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Approaching the potential seismogenic source of the 8 September 1905 earthquake: New geophysical, geological and biochemical data from the S. Eufemia Gulf (S Italy)

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The earthquake that occurred on 8 September 1905 is one of the strongest events that ever affected western Calabria. This event caused 557 casualties, more than 2000 injured, and left about 300,000 people homeless. The mainshock was followed by a feeble tsunami and hundreds of aftershocks. During the last 15 years, various authors proposed hypotheses for a seismogenic source causative of the 1905 earthquake, apparently diverse and without an unequivocal solution. To study the active tectonics of the region and to gain insight into a potential seismogenic source responsible for the 1905 event, we carried out a well-targeted multidisciplinary survey within the Gulf of S. Eufemia (summer 2010) in the frame of the ISTEGE project, using the R/V OGS-Explora. The acquired dataset consists of geophysical data, oceanographical measurements, and biological, chemical and sedimentary samples.
The analysis of the geophysical data (330 km of MultiChannel Seismic, 2223 km of sub-bottom Chirp profiles, and 2231 km2 of high resolution morpho-bathymetric data) allowed the identification of some main morpho-structural features characterizing the sedimentary basin hosted within the S. Eufemia Gulf. The three main tectonic structures shaping the basin and its sedimentary bodies are: 1) an E-dipping large normal fault, N31° oriented; 2) a WNW-trending polyphased fault system; and 3) a likely E-W trending fault with dip-slip motion. Among these, the large normal fault shows evidence of activity, as witnessed by the deformed recent sediments, and by the lineament due to consistent seabed rupture observed on the seafloor along which, locally, fluids leakage occurs. Finally, evidence of probable geothermal activity is reflected by the anomalous distribution of prokaryotic abundance and biopolymeric C content, whereas no such evidence comes from water temperature analysis (CTD measurements).
The various seismogenic sources proposed in the literature make up a composite framework of this sector of western Calabria, and can be reviewed a) in the light of the geological evidence arising from the newly acquired multidisciplinary dataset and b) against regional seismotectonic models – with surprising results. Re-appraising such a major historical earthquakes as the 1905 one located within poorly explored submarine areas, promisingly enhances the seismotectonic picture of western Calabria. A comprehensive understanding of the region and robust constraining of the seismogenic source of the 1905 earthquake may arise from an integrated interpretation of our data together with a) on-land field evidence and b) seismological modeling.