**MINERALOGY OF WEST TITHONIUM CHASMA-NOCTIS LABYRINTHUS, MARS: PUTATIVE VOLCANISM ON NOCTIS CANYON FLOORS.** N. Mangold[1], A. Gendrin[2], B. Gondet[2], S. Le Mouélic[3], C. Quantin[1], J.-P. Bibring[2], Y. Langevin[2], F. Poulet[2], V. Ansan[1], Ph. Masson[1], E. Hauber[4], G. Neukum[5], and the OMEGA and HRSC Co-Investigator Teams (1) IDES-Orsay, UMR 8148, CNRS and Université Paris-Sud, Bat. 509, 91405 ORSAY Cedex, France, nicolas.mangold@u-psud.fr, (2) IAS, Université Paris-Sud, France (3) LPG Nantes, France, (4) DLR, Berlin, Germany (5) FU, Berlin, Germany.

**Introduction:** Tithonium Chasma is located at the western edge of the Valles Marineris canyons, west of Ius Chasma. West Tithonium is at the transition between the main Valles Marineris Chasmata and the deep and narrow canyons of Noctis Labyrinthus which erosional aspect indicates a slightly younger age than the main canyons. Indeed, wallslopes of Noctis Labyrinthus miss the spur and gullies erosion typical of the primitive phase of canyon development [1, 2]. Interior layered deposits are also lacking in most canyons of Noctis Labyrinthus, but they are locally present in Tithonium Chama in several locations. The transition between the two regions is especially interesting for the understanding of the geologic history of this region. We use OMEGA data for mineral mapping, and HRSC and MOC visible imagery for geologic interpretation.

**Distribution of mafic minerals:** Pyroxenes are identified mainly as High Calcium Pyroxene (HCP) using the MGM method [see 3 for details]. They are distributed at the bottom of many canyons (**Fig. 1a**) and fit the areas of lowest albedo of this region. These areas correspond mainly to sand dunes and sand sheets already identified using Viking images [2]. Nevertheless, four canyon floors of Noctis Labyrinthus show HCP in locations out of apparent sand mantling (**Fig. 1b, 1c**). These outcrops are rocky displaying flow patterns, a relative flat topography that embay residual hills (to the right in **Figure 1c**). These textures are not observed elsewhere in Valles Marineris. A putative interpretation of these outcrops is that they correspond to lava flows. They would have formed after the canyon, and after part of its erosion to explain the embayment of eroded hills. This interpretation fits the morphologic aspect of the outcrops and their mineralogy as well. However, no volcanic edifices is observed and the observed patterns are not as usual for lava flows, not excluding other interpretations to be possible for this material. A alternative explanation for HCP-rich material would be volcanic sand or volcanic ash deposits. However, both cases are less compelling due to the absence of sedimentary features for the first case, and the segregation on canyon bottom for the second case. Volcanic flows is the most likely interpretation with the current datasets.

**Distribution of hydrated minerals:** Sulfates are identified with the spectral data OMEGA onboard Mars Express on many areas of the Valles Marineris region, with broad outcrops in the central region (Candor Chasma, Melas Chasma) and the outer canyons( Juventae Chasma, Ganges Chasma) [4,5,6]. Sulfates in layered deposits have been interpreted either as deposition through evaporitic processes or alteration through groundwater circulation [4,5,6]. In West Tithonium, mainly kieserite is identified. No other hydrated minerals than sulfates are detected (clays, etc.). Kieserite is observed on the light toned layered deposits in the eastern part of the studied area (**Fig. 1d, e**). It consists of a pile of thin layers (about 1m thick) which display a sub-horizontal tilt for most of them. Deformed layers are visible in part of the outcrop, but not on the hill of kieserite rich material. HCP material in this area is only present as sand dunes mantling the layers in several locations (**Fig. 1e**).

**Conclusion:** We have identified a rocky unit on the floor of Noctis Labyrinthus that contain pyroxenes and might correspond to lava flows formed after the opening of these canyons. This observation has never been reported and would have many implications in the history of this region. No clear observations of fresh lava flows have been reported in the main canyons of Valles Marineris yet. Different attempts have been made to explain ILD by volcanic layers but no ILD display fresh mafic signatures [6], such as those reported here, and ILD are morphologically different from the observed HCP rich outcrops. However, the presence of volcanism would, at least, involve a high geothermal gradient and fluid circulation easier to explain the overall volume of sulfate rich material present regionally. These relationships require more detailed study, especially it requires a look to the central region (between **Figures 1b and 1d**) where HCP material co-exists with different morphologic units. Our preliminary observations of putative volcanism on Noctis canyon floors confirm the interest of these canyons in the overall geology of the whole region.

**References:** [1] Peulvast et al., Geomorphology, 2001. [2] Lucchitta, JGR, 1994. [3] Mustard et al., Science, 307, 1595, 2005. [4] Gendrin et al, Science, 307, 1587-1591, 2005. [5] Quantin et al, Workshop on sulfates on Mars, Houston, 2006. [6] Mangold et al., The geology and mineralogy of West Candor Chasma, Mars, Icarus, in press.

**Fig. 1**: (a) OMEGA map of HCP rich region superimposed on the MOLA gray level map. (b) MOC context image of the MOC narrow angle image in (c). (d) Identification of kieserite (red) by OMEGA mapped over HRSC image. (e) MOC close-up of the sulfate-rich layered deposits (arrows to the left) together with HCP rich sand dunes present to the right.