Trace element dispersion and REE-HFSE fractionation in a deeply weathered profile: the Albany-Fraser Orogen margin, Western Australia

GONZÁLEZ-ÁLVAREZ[1]*, I. SALAMA[1], W. ANAND[1], R.R. SWEETAPPLE[1], M.T. ABDAT[1], T. LEGRAS[1], M, HOUGH[1], R AND WALSHE[1], J[1]

[1] CSIRO, Earth Science and Resource Engineering, Minerals Down Under Flagship, Perth, Western Australia, *i.gonzalez.alvarez@gmail.com

Trace element dispersion due to weathering processes has been extensively studied under diverse climatic conditions and geological frameworks. However, the mechanisms that fractionate REE and HFSE at low temperature in the regolith remain largely unknown. In the SW of Australia, regolith has been developing for ~65 Ma, and reaches depths of up to 200 m. The paleoclimatic evolution of exposed Albany-Fraser Orogen (AFO) ranged from humid and sub-tropical during the Mesozoic until the Late Tertiary, shifting during the Quaternary to arid and semi-arid. Therefore, weathering profiles in the AFO result from successive climatic overprinting.

The regolith in the NE of the AFO margin presents a total thickness of ~75 m, with a transported cover of ~25 m, and an *in situ* regolith divided into ferruginized lower saprolite; sandy kaolinitic upper saprolite, and a overlying silcrete unit. REE are present mainly in anatase and zircon, which accumulate in the silcrete unit, where ilmenite is altered to anatase. LREE/HREE fractionation ranges from ~35 in the lower saprolite to ~15 in the upper saprolite, whereas Zr-Hf concentration increases from ~60-320 ppm in the basement and lower saprolite, up to 130-700 ppm in the upper saprolite. Zr/Hf varies between 30 and 55 in the basement, whereas in the regolith it spans 40-65. Nb/Ta varies from ~15 to ~65 in the lower saprolite, and ~7 to ~15 for the upper saprolite. Weathering developed in oxidising acidic conditions in a low saline groundwater environment, forming profiles resulting in low vertical hydromorphic dispersion of REE, HFSE and transition metals within the upper saprolite, with no detectable expression in the overlying transported and aeolian soil cover. Zr/Hf and Nb/Ta may be influenced by parent lithology. However, these ratios change in value at the same depth as the water table seasonal oscilations, and remain constant within the upper saprolite and the overlying transported cover, suggesting that the HFSE ratio change is due to a weathering process, which remains enigmatic.