INSIGHTS ON THE SEISMOTECTONICS OF THE MERCURE BASIN AREA (SOUTHERN ITALY) BY INTEGRATED GEOLOGICAL AND GEOPHYSICAL DATA: COEXISTENCE OF SHALLOW EXTENSIONAL AND DEEP STRIKE-SLIP KINEMATICS

L. Ferranti[1,3], G. Milano[2], M. Pierro[1]
[1] Dipartimento di Scienze della Terra, delle Risorse e dell'Ambiente, Università Federico II, Napoli, Italy
[2] Istituto Nazionale di Geofisica e Vulcanologia, Osservatorio Vesuviano, Napoli, Italy
[3] CRUST, Centro inteRUniversitario per l'analisi Sismotettonica Tridimensionale con applicazioni territoriali, Italy

The southern Apennines are characterized by different seismotectonic regimes that affects adjoining regions. Whereas active extension characterizes the ridge and western part of the orogen, strike-slip seismicity is currently found in the eastern part of southern Italy. The boundary between extension and strike-slip deformation is ill-defined, and broadly runs east of the main mountain belt, where large historical and instrumental extensional earthquakes occur. Strike-slip earthquakes in the east have typically deeper (~15-35 km depth) focal depths than extensional earthquakes in the west, the latter being located in the upper ~12-15 km of the crust.

In this contribution, we assess the seismotectonics of the western part of the border area between the southern Apennines and Calabrian Arc, centered on the Mercure extensional basin, by integrating recent seismicity with a reconstruction of the structural frame from surface to deep crust. The analysis of low-magnitude ($M_L \leq 3.5$) events occurred in the area during 2013-2017, when evaluated in the context of the structural model, has revealed that seismic deformation is complex, that and a variety of different tectonic processes may be at work in this region.

This result is partly surprising because existing seismotectonic models hold that the axial part of the southern Apennines experiences solely extension, which is released during moderate and large earthquakes. Instead, low-energy events testify that extensional faulting with ENE-WSW tensile axes in the study area is segregated in the upper crust (above 9 km depth) and is mostly a low-rate prosecution of the so-called Pollino seismic sequence (2009-2012). As published geodetic data show, extensional seismicity is detached from laterally and vertically adjacent crustal domains which are characterized by strike-slip earthquakes. These results are consistent with the last kinematic event recorded on outcropping faults, and with the typical depth and

kinematics of normal faulting earthquakes in the axial part of southern Italy. Extensional earthquakes are located in the Apulian platform and probably reactivate existing faults that had an earlier (Early Pleistocene) and more significant history of transtension, as shown by our analysis of fault-slip lineations on outcropping faults. Thus, as documented elsewhere in the Apennines, active extension may be a young feature.

Strikingly, extensional seismicity abruptly ends where the normal faulting documented in the geological record terminate at the northeastern border of the Mercure Basin and is replaced by reverse and transpressional tectonics. In this latter area, intermediate (~9-17 km) depth strike-slip and locally reverse-oblique seismicity are observed prevalently in the Apulia middle crust. These earthquakes distribute along an ~ESE-WNW trending band and are characterized by NE-SW trending P-axes. Because these observations are at odds with the regional kinematics of strike-slip earthquakes in the eastern part of southern Italy, which have NW-SE trending P-axes, we argue that seismicity here is controlled by inherited mechanical anisotropies. These latter are represented by high-angle faults which acted as reverse during the contractional uplift of the Apulian unit beneath the southern Apennines. Unlike other strike-slip earthquakes in the eastern part of southern Italy, which are located in the Apulia unit underthrusting the Apennines orogen, the intermediate events studied here are found in the Apulia unit involved in contractional uplift. We propose that this departure from the regional pattern is controlled by the local anisotropy represented by an ~ESE-WNW trending deformation belt. This belt could be part of a regional deep crustal to lithospheric boundary stretching from the Tyrrhenian to the Ionian coast and separating the Southern Apennines from the Calabrian Arc.

Deeper (~17-23 km) strike-slip earthquakes differ with respect to intermediate depth strike-slip earthquakes because they have P-axis with a NW-SE trend, more akin to the regional strike-slip seismotectonics of eastern part of southern Italy. These deep earthquakes are found beneath and west of the extensional domain, and are conceivably located in the Tyrrhenian lower crust wedged between the Apennines and underlying Apulia foreland. Alternatively, because of the uncertainty in the reconstruction of the structural model, they could fall in the latter domain, where they would document tearing of the subducted Ionian-Adriatic plate. The deep strike-slip events conform to the regional kinematics, suggesting that they are controlled by the large-scale Adria-Europe plate interaction.