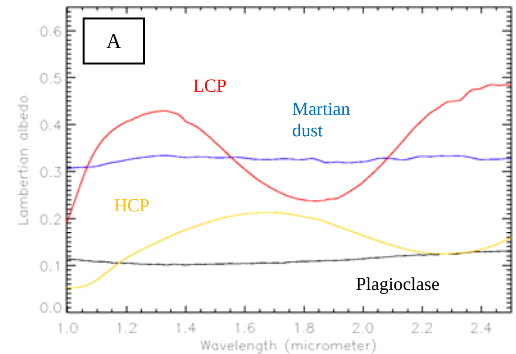
MARS: IDENTIFICATION, MAPPING AND MODAL MINERALOGY OF LOW-CALCIUM PYROXENE-RICH DEPOSITS. F. Poulet[1], Y. Langevin[1], M. Le Roux[1], N. Mangold[2], J.-P. Bibring[1], and B. Gondet[1], [1]IAS, CNRS/Université Paris-Sud, Orsay, 91405, France (francois.poulet@ias.u-psud.fr), [2]LPGN-CNRS, Univ. Nantes, Nantes, 44322, France.

Introduction: The surfaces of the low albedo regions of Mars are dominated by basalt in the southern highlands, and weathered basalt in the northern lowlands [1,2]. They have been further characterized into four primary subcomponents by TES [3], while global GRS data suggest that Mars is dominated by basaltic crust [4]. OMEGA observations has identified different mafic, rock-forming minerals, thus revealing a diverse mineralogy from place to place [5,6,2]. Overall, the modal mineralogy of the most low albedo regions has been constrained: plagioclase (40-60% in Vol.) and high calcium pyroxene (20-40%, HCP) are the dominant minerals, low calcium pyroxene (10-15%, LCP) and minor amounts of olivine are also present [6]. Of special interest is the detection of strong signatures of LCP found in very localized areas [5,6]. These LCP outcrops in the ancient cratered terrains have been interpreted to be possible remnants of the early crustal formation. We present a systematic analysis of such outcrops from the OMEGA dataset.

Identification: The analysis focuses on NIR reflectance measurements of OMEGA (0.95 to 2.6 µm). Pyroxenes are recognized by the presence of two distinct absorptions centered near 1 and 2 µm, where the band centers shift toward longer wavelengths with increasing calcium content. LCPs have short-wavelength band centers (0.9 and 1.8 µm), whereas HCPs typically have long-wavelength band centers (1.05 and 2.3 µm). A comparison of the spectral characteristics of LCP (red spectra) and HCP (yellow spectrum) is shown on Figure 1A. A spectral criterion was developed for detecting an unique LCP signature in the OMEGA data, namely the shape of the bump at 1.35 µm by calculating the following spectral parameter: R(1.35)/(R(1.07)*R(1.64))^0.5. The threshold depends on the OMEGA cube but typically values larger than 1.05 provide a confident detection.

Mapping: Map of the LCP-rich outcrops is given in Fig. 2A. Because the sizes of the spots are small (a few km² at most), they are hardly visible at a planetary scale. Most of the deposits occur in low albedo, southern, and Noachian terrains, but the distribution is not uniform. Four regions exhibit a larger number of occurrences: a region located north of Argyre along the Ladon-Uzboi-Holden corridor and surrounding plains, the walls of Valles Marineris, a portion of the Iapygia quadrangle, and, a Noachian region northeast of the volcanic shield Syrtis Major. They are generally observed in central peaks, crater rims, and isolated massifs. However, detailled mapping with high spatial imagery of each occurrence is still needed to better understand the geological context of the deposits. There is no apparent spatial correlation with olivine as mapped by OMEGA [2].



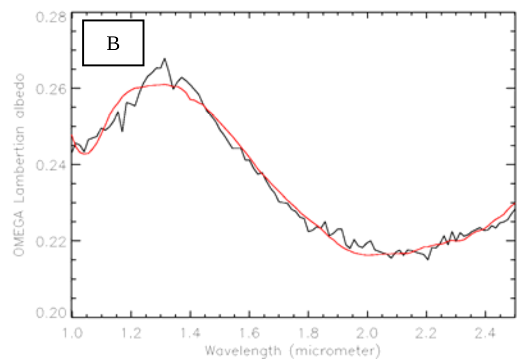


Figure 1. (A) Spectra of the major end-members used in the fit procedures. **(B)** OMEGA spectrum (black line) extracted from the wall of Valles Marineris compared to the best fit model (red line).

Table 1. Derived average mineralogy from the modelling of about 1200 LCP-rich deposits mapped in Figure 2. The modal mineralogy is compared to that obtained for the Hesperian Syrtis Major lavas [6].

	LCP-rich	Syrtis Major lavas
HCP	29%+/-4	34%+/-7
LCP	15%+/-2	9%+/-3
LCP/(HCP+LCP)	0.35+/-0.06	0.20+/-0.05
Neutral Components	48%+/-6	48+/-9
Olivine	<5%	<5%
Others	6%+/-5	8%+/-5

Modal mineralogy: Modal mineralogy of each deposits is derived using a nonlinear unmixing modeling based on the Shkuratov radiative transfer model [6]. The spectral properties between 0.99 and 2.50 µm are well reproduced by an intimate mixture of plagioclase, HCP, LCP, and a minor amount of olivine and dust (Fig. 1B and Table 1). Although the LCP abundance is larger than the values derived for the younger Hesperian-dated lavas of Syrtis Major, the HCP component is still the dominant pyroxene (Table 1). Fig. 2B reveals that the values of ratio LCP/HCP is not uniform across the planet. The outcrops northeast of Syrtis Major has the lowest value, while larger values (but still <0.5) are found in the region between Valles Marineris and Argyre. Global mineral mapping thus provides critical context for understanding local-scale mineralogical variations, such as those that appear related to igneous lithologies in Noachian terrains and for investigating the formation and subsequent differentiation of the planet.

References: [1] Bandfield D. (2002) *JGR*, *107*, doi:10.1029/2001JE001510 [2] Poulet F. et al. (2007) *JGR*, *112*, doi:10.1029/2006JE002840 [3] Taylor et al. (2007) *JGR*, *111*, doi:10.1029/2005JE002645 [4] Rogers A.D., et al. (2007) *JGR*, *112*, doi:10.1029/2006JE002726 [5] Mustard J.F. et al; (2005) *Science*, *307*, 1594–1597 [6] Poulet F. et al ; (2008) *Icarus*, in press.

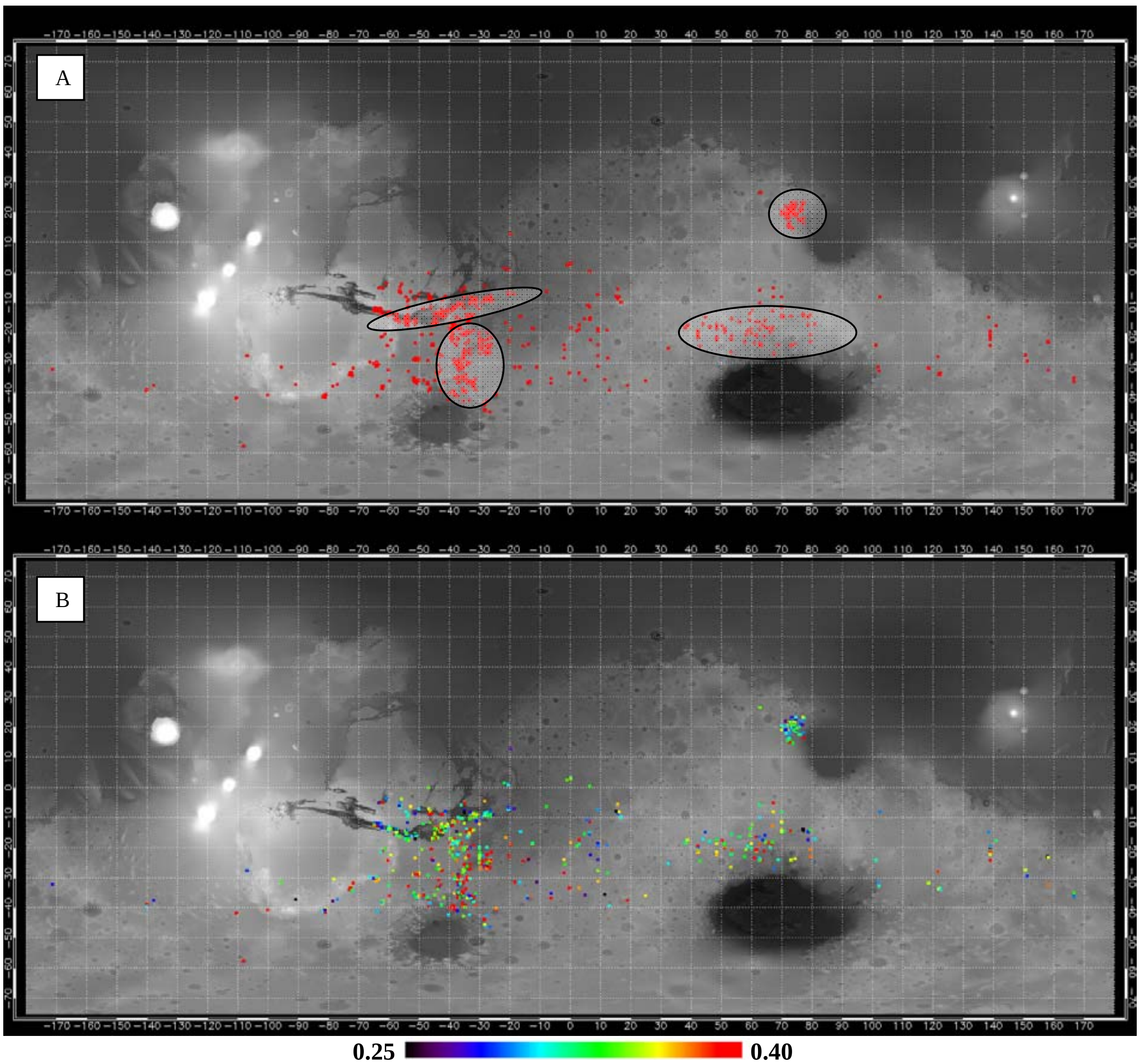


Figure 2. (A) Map showing locations of small deposits of LCP-rich deposits identified thanks to the spectral criterion defined in text. To make them visible on the map, the size of the red squares is much larger than the real size of deposits depending on the spatial resolution of OMEGA swaths. Circles are plotted to emphasize four regions of larger occurences. **(B)** Values of the LCP/(LCP+HCP) ratio derived from the modeling of OMEGA spectra.