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Cenozoic denudation rates of the West African marginal upwarp recorded by lateritic paleotopographies

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Quantifying long-term erosion of tropical shields is crucial to constraining the role of lateritic regolith covers as prominent sinks and sources of CO_2 and sediments in the context of long-term Cenozoic climate change. It is also a key to understanding long-term landform evolution processes operating over most of the continental surface, particularly passive margins, and their control onto the sediment routing system. We study the surface evolution of West Africa over three erosion periods ($\sim$ 45-24, $\sim$ 24-11 and $\sim$ 11-0 Ma) recorded by relicts of 3 sub-continental scale lateritic paleolandsurfaces whose age is bracketed by $^{39}Ar/^{40}Ar$ dating of lateritic K-Mn oxides [1]. Denudation depths and rates compiled from 380 field stations show that despite heterogeneities confined to early-inherited reliefs, the sub-region underwent low and homogeneous denudation ($\sim$ 2-20 m Ma^{-1}) over most of its surface whatever the considered time interval. This homogeneity is further documented by a worldwide compilation of cratonic denudation rates, over long-term, intermediate and modern Cenozoic time scales (10^0 - 10^7 yr). These results allow defining a steady-state cratonic denudation regime that is weathering-limited i.e. controlled by the thickness of the (lateritic) regolith available for stripping. Steady-state cratonic denudation regimes are enabled by maintained compartmentalization of the base levels between river knick points controlled by relief inheritance. Under such regimes, lowering of base levels and their fossilization are primarily imposed by long-term eustatic sea level fall and climate rather than by epeirogeny. The results suggest that Cenozoic post-rift vertical mobility of marginal upwarps in the tropical belt was unable to modify slow, weathering-controlled, steady state denudation regimes. The potentially complex expression of steady-state cratonic denudation regimes in clastic sedimentary fluxes remains to be investigated.

[1] Beauvais et al., Journal of Geophysical Research, 113, F04007, 2008.