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Fluid escape structures in the Graham Bank region (Sicily Channel, Central Mediterranean) revealing volcanic and neotectonic activity.

Daniele Spatola, Valentina Pennino, Luca Basilone, Francesco Interbartolo, Aaron Micallef, Attilio Sulli, and Walter Basilone

Italy (daniele.spatola@unipa.it)

In the Sicily Channel, (Central Mediterranean), two geodynamic processes overlap each other, the Maghrebides-Apennines accretionary prism and the Sicily Channel rift. Moreover, the northwestern sector (Banks sector) is characterised by an irregular seafloor morphology linked to the recent volcanic and tectonic activity.In order to discriminate the role exerted by both the processes in the morphostructural setting of the area we used a dataset of both high and very high resolution single-channel and multi-channel profiles, acquired in the frame of the RITMARE project respectively with CHIRP and sparker, and airgun sources, and high resolution (5 m cell) morpho-bathymetric data.

The data allowed us to identify and characterise two areas where different geological features (sedimentary and volcanic) are prevailing. They present fluid escaping evidence, which often appears to be active and generating different types of morphologies (both positive and negative).

In the western sector we recognised pockmarks at water depths of 195 to 317 m, with diameters from 25 to 580 m, depths from 1.3 to 15 m, and slope up to 23°. They show sub-circular shape in plan-view and reflectors with upward concavity in cross section, and are oriented along a NW-SE trend.The CHIRP and multichannel profiles highlight fluids that affect the Plio-Quaternary succession, especially in areas where the top surface of the Messinian succession is shallower.

Conversely, wipe-out acoustic facies were recognised in proximity of: i) extensional faults of Mesozoic age with NW-SE trend; ii) dip/strike slip faults of Cenozoic age with NW-SE, N-S and about NNE-SSW trends, and iii) extensional neo-tectonic faults with NW-SE and NNW-SSE trends. We cannot exclude that they could feed the shallower reservoir producing a mixing between the two.

In the eastern sector we recognised a cluster of volcanoes composed of seven cone-shaped structures (SCV1-7), pertaining to a wide area known as Graham Bank. A detailed morphometric analysis of these volcanoes has been conducted: they are up to about 115-160 m high and 500-1500 m wide. Most of them show very strongly inclined flanks with 30° of average slope. The SCV2 and SCV3 form the Graham Bank, 3.5X2.8 km wide, elongated in the NW-SE direction. At the top of SCV2 focused seepage plumes were observed in the entire water column, through the CHIRP data, where we calculated that they release, a volume of about 10950 m3 and 43960 m3of gases, respectively.

In this work, we present the first results of a data collection that have got as main result the identification and mapping of the fluid escape structures revealing the relationship between the active tectonic with migration of fluids, to be used to assess the Submarine Geo-Hazard in the Sicily Channel. We identified two fluid escape fields whose genesis and evolution appear linked to the neotectonic and volcanic activities respectively, that represent the main controlling factors for the migration of fluid; considering the good correlation between pockmarks and the main identified fault systems. In conclusion, our results suggest that the degassing of fluids in this region is rooted at depth, and is mainly aligned with the NW-SE dip/strike slip fault systems, repeatedly reactivated, and linked to the volcanic activity.