EPSC Abstracts
Vol. 7 EPSC2012-657 2012
European Planetary Science Congress 2012

Evidence of recent (~4 Ma) activity in Argyre Basin, Mars?: Results from new crater counts

M. R. El Maarry (1), J. M. Dohm (2).
(1) Physikalisches Institut, Universität Bern, 3012, Bern, Switzerland, (2) Department of Hydrology and Water Resources, University of Arizona, Tucson, AZ 85721, USA.

Abstract

Our recent mapping efforts of Argyre Basin on Mars suggest recent activity in the Nereidum Montes region which displays fresh-looking flow material that resurfaces large areas and suggest a very young age for resurfacing. The flow material itself display evidence of hydrologic and periglacial activity which could be indicative of recent transient periods of hydrologic activity and/or remobilization of volatiles.

1. Introduction

The Argyre impact was one of several large impact events (including Hellas and Isidis) that occurred relatively early in the geologic history of Mars. It is the best preserved multi-ring impact basin on Mars. The ever increasing dataset of high resolution images enables more accurate and in-depth mapping efforts (e.g., [1]) to be undertaken. As part of an on-going mapping campaign, we have investigated the northern part of the basin (Fig. 1a) in an attempt to understand the geologic processes that have affected the region. In this work, we report on a region in Nereidum Montes (centred at 36.1° N, 319.5° E) which potentially displays evidence for very recent (a few Myr ago) hydrological or glacial activity by studying images taken with the CTX and HiRISE cameras on board the Mars Reconnaissance Orbiter (with resolutions of ~6 m/pix, and 0.25 m/pix respectively). We use the nearly complete image cover of the former dataset (CTX) to generate accurate crater counts to estimate the age of the recent resurfacing events.

2. Results

Fig. 1a shows the studied area in Nereidum Montes which lies in the northern part of Argyre Basin. The main region of interest is the 38 km-wide un-named impact crater (named here informally Young crater)

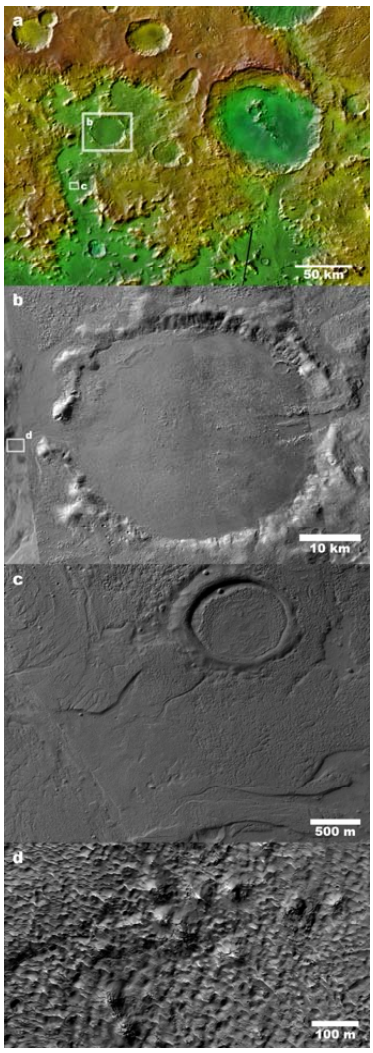

Fig.1. (a) THEMIS day IR mosaic of region of study in Nereidum Montes in Argyre Basin with MOLA colour elevations draped over it. The largest crater in the image is Hale Crater. Small rectangles show locations of the subsequent images. **(b)** CTX mosaic of the informally named Young Crater which shows evidence of resurfacing with flowing material displaying a dearth in impact craters. **(c)** CTX sub-image of the flowing material south of Young Crater. Parts of the flows appear to be later dissected by small channels and display polygonal cracking. **(d)** HiRISE sub-image of the flow material displaying rough texture and interesting mounds. Image IDs: (b) P03_002141_1445, P18_008035_1441 and P22_009749_1456, (c) P17_007745_1410, (d) ESP_024623_1435.

lying west of Hale Crater [2] with evidence of being resurface by a flowing material that breaches (or follows the path of an older breach) in the eastern rim before exiting at the west and covering entire regions in the large valleys and natural depressions (Figs. 1a, 1b). Parts of these flows appear to be later modified by small channels (Fig. 1c) and even display polygonal cracking in some area with a crack spacing ranging from 30 to 50 meters. Close-up imaging with HiRISE shows the flow material to be texturally rough at meter scale which is occasionally mantled and displays interesting mounds that display cracking in their summits (Fig. 1d). However, the most defining character of these flows is the apparent dearth of superposed impact craters which hints at a very young age or these deposits (or weak crater retention). To investigate this more fully, we generated crater count statistics for Young crater to estimate its resurfacing age. In doing so, only superposed craters with diameters larger than 50m were taken into account. The statistics were later fed into the publically available software for age estimates (Craterstats2, [3]) which yields an age of ~ 4 million years for the flowing material according to Hartmann and Neukum isochrones [4].

3. Discussion

Our recent mapping efforts to understand the evolution of Argyre Basin are yielding exciting results that point to recent activity in the Basin. The crater counts generated for the flow deposits are indicative of a very young age, while the presence of various mound structures and cracking may be indicative of volatile-rich terrain. In addition, the wide distribution of the deposits and the presence of many channels dissecting the deposits may be indicative of transient melting periods and remobilization of volatiles throughout the history of the Argyre Basin. Such transient warm periods may be a result of impacts (e.g, Hale), intense volcanism potentially from Tharsis, obliquity variations, or a combination of any of these factors. The research in progress should hopefully address these questions.

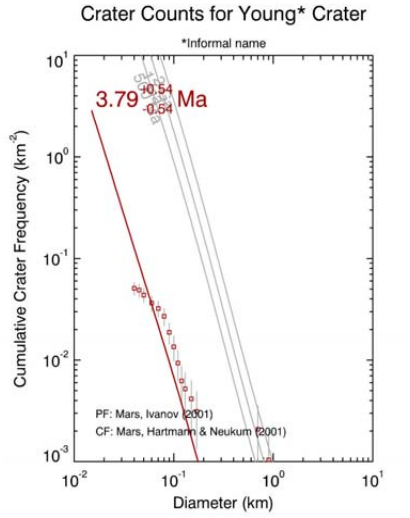

Fig.2. Age estimate for Young Crater (area: ~960 km^2) using Hartmann's isochrones [4]. Dataset includes 49 craters, with the largest being 0.97 km in diameter.

References

[1] Dohm J.M. and Kargel J.S., (2012), Geologic mapping investigation of the Argyre and surrounding regions of Mars. LPSC 43rd meeting, abstract #2468.

[2] Jones A.P. et al., (2011), A geomorphic analysis of Hale crater, Mars: The effects of impact into ice-rich crust. Icarus 211, p. 259-272.

[3] Michael G.G., Neukum G., (2010), Planetary surface dating from crater size-frequency distribution measurements: Partial resurfacing events and statistical age uncertainty, Earth and Planet. Sci. Lett., DOI: 10.1016/j.epsl.2009.12.041.

[4] Hartmann W.K., and Neukum G., (2001), Cratering Chronology and the Evolution of Mars. Space Sci. Rev. 96, p. 165-194.