PLAINS VOLCANISM ON MARS REVISITED: THE TOPOGRAPHY AND MORPHOLOGY OF LOW SHIELDS AND ASSOCIATED VOLCANIC LANDFORMS E. Hauber[1], J. Bleacher[2], D. Williams[3], R. Greeley[3]. [1]Institute of Planetary Research, DLR, Rutherfordstr. 2, 12489 Berlin, Germany. [2]NASA/GSFC, Greenbelt, MD, 20771, USA. [3]ASU, Tempe, AZ, 85287-1404; USA. Ernst.Hauber@dlr.de

Introduction: The morphometry of volcanoes provides critical input to the investigation of their tectonic setting and the rheology of their eruption products. It is also an important prerequisite for studies of comparative planetology, e.g., the comparison between terrestrial and planetary surface features. Numerous small and low shield volcanoes on Mars and associated vents and lava flows have previously [e.g., 1] been compared to terrestrial plains volcanism, as defined by Greeley [2] to be intermediate between flood basalts and the Hawai´ian shields. However, the Martian low shields got relatively little attention so far, and despite some work on their topography [e.g., 3,4], not many thorough analyses have been carried out so far. This study investigates the topography and morphology of the low shields and associated landforms using post-Viking data.

Results and Discussion: Martian low shields and associated landforms display many similarities with terrestrial basaltic volcanic fields, and so far we did not identify any features that are unknown from Earth. They include relatively small and low shields (Fig. 1), lava flows, which are often associated with lava channels and –tunnels, and volcanic rift zones. Our results reconfirm the Viking-based conclusion that plains volcanism in the eastern Snake River Plains is perhaps the best terrestrial morphological analogue for these Martian surface features. Icelandic shields, distinct structures in Hawai´i, and other basaltic landforms also show some similarities to Martian plains volcanism. Landforms previously not known from the low shields are sinuous rilles, interpreted as evidence for high eruption rates, spatter cones, and inflation features. Extremely shallow flank slopes of less than 0.5° (Fig. 2) suggest the eruption of lavas with very low viscosity, which might be the result of high eruption temperatures, high effusion rates, a low Si- and a high Mg-content along with a possible high Fe-content, or a combination of these factors. The distribution of low shields in Tharsis does not show any obvious association with large-scale tectonic features. They represent relatively recent (Amazonian) volcanism, as evident from embayment relationships [e.g., 5] and crater counts. Several mechanisms were proposed to generate this late-stage volcanism. A recent model suggests that "top down" convection might generate deep mantle upwellings without plumes [6]. Another recent model also discards mantle plumes, and favours instead a zone of partial melting in an anomalously warm mantle underneath a thickened crust [7,8]. Such a mechanism is considered to be unlikely by [9], who alternatively favour a plume origin for recent volcanism. We will continue to investigate the spatial-temporal characteristics of the shield fields to assess these different models.

References: [1] Plescia, J. (1981) *Icarus, 45*, 586-601. [2] Greeley, R. (1982) *JGR 87*, 2705-2712. [3] Sakimoto, S. et al. (2003b) *6th Int. Conf. on Mars*, Abs. #3197. [4] Hauber, E. (2007) *7th Int. Conf. on Mars*, Abs. #3287. [5] Bleacher, J. et al. (2007) *JGR in press*, DOI:10.1029/2001JE123456. [6] Van Thienen, P. et al. (2006) *Icarus 185*, 197-210. [7] Schumacher, S. and Breuer, D. (2006), *JGR 111*, DOI: 10.1029/2005JE002429. [8] Schumacher, S. and Breuer, D. (2006) *GRL (in press)*. [9] Li, Q. and Kiefer, W. (2007) *GRL 34*, DOI:10.1029/2007GL030544.

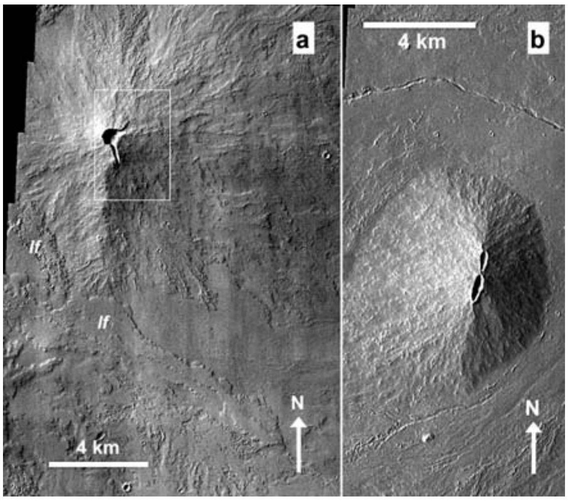

Figure 1. Low shields in Tharsis. Note the small size and the radial lava flow patterns, contrasting with the lack of evidence for major pyroclastic activity.

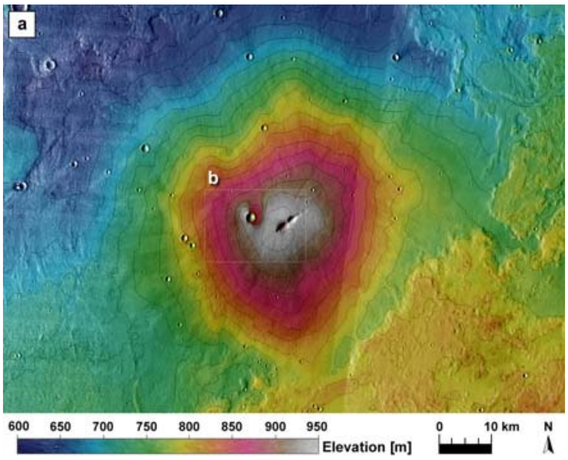

Figure 2. Topographic image map of low shield in Tempe Terra. Note the almost perfectly symmetrical shape, which is enhanced by the 25 m contour lines. The extremely low relief (~350 m height, diameter >50 km) suggests low viscosity lavas. Detail of box b is not shown here.