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Landscape evolution and regolith characteristics of east central Namibia

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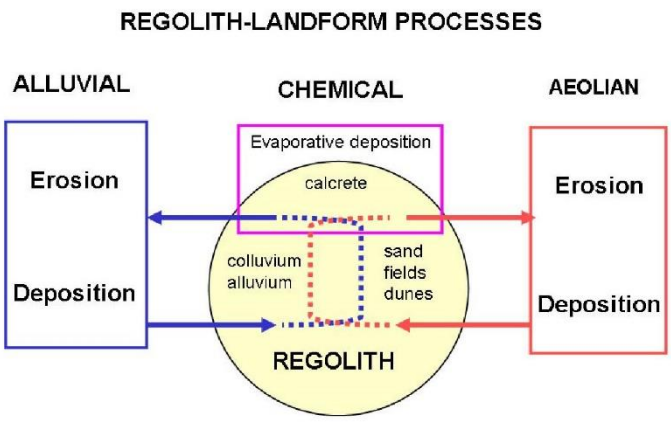
Landscape evolution in much of southern Africa has been strongly influenced by plate tectonic processes since the breakup of Gondwana from 135 Ma, and particularly the development and persistence of the African Superswell with its related episodic tectonic uplift. Climatic change through this period has also played a major role in landscape and regolith development.

This presentation focusses on the eastern inland plateau of central Namibia including the transition from the Khomas highlands to the Kalahari plains. The landscape varies from undulating high plains with prominent inselbergs and some ranges in the west, to sand plains with dunes and ephemeral drainage in the east. Wind-gaps above the present drainage level mark former erosional valleys through the ranges. There are remnants of a NE drainage that fed the Kalahari Basin and was subsequently captured to the SE by the Orange River Basin. Detailed landforms include: sand-choked rivers; inverted, gravel-capped surfaces; multi-stage linear dunes; pans; and omiramba. The area is characterised by a general lack of deep chemical weathering profiles, with saprock commonly persisting to the surface or unconformity with transported regolith.

The *in situ* regolith includes, physically disaggregated bedrock overlying a saprolite/saprock zone typically <1m thick. In the west this is mantled by relatively thin, colluvial and alluvial sheetwash deposits and sandy soils. Thicker colluvial/alluvial regolith is present in valleys and at the base of steeper slopes, as well as in the sand and dune fields developed in the east. A pebble-cobble lag, commonly enriched in quartz clasts with iron oxide surface staining, is widespread on some of the more elevated surfaces. Pedogenic and groundwater calcretes are abundant in the depositional parts of the landscape. Nodular and coalesced layered calcrete occurs in sand and soil cover and in dunes. Groundwater (valley) calcrete occurs along drainage and omuramba lines and around pans.

Landscapes and regolith are intrinsically linked and mutually informative. The present land surface and regolith in this region of Namibia largely developed since the Miocene, but the surface contains remnants and is near coincident with an older surface. The rounded, ferruginised quartz clasts in high level gravels are the last relicts of an earlie, chemically weathered landscape and have been reworked onto eroded surfaces developed under later arid climatic conditions. More recent tectonism has led to drainage diversion and continued incision. Regolith development has involved a complex interaction of alluvial and aeolian processes (Figure 1). Alluvial processes have resulted in sheetwash and channel deposits on regional eastward and later south-eastward sloping surfaces with wind activity overprinting the landscape with sand-silt deposits, including dunes. These aeolian deposits have been reworked by ongoing alluvial/colluvial processes with further wind deposition.



Chemical deposition of calcrete has overprinted significant parts of the regolith.
Figure 1: Summary of surficial processes important in landform and regolith development in central Namibia.

Better knowledge of the regolith and landscape evolution of this region has implications for improved understanding of chemical dispersion, groundwater conditions and soil formation relevant to mineral exploration, resource development land management.