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Imaging the Alboran Domain from a marine MT survey

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On the Western edge of the Mediterranean, the slow convergence of the Iberian and African plates is marked by very intricate tectonic activity, marked by a combination of small-scale subduction and sub-lithospheric downwelling. Delamination or convective instability has also been proposed to have occurred beneath this domain during the past 25 My. And different geodynamic models have been proposed to explain the lithospheric structure of the arc-shaped belt (Betic and Rif orogenies) and the opening of the Alboran Basin.

As part of several international projects carried out in this area, magnetotelluric (MT) methods have been used to explore the crust and upper mantle. The measurements of mantle electrical conductivity are a well known complement to measurements of seismic velocity. Conductivity is sensitive to temperature, composition and hydration of the mantle, and therefore MT is widely used to provide constraints on mantle processes. We present results of electromagnetic studies in the Western Mediterranean, focusing specially in the recently work on the Alboran sea as part of a marine MT survey. Land MT studies have already imaged an area of low resistivity coincident with an area of low velocities without earthquake hypocenters, interpreted as asthenospheric material intruded by the lateral lithospheric tearing and breaking-off of the east-directed subducting Ligurian slab under the Alboran Domain. The marine data show complex MT response functions with strong distortion due to seafloor topography and coast effect, suggesting a fairly resistive lithosphere beneath the seafloor. The marine MT data also shows an anomalous conductive slab towards the Eastern Alboran basin, suggesting a possible hydration of mantle material from an Eastward subducting slab. Both the land and marine MT data suggest that the most likely scenario for the opening of the Alboran Basin is related to the westward rollback of the Ligurian subducting slab.