



A new plate boundary in the Ionian Sea

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The Calabrian Arc (CA) is a narrow and arcuate subduction system resulting from Africa/Eurasia plate convergence and slab rollback in the Tyrrhenian region. The very slow present-day plate convergence suggests a decrease in subduction efficiency, but underplating may still be active in the central CA where GPS data suggests an outward motion of Calabria relative to Apulia. Shortening in the accretionary wedge is taken up along the outer deformation front and out-of-sequence thrust faults (splay faults). Transtensive deformation accounts for margin segmentation along transfer tectonics systems bounding different margin segments. Transfer faults represent the shallow expression of deeply rooted processes at the slab edge. One of these structures is the NNW-SSE trending transtensive STEP (Slab Transfer Edge Propagator) fault system located East of the Malta Escarpment from the Alfeo seamount to the Etna volcano.

Margin segmentation occurs along a second NW-SE trending crustal discontinuity delimiting two distinct lobes of the subduction complex close to the Messina Straits region. The Western Lobe (WL) of the subduction complex, offshore Sicily, is a down-dropped and very low tapered (about 1.5°) wedge detaching on the base of the Messinian evaporites. The Eastern Lobe (EL), in front of Central Calabria, shows a more elevated accretionary wedge, steeper topographic slopes, higher deformation rates and a deeper basal detachment. High resolution tomographic images suggest a strong interplay between structural development and slab dynamics: the WL corresponds to areas where the slab is detached, while beneath the EL the slab is continuous.

Newly acquired geophysical data (Urania cruise, October 2013), reveal that the deformation zone between the two lobes of the accretionary wedge displays fresh seafloor scarps and mud volcanoes suggesting it represents an active tectonic boundary and a deep fluid/mud conduit.

We propose that this discontinuity is a new plate boundary segment in the Ionian Sea, connecting the compressive belt in northern Sicily to the Hellenic Arc system and dissecting the CA subduction complex. This deformation zone accommodates differential movements of the Calabrian and the Peloritan portions of CA and can explain the NW-SE extension observed in the straits of Messina as well as the relative motion between Calabria and NE Sicily.

This reconstruction is in agreement with geodetic data and earthquake slip vectors observations which suggest the existence of a microplate in the central Mediterranean. The discontinuity between the two lobes would thus represent a major component of the southwestern (hitherto poorly constrained) boundary of this microplate. The motion of Africa relative to Eurasia would be accommodated along this structure by relative rotations between the different blocks resulting from African plate fragmentation.