

First results of an INGV project for the integrated analysis of the active tectonics in SW Sicily

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We present the first results of a project financed by the “Struttura Terremoti” of INGV to study the potential sources of earthquakes in south-western Sicily, including the area hit by the 1968 Belice earthquake sequence and the archaeological area of Selinunte, affected by two earthquakes in historical times. We adopt in this project a multi-disciplinary approach, with the goal of addressing the following points: 1) define the active tectonic framework of south-western Sicily, 2) investigate and characterize on-shore and off-shore faults, potential sources of damaging earthquakes, and 3) evaluate the current deformation rates. To do this, we collected a new set of geodetic (GPS and InSAR) and geochemical data, and performed geological and geomorphological surveys on-land in the area between Mazara, Castelvetro and Selinunte. We also acquired high-resolution Sparker seismic profiles off-shore Sciacca.

Geological and geomorphological surveys have been focused around the ~10 km long Castelvetro-Campobello di Mazara (CCM) lineament, where previous research (Barreca et al., 2014) showed geodetic and geoarchaeological evidence of recent deformation. In particular, a detailed survey of Quaternary coastal forms and deposits was performed, in order to reconstruct the sequence of uplifted paleoshorelines and to search for differential motions between adjacent coastal sectors spanning the CCM. Preliminary observations indicate that the footwall of the CCM hosts a larger number, and a more elevated position of paleo-shorelines suggestive of syntectonic uplift. A grid of about 200 km of high-resolution reflection seismic profiles was recorded along the continental shelf in the offshore of Sciacca. Profiles are mostly oriented in the WNW-ESE direction, with tie lines acquired in ENE-WSW direction. The acoustic source used during seismic prospecting was a 1 kJ Sparker power supply with a multi-tips Sparker array. Preliminary seismic data interpretation indicates that a number of high-angle, NNE-SSW-trending, left-lateral strike slip faults are present offshore the town of Sciacca. The offset of the sea floor suggests that the fault movement is still active. Expulsions of fluids along faults have also been observed along the continental shelf where mound-shaped, cold-seep communities formed.

Under the hypothesis that earthquakes related to the Castelvetro-Campobello di Mazara tectonic lineament could have induced the destruction of the ancient town of Selinunte, a re-analysis of the archaeoseismological data on the seismic collapse of Selinunte temples has been performed. The latest seismic event or seismic sequence has been constrained between the 4th and the 6th century A.D.. This event caused oriented collapse in most of the Selinunte temples (e.g. Temples C, D and E), whereas temple G collapsed inwards upon itself. The type of collapse observed in the temple G was matter of debate among scholars and two different hypothesis have been reported so far. Some archaeologists assumed that the temple G was hypaethral, or unroofed with an open central nave and cella, whereas others that the temple was never completed.

As regards the geochemistry, the results of measurements of soil CO₂ flux carried out in the north-eastern area of Belice Valley highlights the presence of sites with high degassing level (up to 350 g m⁻² d⁻¹) with a CO₂ supply of crustal origin. The sites with crustal contribution are mainly aligned along NE-SW direction. The tectonic control on the geochemical characterization and flow path of groundwater is particularly evident in the Santa Ninfa gypsum karst structure, located within the area hit by the 1968 seismic sequence, and close to the epicentres of the most energetic seismic events (M>3.0) occurred in the Belice area during the last 30 years.

We also collected GPS data from permanent and episodically surveyed station in SW Sicily with a twofold aim: 1) to retrieve new insights about the geodynamics of this sector of Sicily and 2) to verify the active deformation

of the creeping segment already identified by Barreca et al. (2014) between Campobello and Castelvetro. We re-surveyed the IGM (Istituto Geografico Militare) benchmarks of this area and a new dataset of benchmarks already measured in 2007 by the University of Palermo for cartographic applications. Finally, the SENTINEL 1A TOPSAR Advanced DinSAR analysis covering the 2014-2016 time spanning, confirms the presence of a lineament running NNE-SSW between Campobello and Castelvetro, showing meaningful LOS displacements.

Barreca G., Bruno V., Cocorullo C., Cultrera F., Ferranti L., Guglielmino F., Guzzetta L., Mattia M., Monaco C., Pepe F., (2014) Geodetic and geological evidence of active tectonics in south-western Sicily (Italy). *Journal of Geodynamics*, 82, 138-149