

Pedogenesis across a climatic gradient in tropical high mountains, Cordillera Blanca – Peruvian Andes

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Studies in alpine environments have shown that chemical weathering and clay mineral formation are mainly controlled by climate and vegetation. However, few studies have focused specifically on pedogenesis in tropical high mountains. We evaluated pedogenic processes and weathering intensity by physical, chemical and mineralogical properties of soils under different vegetation types across a climatic gradient (east/west) in the Northern Cordillera Blanca, Peru. We established 2 catenas and sampled 10 pedons - 6 at Llanganuco valley (east-dry) and 4 at Portachuelo valley (west-wet). Pedons from both catenas are formed on colluvial deposits, gravelly and weakly developed, showing a sequence of O, A, C and C/R horizons. Lithological discontinuities in all pedons revealed sequences of buried A horizons. They also shared the same soil forming processes related to organic matter accumulation, such as humification, melanization and formation of organometallic complexes. The uppermost horizons show high values of total organic carbon and are dark colored. In general, pedons are acidic to slightly acidic, have a low base saturation, a high Al saturation and low effective and potential cation exchange capacity. Seven pedons were classified as Umbrisols, one Fluvisol, one Leptosol and one Regosol. Their similarity is attributed to environmental instability, not allowing for enough time to greater development. However, pedons at Portachuelo valley showed higher weathering intensity revealed by crystalline iron oxide formation and transformation of phyllosilicates minerals. Among them, pedon under Polylepis forest showed the highest weathering intensity, which favored transformation of chlorite to mixed-layered minerals, suggesting that combined climate and vegetation control chemical weathering and mineral transformation.