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Contourite deposits and landslides in the south-eastern Gela Basin (Strait of Sicily, Central Mediterranean Sea), relationships and contributory causes

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Contourite deposits record the activity of along-slope thermohaline bottom currents that accumulate or significantly rework sediment in (typically) deep marine and lacustrine basins. Contourite deposits, particularly if fine-grained have the potential to record the paleoceanographic history of a basin and, by inference, provide a contribution to paleoclimatic reconstructions. Recognized about 50 years ago in the Atlantic deep waters, yet various aspects on their genesis and their association with down-slope sediment-transport processes are still poorly understood. Based on high-resolution multibeam bathymetry, sediment cores, CHIRP sonar and multichannel seismic profiles, we report novel findings on the contourite deposits of the Gela Basin (Strait of Sicily, Mediterranean Sea), where such deposits are known to occur in contexts as shallow as the upper slope and shelf edge region. Along-slope processes formed plastered drifts on the upper slope and outer shelf of the Malta Plateau, while gravity-driven down-slope processes accumulated mass transport deposits in the lower slope and basin. Both processes influenced the stratigraphic architecture of the margin, which record the interaction between sediment supply fluctuations, sea level changes and oceanographic processes.
Located between 180 m and 500 m water depth, these shallow-water contourite deposits occur in the depth range of activity of the Levantine Intermediate Water (LIW; 200-600 m with 13 cm s-1 mean velocity) and the Modified Atlantic Water (MAW; 100-200 m with 11 cm s-1 mean velocity). The Gela Basin contourite deposits show pronounced moats (up to 50-m-deep and up to 45-km-long) parallel to the shelf-edge. Age model, based on 18 radiocarbon dates, reveals a very high Sediment Accumulation Rate (SAR) at the end of the Last Glacial Maximum (LGM; up to 0.5 cm yr-1), followed by a sudden decline at the onset of Heinrich Event 1 (HE1; less than 0.16 cm yr-1). 24 surficial, the largest of which is 1.48 km3, and 3 larger deep-seated slides were mapped along the slope. Several mass-transport deposits originated entirely or partially from the failure of contourite deposits.
In this study, we reconstruct the overall physiographic setting and the oceanographic regime during the last 20 kyr to understand the sediment source area(s) of both landslides and contourite deposits to infer the genetic relationship between these two deposits. Our findings confirm how contourite deposits represent important archives to discern the evolution of a sedimentary basin and how their thickness distribution and sedimentological characteristics favour slope instability.