SEDIMENTARY INSTABILITIES ALONG THE SOUTHWESTERN SLOPE OF THE ALBORAN RIDGE (SW MEDITERRANEAN)

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Abstract

Detail reprocessing and analysis of a multibeam bathymetric data set and seismic profiles have allowed identified several complexes of sedimentary instabilities along the southeastern flank of the Alboran Ridge. A Large Slope Apron System could be defined in this area that includes isolated slides, complex of slides and slope apron systems. These features show different sizes and evolutionary stages. Seismicity and the Quaternary tectonic activity are considered the main factors controlling their development.

Keywords: Geomorphology, Sedimentation, Tectonics, Alboran Sea, Western Mediterranean

Introduction

The development of sedimentary instabilities and mass movements on active tectonic reliefs has been described frequently [1, 2]. The Alboran Ridge is the most relevant physiographic feature of the Alboran Sea Basin, it extents along approximately 200 km in a WSW-ENE trend and is constituted by five aligned seamounts. This complex feature is a tectonic relief uplifted from the Miocene to the Quaternary, by means of folding, lateral and compressive faulting, and volcanism. The structure of the Alboran Ridge has been described as a main anticline bounded by oblique left-lateral/reversed faults [3]. Nowadays, only few sedimentary instabilities have been analyzed in the Alboran Basin [4], but a more important development can be expected.This study focuses on the sedimentary instabilities occurred on the southern flank of the farthest east seamount of the Alboran Ridge. Several methods were used to investigate these features including multibeam bathymetry and a scarce net of ultrahigh (Sub-bottom Profiler and TOPAS systems) and high (Airguns) resolution seismic profiles.

Results and discussion

Sedimentary instabilities have been identified along both flanks of the Alboran Ridge, northeastern and southwestern. Their occurrence has been recognized based on features indicative of the disappearance of sediments and of deformational features. The southeastern flank forms an abrupt scarp (6-10 km wide) that extends between 70 to 1050 m water depths and displays average slope gradients between 8 and 18º. Both types of features, mass-movement deposits (from slides to turbidites) and valleys (canyons and channels) are identified. The following systems have been differentiated based on genetic processes and relationships (Fig. 1): isolated slides (box 2), complexes of slides (boxes 1 and 4), and slope apron systems (boxes 3 and 5). The slide scars are mainly located at upper part of the flank (70-140 m) where gradients average 20º, and have lengths between are 1.5 and 7 km.

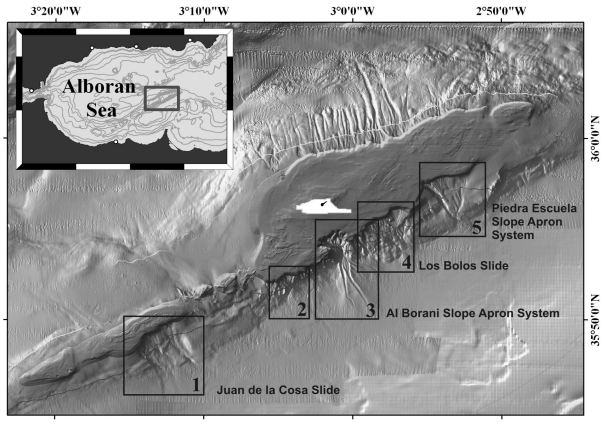

Fig. 1. Bathymetric map of eastern Alboran Ridge segment illustrating the different systems of sedimentary instabilities (Boxes 1 to 5) identified in the southern flank.

The complexes of slides have lengths between 1.8 and 6.6 km, and comprise concomitant slides, some remain on the surface but mostly extend from the slope break toward the Southern Alboran Basin where the deformed and disrupted slide material deposits forming lobes/wedges of chaotic facies with a rough seafloor surface (boxes 1 and 4).Thus, these complexes would represent slides and associated mass-flows deposits.

Two types of slope apron systems are identified based on their internal sediment source that conditions the resulting architecture: point source apron (box 3) and multiple source apron (box 5). The point source apron (box 3) comprises a submarine canyon (3.5 km length) whose head indents into the summit of the ridge and extends down to the break of slope and from that point develops a turbiditic apron (5 km wide, 7.5 km length) defined by chaotic facies with numerous shallow channels (6 km length). The multiple source apron (box 5) comprises several channel systems of different orders of magnitude that extends downslope from the summit of the flank and converge at 870 m water depth, a little before to reach the break of slope of the flank, and develops a depositional turbiditic apron (4 km wide, 5.7 km length) from that point spreads to the Southern Alboran Basin.

From a sedimentary point of view, the southern flank of The Alboran Ridge forms a Large Slope Apron System that is made up of minor-order systems consisting of both constructional and erosional architectural elements. All these elements reflect the occurrence of sedimentary instabilities associated to the general mass-wasting process that affects to the southern flank of the ridge. The continuous moderate seismic activity in the Alboran Sea region and the Quaternary tectonics of the Alboran ridge must be invoked as the main controlling factors of this intensive mass wasting.

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