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Relief forming processes in the Eivissa channel, Western Mediterranean

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The Eivissa Channel, Western Mediterranean, separates the Iberian Peninsula to the west from Eivissa and Formentera to the east; it is a 60 km long and 85 km wide depression, oriented north to south, which constitutes the eastern part of the Balearic Promontory. The channel structure is controlled by thrusts and folds corresponding to the external area of the Betic-Balearic system, and partially, by the extension related to the opening of the western Mediterranean. The seafloor presents a number of morphologic features, namely seamounts, pockmarks, slides, seafloor elevations and localised depressions.

In this study, we present an integration of the available multibeam bathymetric data and interpreted seismic reflection profiles in order to identify the geological processes that have generated these forms of relief. The dataset comprises swath bathymetry data (from 2 m to 50 m grid size), air-gun 2D and 3D seismic reflection profiles and TOPAS parametric very-high resolution seismic reflection profiles acquired onboard BIO Hespérides during BIG'95 (1995), Marinada (2002), Euroleón (2007) and Hermesione (2009) surveys, and onboard RRS Charles Darwin during CD178 (2006) survey.

Relatively prominent seamounts (Xàbia and Es Vedrà) and smoother elevations share a genetic relationship linked to pre-Messinian basement uplift, with magmatic intrussions also playing a fundamental role in the formation of such structures. The Messinian erosion surface forms the seismic basement in the area. Above this unconformity, reflectors G and R separate Pliocene, Pleistocene and Late Quaternary deposits. Overall, these units display continuous stratified seismic facies; reflectors in the Pliocene and Pleistocene units are more attenuated whereas the Late Quaternary units consist of higher amplitude reflectors. Relatively small slide deposits appear interestratified and on top of the sedimentary sequence. Slide deposits are characterised by transparent and chaotic facies. The oldest one observed is a precursor of Ana Slide and is interestratified amidst of Lower Quaternary deposits. Overall, slide deposits provide evidence of the recurrent instability of the Balearic margin of the Eivissa channel, as previously pointed out by other authors. It is also worth noting the proximity of pockmarks to the headwall scarps of slides.

Pliocene deposits overlying the Messinian unconformity pinch out against the basement in the vicinity of the elevations. There, the relief is characterised by markedly sinuous steps at the elevations' foot, which are associated to up to 100 m deep depressions. These may correspond to an amalgamation of pockmarks or to focusing of fluid seepage in such areas, favoured by the presence of the basement highs. All these observations suggest a relationship between basement morphology, fluid flow and seepage, slope destabilisation and the genesis of the many landforms of different sizes constituting the Eivissa channel floor.