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ACTIVE DEFORMATION AND FLUID FLOW IN THE EXTERNAL CALABRIAN ARC – IONIAN SEA

A. Polonia (1), L. Torelli (2), D. Klaeschen (3), M. Ligi (1), P. Mussoni (2), F. Riminucci (1)

1. CNR, ISMAR-Bo, Bologna, Italy, (2) Dip. Scienze della Terra, Univ. Parma, Parma, Italy, (3) IFM-GEOMAR

Corresponding Author: Alina Polonia, alina.polonia@ismar.cnr.it

The Calabrian Arc (CA) is the most prominent accurate subduction system of the Central Mediterranean, well comparable in its geodynamic evolution to the adjacent Meditarranean Ridge against which it impinges in the north-eastern side of the Ionian Sea. The external part of the arc is represented by an accretionary complex bordered by two major structural features, the Malta and Apulian escarpments. Although the regional architecture of the margin geometry has been described through the analysis of old high penetration seismic data, location of major active faults and the fine texture of this huge tectonic structure is still poorly constrained. Moreover, one major question remains unanswered: “is the Calabria subduction zone still active”? The lack of seismicity along the subduction fault plane can be either an indication that subduction is ceased or that there is a large locked seismogenic zone. Different seismogenic behaviours can be predicted depending on which of these hypotheses is taken into account and their implications for the hazard facing the Central Mediterranean vary widely and their likelihood need to be evaluated. These evaluations can only be as reliable as the seismological, geophysical and geological parameters on which they are based.

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 very recently re-processed at the IFM-GEOMAR

processing center through the application of the pre-stack depth migration (PSDM). Seismic images show that at the toe of the Calabrian arc, 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 level is mainly controlled by the lithology of the incoming sedimentary section and geometry of plate convergence.

The neotectonic deformation pattern was addressed through an integrated approach which involves the acquisition of multibeam swath bathymetry and single - channel seismic reflection profiles with the R/V OGS Explora. The main purpose was to gain information on the tectonic regime of the subduction system 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 geometry of the plate boundary, depth of the décollement level, location and geometry of major active faults (both thrust and strike slip faults), and the interplay between fluid flow and tectonics.

An upcoming cruise is planned in December 2008 with the Italian vessel CNR/Urania to address dynamics and kinematics of the Ionian subduction at the transition between the outer accretionary wedge and the abyssal plain through an integrated geophysical and geological approach (submarine earthquake geology) that has been successfully applied along the North Anatolian Fault in the Marmara Sea. We will study the geological signatures of past earthquakes in the sediment column, those produced directed by the fault motion along the rupture plan and secondary structures derived from the shaking (slumps, mass wasting events in the vicinity of the fault and adjacent basins). The main objective is to determine which portions of the arc have experienced great earthquakes in the past, whether the recurrence interval is regular or not, and how often catastrophic events occur.