THE MARTIAN SURFACE REVISITED BY MEx/OMEGA AND IMPLICATIONS FOR THE FORMATION OF SHERGOTTITES.

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Using classical methods of spectral identification (spectral parameter, Modified Gaussian Model, linear mixing), the VIS/NIR imaging spectrometer OMEGA aboard ESA/Mars Express has provided a consensus on the identification and spatial distribution of several classes of mafic minerals [1-2]. The Noachian crust is enriched in low-Ca pyroxene, with respect to more recent lavas flows in which high-Ca pyroxene dominates, whereas olivine is present without hydrated phases in dunes and eroded layers corresponding to ancient lava flows or melt ejectas.

The objective of this work is to: 1) quantify the modal mineralogy of different low albedo regions using OMEGA data, 2) compare the derived modal and elemental compositions with those derived from previous analyses based on thermal measurements, 3) constrain the evolution of the Martian upper crust, and 4) identify relationship with the range of mineral assemblages of the so-called SNCs martian meteorites.

The modal mineralogy of several low albedo regions of Mars is derived by using a spectral model based on the Shkuratov radiative transfer model [3]. The derived mineralogy was classified by the relative abundances of plagioclase, olivine, Low-Calcium Pyroxene (LCP) and High-Calcium Pyroxene (HCP) on ternary diagrams. For all the studied low-albedo regions, both HCP and LCP are modeled above the detection limits, with HCP being the dominant pyroxene. The neutral components (plagioclase) and pyroxene abundances are consistent with those measured by MGS/TES. By contrast, notable difference between this work and the different TES deconvolutions is the larger abundance of LCP found in our work. Region-to-region differences in modal mineralogy exist for the low-albedo olivine-free regions. The variations of LCP abundance show a compositional trend from the oldest terrains exhibiting larger abundance (LCP-rich outcrops, Nili Fossae highlands) to the youngest ones (Syrtis lavas).

This LCP/HCP ratio decrease through time correlates with HCP-rich mineralogy of SNC young volcanics assemblages. Such an evolution translate to CaO increase, Al2O3 and mg# decreases which could evidence decreasing degree of partial melting from Noachian to Hesperian and Amazonian younger volcanics. The basaltic shergottites are LCP-rich compared to nakhlites. The old ages found recently by [4] of about 4.1 Gy for basaltic shergottites would better fit our analysis. This would explain at the same time that the young lava flows are different from shergottites, whereas ancient crustal rocks are much closer to their composition.