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Deformation of the Calabrian accretionary wedge and relative kinematics of the Calabrian and Peloritan backstops: Insights from multibeam bathymetry, high-resolution reflection and wide-angle seismics and analog modeling

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Recently acquired swath bathymetric data in the Ionian Sea document in unprecedented detail the morphostructure and dynamics of the Calabrian accretionary wedge. A boundary zone between the eastern and western lobes of the accretionary wedge is examined here. Relative displacement between the Calabrian and Peloritan backstops is expected to cause dextral strike-slip deformation between the lobes. A wide-angle seismic profile was acquired in Oct. 2014 with the R/V Meteor (DIONYSUS survey) recorded by 25 Ocean-bottom seismometers (Geomar and Ifremer instruments) and 3 land-stations (INGV stations). Inversion and forward modeling of these seismic data reveal a 5-10 km deep asymmetric rift zone between the Malta Escarpment and the SW tip of Calabria. Analog modeling was performed to test if the origin of this rift could be related to the relative kinematics of the Calabrian and Peloritan backstops. Modeling, using two independently moving backstops, produces a zone of dextral transtension and subsidence in the accretionary wedge between two lobes. This corresponds well to the asymmetric rift observed in the southward prolongation of the straits of Messina faults. Paradoxically however, this dextral displacement does not appear to traverse the external Calabrian accretionary wedge, where prominent curved lineaments observed indicate a sinistral sense of motion. One possible explanation is that the dextral kinematic motion is transferred into a region of crisscrossing faults in the internal portion of the Eastern lobe. The bathymetry and high-resolution reflection seismic images indicate ongoing compression at the deformation front of both the western and eastern lobes. Together with the analog modeling results, these observations unambiguously demonstrate that the western lobe remains tectonically active.