Multidisciplinary approach for 3D geological model reconstruction: the example of Mt. San Calogero (Sciacca, Southwestern Sicily)

Rizzo G.F.*[1-2], Maiorana M.[1] & Gasparo Morticelli M.[1]

[1] Dipartimento di Scienze della Terra e del Mare, Università di Palermo.
[2] Dipartimento di Scienze della Terra e Geoambientali, Università di Bari "Aldo Moro".

Corresponding author email: giuseppefrancesco.rizzo@unipa.it

Keywords: 3D geological model, Mt. San Calogero, Sicilian chain

The inability to access continuously and directly to subsurface data forces geologists to use a combination of different methods and a multidisciplinary approach to determine in high detail the possible extents of deep geological geometries. We analysed the carbonate relief of Mt. San Calogero (about 390 m a.s.l.), part of the "geological sheet 628 Sciacca" (CARG project). Field collected data were used for a preliminary 3D geological model reconstruction. The results were integrated with the seismo-stratigraphic and structural interpretation of 2D seismic reflection profiles calibrated with stratigraphic wells, covering the offshore sector of the study area. Mt. San Calogero, which belongs to the outer sector of the western Sicilian Fold and Thrust Belt, represents an outcrop of part of the paleogeographic domain known as the " Saccense". The outcropping succession is characterized by thick shallow-water carbonate platform deposits from the Lower Jurassic overlain by condensed pelagic deposits from the Middle-Upper Jurassic to the Eocene, covered by the Oligo-miocenic syntectonic clastic deposits. The new collected data confirmed that Mt. San Calogero represents the outermost deformed portion of the western Sicilian chain composed of a double verging compressional structure delimited by NNE-SSW-trending left-lateral transpressive faults involving deposits of Calabrian age. In the offshore sector the seismic profiles interpretation highlighted the presence of a NE-SW-oriented ramp-anticline, bounded by high-angle deformation with transpressive kinematics. To establish a structural continuity between Mt. San Calogero structural high and the adjacent offshore compressive structure, additional data were integrated. The gravimetric anomaly map of this sector shows positive values of the Bouguer anomalies, with approximately NE-SW direction. In addition, data regarding heat fluxes show that there is a direct connection between the geothermal field of Sciacca, which reaches a temperature of approximately 76°C at a depth of 2600 m b.s.l., and the offshore sector, where thermal anomalies and fluids evidence are documented. In general, the structure thus identified represents the northward prosecution of a compressive/transpressive structural high with an approximately N-S trend, recognized in different literature data (Catalano et al., 2000; Fedorik et al., 2018). This multidisciplinary approach therefore allowed a more correct and continuous correlation between onshore/offshore structures and the definition of the offshore extent of a structure essential for understanding the tectonic evolution of the Sicilian chain.

Catalano R. et al. (2000) - Central western Sicily structural setting interpreted from seismic reflection profiles. Mem. Soc. Geol. It, 55, 5-16.

Fedorik J. et al. (2018) - Structural analysis and Miocene-to-Present tectonic evolution of a lithospheric-scale, transcurrent lineament: The Sciacca Fault (Sicilian Channel, Central Mediterranean Sea). Tectonophysics, 722, 342-355.