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Geodynamic evolution of the Ligurian Sea area (Northern Italy): hypothesis of modelization from geological and geophysical data

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The anticlockwise rotation of the Sardinia-Corsica block (Oligocene) led to the oceanisation of the Ligurian-Balearic basin (Séranne, 1999). The following anticlockwise rotational crustal shortening that led to the formation of the Northern Apennines (Oligocene - Miocene), left behind its back an extensional regime that caused the opening of the Tuscan graben system (Miocene Sup – Pliocene, Carmignani et Al, 2004).

As a matter of fact, the Ligurian-Balearic basin is under water like the Northern Tyrrenian sea, so we also need to consider the geophysical data in order to learn something more about their deep structure. Seismic tomography is a powerful tool in such cases, as it allows us to know the structure of the crust and the upper mantle beneath the study area, where any other geognostic investigation is impossible. Recent tomographic studies (Scafidi et Al, in press) pointed out a wide high velocity anomaly just in correspondence of the Ligurian Sea, that could be related to the upwelling of the oceanic Moho. This structure seems to follow the geometry of the Italian coastline and it clearly marks the extensional tectonic regime of this area. In particular, and in accordance with other geophysical studies (such as "CROP" profiles), a division of the Ligurian Sea area into two sectors can be observed. In the western part there is an oceanic thinned crust, while going towards the eastern sector there is a gradual transition from the oceanic to the thicker continental crust.

From a geological point of view, the only area where we can find field evidence of the whole rotation (almost ninety degrees) is close to its focus, that is to say Liguria

(North - West Italy).

We have chosen the eastern Liguria area between Genova and Sestri Levante, where it is possible to recognize a big influence of this extensional regime. In this area two different tectonic units, Monte Antola and Monte Gottero, which are part of the Ligurian units, outcrop in the transitional area between the Alps and the Apennines. These two units are made up of Late Cretaceous Flysch, either calcareous or siliceous, and they show an intense pre-Oligocene deformation (Corsi et Al, 2001; Marroni et Al., 2004).

In the study area we can distinguish a certain number of main normal shear zones that witness the evolution of a rotational extension from a NE – SW strike trend to a NW – SE strike trend, which are, roughly, the direction of Ligurian-Balearic basin and Northern Tyrrenian extensional system. These faults and shear zones show a continuous evolution, cross-cutting each other and being scattered on the whole study area. The faults are very often oblique, showing a strike slip component, and they are often part of Riedel systems or conjugate systems, which complicate their framework (Corsi, 2003, Balbi & Corsi, 2005).

It is also evident that a secondary normal faulting has interested the eastern Ligurian coast, by cutting and stretching the already deformed mountain chain, leading to the actual coastline morphology. This faulting, is perpendicular but coeval to the main normal faulting (Corsi 2003), being possibly the accommodation to the major extension.

Finally, either geophysical data or geological evidences point out the existence of an extensional tectonic regime in a rotational geodynamic context in the Ligurian Sea. The integration of both geological and geophysical data helps to develop a structural model combining the shear zone framework and the map of the depth of the Moho.