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Lithostratigraphic Mapping Through Saprolitic Regolith Using Soil Geochemistry and High-Resolution Aeromagnetic Surveys.

Helen Twigg and Murray Hitzman
iCRAG, School of Earth Sciences, University College Dublin, Belfield, Dublin, Ireland

The Neoproterozoic Central African Copperbelt located in southern Democratic Republic of Congo (DRC) and the northwestern Zambia and contains 48% of the world's cobalt reserves and significant resources of copper, zinc, nickel and gold. A good understanding of the geology is critical for successful mineral exploration. However, geological mapping is hindered by low topographic relief, limited outcrop, and a generally deep (10-100m) weathering profile developed since the Late Miocene. Multielement soil geochemistry provides a means for conducting geological mapping. Areas with outcrop or containing drill holes and/or trenches were utilized to relate known geological lithologies with soil geochemical results using major element and trace element ratios.

The lithostratigraphy within a study area along the DRC-Zambia border can be geochemically sub-divided into three units. Mixed carbonate and siliciclastic lithologies of the lower portion of the local stratigraphy are typically characterised by elevated V, Ti, and Nb. Mudstones and siltstones are dominated by elevated Al, Fe and Ba. The upper portion of the local stratigraphy is geochemically neutral with regards to trace elements. Lithological discrimination through analysis of soil geochemical data is limited in some areas by intense weathering. A A-CNK-FM diagram exhibits how complete weathering of carbonate rocks and carbonate-rich breccias (after evaporites) results in the somewhat counter intuitive outcome that residual soils above carbonate rocks are amongst the most aluminum rich in the study area with >80% Al_2O_3 (mol%) or >80% combined Al_2O_3 (mol%) and FeO + MgO (mol%). The weathering of siliciclastic rocks (siltstones, mudstones, and diamictites) result in a shorter weathering path across a A-CNK-FM diagram, probably due to their higher original proportion of resistate phases.

An area specific geochemical database of baseline lithostratigraphy weathering paths allows the identification of atypical geochemistry which could indicate facies change, alteration or mineralization.