GLOBAL MINERALOGICAL MAPPING OF THE MARTIAN SURFACE FROM OMEGA/MEx: AN UPDATE.
A. Ody[1], F. Poulet[1], J.-P. Bibring[1], B. Gondet[1], Y. Langevin[1], J. Carter[1], M. Vincendon[2]. D. Jouglet[3]. [1]Institut d'Astrophysique Spatiale,Université Paris-Sud, 91405 Orsay cedex, France [2]Departement of Geological Sciences, Brown University, Providence, RI USA,[3] CNES Toulouse, 31401 Toulouse cedex 09.

Introduction and previous work: Aboard the Mars Express spacecraft, OMEGA has been mapping the surface of Mars since January 2004 [1]. In 2007, the observations acquired by OMEGA provided a first analysis of the global distribution of some surface materials [2]. This study was based on the first 22 months of observations (about 1 martian year), corresponding to 429 orbits and 1428 OMEGA data cubes. Here, we reassess the detection of these minerals in the light of the analysis of new data acquired since the publication of 2007.

Method and Observations: OMEGA operates from the visible (0.3 µm) to the infrared (5.2 µm) but this analysis focuses on visible and near infrared reflectance measurements using the visible and C channels (0.3–2.5 µm). The OMEGA radiance data was corrected for solar irradiance and atmospheric absorptions features. Global maps of the Fe^{3+} signature, nanophase oxides and mafic minerals (pyroxene and olivine) are derived from diagnostic criteria based on spectral parameters developed in [2]. These parameters were adapted to take into account the aging of the detector due to radiation damage. The thresholds of the parameters are discussed in [2].

Global mineralogical maps are obtained from OMEGA observations acquired until October 2009, which represents 3 Martian years, i.e. 7441 orbits and 5727 OMEGA cubes. This provides an almost complete coverage of the martian surface with a spatial resolution from 300m to several kms depending on the pericentre altitude of the spacecraft's elliptical orbit. Amongst the data cubes acquired, we selected nadir observations with illumination conditions characterized by incidence angle smaller than 75° and emergence angle smaller than 15°. For parts of these observations, the surface was either obscured by icy clouds, or covered with seasonal frosts and ices. To reject these observations, the 1.5 µm water ice absorption band is calculated and every pixel with an absorption larger than 3% is removed from the global study.

Overlapping of observations acquired over different seasons and years show strong variations of the values of criteria, which were not observed on the 2007 maps acquired during the first martian year of observations. These variations are primarily due to the interannual variability of the aerosols opacity and to a lower extent to change in photometric conditions. Because of the grain size (about 1.0 - 1.5 µm on average) of aerosols, criteria in visible range (ferric signatures) are specially affected by the presence of dust. In order to reject data disturbed by dust, we first removed data acquired during the global dust storm of 2007 (220°<Ls<325°). An additional rejection criterion based on the dust opacity measured by the MERs was then applied [3, 4]. The evolution of the dust opacity at 0.9 µm at an altitude of 0 km for the 3 martian years of OMEGA observations is shown in Figure 1. After an evaluation of the correlations between albedo, mineralogic criteria and dust opacity, we have decided to disregard spectra for which the altitude-corrected dust opacity is larger than 0.7 and 0.8 for the Fe^{3+} and the nanophase oxides/pyroxene respectively.

Global maps are restricted between 60°S to 60°N in latitude, because the mineralogy of high latitude terrains were already studied in [5].

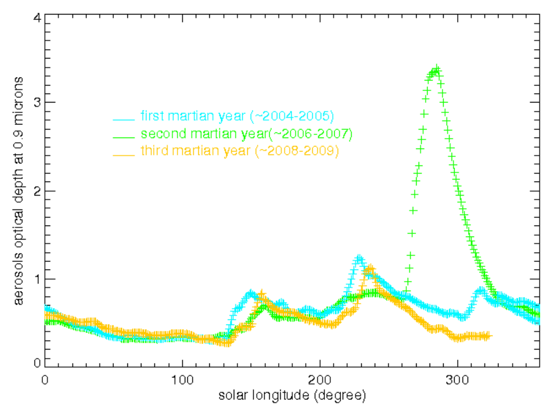

Figure 1. Dust opacity at 0.9 µm (MER/PanCam measurements [3, 4]) vs. solar longitude for the 3 martian years of OMEGA observations (2004-2009) scaled at an altitude of 0km. These optical depth measurements provide a good proxy for OMEGA observations at low to mid-latitudes [6].

Results: Global maps of near infrared albedo, Fe^{3+} signature and pyroxenes are shown in Figure 2a, 2b et 2c respectively. The albedo map shows a significant increase of the OMEGA data global coverage of the martian surface since the 2007 study. Because of the thresholds applied on every OMEGA pixel, the coverage of spectral parameter maps is smaller than that of albedo map. Figure 2 indicates that the bright regions are characterized by strong Fe^{3+} signatures, while pyroxenes are mainly localized in the low albedo regions, both in southern and northern latitude. These results are in good agreement with the 2007 analyses. Maps of other spectral parameters will be presented at the conference.

References: [1] Bibring J.P.et al. (2004) ESA SP 1240, 37-49. [2] Poulet F. et al. (2004) *JGR, 112,E08S02*. [3] Lemmon M. T. et al. (2004), Science 306. [4] Lemmon M. T., private communication (2009). [5] Poulet F. et al. (2008), GRL 35. [6] Vincendon M. et al. (2009), Icarus 200, 395-405.

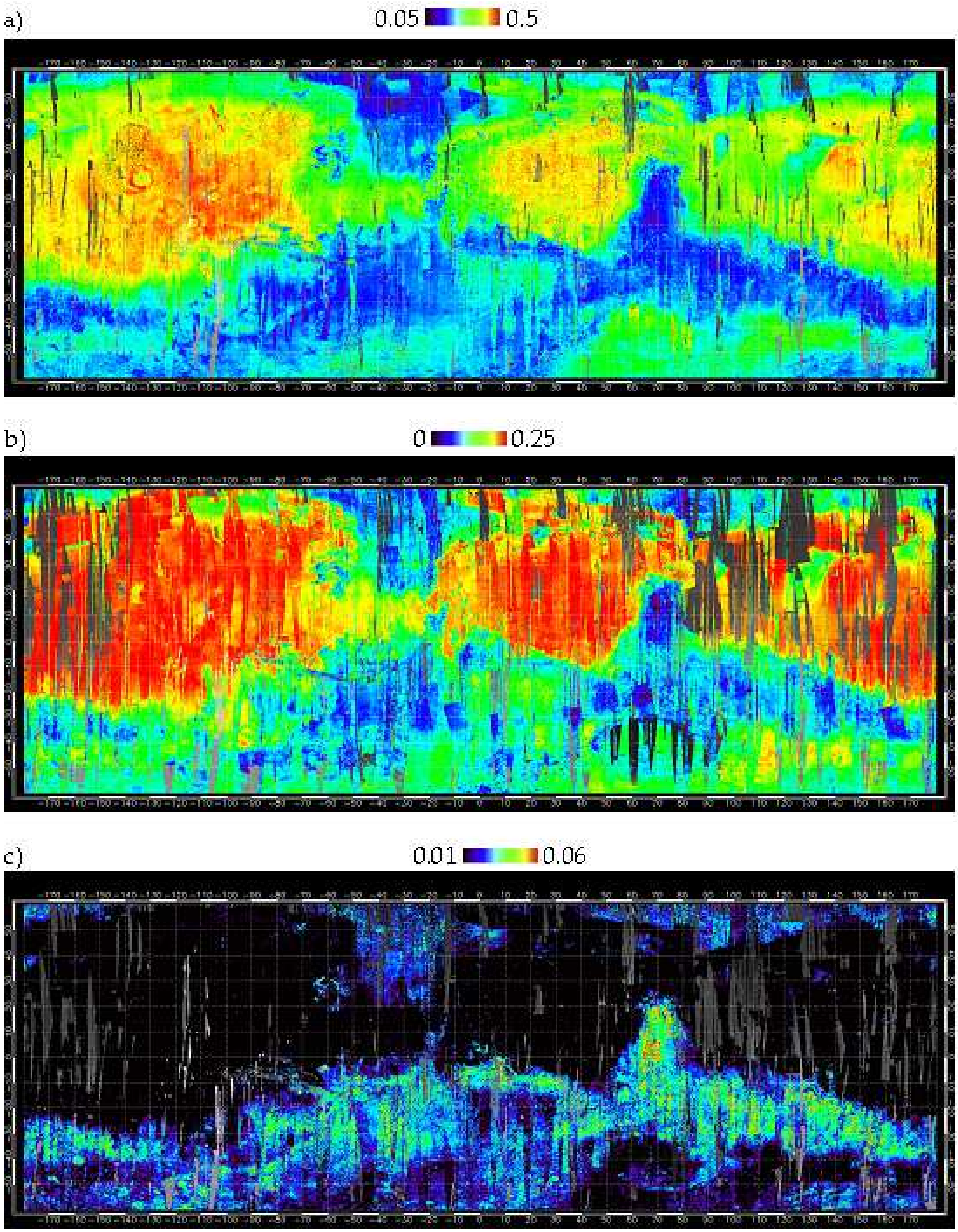

Figure 2. Global maps of a) observed reflectance factor (I/F/cos(i)) at 1.08 µm.. b) Fe^{3+} absorption band depth measured at 0.53 µm. c) pyroxene spectral parameter.