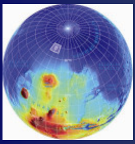

3D steady-state conductive model of Martian crustal heat flux

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Syria Planum shield volcanoes on Mars played an important role on the primordial Tharsis main volcanism and ceased their activity early in its geological history. The progressive cessation of activity might be due to the enhanced crustal thickness in the magmatic processes of this region. The highest crustal thickness beneath Syria Planum led us to think on its principal role on the origin but also on the decline of the volcanism in this area, and it's continuation on the northwestern side of Tharsis, leading to the formation of the present Tharsis Montes. To test this hypothesis, it was done a numerical simulation of the heat transfer within the elastic part of the lithosphere of the Tharis Plateau.

Syria PL/Tharsis

The volcanic history of Syria Planum on Mars was analyzed by extracting topographic information from high-resolution stereo pairs obtained from HRSC. Also, THEMIS, HIRISE and MOC images were used to help in the interpretation of this area, as well as some OMEGA-MEX spectra. We identified and described a pattern of coalesced shield volcanoes, which, taking into account their morphological characteristics, are not known anywhere else on Mars. It was done a detailed study of its shape, border contacts, slopes, rheology, age, morphology and relation to the main tectonic pattern. They are in contact with extensive long and lobate shape lava flows that differ in relative age, rheology and morphology from the shield volcanoes. Syria Planum was dominated by both swarms of small shields, and a single larger edifice as the source of long lava flows.

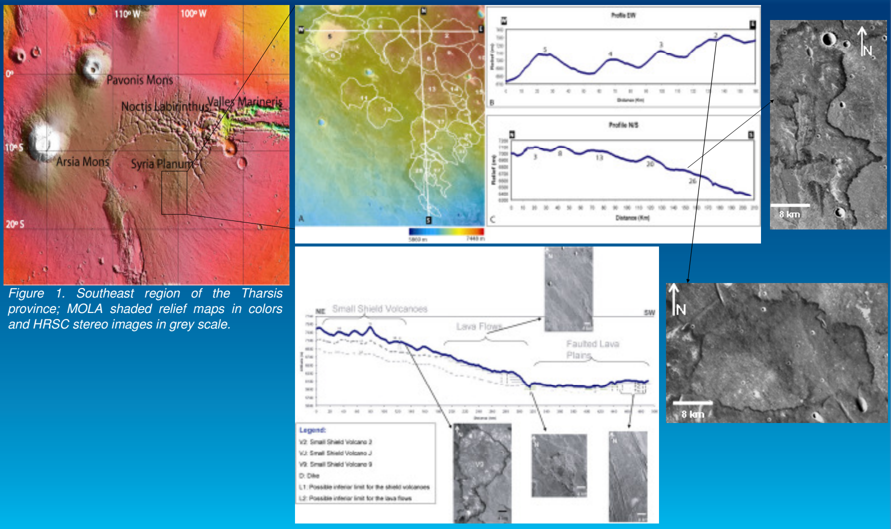


Figure 1. Southeast region of the Tharsis province; MOLA shaded relief maps in colors and HRSC stereo images in grey scale.

TOPOGRAPHY

The MOLA topography and the crust thickness derived from gravimetry were used to determine several 3D blocks of the Tharsis Pleateau for which the heat transfer equation was solved in a steady state case for the crust and upper mantle.

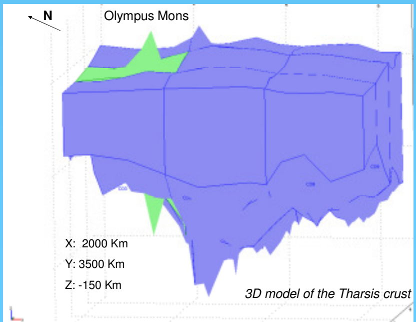
The influence of the topography was the first analyzed parameter, as a constraint for the thermal and heat conductive conditions that would have led the volcanism to extend till the Amazonian on Tharsis. Also, we analyzed the boundaries where there are crustal thickness variations and its role on local temperatures elevation and its influence on the volcanism duration.

By modeling the heat conduction on the Tharsis plateau, some other important issues were posed, like the presence of important heat flow anomalies and lower temperatures around Tharsis peaks, which seems to be locally correlated with exposed scarps.

CONCLUSIONS

These studies allow us to better interpret the telluric functioning of planets, namely the surface conditions (temperature of surface, presence of water) and interior constraints (heat flux, thermal gradient, densities). Its evolution, corresponding to the implementation of the volcanoes and the formation of the surface structures, prove the global evolution of a planet, the climate change that it experimented and the duration of the volcanism.

While it misses a seismic network that would allow to supply direct measures of the seismic survey and the heat flux, the studies of surface accompanied by modeling of the planet's interior must be thus realized, respectively, through direct measures by space shuttles and multiple constraints.



3D model of the Tharsis crust

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3D MODELS

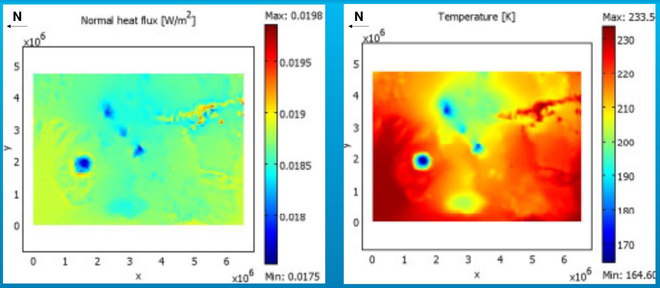

Figure 2. Left: Normal heat flux at the surface of Tharsis. Right: Surface temperature at Tharsis. Constants used: Thermal conductivity (k) = 3 $Wm^{-1}k^{-1}$; Heat capacity (Cp) = 1000$JKg^{-1}K^{-1}$; General heat (Q)= 1.378e^{-8} Wm^{-3}

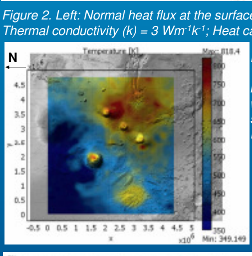

Figure 3. Temperatures at the base of the Moho. It was assumed the same constants as on Figure 1.

Olympus Mons

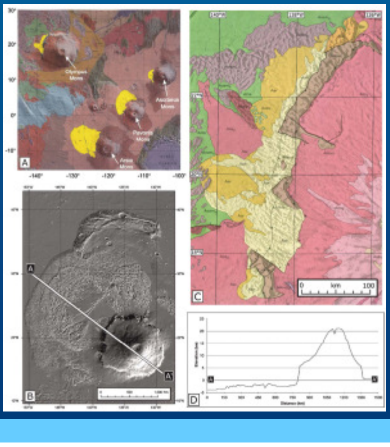

Figure 4. Top: Surface temperature at the Olympys Mons. Bottom: Normal heat flux at the surface of Olympus Mons.