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Crustal root beneath the Rif Cordillera as imaged from both active seismic data and teleseismic receiver functions.

Jordi Diaz (1), Alba Gil (1), Josep Gallart (1), Ramon Carbonell (1), Mimoun Harnafi (2), and Alan Levander (3)
(1) ICTJA - CSIC, Barcelona, Spain (jdiaz@ictja.csic.es), (2) Institut Scienfique, Université V-Agdal, Rabat, Morocco, (3) Rice University, Earth Science Department, Houston

The Rif cordillera forms, together with the Betic ranges, one of the tightest orogenic arcs on Earth. This continental boundary zone is dominated now by the slow convergence between Nubia and Eurasia, but with clear evidences of extensional tectonics. One of the missing elements to constrain the complex geodynamics of the Gibraltar Arc System is the knowledge of the crustal architecture beneath northern Morocco. In the last decade a major effort has been done in this sense, from active and passive seismics. We compile here the recent results available from the Rif domains. Two 330 km long wide angle DSS profiles were recorded end of 2011 across the Rif in NS and EW transects within the Rifsis project, complemented by onshore recordings of the Gassis-WestMed marine profiles. At the same period, BB seismic arrays were deployed in the area within Topo-Iberia and Picasso projects, allowing receiver function analyses of crustal depths. The ray-tracing modeling of the Rifsis profiles reveal a large Moho step and an area of crustal thickening both in EW and NS directions, grossly coincident with the Bouguer gravity anomalies. The deployment logistics allowed that all the stations recorded all the shots, thus providing useful offline data. We will use here all available in-line and offline data to provide a map of the crustal thickness in northern Morocco. We combined two approaches: i) a hyperbolic time reduction applied to the seismic data, resulting in low-fold stacks in which the reflections from the Moho should appear as subhorizontal lines; ii) the arrival times of the observed PmP phases allow, assuming a mean crustal velocity, to assign a midpoint crustal thickness to each lecture. Although some uncertainties may be inherent to those approaches, a large crustal root, reaching more than 50 km, is well documented in the central part of the Rif Cordillera, close to the zone where the Alboran slab may still be attached to the lithosphere. We also compared these results with those from receiver functions recalculated for the Topo-Iberia and Picasso stations, as well as for a new seismic BB array installed in late 2013 to densify the available dataset. The derived crustal depths confirm a deep crustal root beneath the central Rif and a rapid thinning eastward of Nekkor fault, even if some observed differences deserve further analyses.