Interference patterns of two orthogonally converging accretionary wedges: analog modeling applied to the Calabrian prism and Western Mediterranean Ridge collision zone (Ionian Sea)

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In the Central Mediterranean, two very broad (>200km) accretionary wedges have formed ; the Mediterranean Ridge associated with the NE-SW converging Hellenic subduction zone and the Calabrian prism associated with the NW-SE converging Calabrian-Tyrrhenian subduction. Current kinematics (GPS observations) suggest convergence rates of 3.5 cm/yr and 4-5mm/yr respectively for the two systems. Some authors propose that Calabrian convergence may have stopped completely. These two accretionary wedges intersect and overlap in the central and northern Ionian Sea.

We present morphological observations (from swath bathymetric surveys) as well as reprocessed 96 channel seismic reflection data (acquired by the R/V Nadir during the Archimede survey) from the region where the two wedges interact. This includes: the domain where the intervening Ionian abyssal plain is still flat and undeformed, located between two frontal wedges with anticlinal folds formed above a Messinian decollement, a domain where gentle undulations are widespread, and the domain where two sets of anticlinal folds appear to create increasingly complex interference patterns which are difficult to interpret, especially in cross-section.

This deformation pattern is modeled using granular materials (sand) shortened over a weak decollement layer (glass beads). Two rigid, orthogonally moving backstops are used representing resectively the Calabrian crystalline basement block and the Peloponnesus-Cretan block to produce shortening in the foreland domain (representing the Ionian Sea). Two end-member situations are tested : simultaneous shortening at equal speeds,
first construction (and shortening) of one accretionary wedge, followed by a total stop of shortening, and then shortening of only the second accretionary wedge. The first produces a symmetrical interference pattern, the second system is clearly asymmetric, with the second (youngest) convergence direction dominating and carrying the older folds up along younger ramps. We conclude that the current day morphology in the Ionian Sea corresponds more closely to continued convergence in two directions, rather than one active system displacing an older, inactive accretionary wedge.