



Tectonic versus lithospheric origins of the relief of the Atlas Mountains of Morocco

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In Morocco, three main geological domains have long been recognized from north to south: the Rif domain, the Atlas domain, and the Anti Atlas domain. The Rif is an alpine Cenozoic chain situated close to the Africa – Iberia plate boundary. The Atlas system is a Cenozoic intracontinental belt developed within the African plate. The Anti Atlas is made up of a variscan fold-and-thrust belt supporting a tabular Meso-Cenozoic cover. The origin of the relief within the Atlas and Anti Atlas domain remains an open question because the tectonic shortening alone cannot explain the observed topography.

Here, we present three geophysical lithospheric transects crossing the Anti Atlas and the High Atlas. They were realized using a trial and error algorithm taking into account topography, geoid, free air anomaly, Bouguer anomaly, and heat flow. In order to fit real data, the three transect must include a major lithospheric thinning (lithosphere / asthenosphere boundary around 60 km). On a map, it is shown that the thinned lithosphere forms a North-East / South-West elongated stripe crossing not only the structural domains previously described, but also the plate boundary to the north. This major cross element also corresponds to a clear seismic and volcanic trend. To the west it is localised under the Anti Atlas and is at the origin of around 1000 meters of the present topography. To the east, this anomaly mainly affects the central High Atlas with the same amplitude. Further north east, the thermal doming is the main factor controlling the topography of the Middle Atlas.