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The African Surface (85-45 Ma): A record of mantle deformations at the scale of a continent since 35 Ma

Guillocheau, F.¹, Baby, G.¹, Simon, B.¹, Robin, C.¹

¹Géosciences Rennes, UMR 6118 Université de Rennes - CNRS, Campus de Beaulieu, , CS 74205, 35042 Rennes Cedex, France.

Africa is characterized by a bimodal topography with long (x100 km) to very long (x1000 km) wavelength plateaus and domes. The 300-400 m topographic mode corresponds to the Sahara on which is superimposed swells (Hoggar, Tibesti..) and the Congo Interior Basin. The 900-1100 m mode corresponds to the Southern African (Kalahari) Plateau and the East African and Ethiopian Domes.

The landforms responsible of the African topography are of three types (1) etchplains (mantled or stripped), (2) pediments and pediplains and (3) incised valleys. Those different landforms are stepped with mantled etchplains at higher elevation and pediments/stripped etchplains are lower elevation. Some of those landforms can be dated using either direct geochronological evidences on lateritic weathering profiles or geological evidences such as the relationship between landforms and dated magmatism or sediments. We used the stepping of successive pediments as a proxy of deformation, making sure that they record successive base level fall.

We mapped at Africa-scale, a major widespread etchplain known as the African Surface (King, 1949; Burke & Gunnell, 2008). This surface was dated both by geochronology (e.g. Beauvais et al., 2008 in Burkina, Deller, 2012 in North Ethiopia) and on geological evidences (interfingering or reworking of laterites in sedimentary basins such as Iullemedden Basin or the Tanzanian Margin). The paroxysm of weathering was during Early Eocene times (EECO) but started earlier in Late Cretaceous with more or less younger ages according to its location in Africa.

Geometrical restorations of pediments indicate that this surface was (1) at sea level in northern and central Africa with unknown upstream gradients and (2) superimposed on a Late Cretaceous plateau in southern Africa.

The main period of very long wavelength deformation occurred around the Oligocene-Eocene boundary with the uplift of northern Africa or the beginning of the growth the East African dome. Some other long wavelength reliefs are younger, Early Miocene for the Central Africa Atlantic Swell and the uplift of the Congo Basin at 300 m or Pliocene for the Angola Mountains.

The implications in term of mantle dynamics are discussed.

