Regolith and landscape evolution in Peninsular India and West Africa: Morphoclimatic evolution of the two continents over the Cenozoic

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Shields' surfaces of the tropical belt have been continuously shaped over the Cenozoic under the combined or alternating effects of chemical weathering and mechanical erosion that left stepped relict lateritic paleolandsurfaces exposing different generations and type of regolith in today's sceneries. These lateritic paleolandscape remnants are well preserved in West Africa and in highland Peninsular India, particularly on Deccan Traps. The stepped character of such paleolandscape remnants allows to describing a common geomorphic sequence of three successive sub-continental scale lateritic paleolandsurfaces on the two sub regions. The first surface is defined by the oldest remnants, which are generally topped by Al-Fe (mostly bauxitic) lateritic duricrusts upon distant km-scale mesas or as larger provinces on high relictual topographic massifs (e.g., Fouta Djalon in West Africa or Nilgiri hills in South India). The relict bauxitic landforms generally dominate from less than ca. 300 m the relicts of a second geomorphic level (so-called "intermediate" surface), which is mantled by ferruginous lateritic duricrusts. The third and last paleolandsurface remnants lie less than ca. 400 m below the bauxitic landforms, and consist in a weathered lateritic pediment that is locally capped by a ferricrete.

The ages of these continental-scale lateritic paleolandsurfaces may be bracketed using $^{40}Ar/^{39}Ar$ dating of K-Mn oxides (cryptomelane) formed in their underlying weathering profiles in the African and Indian contexts [1,2,3]. The first surface is Eocene and correlates with the Eocene climatic optimum (ca. 50 Ma) that is recorded throughout the tropical belt by the production of bauxite. In South India, the Intermediate surface has evolved by dominant chemical weathering since the Late Eocene (ca. 37 Ma) and records peak weathering activity in the Late Oligocene. In West Africa, that paleolandsurface seems to have only record the late Oligocene interval (ca. 29-24 Ma) of intense weathering. Abandonment of the Intermediate landscape as a result of its dissection by the river network took place in the Latest Oligocene on both continents. By contrast, the later pediment seems to have been shaped quite rapidly (ca. 32-29 Ma) and was weathered around the Oligocene-Miocene boundary (ca. 29-24 Ma) in India, whereas it took longer to form (ca. 24-18 Ma) and was weathered mostly during the Mid-Miocene (ca. 18-11 Ma) in West Africa. The contrasts in the morphoclimatic record of the two sub regions are linked to the spatial diversification of climatic regimes after the Eocene climatic optimum. However, the combination of the ages with the elevation differences between each lateritic paleolandsurface documents denudation rates with comparable and very low amplitudes (5-15 m/m.y.) in these two continents over the last 50 Ma.

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[2] Bonnet NJ et al. (2014) Earth Planet Sci Lett 386:126-137, doi:10.1016/j.epsl.2013.11.002
[3] Bonnet NJ et al. (2016) Chem Geol, in press.