Geophysical Research Abstracts
Vol. 14, EGU2012-9479-1, 2012
EGU General Assembly 2012

Meso-Cenozoic morphological evolution of NW Africa, the case of the Tuareg swell.

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The continental crust of Africa, largely built during the Pan-African orogeny (late Neoproterozoic) has acquired in its northern part, during Paleozoic times, an arch and basin morphology. Meso-Cenozoic large scale topographic anomalies, associated to Cenozoic intraplate volcanism, such as Hoggar, Tibesti or Darfur domes, are superimposed to these structures. Precise ages of swells, as well as their relations with Paleozoic arch and basin morphology of the area, remain controversial. The aim of this study, focussed on the Hoggar dome, in southern Algeria, is to produce new constraints on the Post-Paleozoic evolution of this region.

The Tuareg shield, from which Hoggar is the main central part and Aïr a SE extension, forms a topographic high reaching an altitude >2900m (Mt Tahat, Atakor district), exposing Precambrian rocks over 500000km2. While presumed Cretaceous sedimentary remnants suggest a possible stage of slightly positive topography during the Mesozoic, current high topography is emphasized by Cenozoic volcanic formations, mostly basaltic in composition.

We present new low-temperature thermochronology data, with apatite fission track and (U-Th)/He ages on Hoggar and Aïr substratum. We combine these results with thermal, gravimetric and isostatic two-dimensional lithosphere-scale geophysical models, following the method of Zeyen & Fernandez (1994).

Preliminary thermochronological results present ages from 99+-6 to 166+-10 Myr for AFT, and AHe from 10 to 300 Myr. Thermal simulations of these data suggest that currently outcropping Precambrian Hoggar basement could have experienced temperatures of approximately 80°C between Upper Cretaceous and Eocene. We propose that these elevated temperatures are related to burial beneath a 1 to 3 km thick sedimentary cover, depending on thermal gradient. The base of this sedimentary cover could correspond to the poorly described Upper Cretaceous remnants, currently uplifted up to 1450 m.

These results are in agreement with geophysical calculations showing that, when eliminating the topographical effect of lithosphere heating related to recent volcanism and assuming an Upper Cretaceous to Late Eocene thermally unperturbed lithosphere, a sedimentary basin may have existed. Up to 2 km of Cretaceous sediments could have been deposited on the Hoggar, confirming the thermochronological results.

Ref: Zeyen, H. and M. Fernàndez (1994): Integrated lithospheric modeling combining thermal, gravity and local isostasy analysis: application to the NE Spanish Geotransect. J. Geophys. Res. 99: 18089-18102.