EPSC Abstracts,
Vol. 4, EPSC2009-603, 2009
European Planetary Science Congress,

Pavonis Mons: Volcanic History of the Tharsis Montes based on Geologic Mapping on HRSC Data

M. Al-Samir[1,2], S. van Gasselt[1], S. Walter[1], C. Gross[1] and G. Neukum[1]

[1]Freie Universität Berlin, Geological Sciences, Planetary Sciences & Remote Sensing, Berlin, Germany, [2]Leibniz-Institut für Meereswissenschaften, IFM-GEOMAR, Germany (malsamir@ifm-geomar.de)

Introduction

Data sets, acquired from Mars during several missions have provided detailed data for a better understanding of the evolution of the Tharsis Region in context of the origin of the Tharsis Montes.

The High Resolution Stereo Camera (HRSC) on board of the European Space Agency's Mars Express Orbiter [1] provided high-resolution color and stereo image and topography data of the Tharsis Montes volcano Pavonis Mons. These data sets allow deeper insights into the volcanic history of Pavonis Mons by geologic - geomorphologic mapping with additional quantitative support by deriviation of absolute ages through statistics of crater – size frequency distribution.

Observations

Pavonis Mons is the central volcano of the three Tharsis Montes volcanoes situated on the Tharsis bulge near Mars' equator, which was first observed by the Mariner 9 spacecraft in 1971. Compared to its neighboring volcanoes (Arsia and Ascraeus Montes), Pavonis Mons is the smallest of them, with a volume of 4 x 10^5 km^3 [2]. Similar to its neighbors Arsia Mons to the southwest and Ascraeus Mons to the northeast, Pavonis has gently sloping flanks, whereas the eastern flank is slightly steeper (4.6°) when compared to the western slope (4.1°). These flanks are covered by two lava plain units in the northeast and southwest [3].

Flank vents are located on the northeastern and southwestern slope of each of the Tharsis Montes and show again similar morphologies as Arsia Mons and Ascraeus Mons. The northeastern flank vent of Pavonis Mons (Pavonis Chasma) shows no evidence of debris input from adjacent areas and could therefore be interpreted as being younger than the Pavonis Mons main caldera.

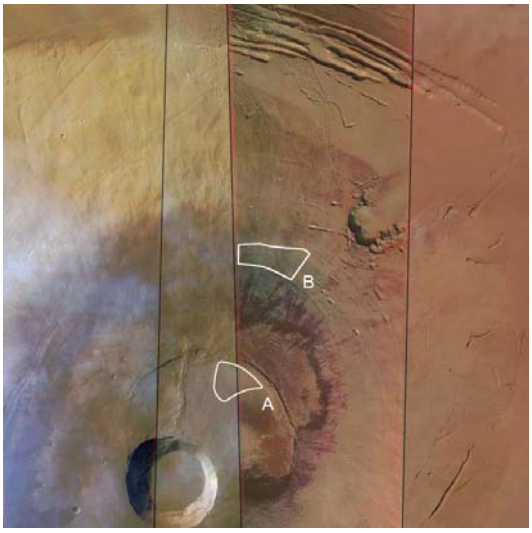

Figure 1: Northeastern flank of Pavonis Mons. Area A and B were used for crater – size frequency distribution datings. Orbits from West to East: 0902, 0891, 2175, 3276 (HRSC-mosaic).

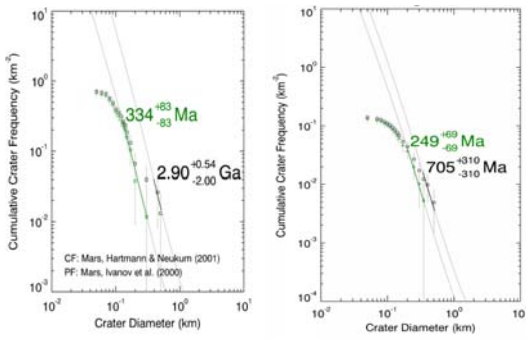

Figure 2: Crater-size frequency distribution with superimposed isochrones with correction for erosional ages in area A (left) and B (right).

EPSC Abstracts,
Vol. 4, EPSC2009-603, 2009
European Planetary Science Congress,

Crater Counts

Recent studies [1][4] assume an episodic activity of the Tharsis Montes. The two larger volcanoes Ascraeus Mons and Arsia Mons have already been investigated by various authors [1], [4], [5] and [6]. Pavonis Mons has not yet been sufficiently explored. Within this study we use crater–size frequency distributions in order to date the planetary surfaces most accurately on high resolution stereo imagery from the HRSC camera-system.

Results

Fig. 2A shows the area used for age determination, a part of the old Pavonis Mons main caldera. The area was selected due to its uniformity. The diagram shows two different ages and the corresponding error-bars. The old age of 2.9 Ga indicates the end of the main activity in this particular part of the caldera. The resurfacing age (green) shows the absolute end of the activity of secondary events (erosion or minor volcanic activity).
The second age determination (Fig. 2B) was carried out between two ring faults where lava was spilled out at the flank of the volcano. The purpose of this dating was to find out context information on the flank- and the caldera age. The age of this area turns out to be younger than the caldera itself and indicates a young age of 705 Ma with a clear resurfacing at 249 Ma. Including the maximum possible error, the resurfacing ages of the two dated areas look fairly comparable and could be interpreted as “normal” erosional effect.

Conclusions

The preliminary dating work shows, that episodic eruptions might have also occurred at the Pavonis Mons volcano. Compared to the ages of the old calderas of Arsia Mons (130 Ma) and Ascraeus Mons (3.6 Ga), both measured by [1], our age determinations of the old caldera with 2.9 Ga are placed in between those ages. Age determinations on the heavily degraded chasma unit in the north provided young ages due to very few impact craters which suggest ongoing activity and resurfacing related to exogenic rather than to endogenic processes.

References

[1] G. Neukum et al. (2004). *Nature*, 432, 971-979. [2] J.B. Plescia (2004). *JGR*, 109, 1-26. [3] D.H. Scott and J.M. Zimbelman (1998). [4] S. Werner (2009). Icarus, 201, 44-68. [5] D.H. Scott and K.L. Tanaka (1986). *U.S. Geol. Surv. Misc. Inv.Ser.*, Map I-1802-B. [6] J.E. Bleacher et al. (2007).*JGR*, 112.