Ten years of NIR mineralogy of Mars: From discovery to global and quantitative investigations

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The chemical and physical effects of major planetary processes on Martian rocks of different age provide a record of the planet's past surface environment. One of the most successful techniques for determining these effects on the mineralogical composition is the visible and near-infrared imaging spectroscopy. During the last 10 years, visible and near-infrared imaging spectrometers have demonstrated the capability of deriving the surface composition of Mars by discovering and mapping various minerals (both aqueous-related and igneous ones) from km- to tens of meter-scales, thus providing a new view of the volcanic and aleration history of the planet as well as critical data in guiding rover landing sites and operations. We will present the major results of relevance, primarily obtained by the OMEGA/Mars Express investigation, and discuss them in the more general framework of Mars exploration and evolution. The virtual global coverage of the planet by OMEGA has in particular provided an unique atlas comprising a series of maps showing the distribution of minerals formed in water and by volcanic activity. They create a global context for the dominant geological processes that sculpted the planet we see today. Thanks to the radiative transfer modeling, these complex spectral data can be deconvolved into mineral abundances. We will also present the modal mineralogy of selected mafic- and phyllosilicate-bearing terrains of different ages ranging from ~4By (Noachian period) to 100My (Amazonian period) exposed on the surface of Mars. The implications for the formation of these terrains will be addressed.