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Fluid escape structures revealing volcanic and tectonic activity in the Graham Bank (Sicily Channel)

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The Graham Bank (NW Sicily Channel, Central Mediterranean) is characterised by a complex seafloor morphology, where morphostructural highs, submarine plain, escarpments, and negative and positive relieves indicate a complex structural setting and the occurrence of seepage fluids.

New high-resolution acoustic data (multibeam, Chirp profiles) and multi-channel profiles, allowed us to differentiate two main morphological sectors, and to identify several pockmarks and mounds linked to fluid escape phenomena.

The eastern sector, corresponding to the volcanic edifices of the Graham Bank, is characterised by volcanic context with rough morphology, several mounds, focused seepage plumes and magmatic acoustic substrate, all related to the activity forming both the Graham Bank and the new volcanic cones here identified.

The western sector displays a generally flat morphology dominated by Late Pleistocene-Holocene outer shelf deposits, where mounds and pockmarks with sub-circular and ellipsoidal shapes, V- to U-shaped in cross-section, are the prevailing features indicating the migration of fluids to the seafloor.

These two areas are separated by a vertical deep fault forming a deeply incised channel with NW-SE direction. The latter is bordered by steep walls forming fault escarpments, which shed the eroded materials to the adjacent lower slope and deep-water zones.

The overall morphostructural setting suggests a tectonic control in the morphological conformation of the seabed and in the distribution of both pockmarks and mounds. The aligned mounds have both NW-SE and NNW-SSE orientation, sometimes extending several hundred metres and forming hummocky surfaces. The aligned pockmarks are strictly comparable to the orientation of the faults related to the most recent tectonic activity.

The good correlation between fluid escape structures and the main fault systems involving the kilometric sedimentary cover suggests that the degassing of fluids is rooted in depth revealing that extensional tectonics acts with very deep sub-vertical recent faults developing along and reactivating the Cenozoic (both Plio-Quaternary and Messinian) and Mesozoic tectonic systems.