Geophysical Research Abstracts
Vol. 19, EGU2017-430, 2017
EGU General Assembly 2017

Reconstructing late Quaternary palaeosol development and landscape connectivity from combined soil magnetic, geochemical and micromorphological analyses: insights from the Wilgerbosch River, Great Karoo, South Africa.

Chris Oldknow, Janet Hooke, and Frank Oldfield
University of Liverpool, Geography and Planning, United Kingdom (chris.oldknow62@gmail.com)

The characteristics, spatial and temporal patterns and drivers of Quaternary climate change across South Africa remain contentious principally due to the paucity of dated proxy records. River and fan terrace palaeosols may offer an important addition to analysis of spatially pervasive geomorphological landforms (palaeolake shorelines, terraces, dunes) conventionally used to reconstruct patterns of palaeoenvironmental change. In the Great Karoo, alluvial and colluvial exposures in the Wilgerbosch River and several of its tributaries have revealed up to five late Quaternary terraces of varying thickness, extent and pedogenic overprinting which may be of palaeoenvironmental significance.

A combination of geochronology (OSL and radiocarbon), soil micromorphology, geochemistry (XRF, XRD) and soil magnetic proxies on both bulk (0-63 μm) and particle size extracts (0-4 and 32-63 μm) from major terrace palaeosols was used in order to establish: 1) changing sediment fluxes and pathways; 2) the characteristics and drivers of palaeosol formation; and 3) evaluate the suitability of these terrace palaeosols as indicators of palaeoenvironmental change. The results are used to test a conceptual model of landscape connectivity.

Colluvial (slopewash, head deposits) sedimentation on the valley floors occurred around the time of the LGM due to enhanced regolith production through physical weathering. Soils overprinting these deposits (T1) are goethite-rich attesting to reducing conditions. Incision into T1 resulted in an extensive channel network forming. High concentrations of mafic minerals (Fe, Cr, Ca, Ti) and enhanced ferrimagnetism ($X_{LF} > 80$) in the 32-63 μm fraction indicated connectivity with slope colluvium proximal to weathering dolerite tors. Fluvial aggradation (T2) occurred as a complex response to this phase of connectivity and terminated in the Late Glacial period (around 17$\pm$2.5 ka). The development of a rhizogenic calcrete overprinting T2 indicated an elevated water table and wetlands on the valley floors. Inset clay coatings and calcite hypocoatings attest to fluctuating groundwater levels. The calcrete acted to blanket T1 and T2 reducing extent of connectivity in subsequent phases of terrace development. Sediment in inset fills (T3-4) exhibited diminished primary mineral concentrations and ferrimagnetism (X_{LF} = 20-60) due to recycling of earlier deposits (T1/T2), disconnectivity with 1st order tributaries and episodic gleying and dissolution of organic matter due to fluctuating groundwater level.

The terrace palaeosols in the Wilgerbosch catchment are therefore polygenetic reflecting both changing sources of sediment (slope or channel) and multiple phases of soil development under varied palaeohydrological conditions. Caution is therefore urged attempting to relate conventional magnetic (X_{LF}, X_{ARM}, X_{FD}) and geochemical (CIA, CIW) metrics of pedogenesis in morphologically similar catchments to palaeoclimatic records. The approach taken in this study is presently useful for reconstructing extent of connectivity between landscape components.