Geophysical Research Abstracts
Vol. 16, EGU2014-8888, 2014
EGU General Assembly 2014

Lithospheric structure of northwest Africa: Insights into the tectonic history and influence of mantle flow on large-scale deformation

Meghan S. Miller and Thorsten Becker
University of Southern California, Los Angeles, United States (msmiller@usc.edu)

Northwest Africa is affected by late stage convergence of Africa with Eurasia, the Canary Island hotspot, and bounded by the Proterozoic-age West African craton. We present seismological evidence from receiver functions and shear-wave splitting along with geodynamic modeling to show how the interactions of these tectonic features resulted in dramatic deformation of the lithosphere. We interpret seismic discontinuities from the receiver functions and find evidence for localized, near vertical-offset deformation of both crust-mantle and lithosphere-asthenosphere interfaces at the flanks of the High Atlas. These offsets coincide with the locations of Jurassic-aged normal faults that have been reactivated during the Cenozoic, further suggesting that inherited, lithospheric-scale zones of weakness were involved in the formation of the Atlas. Another significant step in lithospheric thickness is inferred within the Middle Atlas. Its location corresponds to the source of regional Quaternary alkali volcanism, where the influx of melt induced by the shallow asthenosphere appears restricted to a lithospheric-scale fault on the northern side of the mountain belt. Inferred stretching axes from shear-wave splitting are aligned with the topographic grain in the High Atlas, suggesting along-strike asthenospheric shearing in a mantle channel guided by the lithospheric topography. Isostatic modeling based on our improved lithospheric constraints indicates that lithospheric thinning alone does not explain the anomalous Atlas topography. Instead, an mantle upwelling induced by a hot asthenospheric anomaly appears required, likely guided by the West African craton and perhaps sucked northward by subducted lithosphere beneath the Alboran. This dynamic support scenario for the Atlas also suggests that the timing of uplift is contemporaneous with the recent volcanismin the Middle Atlas.