THE 2013-2015 SEISMICITY IN THE MERCURE BASIN (CALABRIA-LUCANIA BORDER, SOUTHERN ITALY): INSIGHTS ON THE SHALLOW AND MIDDLE CRUST KINEMATICS

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Introduction. The Mercure basin lies in the axial zone of the Southern Apennines and is part of an array of troughs formed during Quaternary extension (Fig. 1). Many of the extensional faults bordering these basins are active as demonstrated by earthquake focal mechanisms (Fig. 1), geodetic velocities (Ferranti *et al.*, 2014), and active fault studies (Papanikolaou and Roberts, 2007). East of the chain, strike-slip motion on mostly buried faults dominate the present-day deformation (Fig. 1), with focal depths that are deeper (15-35 km) than the extensional earthquakes in the west (Boncio *et al.*, 2007).

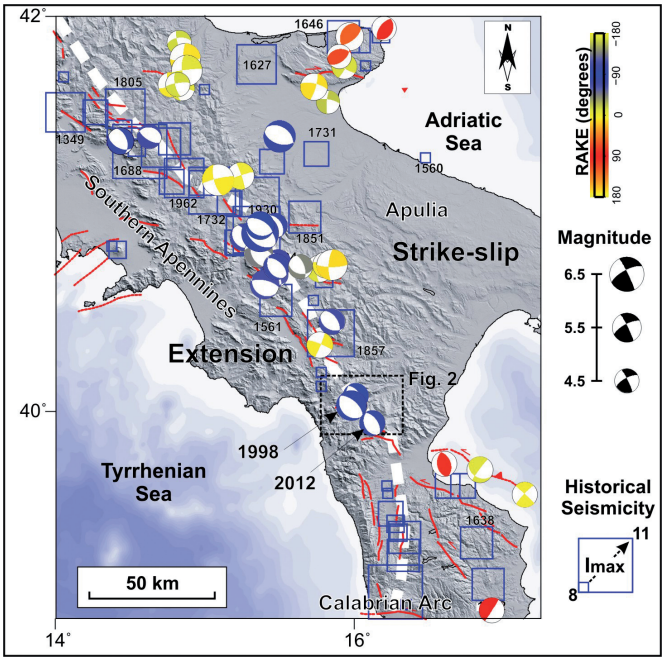

Fig. 1 – Seismotectonic regimes in southern Italy (modified from Ferranti *et al.*, 2014). Lower hemisphere, equal area projection of focal mechanisms compiled from recent literature and on-line catalogs for earthquakes with M > 4.5; focal mechanisms are colored according to rake. Blue squares are historical earthquakes from CPTI catalog (Rovida et al., 2016); Imax,maximum macroseismic intensity.The dashed white line represents the boundary between the Adriatic and Tyrrhenian Moho.

Between 2010 and 2013, a seismic crisis (the Pollino sequence) affected the area southeast of the Mercure basin. The strongest event had a Ml=5.0, and earthquakes distributed between 5-10 km depth, with chiefly extensional kinematics (Totaro *et al.*, 2015). The authors suggested that the faults activated at depth during the sequence are located SE of the basin. These faults align with WNW-ESE striking faults that bound to the north the Mercure basin (CaF and CPST, Fig. 2). The CPST is considered to be the seismogenic source of the Mw=5.5 1998 earthquake (Brozzetti et al., 2009). After the Ml=5.0 event occurred on October 25, 2012, the seismicity in the epicentral area abruptly decreased and the sequence could be considered ended in spring 2013.

In order to assess the latest background seismicity of the Mercure basin and surroundings, we analyzed the seismicity between June 2013 and December 2015, immediately following the significant slowdown of the Pollino sequence.

Data and results. We utilized data recorded by the seismic stations belonging to the Italian National Seismic Network of the INGV (Fig. 2). In order to obtain reliable hypocenters distribution and fault plane solutions, we collected the waveforms of the events occurred in the area between Latitude 39.300 – 40.140 and Longitude 15.800 – 16.200 to perform a re-picking of P- and S-phases and to obtain a P-wave dataset polarity. Overall, ~250 events with 1.0=Ml=3.0

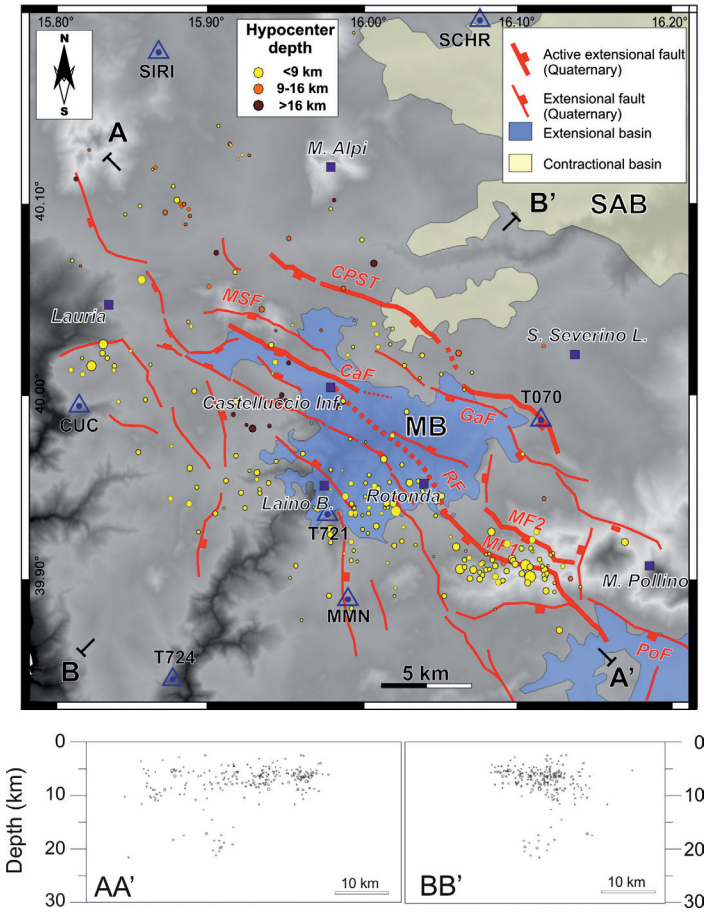

Fig. 2 – 2013-2015 seismicity and fault map of the Mercure Basin (MB) and surroundings (SAB=Sant Arcangelo Basin). Faults: CPST=Castello Seluci-Piana Perretti-Serra Mancieri-Timpa della Manca; MSF=Madonna del Soccorso; CaF=Castelluccio; RF=Rotona fault; MF1, MF2=Mercure fault 1, 2, which are considered the seismogenic sources of the 2010-2013 sequence. Sources: Brozzetti *et al*. (2009); Totaro *et al*. (2015). Inverted triangles are INGV stations used in this study.

were re-located (Fig. 2) and ~25 well-constrained focal mechanisms were computed.

The epicentral distribution is nearly parallel to the mapped faults and to the axis of the chain (Fig. 2). The concentration of events SE of the Mercure basin falls in the same area affected by the Pollino seismic sequence. The hypocenters distribution show that about 85% of the events are confined between ~5-12 km depth, whereas the remaining events have depth between 16 and 22 km (Fig. 2).

Fault plane solutions of the 5-12 km deep events show an extensional kinematics with prevailing NNW-SSE to NW-SE trending nodal planes. The trend of the T-axes ranges from ENE-WSW to NE-SW (Fig. 3) and keeps sub-orthogonal to the mapped normal faults (Fig. 2).

The projection of nodal planes from the focal depth to the surface suggests possible relation with the mapped normal faults (Brozzetti *et al*., 2009; Totaro *et al*., 2015). Although the dataset is relatively limited, we found that some events are consistent with activation of the deep (5-12 km) parts of the WNW-ESE striking Castelluccio and Castello Seluci-Piana Perretti faults (thick solid faults in Fig. 2). The latter fault, including its southward extension to Timpa della Manca (CPST fault), was considered the seismogenic structure of the Mw=5.5 1998 earthquake by Brozzetti *et al*. (2009).

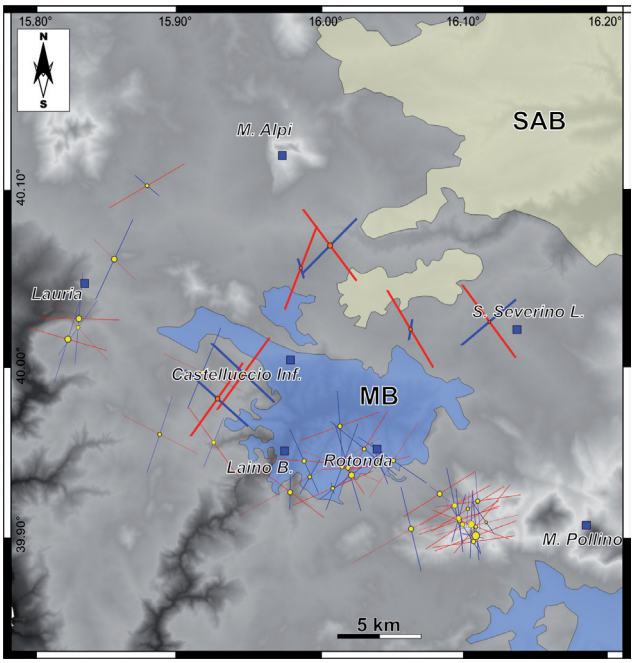

Fig. 3 – Distribution of T- (redlines) and P-(blue lines) axes computed from focal mechanisms. Thin and thick lines lines are axes from earthquakes with depth < and >9 km, respectively. The length of each axis is proportional to the cosine of the plunge.

As regards the second, more limited group of events distributed between 16-20 km depth, 9 of them (Ml<2.5), all with focal depth around 20 km, occurred in few hours on August 28, 2013. The fault plane solutions of two events from this swarm (located few km SW of Castelluccio inferiore, Fig. 3) are characterized by strike-slip kinematics with ~E-W and N-S nodal planes. Their T- and P-axes have NE-SW and NW-SE trends, respectively. Apart this swarm, all the remaining deep events with strike-slip to reverse-oblique kinematics are confined just to NE of the extensional fault belt (Fig. 3).

These observations hinder the possibility that the deep strike-slip regime (Ferranti *et al.*, 2014), which characterize the eastern part of southern Italy (Fig. 1), is present also beneath its western part.

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