

Origin of morphological depressions on the Guadalquivir Bank uplifted area (Gulf of Cadiz middle slope)

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Abstract

We have investigated the origin of morphological depressions (circular-elliptical depressions, amphitheatre-shaped escarpments and valleys) on the Guadalquivir Bank uplifted area (Gulf of Cadiz middle slope). This work is based on swath bathymetry and high- and mid-resolution reflection seismic datasets. Depressions occur on the distal (depositional) sector of the Gulf of Cadiz Contourite Depositional System, which has been developed under the influence of the Mediterranean Outflow Water (MOW). The Guadalquivir Bank is a NE-oriented relief that was uplifted along the Neogene and Quaternary. It forms the southern limit of the Bartolomeu Dias and Faro Sheeted Drift (SD) plateaus that are separated by the NW-trending Diego Cao Contourite Channel. Circular-elliptical depressions occur on the Bartolomeu Dias SD plateau, aligned parallel to the rim of the Diego Cao Channel. Irregular, crescent-shaped depressions occur to the SE of the study area and a valley surrounds the Guadalquivir Bank. The origin of these features is interpreted as the result of the interplay between oceanographic, mass-wasting, tectonic and fluid-escape processes. Four stages define the development of these features: 1) Onset of a contourite mounded drift associated with a proto-Diego Cao moat originated by a weak MOW circulation as it interacted with the structural features of the Guadalquivir Bank during the Lower Pliocene; 2) Evolution to a more complex multi-crest drift and moat system, probably as a result of an enhanced MOW and increased deformation of the underlying structures during the Upper Pliocene-Early Quaternary; 3) Event of enhanced tectonic activity that provoked widespread mass-wasting events along middle slope sheeted drift plateaus during the Mid Pleistocene. It was recorded in a prominent erosive surface under the present-day Diego Cao channel western rim and numerous slide scars displaying amphitheatre shapes on the limits of the plateaus; 4) Final stage (Late Quaternary) when the Mediterranean Intermediate Branch started flowing towards the N-NW along the deep gateway that was opened as a result of the mass-wasting event and/or structural adjustments. The contourite system evolved, due to tectonic events, to the present-day channel and a complex separated drift that includes circular depressions. They result from the interaction between the bottom current and the irregular basal surface created by the slide scars. During this phase, crescent-shaped depressions were created, probably by the interplay between bottom currents and fluid escape processes, and the marginal valley around the Guadalquivir Bank resulted from current reworking of the irregular topography of contouritic deposits affected by slide scars.