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Lithological control on erosional dynamics in a tectonically inactive mountain belt (Anti-Atlas, Morocco)

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Topographic relief results from the complex interactions between tectonics and erosional surface processes. The efficiency of surface processes is a function of topographic slopes, bedrock erodibility and climatic conditions. Ancient orogens offers a favourable setting to isolate the contribution of lithology, as tectonically driven surface uplift is typically negligible and channel steepness is directly controlled by bedrock erodibility. The Anti-Atlas in NW Africa is a late Paleozoic orogen that contains a well-preserved, uplifted, relict landscape that has been slowly eroding since the late Cretaceous. Here, we combine geomorphic analysis with ^{10}Be-derived denudation rates, to quantify the impact of bedrock erodibility and get insight into the surface evolution of the Anti-Atlas and the adjacent Siroua Massif. Specifically, we show that basin-wide denudation rates from the relict landscape range from 5 to 20 m/Myr, in agreement with the average long-term rates estimated from eroded volumes of Miocene volcanics and available thermochronometric data. This suggests that the regional relict topography has attained an erosional steady state and has been slowly decaying over geological time. Our results are comparable with data from other tectonically quiescent settings and demonstrate a positive linear correlation between denudation rates and normalized channel steepness indices. This allows constraining a narrow range of bedrock erodibility values for different rock-types (quartzite, granitic and sedimentary rocks), that are comparable with estimates from different stable settings. Finally, our compilation from tectonically inactive regions indicates that channel steepness, denudation rates and bedrock erodibility do not change significantly across different climatic zones and precipitation regimes highlighting the critical role of lithology in controlling the topographic relief.