Late Miocene-Quaternary diapiric activity in the SW Iberian Margin: Interaction between salt and shale structures and deep-water sedimentation

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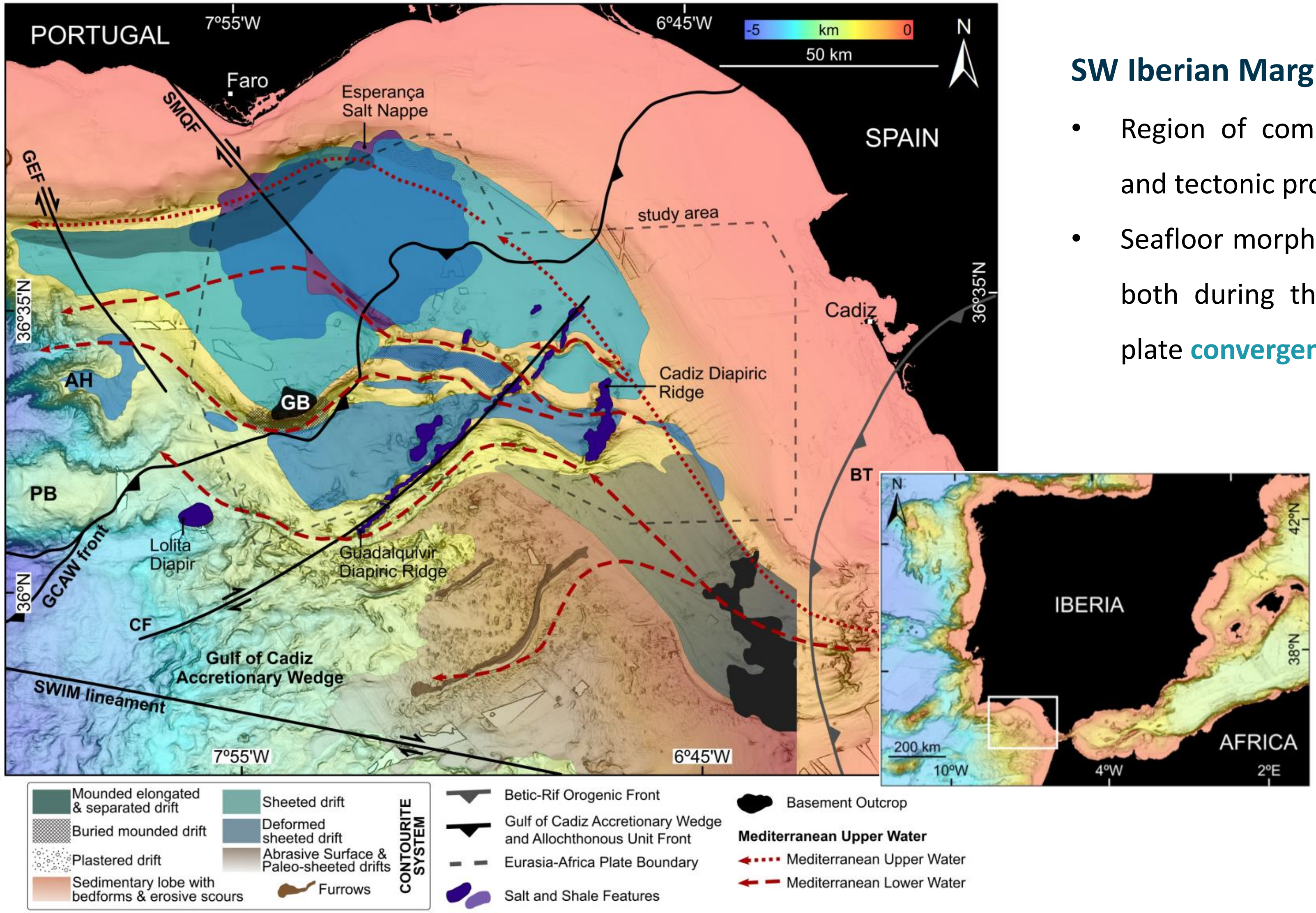
Introduction



SW Iberian Margin – Northern Gulf of Cadiz

- Region of complex interplay between sedimentary, oceanographic and tectonic processes.
- Seafloor morphology influenced by regional lithospheric movements, both during the Mesozoic **rifting** and the following Eurasia-Africa plate **convergence**[1,2], and by local **diapiric processes**[3,4].

Gulf of Cadiz Contourite System

- Developed as consequence of the interaction of the Mediterranean Outflow Water with the continental middle slope.
- Key location for exploring the influence of diapiric activity on deep-water sedimentation.

Fig. 1 Geographic location of the study area: (a) Regional setting, with the main tectonic structures. White rectangle show the study area; (b) Detailed map of the margin showing the main oceanographic and structural features. GB: Guadalquivir Bank, PB: Portimão Bank, AH: Albufeira High. Coordinate system: UTM-29N WGS84. Bathymetric data from the EMODnet Bathymetry Consortium, (2018)

Introduction

AIM

- Understand how the diapiric structures controlled the evolution of the deep-water sedimentation during the late Miocene-Quaternary.

DATA & METHODS

- Analysis of a multi-survey dataset of 2D and 3D multichannel seismic reflection profiles.
- Multibeam bathymetry from EMODnet database.
- Well data and industry and IODP Exp. 339.

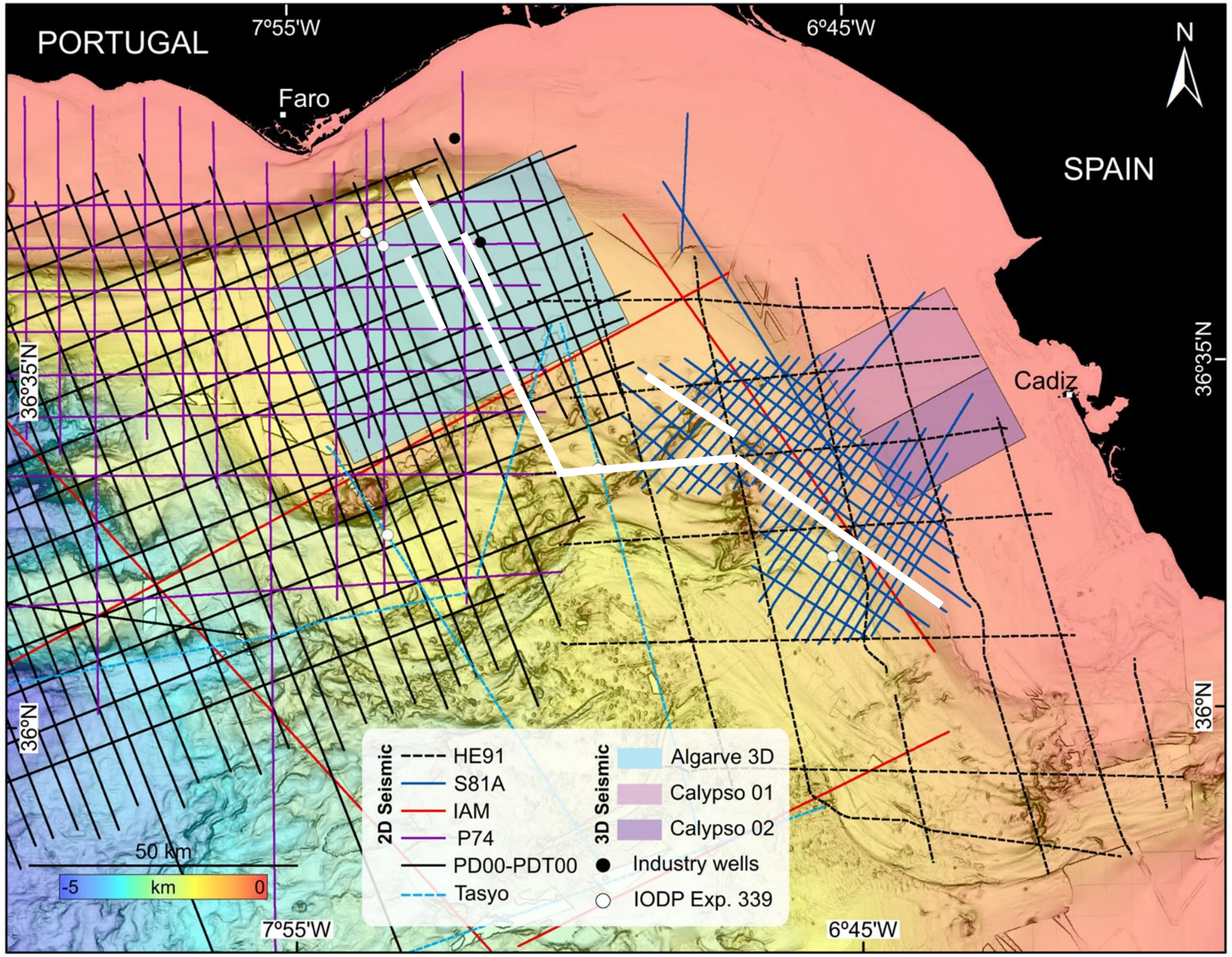


Fig. 2 Dataset used in this work – 2D seismic surveys from TGS-Nopec (PD00-PDT00), Chevron P74, Repsol (HE91, S81A) and IAM and 3D Algarve and Calypso cubes. Coordinate system: UTM-29N WGS84. Bathymetric data from the EMODnet database (EMODnet Bathymetry Consortium, 2018).

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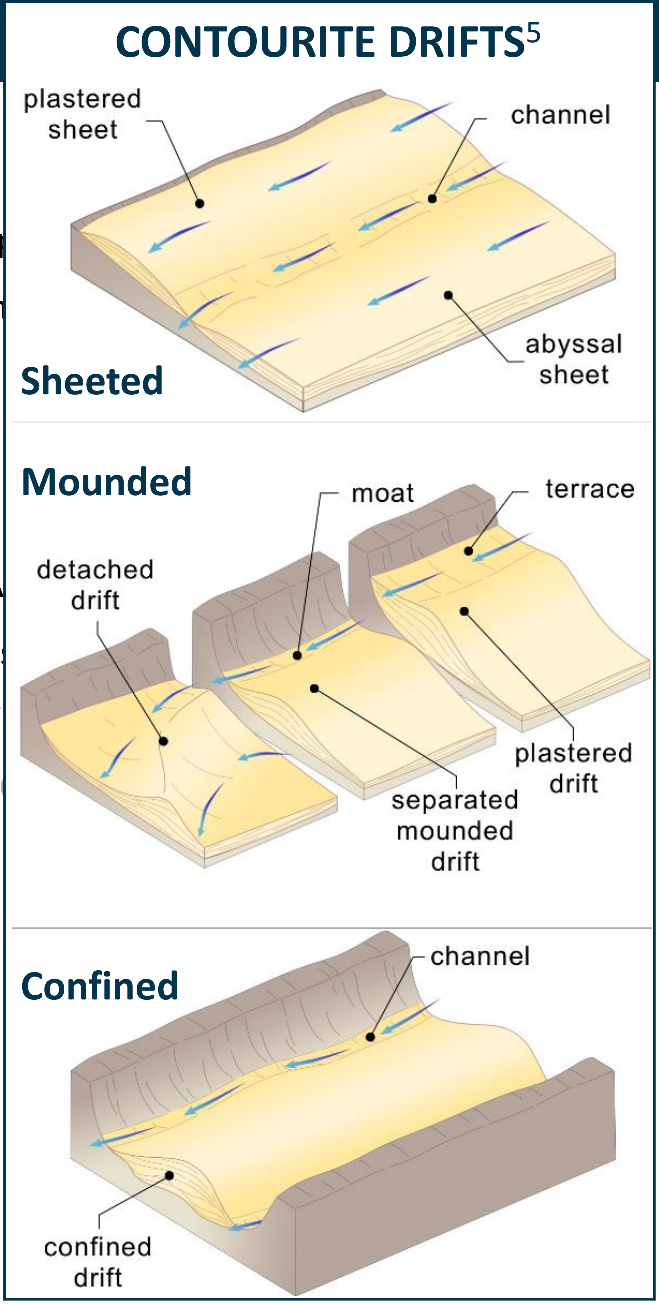

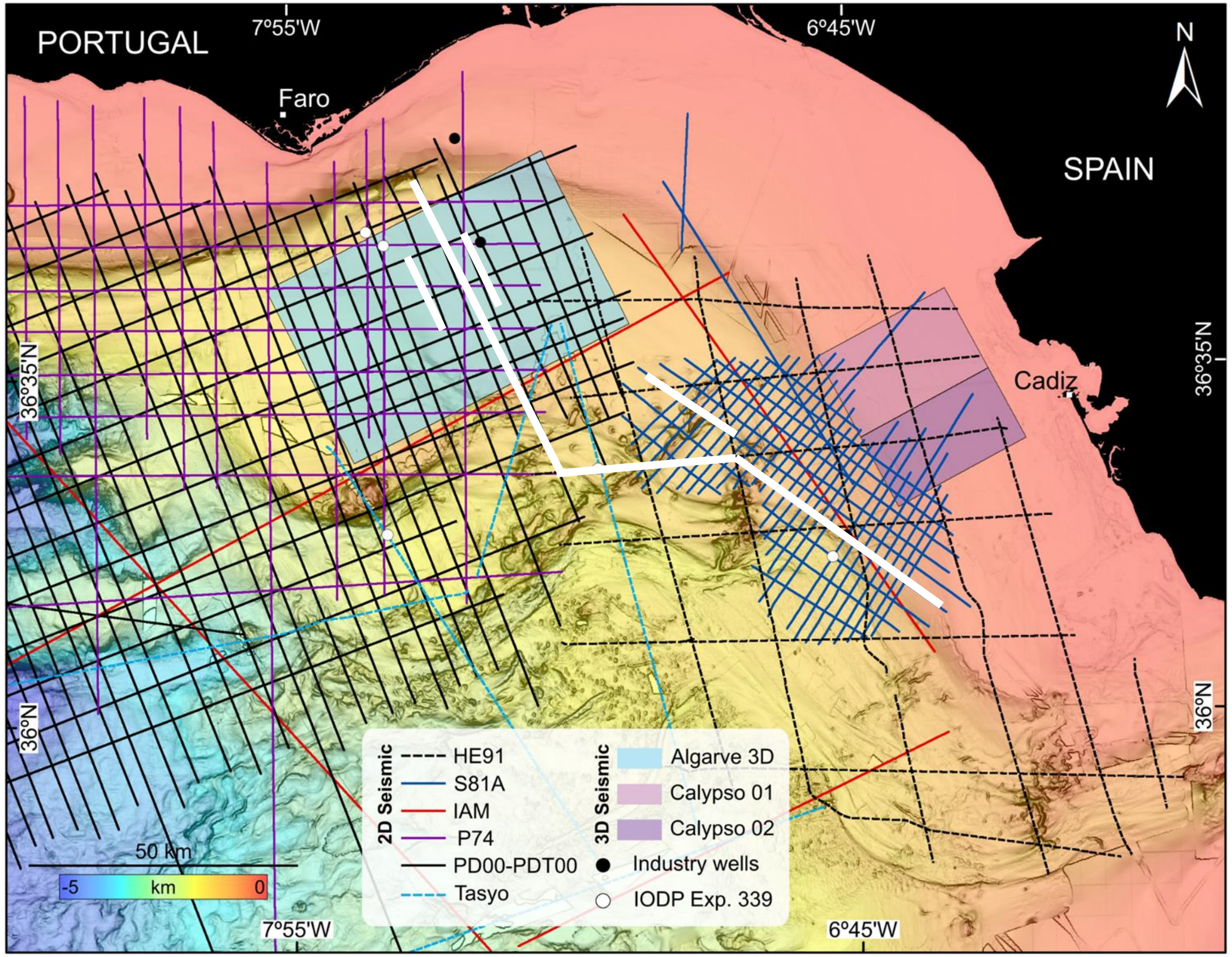

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Basins and deep-water deposits

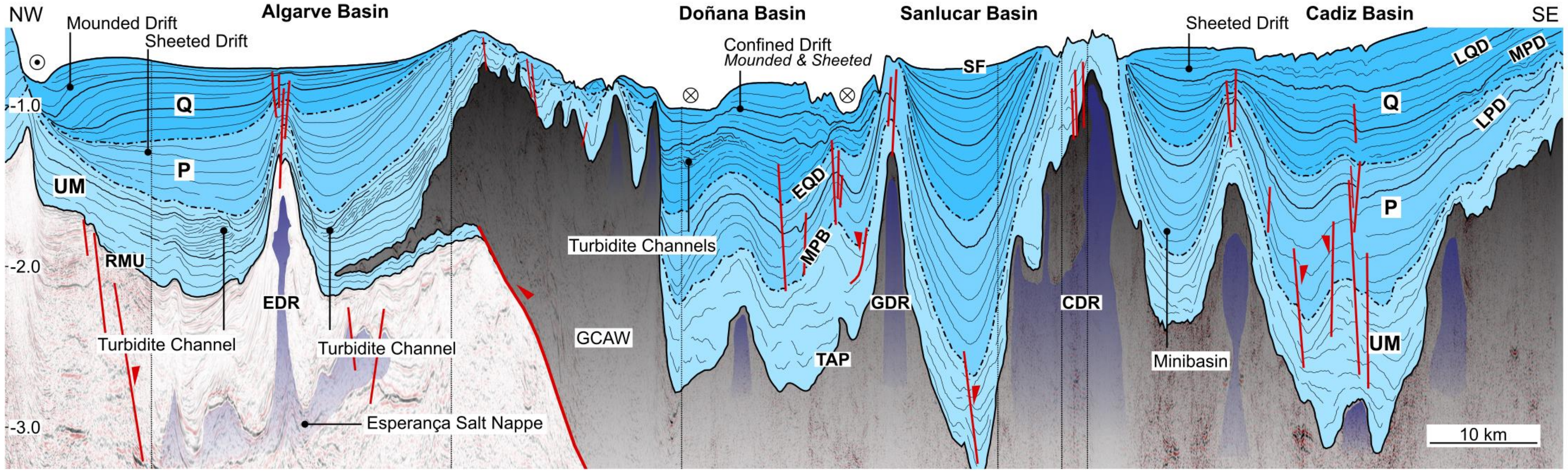
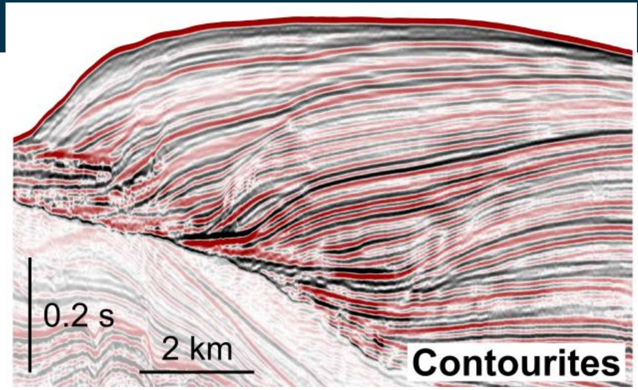
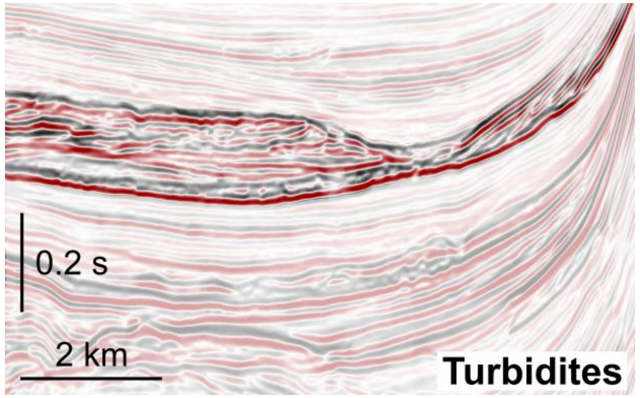
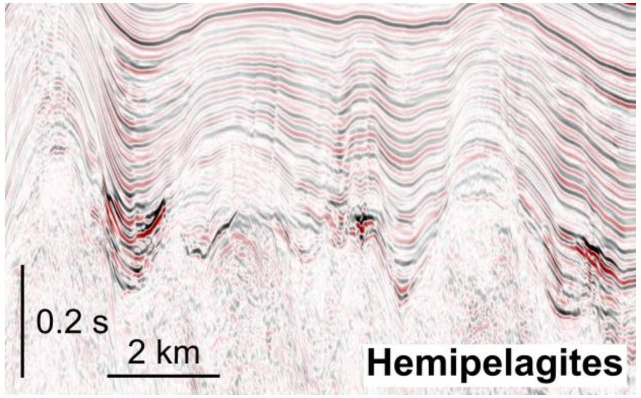


Fig. 3 Regional NW-SE composite seismic line, showing the Algarve Basin and the wedge-top Doñana, Sanlucar and Cadiz Basins. Important diapiric structures are observed: the Esperança Diapiric Ridge (EDR) rooted in the Esperança Salt Nappe and the Guadalquivir (GDR) and Cadiz (CDR) Diapiric Ridges rooted in the chaotic units associated to the accretionary prism (GCAW). Diapiric-related deformation (intrusion, folding and faulting of seismic units *UM*, *P* and *Q*) can be observed across all the basins. Diapiric structures influence the distribution and evolution of turbidite (erosive channels) and contourite (drifts) systems and hemipelagic sediments. Location is given in Fig. 2. TAP: Top of the Accretionary Prism, RMU: Regional Miocene Unconformity, MPB: Miocene-Pliocene Boundary, EQD: Early Quaternary Discontinuity, SF: Seafloor.





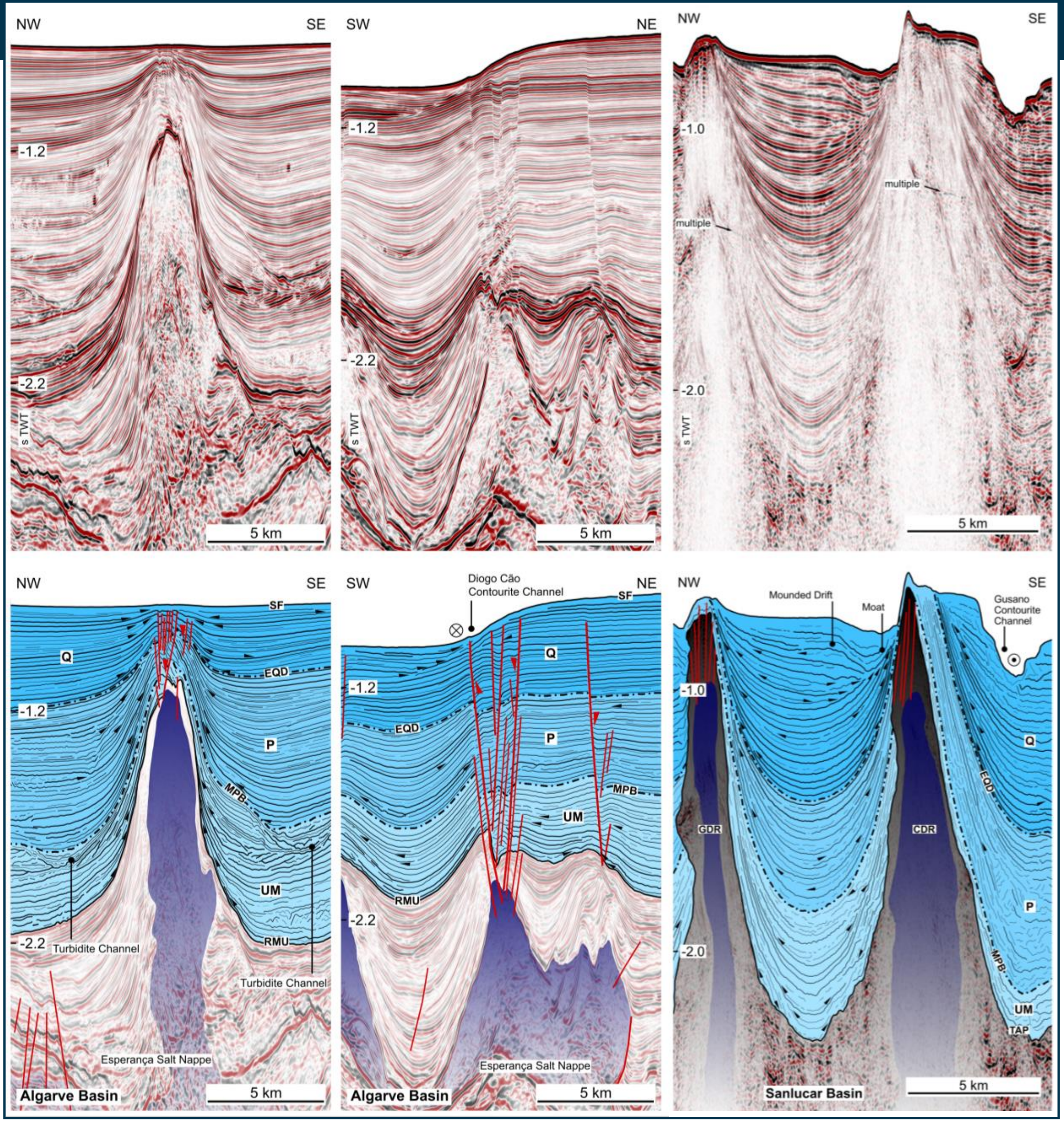


- Studied depositional succession ranges from the **Upper Miocene to the Quaternary** (seismic units defined for the Upper Miocene (*UM*), Pliocene (*P*) and Quaternary (*Q*).

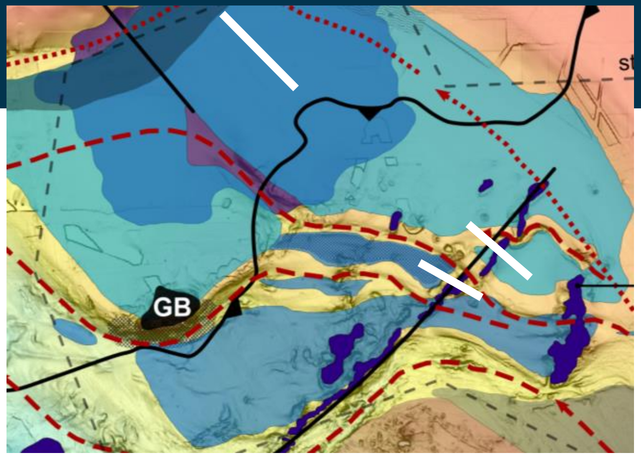
- Deep-water deposits recognised in the Algarve, Doñana, Sanlucar and Cadiz Basins: **contourite drifts**, **turbidites** and **hemipelagites**.

Diapiric Structures

- Numerous **salt and shale structures** were identified throughout the study area.
- Transparent to chaotic internal reflections, with moderate to low amplitudes.
- Topped by a high amplitude reflection with local continuity or by an indistinct top and imprecise limits.
- Deform the late Miocene-Quaternary sequence in different ways: piercing or associated faulting and folding.

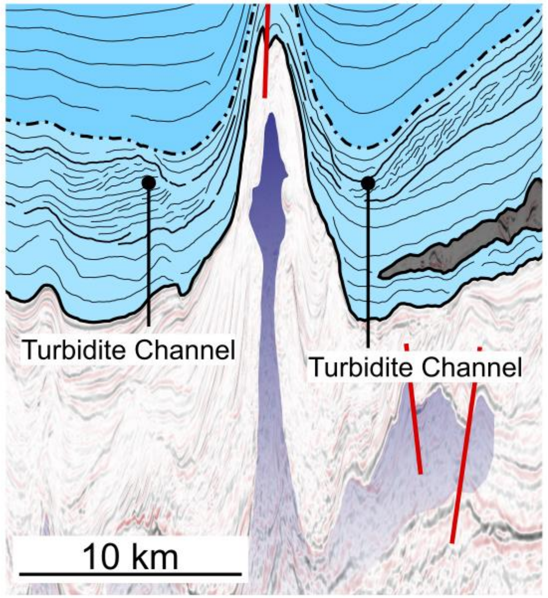


Influence of diapirism on deep-water deposits

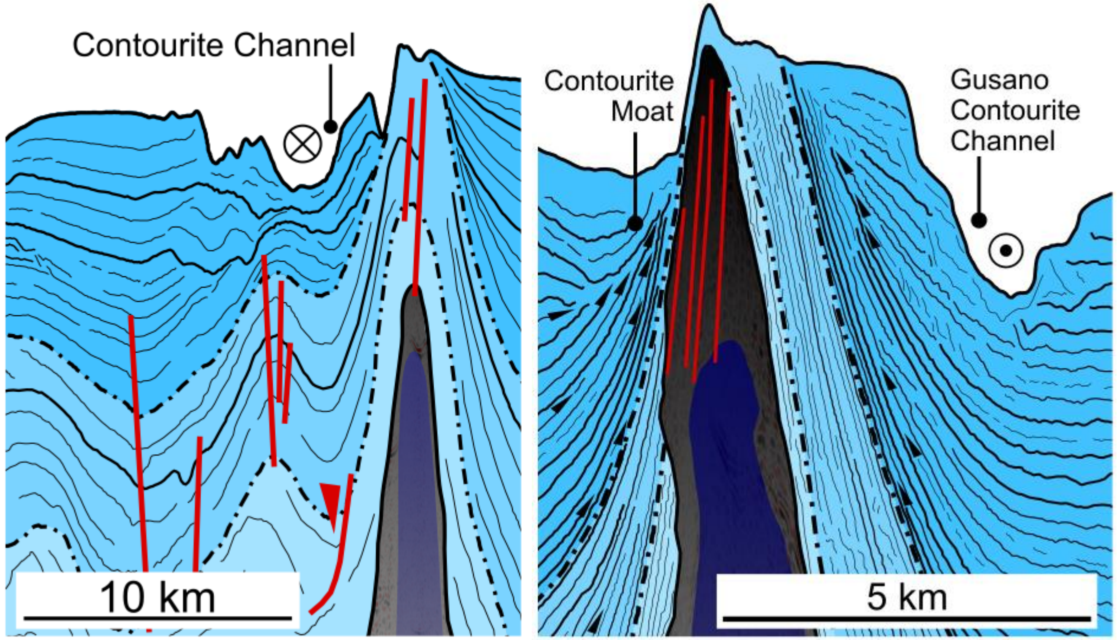


Diapir-related positive reliefs

Diapiric growth creates positive-relief morphologies that exert control on both **down-** and **along-slope currents** pathway, and thus controls sediment distribution.



Turbidite channels on both sides of the diapiric ridge



Contourite erosional features adjacent to diapirs

Currents are diverted or deflected by diapiric-related reliefs.

Hemipelagic deposits drape over diapiric-related seafloor morphology.

The rise of diapirs can create local instabilities in the structure flanks, leading to the failure of the roof hemipelagic sediments and thus the formation of mass transport deposits.

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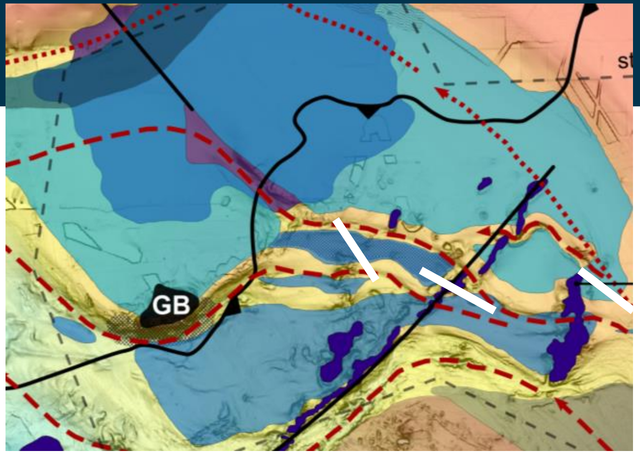
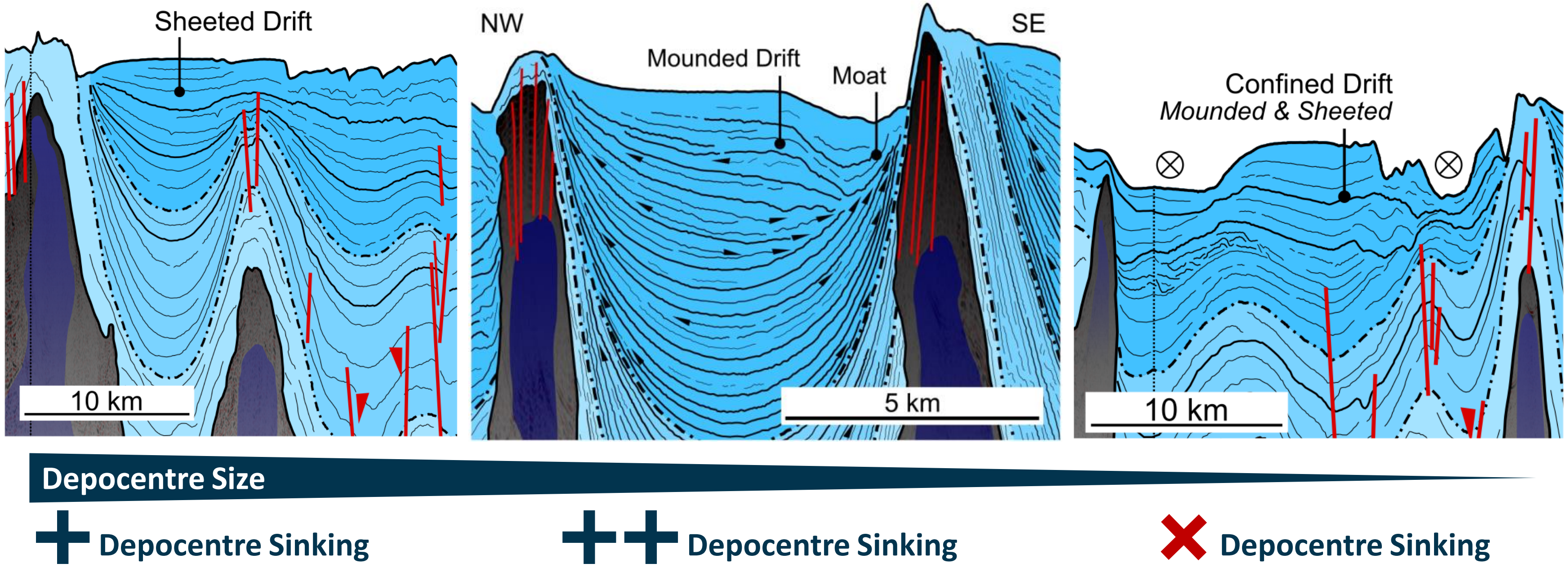


Control on accommodation space

Local subsidence related to downbuilding processes, create new space for sediment accumulation, promoting the formation of restrict and localized depocentres.

Contourite deposits respond to changes in the depositional environment by altering their geometry and size due to the complex interplay between current strength and depocenter characteristics.



Thus…

Drift characteristics result from the interaction between processes that can suffer great influence from diapiric processes: accommodation space, bottom-current strength and in a smaller scale sediment input.

Thank you!

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Acknowledgments

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