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Fault pattern and kinematics at the Tyrrhenian-Ionian transition zone (northern Messina Strait)

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The Messina Strait and surrounding areas are one of the most interesting regions of the western Mediterranean Sea, characterized by the complex interplay between the Mesozoic-Paleogene Ionian basin, where the Calabrian Arc accretionary prism extends towards the southeast, and the Neogene Tyrrhenian back-arc basin to the northwest.

Complex fault networks with different kinematics, running from the inner side of the Calabrian arc through the Messina Strait and the Ionian coast of Sicily, as far as the Hyblean Plateau, result from the coexistence of different geodynamic settings in the area. Some of these faults are responsible for several of the largest earthquakes occurred in southern Italy and the Mediterranean Sea in recent times. Different works aimed at establishing a relationship between seismogenic sources and mapped faults, defining the location and rupture mechanism of some of these fault lineaments. Even tough, many uncertainties still exist for earthquakes occurred in offshore areas, where the fault kinematics and geometry are in some cases still poorly constrained.

In this work, we focus on a group of offshore faults located between the northern sector of the Messina Strait and the Gioia Basin (southern Tyrrhenian Sea). We aim at understanding the kinematics and the style of deformation in this area, and to investigate the role played by the main fault networks in the framework of the regional complex geodynamic setting of the Ionian-Tyrrhenian transition zone. This study is based on the interpretation of a multichannel seismic dataset (TIR10 survey), combined with the analysis of morpho-bathymetric and geodetic data, and with numerical modeling. This multidisciplinary and multiscale approach can contribute to unravel the particular role of this region in the context of a stepwise migrating subduction system and provides new constrains for the study of this highly populated area characterized by severe seismic and tsunamigenic hazard.