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Plains volcanism in Tharsis, Mars (I): Chronology and resurfacing history.

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Abstract

High-resolution image and topographic data show clusters of small and low shield volcanoes in the Tharsis region of Mars. Plains volcanism of the eastern Snake River Plains in Idaho (USA) [1] is perhaps the best terrestrial morphological analogue for these Martian surface features [2, 3]. The low shields and associated landforms share many morphologic details with basaltic volcanic provinces on Earth [3]. While a number of recent studies addressed some aspects of low shields (in particular their morphology, morphometry, and lava rheology), no systematic and Tharsis-wide chronology is available so far. Here we use newly available high-resolution images (HRSC, CTX) to determine relative and absolute ages, using the methods outlined by previous studies [4, 5].

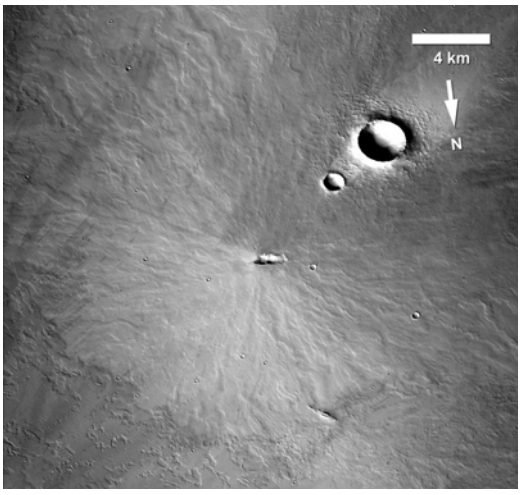

Figure 1 | Example of a low shield volcano in a shield cluster near Pavonis Mons (detail of CTX image P20_008789_1735; center at ~6.5°S, 246.7°E).

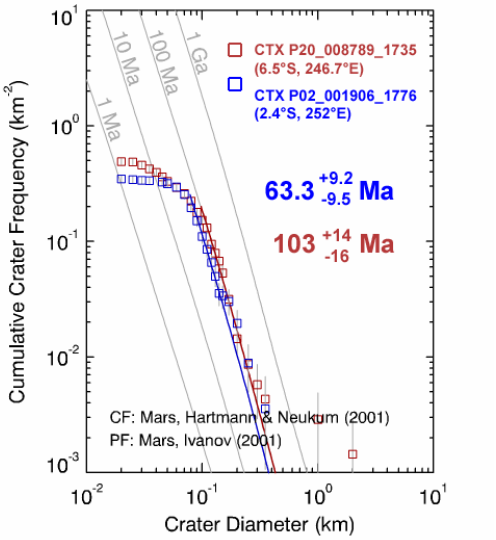

Figure 2 | Results of age determination of two low shields (red curve and age corresponds to shield shown in Fig. 1).

Methods and data

Representative surface areas for age determination are selected and mapped in CTX and HRSC data (Fig. 1). Several low shields in each shield cluster were dated by crater counts. Resurfacing events in the crater-size frequency distribution were identified by kinks in the crater size-frequency distribution curves. Our goal is to determine whether the shields within one cluster formed at roughly the same time or over a prolonged period, and whether the clusters have comparable ages or not. The results are key to determine the history of late-stage volcanism in Tharsis and, therefore, help to put constraints on models of the endogenic evolution of Mars.

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Preliminary results

First results yield ages of several tens of millions of years (Fig. 2). No major resurfacing events are obvious from inspection of the crater size-frequency distribution curves, possibly indicating significant thicknesses of lava flows. It has to be noted that these counts were performed on central volcanic edifices, which are expected to completely cover previous cratered surfaces. To assess the resurfacing history of the surrounding plains, we will also analyse flat-lying lava flows adjacent to the low shields.

References

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