Geophysical Research Abstracts
Vol. 17, EGU2015-7819-2, 2015
EGU General Assembly 2015

Systematic High-Resolution Remote-Sensing Investigation of Martian South Polar Landforms: Thermal Contraction Polygons

Stephan van Gasselt (1) and Jingyan Hao (2)

(1) Freie Universitaet Berlin, Institute of Geological Sciences, Department of Earth Sciences, D-12249 Berlin, Germany (stephan.vangasselt@fu-berlin.de), (2) State Key Laboratory of Remote Sensing Science, Institute of Remote Sensing and Digital Earth (RADI), Chinese Academy of Sciences, Beijing 100101, China (haojy@radi.ac.cn)

The Martian poles are geomorphologically highly diverse as orbital high–resolution imaging data have shown since the early 2000s [1]. Apart from an initially unexpected diversity and an abundance of different and exotic landform types, image and topography data presented evidence for seasonal changes, not only with respect to the seasonal extent of the polar–caps but also with respect to individual landforms that have later been addressed as cryptic material [2].

Most of these features are – though not exclusively – located within the seasonal CO_2 cap and their changes imply not only seasonal but also potentially long-term climatic changes [3]. Today, plausible formation processes for some of these landforms have been proposed [7–9; 11–13] and modelled but despite a wealth of new data, systematic surveys are relatively rare [10]. For more than 13,500 images taken by the MGS Mars Orbiter Camera (MOC–NA) over the south–polar area (75—90°S) systematic mapping and classification of thermal contraction polygons have been conducted in previous work by the author and others [4–5], but seasonal changes were identified for few locations only due to limitations of image coverage. Reconstruction of thermal-contraction crack development suggests a complex interplay between seasonal H_2O and CO_2 ices [6] but image coverage was too sparse at that time to build a representative distribution model and to confirm formation models.

Due to the small size of thermal contraction polygons (few tens of meters in diameter), data obtained by MEx/HRSC and MO/THEMIS could only marginally help to identify features and feature distributions. With the arrival of Mars Reconnaissance Orbiter, the Context Camera (CTX) provided new detailed insight into the seasonal behaviour of the south polar area of Mars and its landforms at geometric resolutions comparable to those of MOC. Four Martian years have been covered by now which allows us to reconstruct formation and analyse distribution of featured landforms and combine results of two polar surveys.

The work presented here provides a detailed assessment of data coverage, a review of polygonal landform types and of their distribution based on CTX observations.

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