Geophysical Research Abstracts
Vol. 14, EGU2012-8716, 2012
EGU General Assembly 2012
© Author(s) 2012

Constrains on the topography of the Moroccan High Atlas: Contribution of the SIMA (Seismic Imaging across the Moroccan Atlas) project

P. Ayarza (1), R. Carbonell (2), A. Teixell (3), A. Kchikach (4), M. Harnafi (5), D. Marti (2), I. Palomeras (6), A. Levander (6), J. Gallart (2), M.L. Arboleya (3), M. Charroud (7), and M. Amrahr (4)

(1) Geology Department, Salamanca University, Spain (puy@usal.es), (2) Institute of Earth Sciences, 'Jaume Almera', CSIC, Barcelona, Spain (rcarbo@ictja.csic.es, dmarti@ija.csic.es, jgallart@itcja.csic.es), (3) Geology Department, Universidad Autónoma Barcelona, Bellaterra, Spain (antonio.teixell@uab.es, marialuisa.arboleya@uab.es), (4) Faculté des sciences et techniques, Universite Cadi-Ayyad, BP 549, Marrakech, Morocco (kchikah@gmail.com, amrhar@ucam.ac.ma), (5) Institut Scientifique, B.P. 703, Agdal, Rabat, Morocco (harnafi@yahoo.com), (6) Department of Earth Sciences, Rice University, Houston, Texas 77005 USA (immaculada.Palomeras.Torres@rice.edu, alan@rice.edu) , (7) Faculté des Sciences et Techniques, Universite Sidi Mohammed Ben Abedellah, BP 2202, Fes, Morocco (mcharroud@hotmail.com)

The Atlas Mountain Range is a young intra-continental Cenozoic orogenic belt located at the southern edge of the diffuse plate boundary zone separating Africa and Europe. The Moroccan High Atlas, part of this range, features high topographies that locally exceed 4000 m. However, geological studies suggest that it has experienced low to moderate shortening. Furthermore, shortenning and elevation keep an inverse relationship: while shortening decreases to the west, elevation increases in the same direction. Geophysical studies support these interpretations with potential field models where crustal thickness never exceeds 40 km.

These observations rise the question about the origin of the Atlas Mountains topography. If topography does not respond to isostatic equilibrium at a crustal level, then the mantle must be involved in this process. Potential field based multidisciplinary models suggest that an astenospheric upwelling place the mantle as shallow as 70 km and that it is this feature that helps to support the mountain load. The only uncertainty related to these models lies in the assumed crustal thickness: if it increased, the LAB would be displaced downwards and conversely.

In order to picture the Moho topography and depth, and to constrain the seismic velocity structure of this mountain system, a 700 km long, seismic wide-angle reflection and refraction transect was acquired in 2010 by an international team. The north-south transect extends from the Sahara Desert south of Merzouga, to Ceuta at the Gibraltar arc, crossing the High and Middle Atlas and the Rif mountains. Seismic energy released at 6 shot points was generated by the detonation of 1 TN of explosives and was recorded by $\sim$ 900 Reftek-125a seismic recorders from the IRIS-PASSCAL pool.

Even with a low signal/noise ratio, the data allows the identification of crustal phases (Pg and PiP) and mantle reflected/refracted phases (PmP and Pn). Forward modeling pictures the Moho as an asymmetric feature that locally defines a crustal root characteristic of young orogens. The crust-mantle boundary is modeled at relatively shallow depths that are in accordance with other geophysical data, thus supporting the idea of a 'mantle plume' as main contributor to the High Atlas topography.