

Seismostratigraphic model of the Sines Contourite Drift (SW Portuguese Margin) - depositional evolution, structural control and paleoceanographic implications

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The Sines Contourite Drift, located in the Southwest Portuguese margin, is a distal drift of the Contourite Depositional System of the Gulf of Cadiz, built by the influence of the Mediterranean Outflow Water (MOW). This drift is located between 1000 and 2000 m water depth on the Alentejo margin continental slope. The Sines Drift is bounded by four major morphologic features, the 1.4 km high Pereira de Sousa Fault escarpment to the west, the upper continental slope to the east and the Setúbal and São Vicente canyons to the north and south, respectively. This work presents a seismic stratigraphic analysis and proposes an evolutionary model for the Sines Drift, as well as the identification of its main driving mechanisms and constraints. We used new seismic reflection lines acquired during the MOWER/CONDRIBER cruise in September-October 2014, pre-existent multichannel seismic lines and lithostratigraphic and chronological data from Site U1391 of IODP Expedition 339 carried out in 2011-2012.

Three evolutionary phases are identified for the Sines Drift development: 1) a sheeted-contourite-drift phase (<5.3-3.2 Ma) built since the Late Miocene by an initially weak flowing MOW; 2) a mounded-contourite-drift phase (3.2-0.7 Ma) from Late Pliocene to Early Quaternary times characterized by a mounded drift in the north and sheeted in the south, with a succession of sinuous N-S paleomoats in the east built as a result of a MOW enhancement; and 3) a plastered-contourite-drift phase from Mid-Pleistocene (0.7 Ma) till the present day, characterized by the present depositional (sandy-muddy drifts) and erosional (moats) contourite features associated with two major events of MOW intensification.

The growth of the Sines Drift was constrained, in a long-term, by seafloor morphologies that resulted from the Mesozoic rifting processes of the Southwest Portuguese margin, inherited from the Mesozoic rifting phases. The paleomorphology provided accommodation space for drift growth and conditioned its overall architecture. The N-S horsts built during the Mesozoic rifting confined drift formation and did not allow lateral migration. The formation of the Sines Drift has also been influenced, in short-term, by climatic fluctuations and sea-level changes especially during the Quaternary. The succession of sinuous paleomoats beneath the present-day moat suggests a persistent and northward flowing MOW with several phases of enhancement. It was also perceived that the São Vicente and Setúbal canyons took most of the downslope sediment supply, as well as the occurrence of mass-movement processes in the west associated with the steep gradient of the Pereira de Sousa escarpment. All these results suggest the Sines Drift had a complex evolution controlled by several and varied factors at different scales.