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Crater retention ages of the ice-dust mantle deposit in Malea Planum, Mars

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Abstract

The mid- and high-latitudes of Mars are covered by a young, smooth ice-dust mantle that is independent of local geology, topography and elevation. It is generally interpreted as an atmospherically derived air-fall deposit, related to recent climate changes caused by shifts in martian obliquity. These obliquity cycles have led to the repeated emplacement and degradation of layers of the ice-dust mantle over million year time scales. In order to determine absolute ages of the ice-dust mantle within the southern hemisphere, a systematic survey of all available HiRISE (~0.25-0.5 m/pxl) and CTX (~5 m/pxl) images from 55-60° S latitude and 50-70° E longitude was performed in the Malea Planum region. Malea Planum is a flat volcanic plain at the southern rim of the Hellas basin, and under current obliquity conditions the ice-dust mantle in this region is undergoing degradation. This has led to the formation of large patches of smooth mantle that are surrounded by degraded terrain, which has exposed deeper layers of the ice-dust mantle. Using crater size-frequency measurements, we derived absolute model ages of ~3-5 Ma for the surface of the smooth mantle. The

degraded terrain lacks impact craters, hindering the determination of reliable age estimations using crater statistics. Nearly all observed craters on the smooth mantle in Malea Planum are small and show signs of erosion, evidence for the ongoing modification of the ice-dust mantle since ~3-5 Ma. However, in comparison to the ice-dust mantle in other regions at mid- and high-latitudes on Mars, which have been heavily influenced by the most recent obliquity excursions 0.4 and 2.1 Ma ago, the mantle in Malea Planum has been relatively stable. This further indicates that the latitude dependent ice-dust mantle is a complex surface deposit of several layers, which have been deposited and degraded at different times in martian history.

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Presenting Author short biography (200 words or less)

I began my studies in Geosciences in 2005 at the University of Muenster in Germany with a focus on geology, geochemistry and geomorphology. During the end of my Bachelor studies in 2008 I worked in the planetology department (Institut für Planetologie), first as student assistant and later on as a research assistant. There I used high resolution images (HiRISE and CTX) to investigate impact craters on the ice-dust mantle in various regions on Mars. This work continued as a side project and has resulted in a paper, which will be published in Space and Planetary Sciences later this year. An internship at DLR (German Aerospace Center) introduced me further to the analysis of remote sensing images and the diverse morphologic features of Mars. I finished my Master studies in 2011 having worked on remote sensing and structural geology of the Ries impact crater, Germany. In preparation for this project I participated in several excursions to investigate craters in Sweden (Siljan, Lockne, Mien), Norway (Gardnos), South Africa (Vredefort) and Arizona (Meteor Crater). Since April 2011 I am enrolled in the PhD program at RSES, ANU investigating the migration of prehistoric populations by means of direct dating and isotope tracking.

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