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Deep view of the Subduction-Transform Edge Propagator (STEP) fault in the Calabrian Subduction Zone

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The Calabrian Subduction Zone plays a key role in the evolution of the central Mediterranean in the framework of the convergence between Africa and Europe.

Here, the remnants of the World's oldest oceanic crust form a narrow NW-dipping slab passively subducting beneath the Calabrian Arc.

Recently published high-resolution seismic profiles and bathymetric data of the western Ionian Sea highlight the presence of a NNW-SSE faulting system connected with a series of Plio-Pleistocene syn-tectonic basins. These features are correlated with the recent activity of a major NNW-SSE deformation zone confining the active subduction to the SW and interpreted as a Subduction-Transform Edge Propagator (STEP) fault.

The goal of this work is to jointly reconstruct the geometry of the STEP fault and the subduction interface in its surroundings. We use multichannel seismic profiles acquired in the southwestern part of the Calabrian accretionary wedge to focus on the STEP fault geometry at depth and to analyse its relationships with shallow deformation features.

The quantitative analysis and enhancement of seismic data provided an accurate image of the internal structure of the accretionary wedge at various depths, showing growth strata in the Plio-Pleistocene succession and major discontinuities in the lower crust.

Our results depict a main subvertical, slightly east-dipping, lithospheric fault cutting the oceanic crust down to the Moho, and a rich set of associated secondary synthetic and antithetic faults. This picture also provides new insights on the STEP fault propagation mechanism.

In addition, the tridimensional correlation of the STEP fault occurrences in various seismic profiles provides a preliminary scheme of its segmentation and highlights the relationships of this master fault with other main structural elements of the Calabrian Arc and Eastern Sicily, including some of the faults deemed to be responsible for major historical earthquakes in the area.