Geophysical Research Abstracts
Vol. 12, EGU2010-6265, 2010
EGU General Assembly 2010

TOPOAFRICA project: reconstruction and quantification of the past topography of Africa over the last 250 My.

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The goal of this project is to quantify the growth of long wavelength (x1000 km) topography over the last 250 My at the scale of a continent – Africa – and to understand (1) their relationship with the underlying mantle dynamics over such a time period and (2) their consequence over some Earth surface processes.
Most studies of past topography reconstruction have focused on orogenic areas. Few efforts have been devoted to characterizing the more subtle long wavelength topography, such as the doming or plateau uplift of continental areas at the 1000 km wavelength, with a paleoelevation of few hundreds of meters to a maximum of 1000-2000m. A direct inversion of the geological data into estimates of paleotopography is difficult. Quantification of past topographies of a continent requires coupling of geological data with a sediment production (erosion) and transport numerical model. The quantification of the Meso-Cenozoic topographies of the African continent is based on uplift (mean time interval 10 my) and paleoprecipitation maps (input of the model) and siliciclastic sedimentary fluxes and thermochronological data.
One of the advance of this project is to draw new-style paleogeographic reconstructions focussed on the continental environments yielding the geometry of paleocatchments, the lacustrine baselevel, the type and the flow direction of the fluvial systems... All those data are registered in database and GIS (ArcGis). Uncertainties are quantified. The uplift maps, in a first step semi-quantitative, are based on the paleogeographical changes and on synthesis of the tectonically induced-unconformities both onland and offhore (seismic) and their consequences (incised valleys, forced-regression wedges, changes of weathering types....). The paleoprecipitation maps are product by coupling climatic numerical models with a geological database (GIS) including all the climate recorders (lithology, type of clays, paleosoils; woods, pollens...). The measure of the siliciclastic sediment flux is based on a geometrical, chronostratigraphical and lithological synthesis of the peri-African (margins) and intra-African (SAG) basins. The thermochronological database is a compilation of all the data available in Africa, plus some new field collections.
The new numerical model of sediment production and transport at the continental scale, TOPOSED, will form the basis of the quantitative inversion of the geological data to yield estimates of past topography. Its original aspect consists in investigating separately erosion and transport processes, and in assuming that both are controlled by slope and discharge.

Studied time interval: Triassic (Induan, Ladinian, Norian), Jurassic (Sinemurian, Bajocian, Late Kimmeridgian), Cretaceous (Valanginian, Barremian, Middle Aptian, Lower to Middle Albian, Late Cenomanian, Late Coniacian-Early Santonian, Maastrichtian), Paleogene (Thanetian, Lutetian, Chattian), Neogene (Early Miocene, Early Pliocene).