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Tectonic and seismic activity of deep structures imaged by wide-angle seismic forward modeling in the Ionian basin (Central Mediterranean Sea).

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In the Ionian Sea (Central Mediterranean) slow convergence between Africa and Eurasia plates has resulted in the formation of a narrow subduction zone. The origin of this deep basin is debatable, especially concerning the rifting mechanisms as the Malta Escarpment could represent a remnant of this opening. For the last 35 Ma this subduction zone is still retreating in a south-east direction however it is recently confined to the narrow Ionian Basin. As a result, a major lateral slab tear fault is required to accommodate the slab roll-back along the western side of the subduction and is thought to propagate along the eastern Sicily margin but its precise location remains controversial.

This study focuses on the deep crustal structure of the eastern Sicily margin and the Malta Escarpment observed through two geophysical approaches: wide-angle seismic and 3D gravity modeling (using the IGMAS+ software). The distribution of seismicity is analyzed along three major structures known from their morpho-bathymetric expression and identified in our wide-angle seismic profiles: the Malta Escarpment, the Alfeo Fault System (AFS) and the Ionian Fault system (IFS). We present two P-wave velocity profiles obtained from forward modeling of wide-angle seismic data acquired onboard the R/V Meteor during the DIONYSUS cruise in 2014. We also analyze seismologic data from the INGV's Sismoweb (Scarfi et al. 2013), the European-Mediterranean RCMT Catalog (Pondrelli et al. 2016) and the Time Domain Moment Tensor catalog from the Centro Nazionale Terremoti of the INGV.

The wide-angle profiles image an oceanic crust within the Ionian basin as well as the deep structure of the Malta Escarpment which presents typical characteristics of a transform margin. A deep and asymmetric sedimentary basin is imaged south of the Messina strait and seems to have opened up between the Calabrian and Peloritan continental blocks. Small to moderate earthquakes occur in proximity to the three aforementioned structures identified on the velocity models. The majority of the earthquakes exhibit a dextral strike-slip sense of motion along the AFS and the IFS. The IFS appears to control the deep sedimentary basin evolution and thus may be associated with dextral strike-slip earthquakes close to Calabria and the straits of Messina.