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Cenozoic palaeogeography of Africa: a record of mantle dynamic and isostatic rebounds

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Palaeogeographic maps at Africa-scale were drawn with a first attempt of palaeotopographic reconstructions and quantification. This was based on (1) mapping and dating of stepped planation surfaces of pediment/pediplain and etchplain types and (2) the assumption that these stepped planation surfaces result from uplifts combined with climatic changes leading to periods of more intense erosion for shaping the pediments/pediplains (see for more arguments Guillocheau et al., 2018, Gondwana Research). Six time intervals were mapped (1) 59-56 Ma (Late Paleocene), (2) 48-41 Ma (Middle Eocene), (3) 34-28 (Early Oligocene), (4) 23-16 Ma (Early Miocene), (5) 11-5Ma (Late Miocene) and (6) 5-3 Ma (Early Pliocene). The main outcomes are as follows.
(1) Pre-existing relief were created during a major period of uplift during Upper Cretaceous times with remnants along the Southern African Plateau (important remnant topography), the future East African and Ethiopian Domes and the Guinean Rise.
(2) Paleocene to Late Eocene (66-40Ma) was the time interval during which Africa is (i) near sea level except the remnant relief mentioned before and (ii) intensely weathered.
(3) Late Eocene (40 Ma) was a major palaeogeographic reorganization with the initiation of the modern drainages.
(4) Oligocene to today (40-0 Ma) was a period of Africa-scale uplifts that reach a paroxysm during uppermost Miocene-lowermost Pliocene times (around 5 Ma).
The wavelength of the topographies created since 40 Ma are higher than 1000 km and sometimes longer (e.g. all North Africa). This means that their causes of uplift can only be related to mantle dynamics. Nevertheless, denudation data (e.g. thermochronology) shows that most of the denudation was located along the “coastal” plains of Africa or on the rift flanks (with the noticeable exception of the Congo catchment).
These observations suggest that the South African superplume had a significant role in the growth of these topographies since 40 Ma, with a propagation of the superplume toward the north and a progressive spreading below the North African lithosphere during the locking of Africa Plate with Eurasia Plate. The initiation of the uplift at 40 Ma localized the erosion along the “coastal” plains, enhanced from 40 Ma to today by isostatic rebounds and modulated by plate-scale deformation and/or major climatic changes.