019093B19134; (2) Rodionova, S019127R00792; (3) Boyce, S042146C01833 (TL), S042147C01832 (TR), S042149C01821 (BL) and S042148C01820 (BR); (4) Kuzmin, S050964K08416 (TL), S050967K08447 (TR), S050963K08674 (BL) and S050965K08675 (BR); (5) our previous work, S057533N00291 (TL), S057534N01357 (TR) and S057535N03173 (BR); and (6) Ston crater, S057633.