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From the Atlas to the Rif a Crustal seismic image across Morocco: The SIMA & RIFSEIS control source wide-angle seismic reflection data

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The velocity structure of the crust and the geometry of the Moho across Morocco has been the main target of two recently acquired wide-angle seismic reflection transects. One is the SIMA experiment which provided seismic constraints beneath the Atlas Mountains and the second has been the RIFSEIS experiment which sampled the RIF orogen. Jointly these controlled source wide-angle seismic reflection data results in an almost 700 km, seismic profile going from the the Sahara craton across the High and Middle Atlas and Rif Mountain till the Gibraltar-Arc (Alboran). Current work on the interpretation of the seismic data-set is based on forward modeling, ray-tracing, as well as low fold wide-angle stacking. The data has resulted in a detailed crustal structure and velocity model for the Atlas Mountains and a 700 km transect revealing the irregular topography of the Moho beneath these two mountain orogens. Results indicate that the High Atlas features a moderate crustal thickness and that shortening is resolved at depth through a crustal root where the Saharan crust under-thrusts below the Moroccan crust, defining a lower crust imbrication which locally places the Moho boundary at, approximately, 40 km depth. The P-wave velocity model is characterized, in averaged, by relatively low velocities. These low deep crustal velocities together with other geophysical observables such as: conductivity estimates derived from Mt measurements; moderate Bouguer gravity anomaly; surface exposures of recent alkaline volcanics; lead the interpretation to propose that partial melts are currently emplaced in the deep crustal levels and in the upper mantle. The Moho discontinuity defines a crust which is in average relatively thin beneath the Atlas which is almost a 4000 m high orogenic belt. The resulting model supports existence of mantle upwelling as a possible mechanism that contributes, significantly, to maintain the High Atlas topography.