



Geodynamic evolution in the West Alboran Sea: New evidence

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The presence of continuous upper crust blocks between Iberian Betic and Moroccan Rif in the western and in the middle of Alboran Sea detect by tomography and interpreted as the remains of the Ligurian oceanic crust that was separating Iberia and Africa, can add new information about lithosphere structure and geodynamic evolution in this region.

A large volume of seismic data (P and S arrival times) has been collected for the period between 12/1988 and 30/2008 by 57 stations located at north of Morocco (National Institute of Geophysics, CNRST, Rabat), south of Portugal (Instituto de Meteorologia, Lisbon) and Spain (Instituto Geografico National, Madrid) and used for investigate the lithosphere in the western Alboran Sea region. We use a linearized inversion procedure to find a 3D velocity model. The resolution tests indicate that the calculated images give near true structure imaged from 5 to 100 km depth for northern Morocco, and southern Spain and the Alboran Sea.

The resulting tomographic image shows that the presence of two upper crust bodies (velocity 6.5 km/s) from 5 to 10 km depth between Iberian Betic and Moroccan Rif in the western and central Alboran Sea. This new evidence provides a prove that the Ligurian oceanic upper crust in the West Mediterranean Sea is not totally collapsed or broken down during the middle and late Miocene. The slab rollback of old subducting Ligurian oceanic lithosphere stopped in the central and western Mediterranean at level of Melilla in middle to late Miocene. The geochemical of volcanic rocks (calc-alkaline) from Alboran Island and in the Alboran sea floor attest of this subducted oceanic lithosphere.

In the middle to late Miocene the slab break off in this region and caused the tearing of the Ligurian oceanic lithosphere in the west Mediterranean region. The slab break off is the cause that the major part of lower crust was peeled off (delamination) and removed beneath the area, but two detached lower crust still present. The first one is oriented in NW- SE direction and dipping SE (peeled back to the west), it's attached to the south-western block at level of Moroccan Rif and it's extending in the southern part of Alboran Sea parallel to Rif mountain to join the middle of Alboran Sea. The other is oriented in NE-SW direction and dipping NE, it's orthogonal to the Rif to join the south of Iberia. These two bodies are presented by a positive anomalies with fast Pn (7.5 -8.0) at 45 to 60 km depth.

The lithosphere removed from the base of the crust was replaced and heated by extrusion of asthenospheric material. The negative anomalies with a slower Pn velocity (7.0-7.5 km/s) in 20 km depth showing by tomography attest of this process