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The Calabrian Arc subduction complex in the Ionian Sea

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The Calabrian Arc (CA) is a subduction system related to the slow convergence between Africa and Eurasia, well comparable in its geodynamic evolution to the adjacent Mediterranean Ridge against which it impinges in the eastern side of the Ionian Sea. The external part of the arc is represented by a well developed accretionary complex resting on the seaward dipping continental backstop and bordered by the Malta and Apulian escarpments. Although the regional architecture of the margin geometry has been described through the analysis of high penetration seismic data, location of major active faults and the fine texture of this tectonic structure is still poorly constrained. We reconstructed geometry and structural setting of the external CA through the interpretation of seismic data belonging to the Crop-Mare and –MS datasets. Three seismic sections have been selected and re-processed through the application of the pre-stack depth migration (PSDM). Seismic images show that at the toe of the CA, the thick sedimentary section of the African plate has been scraped off from the descending plate and piled up along thrust faults. This contributed to emplace a 10 Km thick and 200 Km wide accretionary complex whose geometry, structural setting and décollement depth is mainly controlled by the lithology of the incoming sedimentary section, pre-existing structures on the incoming plate and geometry of plate convergence.
The neotectonic deformation pattern was addressed through an integrated approach which involves the analysis of multibeam swath bathymetry, high resolution multichannel and single channel seismic profiles acquired during two expeditions in 2007 and 2008 (R/V OGS Explora and R/V CNR Urania). The main purpose was to reconstruct structural style and recent deformation at the transition between the accretionary wedge and the Ionian abyssal plain. This area has the potential to record the most recent tectonic evolution of convergence processes, and, containing the transition to foreland zones, is the ideal site to address uplift and outward growth rates of the accretionary wedge. Newly acquired high resolution geophysical data combined with the interpretation of PSDM seismic sections, contributed to reconstruct depth of the décollement, structural style of the accretionary wedge in the different portions of the subduction complex and location and geometry of major active faults.
The CA is part of the most active seismic belt in Italy and has been struck repeatedly by very strong historical earthquakes often associated with destructive tsunami. We collected well targeted sediment samples in tectonically controlled sedimentary basins to study the indirect effects of fault activity (i.e. mass wasting events, sand injections, turbidites, etc). Sediment cores from the Ionian abyssal plain and slope basins have sampled turbidite sequences which likely contain a record of the great earthquakes or catastrophic events in the region. If we will be able to make correlations between the sedimentary record of earthquake-triggered slumps or turbidites and the earthquake catalogue in Southern Italy, we will try to extend the paleoseismic catalog further back in time. This approach has the potential to determine which portions of the arc have recorded catastrophic events in the past and which is the recurrence time of major events in the different regions of the subduction system.