Seismic markers of the Messinian Salinity Crisis in the deep Ionian Basin

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With the aid of extensive velocity analyses, pre-stack migration in time and depth domains, and seismic imaging, we have been able to define for the first time the seismic signature of the Messinian evaporites in the deep Ionian Basin, which differs from the known Western Mediterranean and Levant Basin end-members. In addition, the rough pre-Messinian topography in the deep Ionian Basin allows to identify different evaporitic depositional settings suggesting a laterally discontinuous deposition of evaporites. With the information gathered, we quantify the volume of evaporitic deposits in the region.

This presenation summarizes the results of a published work:
Camerlenghi, A., Del Ben, A., Hübscher, C., Forlin, E., Geletti, R., Brancatelli, G., Micallef, A., Saule, M., Facchin, L., 2019. Seismic markers of the Messinian salinity crisis in the deep Ionian Basin. *Basin Research*.
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Note:

The seismic markers of the Messinian evaporites in the deep Mediterranean basins can be divided in **two end-members:**

1) The typical "**trilogy**" traced in the **Western Mediterranean** Basin (sensu Lofi, 2011, 2018) :

- Lower Unit (LU), generally poorly known due to the high absorption of seismic energy by the upper evaporitic layers, inferred to be composed of gypsum and clastics;
- Mobile Unit (MU), reflector-less, corresponding to salt filling the basins and onlapping the Late Miocene continental margins;
- Upper Unit (UU), consisting of a package of parallel and continuous reflectors, interpreted as an alternation of anhydrite and marl layers.

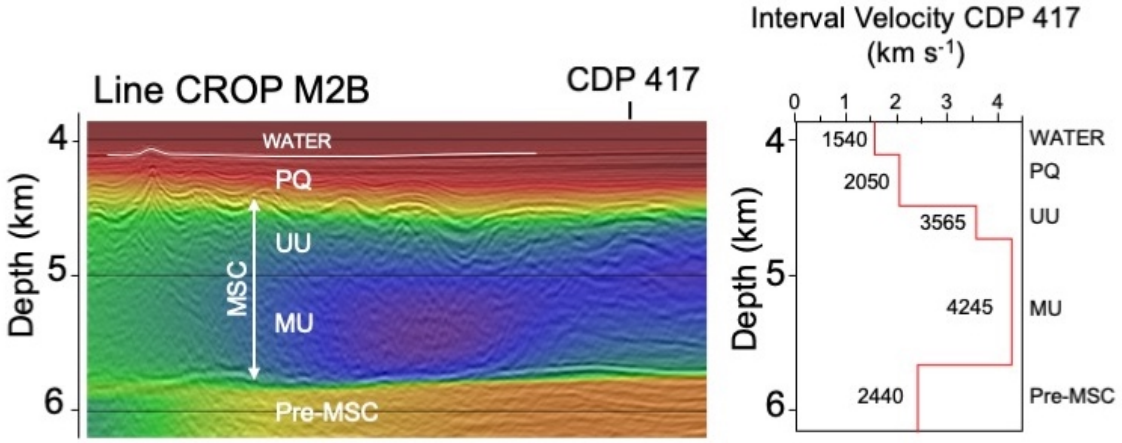
2) a **single MU unit** subdivided in seven sub-units by clastic interlayers located in the **Levant Basin**.

1 Study Area and Data set

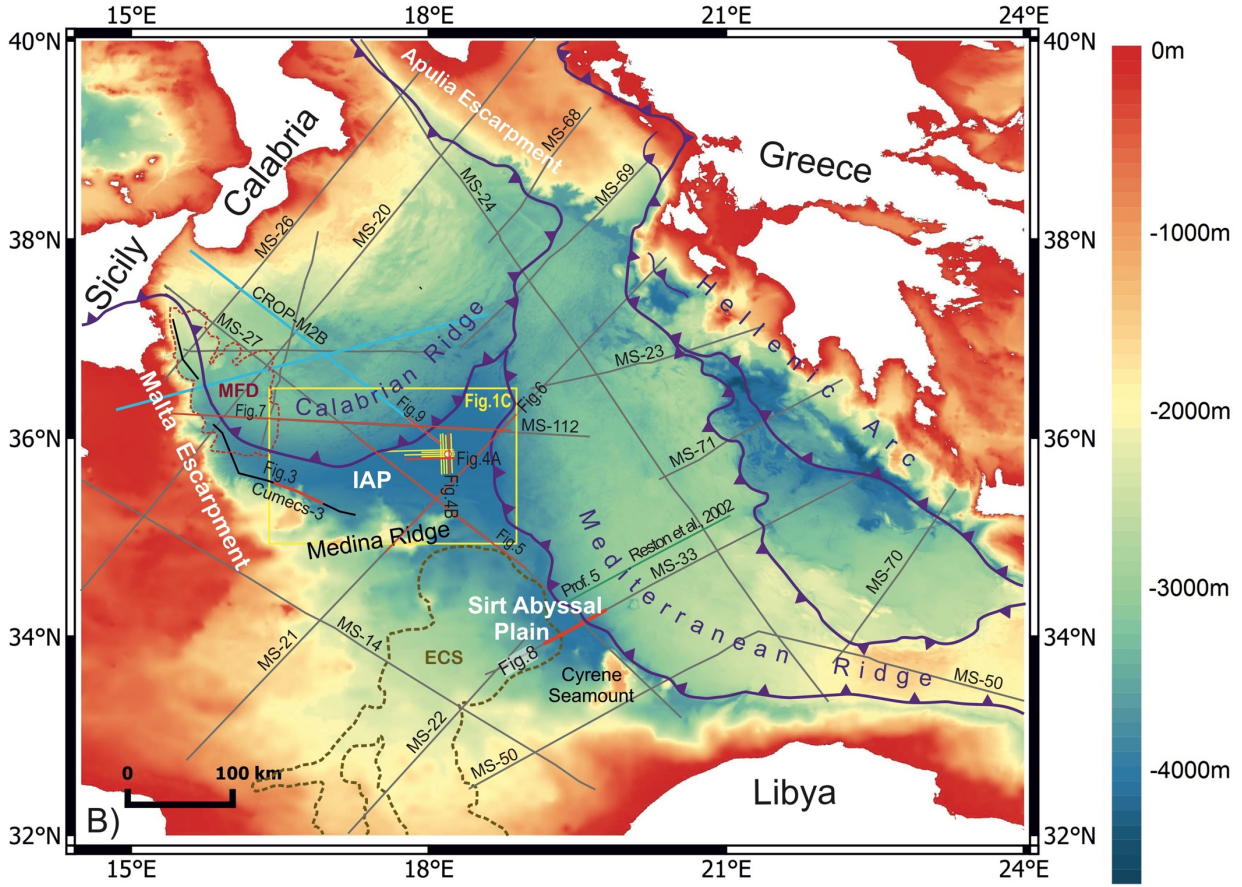
Vintage, deep penetration seismic
MS (Mediterranean Sea) and CROP (Crosta Profonda) deep penetration seismic data set

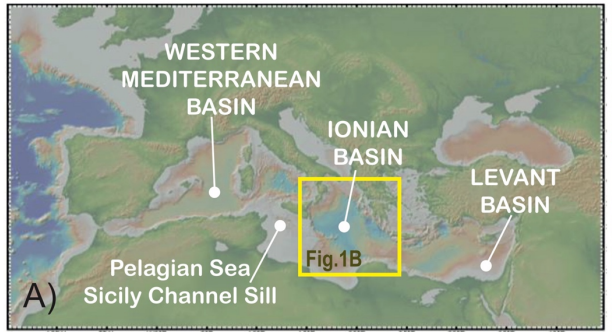
Modern, high-resolution multi-channel seismics
CUMECS-3 seismic survey
M144/2 seismic survey

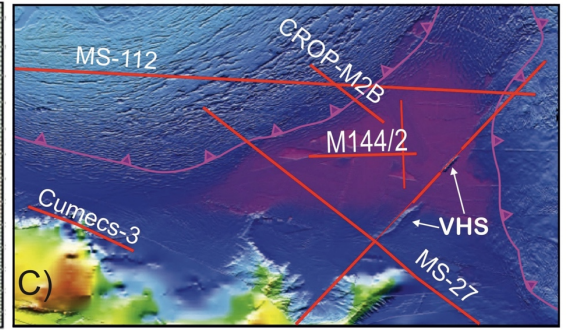
Identification of evaporiteic units was aided by seimsic velocity information:



See published paper for details

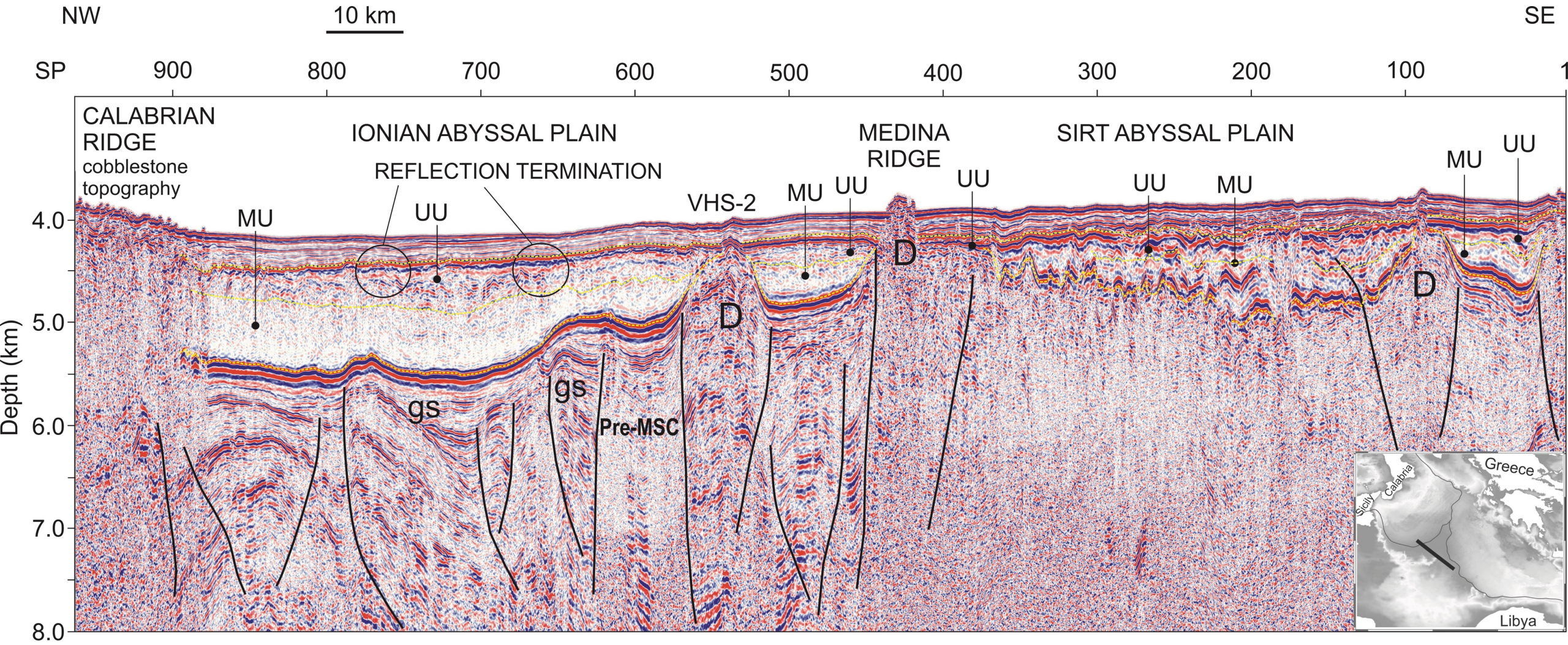






2

Ionian abyssal plain: MSC evaporites fill a pre-existing topography
Marked different in MSC seismic expression across the Medina Ridge
No evidence of LU. UU is poorly reflective without a sharp boundary with MU



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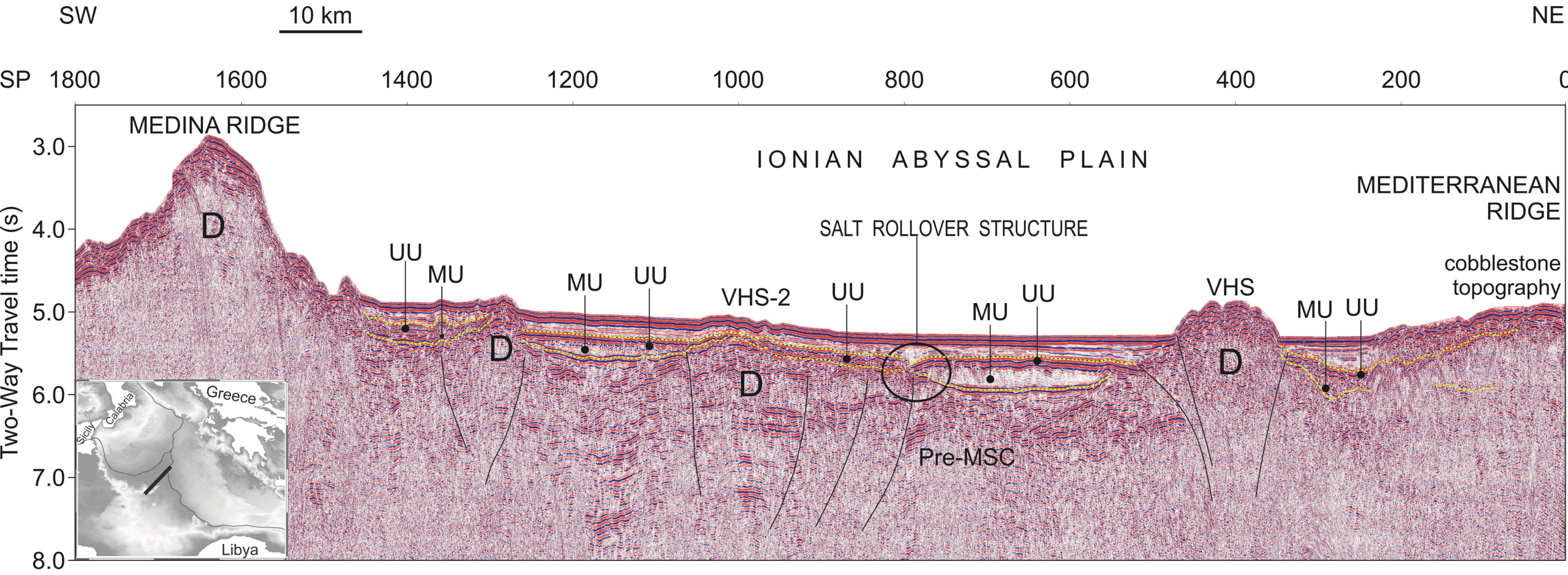
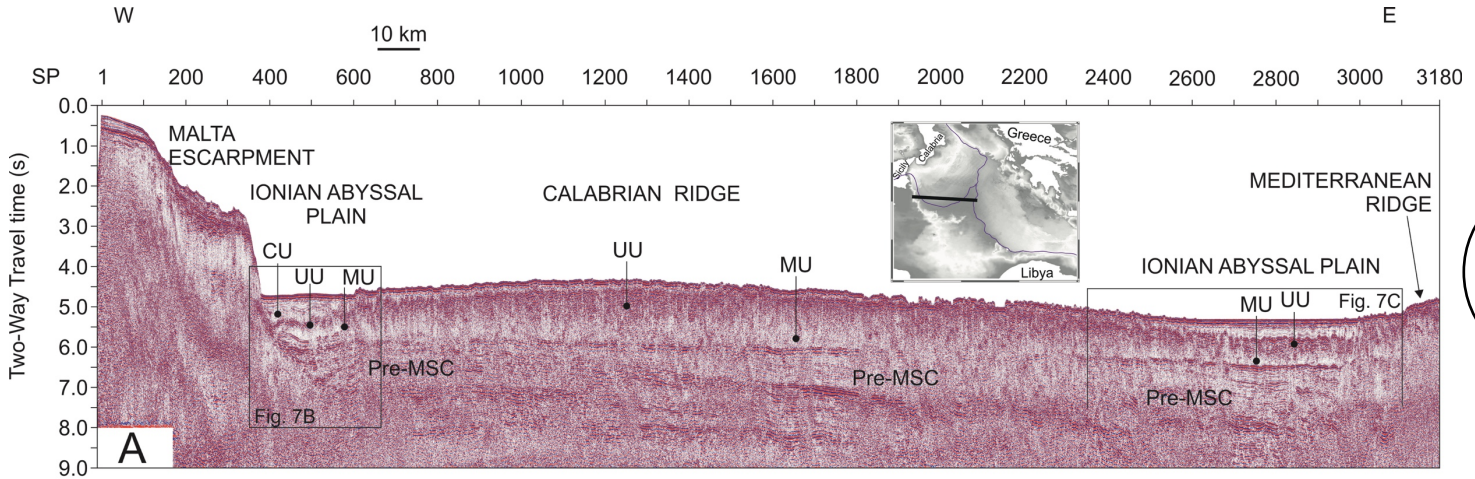
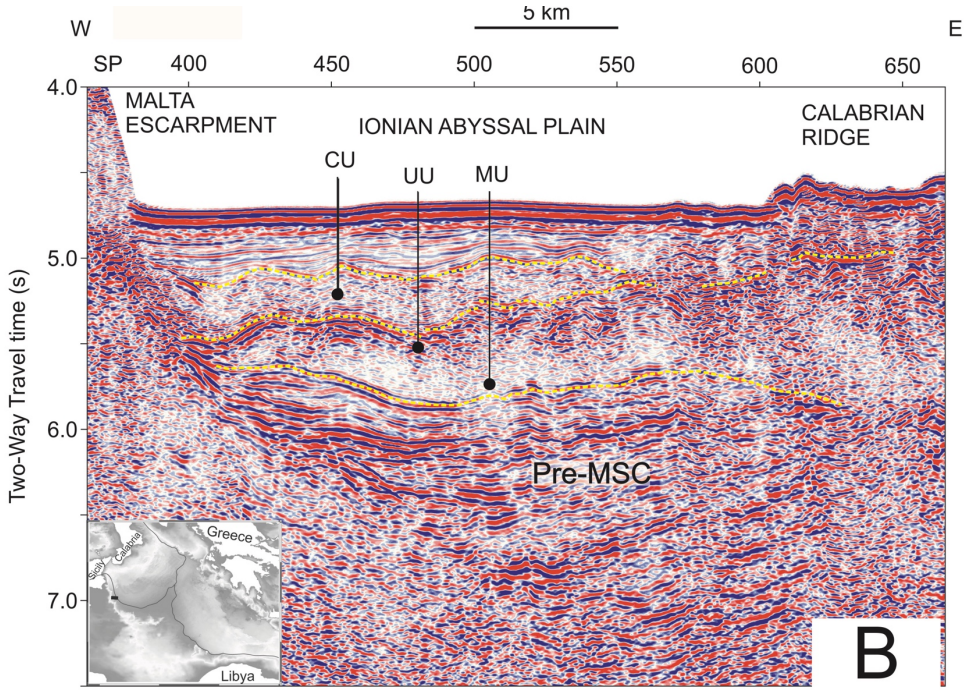
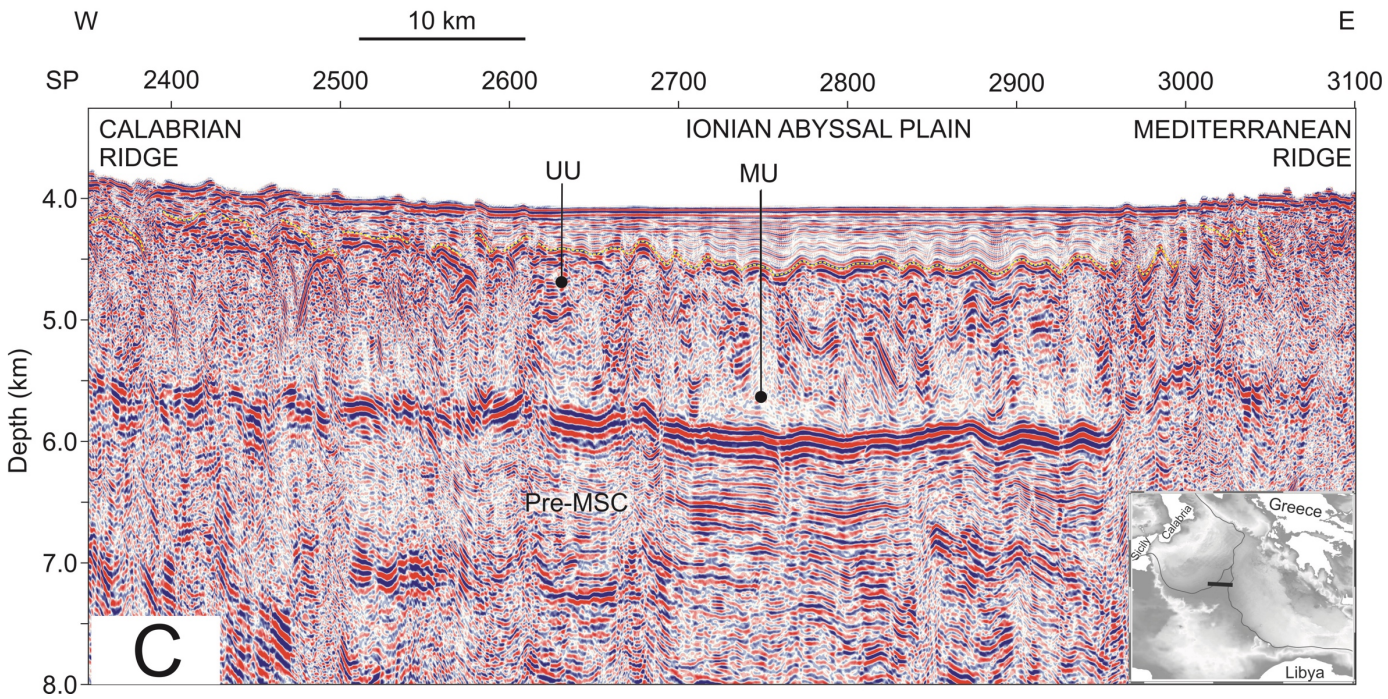




4

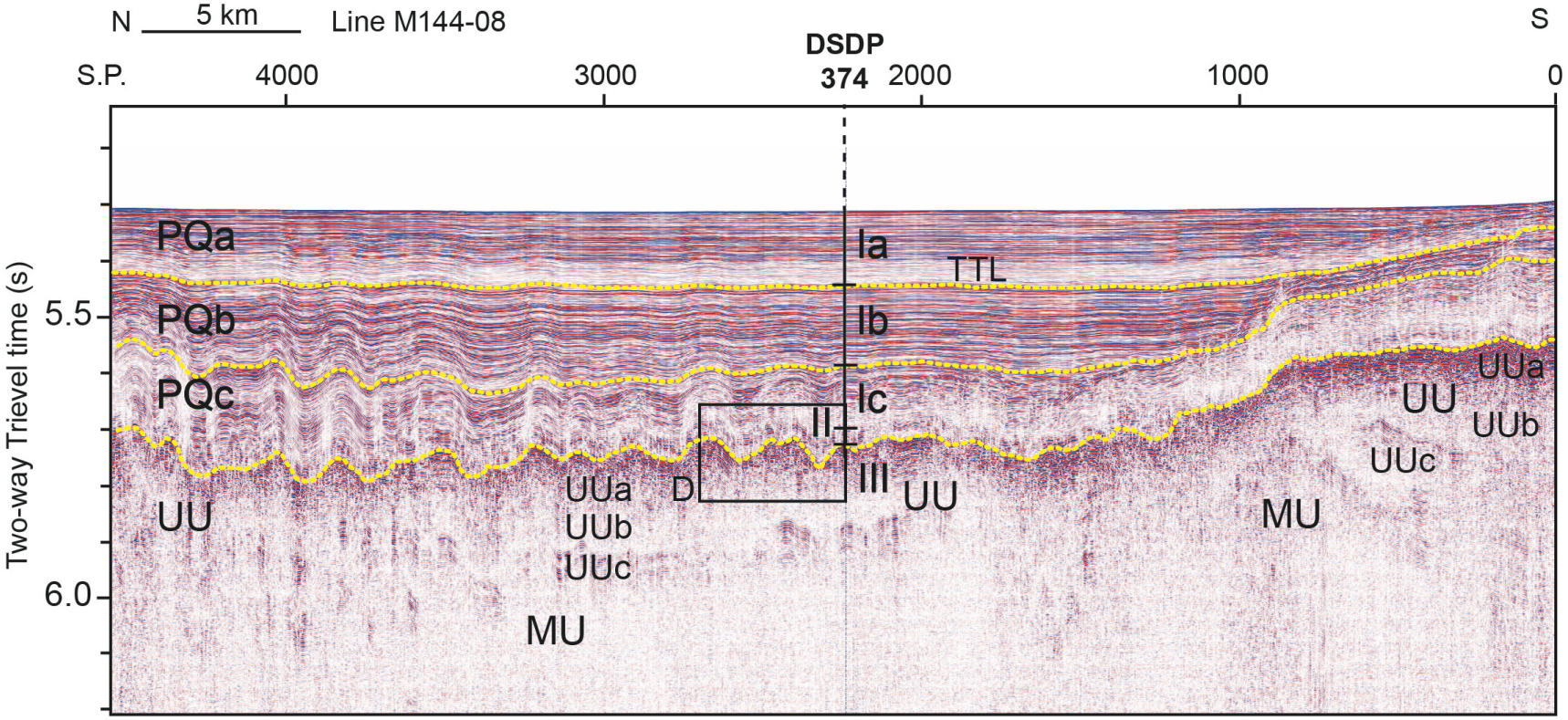
Base of UU continuous and flat across the outer deformation of the Calabrian accretionary complex

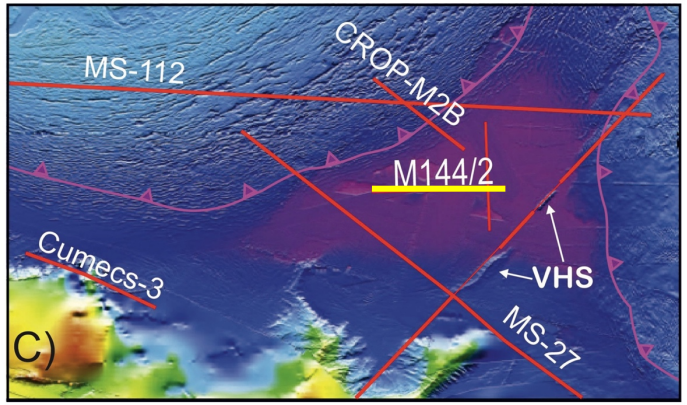


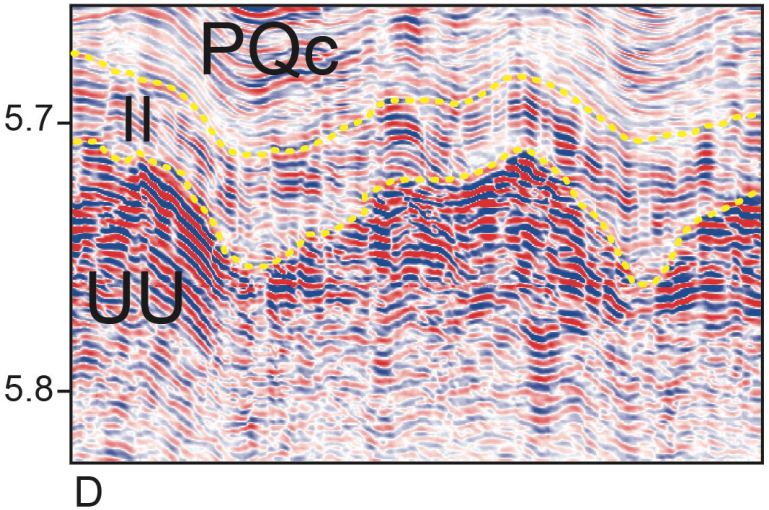


5

Erosional surfaces and V-shaped valleys, supporting an extreme sea level draw down and the presence of Late Messinian (Lago-Mare) fluvial deposition analogous to the Eosahabi channel system (ECS) in the Sirt Gulf. Such evidence is restricted to the Ionian Bains and needs careful consideration in further studies.

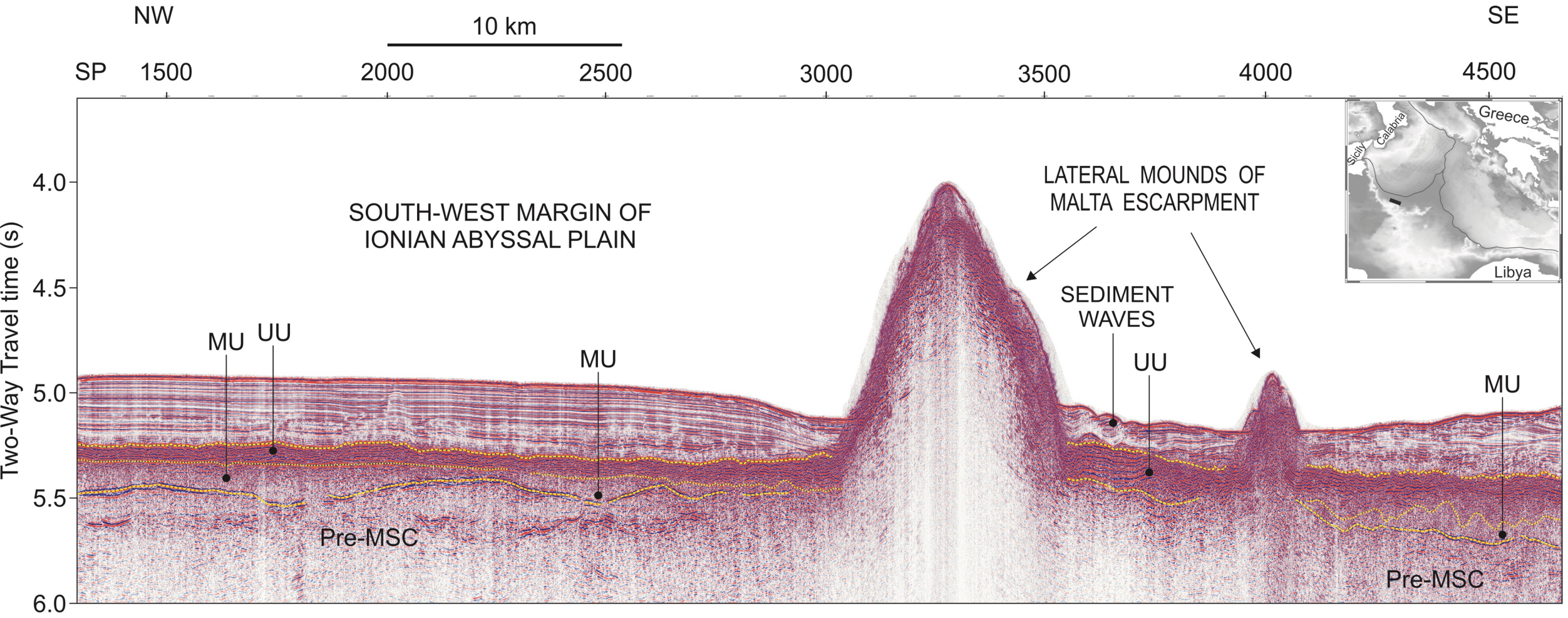






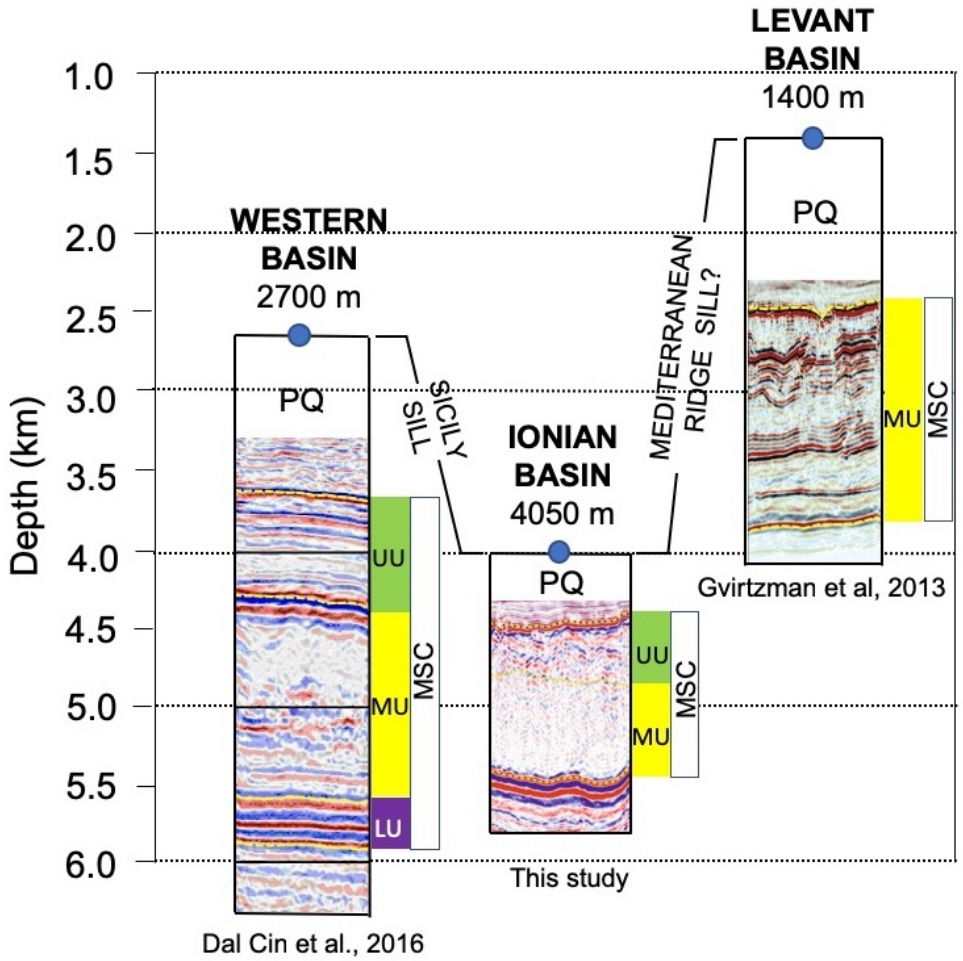
6

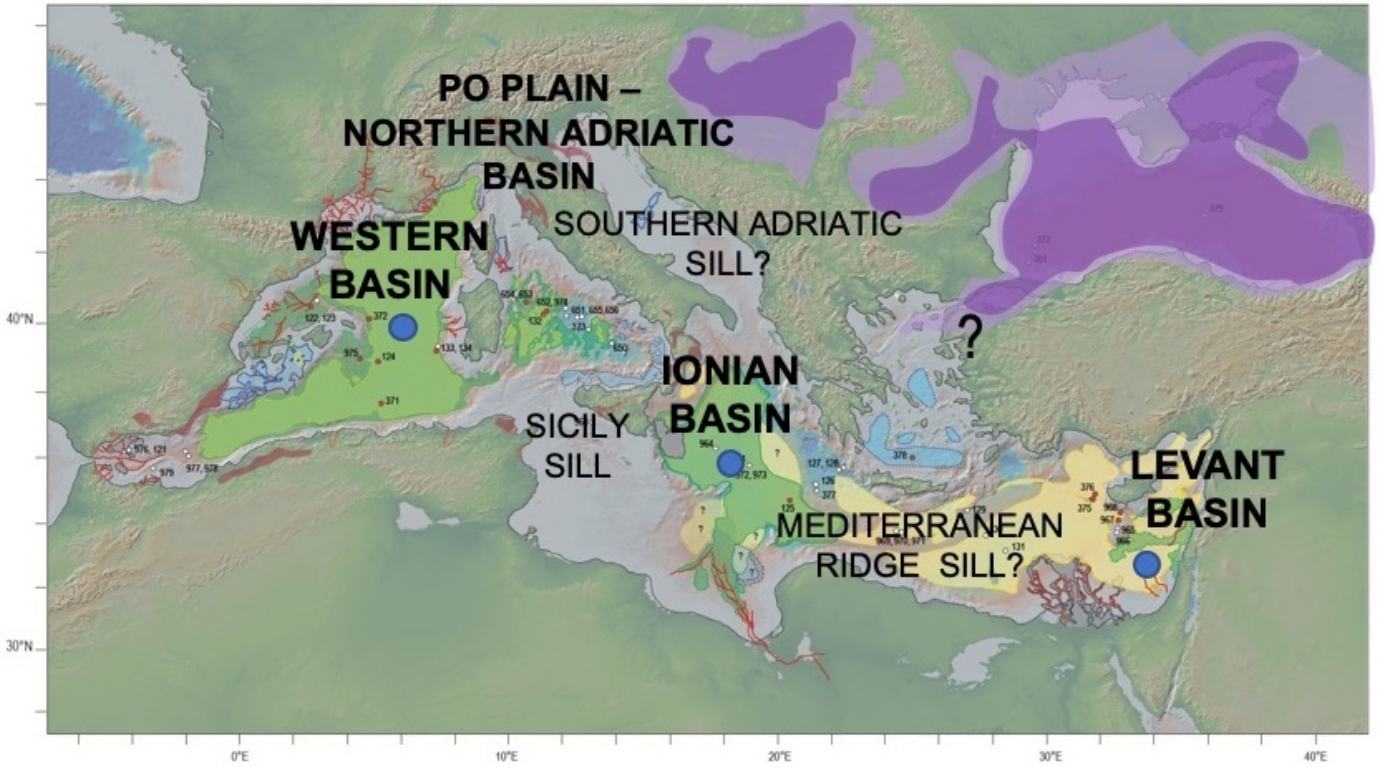
At the Western Ionian Basin margin, UU is highly reflective, with a sharp boundary with UU, and UU appears to fill channels and valleys likely originated by sediment mass transport from the Malta Escarpment into the basin



8

The different MSC depositional units suggest that the Messinian Ionian Basin was separated by physical thresholds from the Western Mediterranean (Pelagian Sea/Sicily Channel), from the Po Plain/Northern Adriatic Basin (Mid-Adriatic sill) and the Levant Basin (undefined sill hidden below the Mediterranean Ridge accretionary complex between Crete and the Cyrenaica Peninsula).





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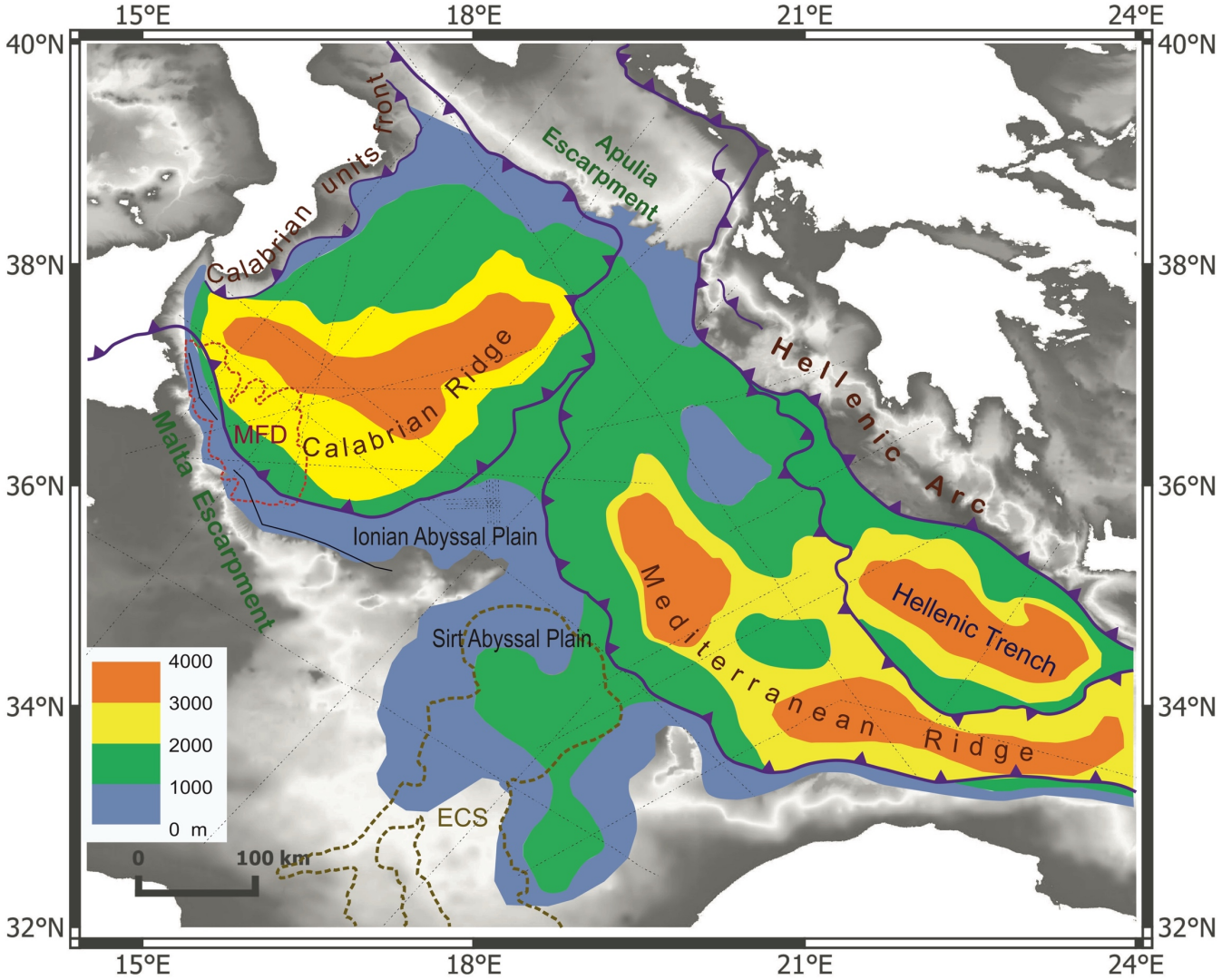
The volume of MSC evaporites calculated in the Ionian Basin, a small portion of the Mediterranean Basin, using PSDM velocity information and a regionally and consistent seismic data set, is 500,000 km3



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Processing of the M144/2 has been carried out with Schlumberger VISTA software provided to the University of Hamburg by an academic license agreement.