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Cosmogenic nuclide rates and (U,Th)-He dates of denudation in the eastern Great Escarpment, South Africa

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In Southern Africa, cosmogenic nuclides have been used during the past two decades to determine the denudation rates, exposure dates, and burial dates of surfaces, soils and deposits. That work has focused on the Great Escarpment in the semi-arid to arid western segment in Namibia and the humid south and southeast segments in South Africa [1]. We present the first cosmogenic beryllium-10 (^{10}Be) denudation rates and uranium-thorium-helium ((U,Th)-He) dates in the very humid eastern segment of the Great Escarpment in South Africa [2]. The ^{10}Be denudation rates were obtained from river sediments and bedrock outcrops (2.7 – 14.1 m/Ma and 1.8 – 24.0 m/Ma, respectively), and they are similar in range to the values determined from the other segments of the Great Escarpment [1]. These denudation rates are positively correlated with mean annual precipitation above 800 mm/yr, but the similarity of the denudation rates across the segments of the escarpment with different climates suggests that topography is the main driver of denudation. The (U,Th)-He dates were determined on pedogenic goethite concretions in oxisols at Graskop near the escarpment edge, using a new approach that incorporates helium data into U/Th disequilibrium dating [2]. The ages range from 0.85 Ma to 1.05 Ma, documenting a long soil residence time. These ages coincide with the Mid-Pleistocene Transition and appear to indicate the last period of intensive chemical weathering on the eastern escarpment, when the climate of the region changed from wet to dry conditions which lasted for ca. 600 kyr before the present humidification [3]. Our results demonstrate that the combination of cosmogenic nuclides and U-series offer a novel way of dating and quantifying Earth surface processes in the context of past climate change.

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