Slab Tearing and Upper Plate Segmentation in the SW Hellenic Subduction Zone: Insights from Receiver Functions and OBS Tomography

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Résumé

The Hellenic-Aegean subduction zone has long been the focus of extensive study, particularly concerning surface morphology, upper crustal geology, and deep mantle processes such as slab rollback. However, the structure of the subduction system at intermediate depths down to 100–150 km has remained poorly constrained-especially the geometry of the actively subducting Ionian oceanic lithosphere.
Using a dense seismic network deployed along a 300-km-long transect across the Peloponnesus, central Greece, and the western Aegean Sea (as part of the EU-funded *THALES WAS RIGHT* project), we have resolved the 3D geometry of the subducting slab Moho with unprecedented detail. Receiver-function analysis reveals that the oceanic crust is segmented by nine trench-normal, subvertical faults, which are seismically active at intermediate depths. These structures point to dynamic interactions involving slab tearing, fluid-induced embrittlement, and fluid migration into the overlying mantle wedge.
Moreover, these faults appear to influence seismicity in the overriding plate and reflect its evolving tectonic regime. Their kinematic significance has been discussed by Le Pichon et al. (2019), who proposed a new model for the opening of the Eastern Mediterranean and the origin of the Hellenic Subduction Zone. Complementary results from ocean-bottom seismometer (OBS) local tomography of the SW Hellenic megathrust reveal slip segmentation and provide further insight into upper plate structural segmentation. Together, these findings suggest that crustal tectonic discontinuities and trench-normal slab tearing may both act to reduce the likelihood of M> 7 earthquakes.

Mots-Clés: Hellenic subduction zone, Receiver functions, local earthquake tomography

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