Denudation rates and geomorphic evolution of the Cape Mountains determined by the use of in-situ produced cosmogenic $^{10}$Be

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ABSTRACT

The Cape Mountains of southern Africa are the remnants of an exhumed Permo-Triassic mountain belt, excavated from beneath 2-7 km of material between 80-120 Ma. This ancient passive margin mountain belt is morphologically comparable to present-day active orogens, yet returns some of the lowest $^{10}$Be-based denudation rates known. Within the Cape Mountains, slope angles are often in excess of 30° and relief frequently exceeds 1 km, yet $^{10}$Be-based catchment-averaged denudation rates vary between 2.32 ± 0.29 m/m.y. and 7.95 ± 0.90 m/m.y. and $^{10}$Be-based bedrock denudation rates vary between 1.98 ± 0.23 m/m.y. and 4.61 ± 0.53 m/m.y. We attribute the suppression of denudation rates and long-term maintenance of alpine-like topography within these mountains to the physically robust and chemically inert quartzites that comprise the high-lying backbone of the mountains. The Cape Mountains thus present an exception to the often noted and sometimes merely inferred coupling of tectonics and topography, whilst providing a striking demonstration of the overwhelming control that lithology may exert on landscape evolution.

KEYWORDS: Cape Mountains, denudation rate, cosmogenic nuclide analysis, passive margin