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TITLE: Geomorphology and sedimentary features in the Central Portuguese submarine canyons, Western Iberian margin

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ABSTRACT:

The Central Portuguese submarine canyons (Nazaré, Cascais and Setúbal?Lisbon canyons) dissect the Western Iberian margin in an east?west direction from the continental shelf, at water depths shallower than 50 m, down to the Tagus and Iberian abyssal plains, at water depths exceeding 5000 m. We present an analysis of the geomorphology of the canyons and of the sedimentary processes that can be inferred from the observed morphology of the three canyons, based on a compilation of swath bathymetry data and TOBI deep-towed side-scan sonar imagery. This first complete detailed mapping of the Central Portuguese canyons reveals substantial differences in their morphologies and downslope evolution. The canyons are divided into three sections: 1) canyon head and upper reach, 2) middle canyon, and 3) canyon mouth and distal part. The canyon heads and upper reaches are severely indented into the continental shelf, and they are characterised, in the Nazaré and Setúbal?Lisbon canyons, by sinuous V-shaped valleys entrenched within high canyon walls occupied by rock outcrops dissected by gullies. The Cascais upper canyon is complex, with multiple branches with high axial gradients and signs of mass wasting. Middle canyon sections, indented in the slope, display axial incisions with perched, stacked terraces, and are affected by debris avalanches originating from the canyon walls. At the base of slope, the distal Cascais and Setúbal?Lisbon canyons show many characteristics of channel-lobe transition zones: erosional features such as isolated to amalgamated chevron scours, and depositional bedforms such as mud to gravel waves. Pervasive scouring occurs up to 95 km beyond the canyon mouths. By contrast, the Nazaré canyon opens into a 27 km wide and 94 km long channel, whose flat-bottomed thalweg is occupied by sediment waves, irregular, comet-shaped and crescentic scours, and a second-order channel. Transverse, kilometre-scale sediment waves occupy the overbank area of the southern channel margin. The present morphology of the Central Portuguese canyons is the result of erosive processes, subsequent sediment transport and deposition, and sediment instability, whereas inherited tectonic fabric controls their location. Morphological differences between the canyons are explained by the main mechanisms driving their activity. Overall, these morphological features suggest that these canyons have acted as an efficient conduit of sediment to the deep basin, transporting large quantities of material to the deep sea during high-energy events.

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