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Geological relationships between phyllosilicates and olivine outcrops in Nili Fossae region, Mars.

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OMEGA provided a new spatial distribution of localized concentrations of olivine and phyllosilicates on Mars. Their distribution is examined in Nili Fossae using HRSC and MOC images. We combined OMEGA data from multiple orbits which covered Nili Fossae, NE of Syrtis Major. Strong evidence of alteration in Nili Fossae comes from the identification of phyllosilicates, especially Fe-rich or Mg-rich smectites (typical metal-OH band at 2.29 to 2.31 microns). OMEGA has identified smectites especially on outcrops of the Noachian crust and ejecta blankets of impact craters suggesting that clay minerals are present mainly in the Noachian crust. Of particular interest is the identification of olivine-rich regions displaying spectra of olivine mixed with Fe/Mg-rich smectites. These spectral properties are unique on Mars and they may indicate an alteration state more than a spatial combination of phyllosilicates with olivine. Indeed, olivine is present without hydrated phases in dunes and eroded layers, whereas olivine is present together hydrated phases in a flat unit without fresh dissection suggesting this corresponds to an ancient weathered surface. This association shows that the olivine was possibly formed at a time the alteration process forming clay minerals was still active and that the presence of olivine should not be taken as a criteria for the absence of alteration. Different processes of alteration can be considered (warmer climate, hydrothermal alteration by volcanism or impact, etc.). Netherveless, no serpentine (with typical 2.33-2.34 strong band) has been yet identified here suggesting that the alteration of mafic minerals occurred at relative low-T whereas relatively higher temperatures are required for of hydrothermal alteration of olivine to serpentine.