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To what extent can we attribute accelerated landscape change to human activity? A cautionary tale from the drylands of the South African interior

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Across many parts of interior South Africa, alluvial and colluvial sediments are currently subject to widespread erosion by rivers, dongas (gullies), sheetwash and wind. This creates an impression of accelerated landscape change that is commonly attributed to factors such as poor land management by European settlers (mid 18th century onwards) or indigenous peoples, possibly in combination with decadal-scale climatic fluctuations and/or susceptible soil characteristics. Many resources are devoted to managing degrading lands, but effective conservation and restoration efforts are contingent on correctly identifying the underlying causes of erosion. Across South Africa, varied population densities, and diverse climates and soil types, mean that the causes of erosion are likely to be complex and to vary regionally. In some regions, examples of accelerated erosion resulting from vegetation clearance, overburning, overstocking, artificial drainage or land abandonment can be demonstrated. In other regions, however, our geomorphological, sedimentological and geochronological investigations provide an alternative 'geological' perspective on this erosion 'problem' by demonstrating that erosion may be a recurring, natural process linked to late Quaternary climate change and/or longer term landscape denudation.

In particular, luminescence chronologies for hillslopes, alluvial fans and river floodplains/terraces at various locations across interior South Africa have enabled comparison with other regional/global palaeoenvironmental records. These comparisons reveal that climatically-controlled changes in runoff and sediment supply, mediated through vegetation cover changes, resulted in shifts between sedimentation (relative aridity), soil formation (relative humidity) and minor channel/donga erosion (semiaridity) from at least 40 kyr until the late Holocene. By contrast, major erosion involving sustained channel incision and associated donga formation appears to have been initiated during the last few thousand years, at some sites apparently corresponding with rapid climatic fluctuations associated with the Mediaeval Warm Period and Little Ice Age. In some instances, channel incision depth has been controlled by the stability of downstream resistant rock barriers (e.g. dolerite sills and dykes) that form local baselevels in river long profiles; upstream of stable barriers, incision has been restricted but where barriers have been partially or fully breached, then deep incision into bedrock is characteristic. These findings provide evidence that: 1) during the late Quaternary, erosional phases have occurred independently of human activity, in different climatic settings, and across different soil types; and 2) in many regions, even the present phase of deep channel incision and donga formation predates the advent of European settlement or indigenous population expansion. These 'geological' perspectives on the age and history of major erosional features demonstrate that accelerated landscape change in South Africa is not necessarily a consequence of human activities, and cannot be assumed to represent an unequivocal signature of the Anthropocene.

These perspectives also have implications for land management. Where erosion is indisputably occurring as a result of land mismanagement, then alternative land use practices and erosion-control measures may succeed in slowing or reversing erosion, but where erosion results from natural climatic or denudational processes, then such schemes are unlikely to succeed in the medium- or long-term.