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Retention of metal nutrients and water by nanominerals in regoliths from Santiago Island, Cape Verde

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The formation of nanoscale mineral phases is typical of olivine degradation in basaltic pyroclasts, giving raise to an assemblage dominated by ferrihydrite, a poorly defined mineral with simplified general formula $nFe_2O_3.mSiO_2.pH_2O$. These nanophases are a valuable mineral reserve for the out coming soil, play an important role as water reservoirs in semi-arid volcanic regions and display a high capacity of retaining metal ions that are essential for plant metabolism.

Ferrihydrite-rich regoliths – loose weathered rock and mineral debris with no organic content (humus) – underlying pillow lavas were assigned at Ribeira Seca basin in Santiago Island (Cape Verde) [1]. In view of their pedologic relevance, allied to the fact that such reddish pre-soils are nowadays considered the best terrestrial analogues of surface materials in Mars [2], a minero-chemical study was undertaken. Laboratorial X-ray diffraction (XRD) was applied for mineral identification in soil samples. Non-destructive chemical analysis of selected fragments by synchrotron X-ray fluorescence (SRXRF) was performed using the LURE photon microprobe [3].

SRXRF data evidenced the presence of minor transition metals (V, Cr, Co, Ni, Cu, Zn) and heavier metals (Tl, Pb, Bi, U), along with dominant Fe and Mn, plus elements inherited from the original basaltic rock (mainly K, Ca, Ti, Rb, Y, Zr, Nb). Non metallic elements of great geochemical meaning were also assigned, like As, Sr and Br, the latter two being a clear chemical signature of the under-water alteration process acting on the vitreous material present in the original hyaloclastites [4,5].

Further comments are presented on the bulk chemistry of Santiago regoliths and conclusions are drawn about the possible mechanisms of alteration underlying the observed minero-chemical data. Results of a spectroscopic study (XANES) concerning the speciation state of iron in these regolith materials are presented in another session.

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