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Rates of surface lowering and landscape development in southern South Africa: a cosmogenic view

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The landscape of southern South Africa is characterised by large-scale erosion surfaces, including extensive pediments and multiple strath terraces, which document discordant river evolution through resistant quarzitic lithologies of the Cape Fold Belt (CFB). The timing and rate of erosion is poorly constrained. New cosmogenic ages from surfaces in South Africa are presented using in situ produced 10Be. Strath terraces in deeply incised rivers at two sites within the CFB indicate slow rates of erosion (1.54 - 11.79 m/Ma), which are some of the lowest rates recorded globally. Four pediment surfaces and a depth profile of the thickest pediment were also dated, and the results indicate that there are low rates of surface lowering on the pediments (0.44 - 1.24 m/Ma). The pediments are long-lived features (minimum exposure ages of 0.47 - 1.09 Ma), and are now deeply dissected. Given the minimum exposure ages, calculated river incision rates (42- 203 m/Ma) suggest that after a long period of geomorphic stability during pediment formation there was a discrete phase of increased geomorphic activity. The calculated minimum exposure ages are considered dubious because: 1) known rates of surrounding river incision (published and ours); 2) the climate conditions and time necessary for ferricrete formation on the pediment surfaces and; 3) the deeply incised catchments in the CFB on which the pediments sit, which all point to the pediments being much older. The pediments are fossilised remnants of a much larger geomorphic surface that formed after the main phase of exhumation in southern Africa. They form a store of sediment that currently sit above the surrounding rivers that have some of the lowest erosion rates in the world. These results indicate that steep topography can prevail even in areas of low erosion and tectonic quiescence, and that whilst cosmogenic dating of landscapes is an exciting development in earth sciences, care is needed especially in ancient settings. We strongly suggest benchmarking chronometric information with geomorphic and stratigraphic information.