

TOPOGRAPHIC PROFILES ACROSS VALLES MARINERIS WALLS: IDENTIFICATION AND EXTENT OF LAVA LAYERS IN THE VOLCANIC BASEMENT D. Gatineau and D. Mège, Laboratoire de Tectonique, UMR 7072, Université Pierre et Marie Curie, Case 129, 4 Place Jussieu, 75252 Paris cedex 05, France (delphine.gatineau@wanadoo.fr and dmege@lgs.jussieu.fr)

Summary: Analysis of slope breaks in the Ius and Candor chasmata walls using MOLA altimetry data reveals that some of them can be followed laterally along the walls. They are interpreted as stratigraphic contacts between layers of contrasting strength within the lava pile, such as pyroclastic deposits and fluid lava flows. Five to 10 such lithologic boundaries have been identified. Their extent parallel to graben strike is between 200 and 400 km at least and 50 to 100 km at least across graben strike, which suggests that the surface area covered by individual volcanic layers may be on the order of 10^4 - 10^5 km² or more.

Introduction: MOC images have revealed that the wallrock of Valles Marineris is made of hundreds of layers analog to layers in trap series [1]. While trap series sometimes present rather monotonous lithologic successions, like in the Columbia River Flood Basalt Province [2], other provinces, such as the Ethiopian Flood Basalt Province, display huge volumes of interstratified differentiated lava products, including e.g. welded and unwelded ignimbrites [3], as well basaltic flow and tuff successions, resulting in major slope breaks on trapean walls (Figure 1). In proportion, gravity conditions on Mars make pyroclastic deposits theoretically more abundant on Mars than on Earth [4] so that strength contrasts within lava piles akin to terrestrial trap series should be enhanced. We have explored slope breaks on the Ius and eastern Candor chasmata walls to find evidence of laterally continuous lithologic units.

Topographic profiles: Using MOLA altimetry data we have analyzed 6 series of topographic profiles along the crest lines of Valles Marineris spur and gullies (Table 1) in order to seek evidence of laterally continuous slope breaks that would suggest existence of lithologic contrasts and give clues to the areal extent of lava formations. Comparison between altimetry data and Viking images allowed to remove slope breaks resulting from local effects such as transverse inherited fractures.

Interpretation: Slope breaks that can be followed laterally and are observed on the walls where evidence of faulting is negligible are likely to be of lithologic origin, and help separate slope breaks on other chasma walls having a lithologic origin and those having a different origin, for instance tectonic. The southern Ius Chasma wall displays only minor evidence of normal faulting, and the southern East Candor wall does not

display evidence of normal faulting at all (Table 1). All the other walls display extensive evidence of tectonic activity [5]. In practice, comparison between imagery and altimetry has shown that only a few slope breaks on the northern Ius and Candor chasmata walls have a likely tectonic origin.



Figure 1. Major slope break due to lithologic strength contrast within the Ethiopian trap series (Tekeze River valley, Abyssinia).

Wall	<i>n</i>	Wall	<i>n</i>
Ius Chasma, N	20	Ius Chasma, S	14
Geryon Montes, N	23	E Candor Chasma, N	29
Geryon Montes, S	24	E Candor Chasma, S	38

Table 1. Location and number (*n*) of analyzed topographic profiles. N = North, S = South.

Figures 2 and 3 show the distribution of the slope breaks for the six studied walls. They define 5 to 10 subhorizontal levels.

Discussion: The extent of the interpreted stratigraphic boundaries parallel to graben strike is between 200 km and 400 km at least. Slope breaks are frequently observed at similar elevation at opposite walls, suggesting that the across graben strike extent of the inferred lithologic units is 50 to 100 km at least. Their areal extent may thus frequently exceeds 10^4 - 10^5 km². In comparison, the surface area covered by many lava flows of the Columbia River Basalt Group exceed 10^4 km², the largest more than 10^5 km², and the longest ones are known to have advanced more than 750 km long from their vent [2].

LITHOLOGIC SUCCESSIONS IN VALLES MARINERIS BASEMENT: D. Gatineau and D. Mège

References: [1] McEwen, A.S., et al. (1999) *Nature*, 397, 584-586 [2] Tolan, T.L., et al. (1989) *Geol. Soc. Am. Sp. Pap.* 239, 1-20. [3] Mohr, P., and B. Zanettin (1988) in *Continental Flood Basalts*, Kluwer, 63-110. [4] Wilson, L., and J.W. Head (1994) *Rev. Geophys.*, 32, 221-263. [5] Peulvast, J.P., D. Mège, J. Chiciak, F. Costard, and P. Masson (2001) *Geomorphology*, 37, 329-352.

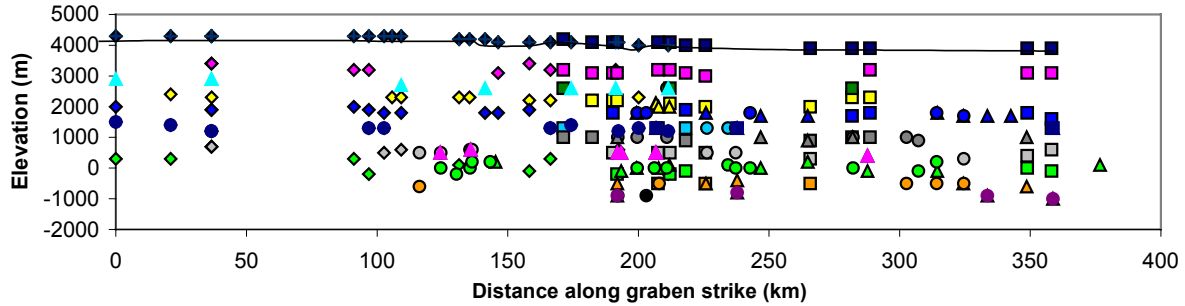


Figure 2. Slope breaks observed along Ius Chasma walls (West on the left). Diamonds: northern wall, circles: northern wall of Geryon Montes (Ius' central horst), triangles: southern wall of Geryon Montes, squares: southern wall. The line and uppermost data points indicate the plateau surface.

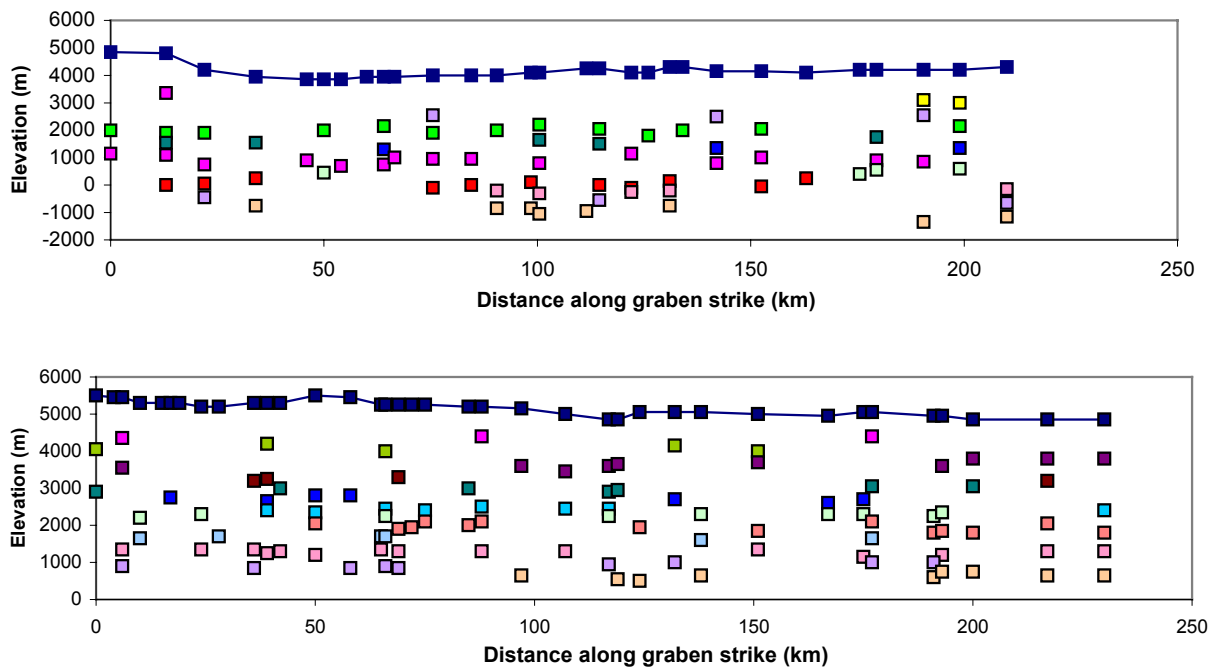


Figure 3. Slope breaks observed along the northern (top) and southern (bottom) walls of eastern Candor Chasma (West on the left). The lines and uppermost data points indicate the plateau surface.