GLOBAL MINERAL MAPS ON MARS. C. Gomez[1], F. Poulet[1], J.P. Bibring[1], Y. Langevin[1], B. Gondet [1], S.M. Pelkey[2], J.F. Mustard[2], G.C. Bellucci[3] and The OMEGA Science Team, [1]Institut d'Astrophysique Spatiale, Université Paris-Sud, 91405 Orsay cedex, France, [2]Department of Geological Sciences, Brown University, Providence, RI USA, [3]IFSI-INAF, Rome, Italy. (Email: francois.poulet@ias.u-psud.fr)

Introduction: Determining the mineralogy of Mars constitutes an essential part of understanding of the present and past condition of the surface. After two years of operation, the OMEGA imaging spectrometer on-board Mars Express has achieved near-global coverage with spatial resolution varying between 300 m and 4.8 km depending on the pericentre altitude of the spacecraft's highly elliptical orbit. We report the global surface distributions of some materials based on the OMEGA observations. Global maps of mafic minerals, hydrated minerals, nanophase ferric oxide, and surface ices have been derived from spectral parameters using the Visible and C channel wavelength domains of OMEGA (0.3-2.5µm). The distribution of these materials highlight unique as well as familiar processes that have occurred during Mars' history. These global maps will be also useful to identify scientifically interesting regions and targets for CRISM.

Observations: OMEGA operates from the visible (0.3µm) to the thermal infrared (5.2µm). This analysis focuses on Visible/NIR reflectance measurements of OMEGA (0.3-2.5µm). The OMEGA radiance data is corrected for solar irradiance and atmospheric effects [1]. The global mineral maps are realized by using the first 22 months of OMEGA operations. 1445 OMEGA cubes (i.e. 160 millions spectra) have been considered, which correspond to a coverage of about 90% of the surface at a few km spatial resolution. To avoid artifacts on the global mineral maps, we have taken into account the OMEGA reflectance data recorded when 1) the spectrometer points directly towards the planet, 2) the operation mode is nadir, and 3) the lamp of calibration is switched off. To avoid false detections, the saturated data have been also removed.

Spectral parameters: To identify the minerals from the OMEGA reflectance spectra, we define spectral parameters based on the spectral characteristics of each class of materials: mafic minerals, water-bearing minerals, nanophase oxide and ices. The hydrated minerals resulting from an aqueous alteration are identified with the 1.9 µm absorption band which is attributed to a combination of an O-H stretch and H-O-H bend [2]. As the water ice has a close absorpion band centred at 2 µm, we create a water ice index using the 1.5 µm absorption band. Only the pixels showing a band at 1.9 µm without band at 1.5µm are plotted on the global hydrated minerals map in order to avoid false detection. Two global pyroxene maps are derived using a band at 2.2 µm (Fig. 1), and one at 0.85µm. The Mg-rich (forsterite) and Fe-rich (fayalite) olivine are identified by calculating the slope around respectively the 1.55 µm and 1.7 µm bands (Fig. 2).

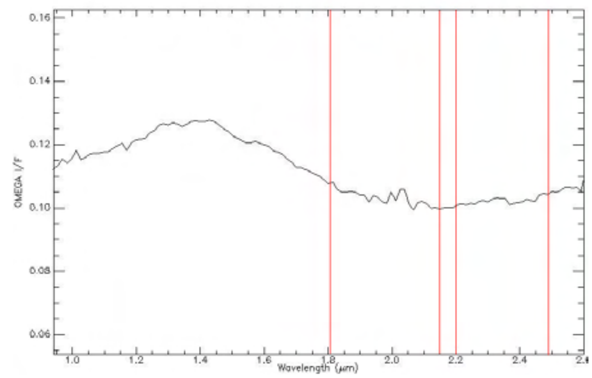

Figure 1: OMEGA I/F atmospherically corrected spectrum of a pyroxene-rich terrain. The vertical red lines indicate the wavelengths used for the Ca-pyroxene spectral parameter.

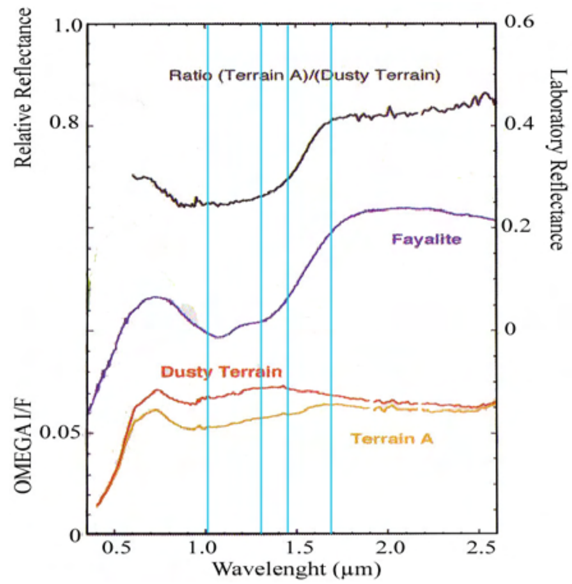

Figure 2: OMEGA I/F atmospherically corrected spectra of olivine-rich terrain (Terrain A) and dusty terrain [2]. The vertical blue lines show the wavelengths used for the Fe-rich olivine parameter.

The most distinctive spectral characteristics for anhydrate poorly crystalline ferric oxides are the reflectivity in the visible channel [3]. The presence of such material is identified in calculating a ratio between 0.97 µm and 0.79 µm. An additional parameter is calculated from a band at 0.54 µm [3]. As shown by [3,4], most ferric weathering products, commonly called “bright dust”, have values >1 and positive values for these two respective criteria. Our global mineral maps cover the latitudes -50°S to 50°N, and have a resolution of 32 pixels by degrees. Each criterion is plotted on MOLA data.

Mineral Distributions: The nanophase ferric oxide global map indicates a high concentration in high-albedo terrains (Fig. 3a) similar to the TES global map of dust [5]. However, there is no evidence for the presence of a water-bearing minerals as shown in map 3c, which is in contrast to the interpretation of TES data [5]. This nanophase ferric oxide component is also decorrelated to the pyroxene component, which is present in significant concentration in low-albedo surfaces both in southern and northern latitudes (Fig. 3b). Note that the map is very similar to that derived from the MGM method [6]. Fig. 3c shows that hydrated minerals are remarkably limited in occurrence at the surface, as detailed in [7,8,9]. Zooms on specific regions show the presence of hydrated minerals but these deposits are too small to be identified on global maps [9]. The Mg-rich and Fe-rich olivine global maps indicate the presence of numerous occurrences in volcanic terrains like Tyrrhena Terra and Syrtis Major, in craters (e.g. Huyguens, Herschel for large deposits) and around basins (Argyre, Isidis). The other spectral parameters will be discussed.

References: [1] Mustard, J.F. et al. (2005) *Science* 307, 1594-1597 (2005). [2] Clark R.N. et al. (1990) *JGR, 95,* 12,653-12,680. [3] Bell, J.F. et al. (2000) *JGR*, 105, 1721-1755. [4] Morris R. et al. (2000), *JGR*, 105, 1757-1817. [5] Ruff S. (2004) *Icarus, 168*, 131-143. [6] Bibring et al. (2005) *Science,* 307, 1576-1581. [7] Poulet et al. (2005) *Nature*, 438, 7068, 623-627. [8] Poulet et al. (2006) *this conf.*, [9] Bibring et al., *submitted*.

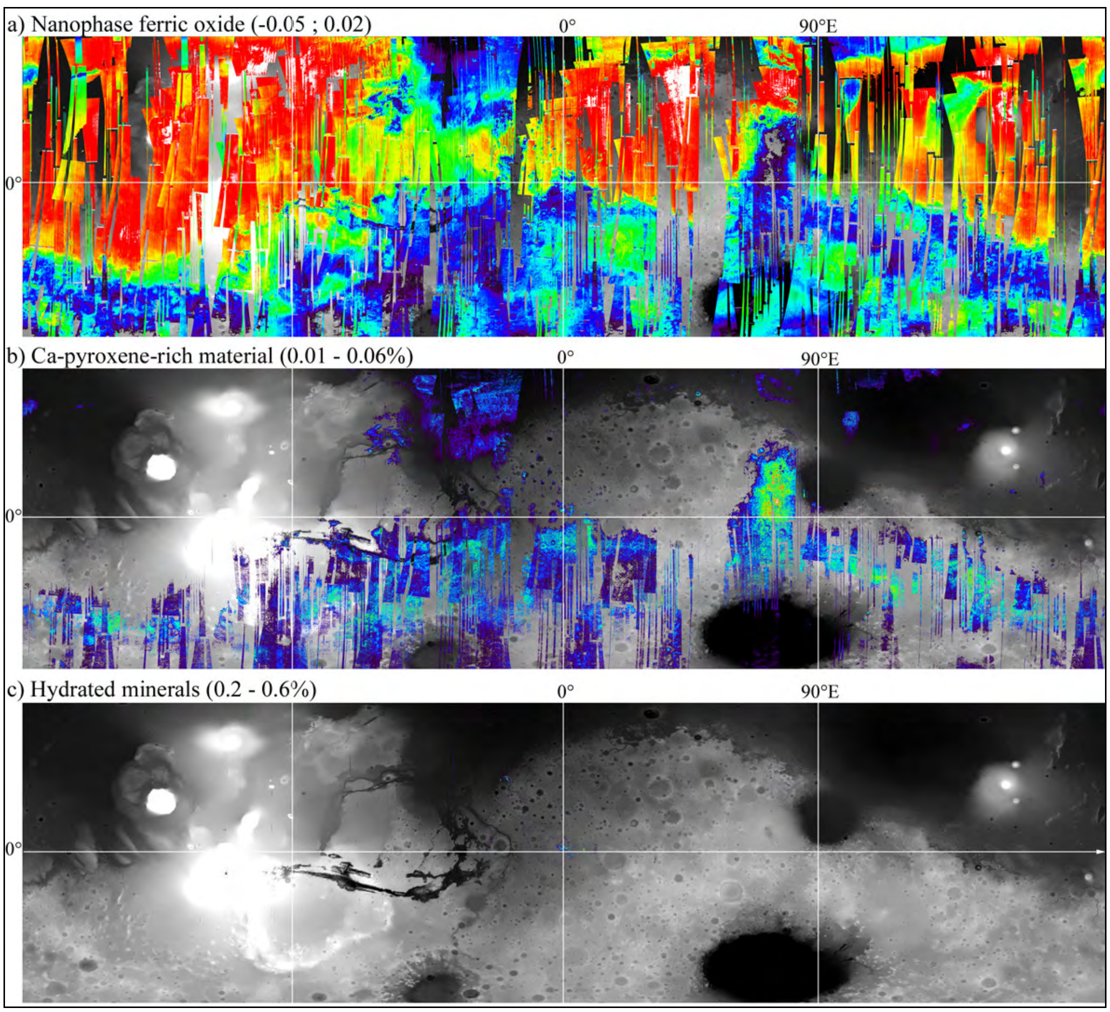

Figure 3: Global Mineral maps on Mars of ***a)*** *nanophase or poorly crystalline ferric oxide using the 0.54 µm band. The red and white regions correspond to positive values of the spectral parameter.* ***b)*** *2.2 µm band depth indicator of Ca-pyroxene-rich material and* ***c)*** *1.9 µm band depth indicating the presence of hydrated minerals. For the maps (b) and (c), the ranges in parentheses give the lowest unit (blue) to the highest unit (red/white) on the scale bar.*