Terrestrial weathering of Ilmenite and Olivine in the Northwest Africa 11273 Lunar Meteorite

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The terrestrial weathering in meteorites is dominated by the atmospheric oxidation and the entrance and exit of dissolved ions into the body [1]. The aim of this work is to show the oxidation of the ilmenite ($FeTiO_3$) and the olivine ($(Mg,Fe)_2SiO_4$) mineral phases in the 625 specimen of the Northwest Africa (NWA) 11273 Lunar meteorite [2].

The analyses of minerals was carried out by micro-Raman spectroscopy (Renishaw inVia Confocal Raman micro-spectrometer), using a 785 nm exitation laser and a high sensitive CCD with a mean spectral resolution of 1 cm^{-1}.

The chemical structure of olivine is composed of independent (SiO_4) tetrahedra linked to the readily soluble Mg^{2+} or oxidizable Fe^{2+} ions. The trigonal Ilmenite alternates Fe^{2+} and Ti^{4+} layers, that can be broken by oxidation of the ferrous ion. Figure 1 shows the Raman spectra of partially oxidized single crystals of ilmenite and olivine respectively, showing the simultaneous presence of all the mineral phases involved in their terrestrial weathering.

Raman identified anatase as the TiO_2 polymorph. Anatase transforms to rutile at T>1150K, thus the terrestrial oxidation was done at "low temperature". The partial oxidation of olivine affects only to its fayalite (Fe_2SiO_4) part, promoting the formation of hematite and quartz, while the corresponding magnesium ion probably was removed by dissolution.

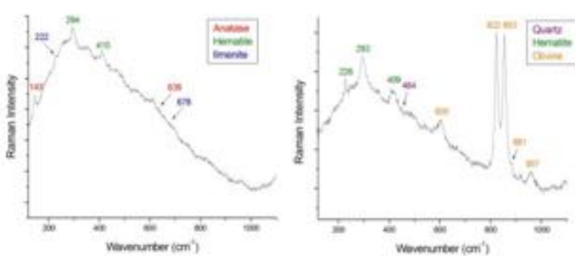

Figure 1. Raman spectra of weathered a) ilmenite and b) olivine due to oxidation at low temperature (T < 1150 K).

[1] Lee *et al*. (2004) *GCA* **68**, 893-916. [2] Huidobro *et al*. (2018) *EPSC* **12**, 833.