Tectonic evolution of the western Catanzaro Trough (Calabria, South Italy), preliminary results

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Abstract

The study area is located in the western sector of the Catanzaro Trough (central Calabria), extending from the Sila Massif, on the South, to the Serre Massif, on the North (Fig. 1). The aim of this work is to define the Plio-Quaternary evolution of central Calabria Arc. The preliminary structural and geophysical data analysis allow us to identify two main fault patterns: 1) the WW-ESE oriented system has controlled the opening of Catanzaro Trough during the Middle Miocene; 2) the NE-SW oriented fault system which produce an overall WW-ESE extension, likely due to the development of the Tyrrhenian Rift Zone. The structural framework of the Calabrian belt is further complicated by the re-activation of these oriented fault systems, time after time, with different kinematics. The structural complexity is strictly related with the highest probability of occurrence of major earthquakes in the Mediterranean region. The distribution of crustal seismicity shows that most of the events which have occurred in the study area are located in the hanging-wall of Plio-Pleistocene normal faults, the largest of which reached magnitude, instrumentally estimates, in a range of Mw>7 (as the earthquakes sequence of 1738, the 1838 and the 1905 earthquakes) (Fig. 2).

Fig. 2: Episternal location of historical earthquakes and major faults in the study area.

Structural features of Catanzaro Trough

The CT (Catanzaro Trough) is bounded by different fault sets influencing its morpho-tectonic evolution. The preliminary structural results, coming from structural data and seismic lines interpretation allow us to identify several tectonic phases that have characterized the study area since Middle Miocene. Assuming a constant seismic velocity of 2200 m/s for Plio-Quaternary sediments, we can estimate discontinuities existing within the Plio-Quaternary sedimentary sequence of the VIDEPi profiles (Fig. 3).

Fig. 3: On the right, structural map of study area, we have defined some morpho-tectonic fault patterns: a) WW-ESE oriented faults system with normal and oblique kinematics bounding to the north the CT, whereas the NE-SW oriented faults showing normal and right oblique kinematics, extruding to the northeastern edge; b) NE-SW and NE-GW oriented faults system, south of CT showing normal and oblique kinematics and describing a new extensional tectonic phase, likely active during the Pliocene and producing a further deepening of the basin.

Conclusion

The new geo-structural data allowed us to provide further insights on the Neogene-Quaternary “Catanzaro Trough” evolution. The development of this basin has been intensely influenced by two sets of Major Faults. The first of these, the WW-ESE oriented faults system, borders the northern (Lamezia Terme-Catanzaro Fault; Tansi et al., 2007) and southern (Staletti-Squillace-Maida Fault) edges of the Catanzaro Trough. The second ones are characterized by the NE-SW (Vibo Valentia faults) and the NNE-SSW (Curinga faults) oriented fault systems.

These Major Faults show different kinematics phases:

• Extensive Phase (Middle Miocene)
• Compressional/transpressional phase (late Miocene -Pliocene)
• Extensive locally transtensive phase (Pliocene-middle Pleistocene),
• Extensive phase (late Pleistocene)

The first two phases are mainly related to the WW-ESE faults system, even though locally they show transtensional kinematics. The latter have been related to the NE-SW and NNE-SSW faults system, outcropping along the northwestern and southwestern margins of Catanzaro Trough. By agreement with the latter faults system, in the offshore Tyrrhenian area, the S. Eufemia Fault activity has been described, this NE-SW oriented normal fault offsets the Holocene sedimentary cover (Loreto et al., 2013) contributing to the deepening of the sedimentary basin (Fig. 4).

In conclusion: the WWN-ESE oriented faults are responsible for opening of a NW-SW palaeostrait that connected the Tyrrhenian area to the Ionian Sea during multiple tectonics until early Pleistocene. While NE-SW and NNE-SSW fault systems border and control a Late Quatemary Catanzaro Trough Sub-basin, arranged as a Graben System, in response to the last extensional stages of Tyrrhenian back-arc basin opening.

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References