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Zambezi River System, from source to sink: a record of plateau and dome uplifts related to mantle dynamic and climate changes

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The Zambezi System has been studied from its upstream catchment to the distal part of its deep-sea fan from 145 Ma (Cretaceous to today), in the frame of the PAMELA project (Passive Margin Experiment Laboratory) funded by TOTAL and IFREMER. This study was based offshore for the sink, on the sequence stratigraphic analysis of an extensive dataset of seismic lines calibrated on re-dated wells and onshore for the source, on a geomorphological analysis of the stepped planation surfaces.
The geological history can be summarized as follows. (1) The Lower Cretaceous is characterized by a decrease of the sediment supply from 46 000 to 16 000 km3/Ma, at time of the margin topographic differentiation. (2) The Late Cretaceous-Paleocene is characterized by three major uniformities intra-Cenomanian, uppermost Santonian and around the K-T boundary and is coeval with an increase of the sedimentary flux (21 000 km3/Ma) located in two depocenters, north of the Limpopo Plain and below the modern Zambezi Delta. (3) The Eocene period is a period of carbonate production and of sharp decrease of the siliciclastic flux (3 000 km3/Ma). (4) The Late Eocene (up to today) is the birth of the modern Zambezi Delta characterized by a dramatic increase of the sedimentary flux, from 13 000 km3/Ma (Oligocene) to 78 000 km3/Ma (Plio-Pleistocene) with three major unconformities at base Early Miocene, base Late Miocene and base Pliocene.
The efficiency of the sediment transport toward the deepest part of the sedimentary system - i.e. the ratio between the volume of sediment in the delta and the one in the deep-sea-fan - changed trough time with three periods of efficient transport during the Late Cretaceous, the Late Miocene and the Early Pliocene.
These changes of sedimentary systems reflect the deformation of the African Plate, with (1) a major uplift of the South African Plateau from Late Cenomanian to Campanian times due to the migration of Africa over the South African superplume, (2) a period with no deformation and a hot humid climate during Eocene and (3) the growth of the three modern domes from 40 Ma with an increasing rate around 10 Ma: the eastern side of the South African Plateau, the East African and the Madagascar Domes.