MINERALOGICAL CONTEXT FOR LANDING SITE SELECTION: THE OMEGA/MEx POTENTIAL CONTRIBUTION, J-P. Bibring[1], on behalf of the OMEGA team, [1]IAS, Orsay Campus, France.

Complementing the GRS global elemental coverage and the thermal infrared (TES, THEMIS) mineralogical mappings, the visible/near infrared hyperspectral reflectance imaging acquired by OMEGA on board the Mars Express mission reveals a high degree of surface mineralogical diversity, at a kilometer to sub-kilometer scale [1]. When inserted in their structural and morphological context inferred from high resolution visible images (MOC, HRSC), the OMEGA mineral detections enable to trace back the Mars evolution with a special emphasis on the alteration processes implying water as a major environmental constituent; consequently, they offer clues towards identifying areas most favourable to constitute extinct/extant habitats.

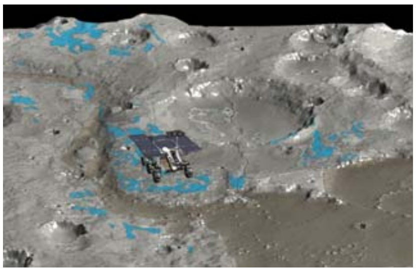
Within the OMEGA spectral domain (0.35 to 5.1 µm), most rock forming minerals (pyroxene and olivine primarily) and their alteration products through a variety of processes (e.g. ferric oxides, hydrated silicates, salts) have diagnostic signatures, enabling their detection (provided the spectral sampling is sufficient), and in a few cases a quantitative evaluation of their abundance. The OMEGA spectral sampling of < 13 nm for wavelengths < 2.6 µm is indeed sufficient to discriminate between classes (e.g. pyroxene vs olivine), and within some of them, between members: e.g. low vs high calcium pyroxene (orthopyroxene vs clinopyroxene respectively), Mg-rich vs Ca-rich sulfates, Al-rich vs Mg/Fe-rich phyllosilicates…

OMEGA has confirmed that areas with "pristine" mafic minerals are still present at the surface, dating either from the early crust formation (enriched in low calcium pyroxene) or from more recent lava outpouring (enriched in high calcium pyroxene) [2]. In addition, OMEGA has identified sites with hydrated minerals: phyllosilicates and sulfates primarily.

Phyllosilicates are observed within the more ancient terrains, exposed through erosion or impact [3]. The formation of these minerals requires abundant water: they could thus represent the most favourable niches to have harboured life, either at the surface, or deep below, in the early Noachian. Sulfates have been detected by OMEGA in three major areas: coupled to deposits within Valles Marineris, over large areas in Terra Meridiani, and as a major constituent of the dark dunes in the northern polar cap [4,5,6]. It is strongly suggested that in the first two cases, sulfates formed in episodes having followed that of phyllosilicate formation, after Mars underwent a global climatic change triggered by the massive outgassing that accompanied the volcanic events that built the Tharsis bulge and filled the northern plains. Sulfates, although they also require water to form, do not necessarily trace an episode when surface liquid water was stable over long durations. The third alteration minerals detected by OMEGA are anhydrous ferric oxides, found both in connection with sulfates, and as a major constituent of the bright soil.

These different classes of minerals trace back distinct areas over the Mars History [7,8]; depending on scientific prioritization, these mineralogical assignments can be used as targeting criteria for MSL. OMEGA global maps have already been obtained at a kilometre resolution typically, exhibiting for each mineralogical type a number of potential sites. In a few areas, some tens of km wide, distinct classes are accessible, thus enabling to cover a wider range of scientific goals. A few examples will be shown, in this and related papers [9,10]. One example is that of Marwth Vallis (figure below): as for every channel, the violent outflow did not lead to hydration of either the floor or its opening, in which no sedimentary rocks are detected. However, the induced huge erosion exposed on the flanks of the channel spots of old terrains in which hydrated phyllosilicates are detected: they could constitute favoured targets, as having preserved the record of an era during which water was available on long time scales. Potentially, rocks containing phyllosilicates could themselves still host biorelics if ever life emerged at Mars.

In the upcoming MSL landing site selection process, the OMEGA team could also offer to study, for their mineralogical content, sites suggested by other investigations/teams on distinct criteria. The optimized procedure would then to have this OMEGA screening followed by CRISM/MRO mapping at a x10 higher spatial sampling, to possibly identify fine scale mineralogical structures enhancing the potential scientific outcome of the MSL in situ exploration.



References: [1] Bibring et al., *Science 307*, 1576-1581, 2005; [2] Mustard et al., *Science 307*, 1594-1597, 2005; [3] Poulet et al., *Nature 438*, 623-627, 2005; [4] Gendrin et al.., *Science 307*, 1587-1591, 2005; [5] Langevin et al., *Science 307*, 1584-1586, 2005; [6] Arvidson et al., *Science 307*, 1591-1594, 2005 ; [7] Bibring et al., XXXVII LPSC, 2006; [8] Bibring J.-P. et al., *Science*, in press, 2006; [9] Mustard et al., this volume; [10] Mangold et al., this volume.