Two different uplifting systems offshore Mount Etna: salt and tectonics in the Ionian Sea

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Motivation

The Ionian Sea is a complex tectonic and stratigraphic area. The Calabrian Ridge subduction system records a long history of sedimentation, erosion, vertical movements, and tectonic activity. However, its precise structural controls and the extent of Messinian evaporitic deposits are still debated. Here, an structural high evidenced by the deviation in the drainage paths (Fig. 1) raise the question on **salt presence in the Upper Ionian Basin and tectonic uplift**.

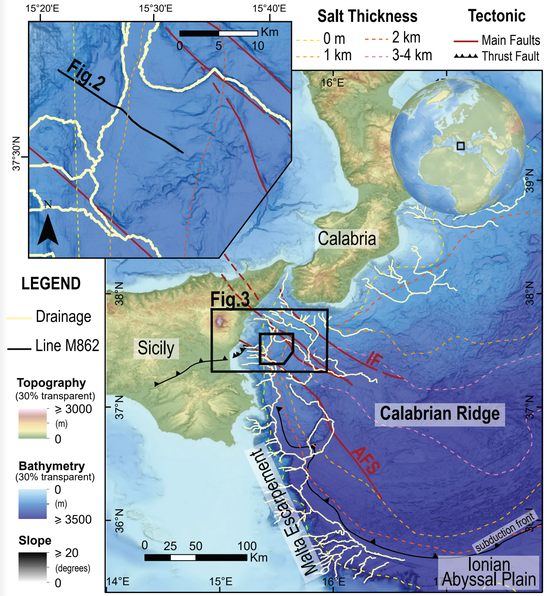

Fig. 1 Study area in the Ionian Basin with the main tectonic features (Gutscher et al., 2017, 2019), and the salt thickness contour lines proposed by Camerlenghi et al. (2020). Main canyon and channel paths show an unusual deviation indicating a structural high, here referred to as the Central Area (Fig. 3). The changes in the seafloor morphology indicate a vertical movement or uplift between two fault systems.

We use high-resolution 2D seismic data along with ship-based bathymetry and its derivatives (BPI and SVF) to understand the causes and effects of this isolated uplifting feature (Fig. 2 and 3).

Results

We identify two distinct vertical movements (Fig. 2):

1. Long-wavelength diapirs - central area uplifted between two fault systems with a long-lasting and slow tectonic uplift affecting the depositional processes, such as the channels paths, landslides, and bottom current reworking (sediment waves).

Evidence of "slow" uplift: *central area doming, folding deep strata, mass transport deposits (MTD), thinning and pinching the sediment package, minibasin formation, channel devitation (C1).*

2. Short-wavelength diapirs - four diapirs surrounding the central area (three elongated and one dome-shaped), two of them adjacent to the faults systems (D2 and D4) and the other two in between them (D1 and D3). A fast uplifting is suggested due to the minibasin formation and salt density inversion.

Evidence of "fast" uplift: *narrow vertical uplift, cutoff sediments, onlap termination, chaotic facies, thinning package, faulting and radial faults, channel restriction and deviation (C2).*

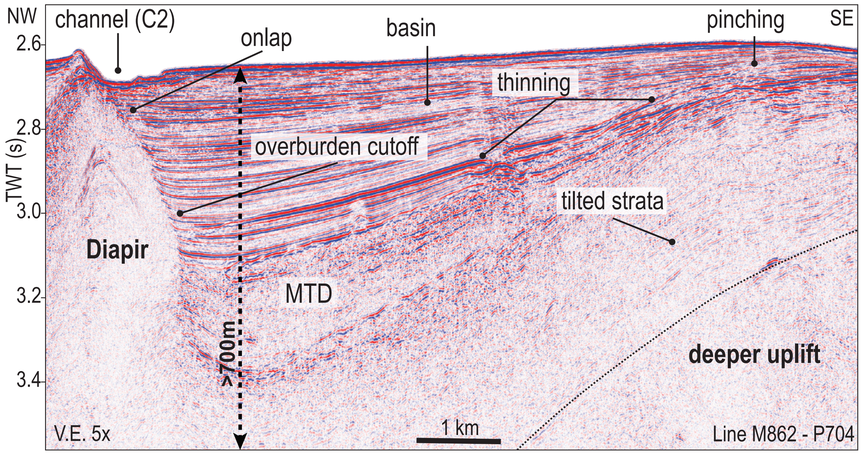

Fig. 2 Seismic profile crossing the central area (Fig. 1) showing the two uplifts, long-wavelength (to the left) and short-wavelength (diapir), and its imprint in the basin stratigraphy. Minibasin overburden is over 900m thick (first 700m shown in Fig. 2, considering a velocity of 1600m/s)

The response to the uplift in the basin is seen through changes in the seafloor channel paths, landslide scars, separated drifts, minibasin formation, lineaments, radial faults, and offsets of seafloor structures that can be linked back to **active tectonics and halokinesis** (Fig.3).

Results

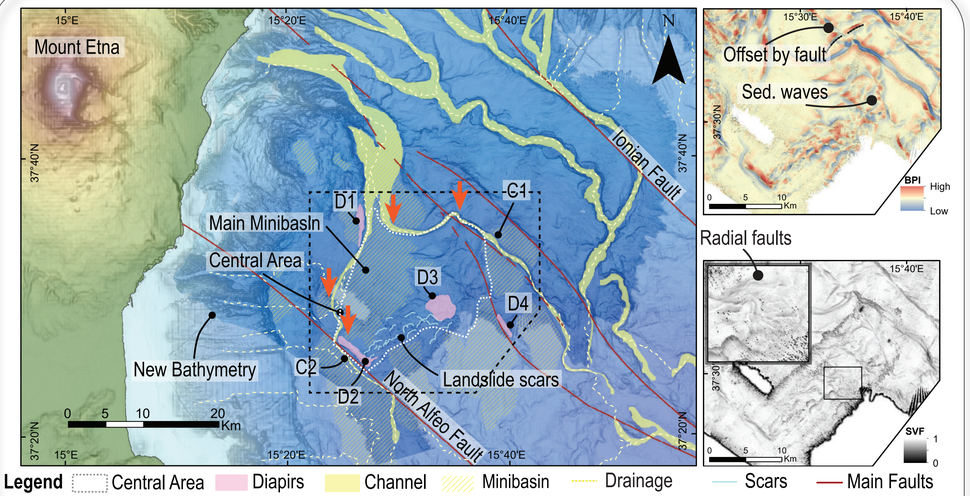

Fig. 3 Geomorphological interpretation of the seafloor imprint from the vertical movement of the Central area and the diapirs (D1 to D4). The main minibasin is formed by the uplift of the central area and it leads to channels (C1 and C2) deviation (orange arrows). Bathymetry Position Index (BPI) shows structural highs (red) and depressions (blue). The Sky View Factor (SVF) highlights the relief and in this case the radial faults over D3. Localization in Fig. 1.

Conclusions

- Salt evidence in the Upper Ionian Basin inside the Accretionary Wedge.
- Vertical movement imprinted in the seabed.
- Interaction between tectonic and sedimentation to control uplift.
- Long-wavelength uplift is responsible for triggering the short-wavelength rising through minibasin formation and later density inversion.

Acknowledgments

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