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Seafloor morphology in the different domains of the Calabrian Arc subduction complex – Ionian Sea

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The Calabrian Arc (CA) is a subduction system that develops along the African-Eurasian plate boundary in the Ionian Sea and connects the E-W trending Sicilian Maghrebian belt with the NW-SE trending Southern Apennines. The first systematic geophysical investigation in the offshore region of the CA was conducted during the 70's by the Institute of Marine Geology (now ISMAR) with the R/V 'Bannock' [1]. In the last 30 years, further geophysical data (high penetration multichannel seismics, CHIRP and multibeam data) has been acquired in the offshore of the CA, down to the Ionian Abyssal Plain. The integrated interpretation of the existing geophysical data [2] has outlined the regional architecture of the subduction complex, the main tectonic features absorbing plate motion and variation of seafloor morphology in the different structural domains.

Pre-stack depth migrated seismic profiles has revealed that the accretionary complex is constituted by two distinct wedges whose geometry, structural style and seafloor morphology widely vary. The outermost accretionary wedge has been emplaced in post-messinian times. It is a salt-bearing complex as pointed out by the internal structure of the wedge (acoustically transparent assemblage), very low taper angle and high seismic velocities. The seafloor shows a rough morphology, short wavelength folds and depressions superimposed on a rather constant gentle regional slope. Landward of the outer wedge, the evaporites are no longer present and the transition to the clastic rock assemblage is reflected in a different structural architecture, which shows steeper slopes and a succession of topographic scarps separated by sedimentary basins and mid slope terraces. The topographic scarps are controlled in depth by a series of high angle landward dipping reflectors, that we interpreted as out of sequence thrust faults absorbing shortening at the rear of the wedge.

Landward of the inner wedge a mid slope terrace develops (inner plateau) between 1300 and 1600 m water depth. It is a relatively flat area of variable width ranging from 10 to 50 Km, represented by the forearc basin and the innermost accretionary wedge. Seafloor morphology is related to small undulation of the seafloor. A thick section of Plio-Quaternary and Messinian sediments is present below the flat terrace. Sediments appear to be folded and, in some regions highly disrupted along local sub-circular structures that affect the seafloor morphology as well. Geometry and seismic facies of these sub-circular swells rising from the surrounding suggest they are diapiric structures.

Variation of seafloor morphology is strictly related to the progression of structural domains within the Calabrian Arc subduction complex. The integrated analysis of seafloor morphology and structural style through an integrated approach involving the interpretation of seismic data at different scales has been carried out in order to outline relationships between shallow tectonic processes and deep structures. Moreover, the analysis of morphobathymetric and seismic data, combined with well targeted sediment samples has the potential to reveal relationships between tectonics, sedimentation and fluid flow in the different portions of the accretionary wedge.

References:

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2 - Polonia A. et al., The Calabrian Arc subduction complex: plate convergence, active faults, and mud diapirism. New results from the CALAMARE-2008 cruise (N/R CNR Urania). Submitted to G3.