

Characteristics of the recent seismic activity on a near-shore fault south of Malta, Central Mediterranean

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The tectonic setting of the Maltese islands is mainly influenced by two dominant rift systems belonging to different ages and having different trends. The first and older rift created the horst and graben structure in northern Malta. The second rift generation, in the south, including the Maghlaq Fault, is associated with the Pantelleria Rift. The Maghlaq Fault is a spectacular NW – SE trending and left-stepping normal fault running along the southern coastline of the Maltese islands, cutting the Oligo-Miocene pre to syn-rift carbonates. Its surface expression is traceable along 4 km of the coastline, where vertical displacements of the island's Tertiary stratigraphic sequence are clearly visible and exceed 210m. These displacements have given rise to sheer, slickensided fault scarps, as well as isolating the small island of Filfla 4km offshore the southern coast. Identification and assessment of the seismic activity related with Maghlaq fault, for the recent years, is performed, re-evaluating and redetermining the hypocentral locations and the source parameters of both recent and older events.

The earthquakes that have affected the Maltese islands in the historical past, have occurred mainly at the Sicily Channel, at eastern Sicily, even as far away as the Hellenic arc. Some of these earthquakes also have caused considerable damage to buildings. The Maghlaq fault is believed to be one of the master faults of the Sicily Channel Rift, being parallel to the Malta graben, which passes around 20km south of Malta and shows continuous seismic activity.

Despite the relationship of this fault with the graben system, no seismic activity on the Maghlaq fault had been documented previous to 2015.

On the July 30th 2015, an earthquake was widely felt in the southern half of Malta and was approximately located just offshore the southern coast. Since then, a swarm of seismic events lasting several days, as well as other isolated events have occurred, indicating the fault to be seismically active. Investigation of the nature of the seismic events and other previous activity that may have been misclassified due to poor location capability, is performed. Such results are of utmost importance in order to reveal the implication of this newly-discovered activity on the seismic hazard to the Maltese islands and also to improve understanding of the local geodynamics, highlighting the mechanisms that contribute to both the crustal deformation and the tectonics of the upper crust.

The investigation is carried out using the stations of the recently extended Malta Seismic Network and regional stations. The results are evaluated in the context of the role of the Maghlaq fault in the extensional tectonics associated with the Sicily Channel Rift and the African continental margin.