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Active tectonics and potential seismogenic behavior of newly imaged structures in the Gulf of Santa Eufemia (southern Italy)

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During the summer of 2010 a wide geophysical, geological, bio-geochemical and oceanographic dataset was acquired within the Gulf of Santa Eufemia (SE Tyrrhenian sea, Italy). The aim of the project was to study the active tectonics of the region, including the potential seismogenic structure responsible for the 8 September 1905 (Mw 7.5) earthquake, which caused a 1.5 m of tsunami wave and several casualties and damage to the entire Calabria region. To achieve this aim, 330 km of seismic data, 2223 km of Sub Bottom Chirp profiles, and 2231 km^2 of high resolution morpho-bathymetric data were acquired and analyzed.

Morpho-bathymetry highlighted the presence of a deep and wide canyon, already identified as Angitola Channel (Gamberi & Marani, 2004); this feature shows an E-W trend in the sector toward the coast, and a meandering trend in the seaward segment. The first segment of the channel shows a likely tectonic control, as imaged by Chirp profiles, and could be associated with a likely N75° oriented transtensive structure. The analysis of the seismic dataset shows that such tectonics locally affects the entire sedimentary cover from Pre-Pliocene units up to the seafloor. The seismic images also highlight another key structure trending about N113°, whose character is defined by the sediments deformation and associable to a strike-slip fault with vertical movements.

The top of Pre-Pliocene units, whose map was interpolated using the Kingdom software (Seismic Micro-Technology Inc.), rises in the central part of the Gulf and deepens in the inner sector close to the coast, near the Angitola Channel. While the analysis of the high resolution morpho-bathymetric image yields no evidence of sediments deformations in the central part of the Gulf, several gravitational instability scars are recognisable along the internal slope. Moreover, several fluid escape features and mud volcanoes are recognized, even on bathymetry and on Chirp data, from the coast toward the internal slope of subsea sediments.

To obtain an hypothesis about the source location of the 1905 earthquake, the KF inversion method (Pettenati and Sirovich, 2007), based on the macro-seismic intensity catalogue data (Gruppo di Lavoro DBMI04, 2004), was applied. One preliminary solution of the inversion is represented by a dip-slip structure, NNE-SSW oriented and located inside the Gulf of Santa Eufemia close to the coast. Another possible solution defines a structure with strike-slip motion, oriented N110 close to the Angitola Channel. Although preliminary is still needing validation by historical seismograms, the latter solution promisingly fits the transpressive structure identified in the Gulf. In spite of this fact, the structure that controls the Angitola Channel must also be taken into account.

1 References

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