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Low heat flow in the Atlas Mountains and the implications for the origin of the uplift

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The Atlas Mountains in NE Africa form a large topographic high between the Western Mediterranean and the Sahara Platform. The uplift in the High and Middle Atlas only started in the Eocene as a result of transferred effects of the Africa-Eurasia plate convergence (Alpine-Himalayan orogeny), while the Anti-Atlas has a longer history and formed on the edge of the West African Craton. Because crustal thickness in some parts of the Atlas is apparently insufficient to isostatically compensate for the present-day topography, there is still a lot of uncertainty on the relative importance of tectonic versus thermal origin of the uplift. In order to obtain isostatic balance, Missenard et al. (2006) evoked and modelled a large mantle upwelling in the middle Miocene that produces a surface heat flow anomaly of $\sim$80-90 mW/m^2 in the High and Anti Atlas. Heat flow measurement in the Anti Atlas, however, only showed values of 36-48 mW/m^2 and questions a large mantle induced thermal anomaly.

We will present newly collected thermal gradient and thermal conductivity data from the Anti Atlas (Akka site), the High Atlas (Seksaoua) and nearby sites (Draa Sfar and Guemassa) that confirm a low to normal heat flow in and near the mountain ranges. We believe that the thermal state of the Anti-Atlas merely reflects the cratonic nature of its lithosphere and that its apparent isostatic deficit may be largely due to compositional differences and flexural effects. We do not completely exclude a deep thermal anomaly under the Atlas, but a middle Miocene timing and a low surface heat flow can only be explained if the thermal state is strongly transient and the thermal anomaly has not reached shallow levels yet.