

SEDIMENT PATTERN DISTRIBUTION AND MORPHOLOGY OF THE ALBORAN RIDGE AND ITS RELATION WITH THE ANTICYCLONIC GYRE

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Abstract

The Alboran ridge is a linear seamount that divides the Alboran basin in two sectors and interferes in the general circulation pattern. The north-eastern segment of this ridge has been studied by means of high resolution seismic, side scan sonar data and dredges. The sediment pattern shows a transition southwards from sands to biogenic sands or biogenic carbonates and muds. This particular distribution has been related to the interaction between the Atlantic inflow and the ridge generating a high pelagic and benthic productivity as well as mud sediments domination southwards the ridge.

Keywords: Western Mediterranean, Alboran Ridge, sediment transport.

Introduction

The Alboran Sea is a narrow (~200 km wide and 350 km long) basin located in the westernmost Mediterranean Sea. It is connected to the Atlantic Ocean through the Straits of Gibraltar and is characterized by narrow shelves, an irregular slope and several sub-basins, ridges and seamounts. The Alboran Ridge is a linear NE-SW and strong bathymetric high that extends 180 km and rises locally in the Alboran island. The Alboran Sea is a key location to understanding the influence on the Mediterranean paleoceanography of the Atlantic-Mediterranean gateways. The Atlantic surficial waters pass through the Straits of Gibraltar, shows a wide anticyclonic gyre in the western Alboran basin and takes a WNW-ESE direction on the Alboran Ridge before moving eastwards (1). The Quaternary evolution has been controlled mainly by the interplay of tectonics, sea level, climate changes, and ocean circulation (2, 3). The goal of this paper is to study the relation between sediment distribution and ocean circulation as well as the influence of the Alboran ridge.

Material and methods

Bathymetric (echosounder Furuno FUG 11), high resolution seismic reflection (ORE 3.5 kHz) and side scan sonar (EG&G, 500 kHz) data and dredges ranging from 0 to 500 m depth were used to study the northeastern segment of the Alboran ridge along two oceanographic cruises (Coral 8209 and Alboran 9409). A microphysiographic study has been performed based on a side scan sonar mosaic (4).

Bathymetric characteristics

The ridge in this area can be divided in three sectors (Fig 1). The northeastern one shows two main relieves at 50 meters depth and the shelf gently deep to 130 meters. In the Central Sector, the shelf is constituted by some irregular relieves which the main is the Alboran Island. From 0 to 50 m depth, the bathymetric contours, rhomboedric and concentric, rounds the island. Between 50 and 100 m depth, the bathymetric lines are elliptic with a NW-SE major axis. The southern face is abrupt with a high slope from 100 meters depth, meanwhile, a flat zone, without relief, emphasizes the northern face between 110 and 120 meters depth. The southwestern sector is a very narrow shelf with two highs at 85 and 80 m depth respectively. Two submarine canyons (Piedra Escuela and Al Borani) have been differentiated in the southern slope, the second one is related to a well-developed submarine fan (5).

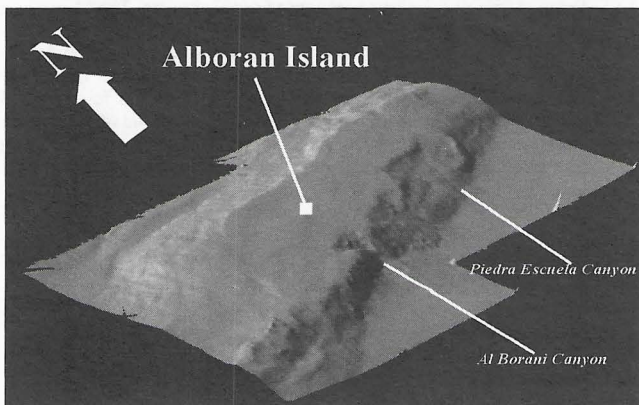


Figure 1. Digital terrain model of the Alboran ridge northeastern segment.

Sediment distribution

The sedimentary pattern on the Alboran ridge shows two main characteristics: 1) the textural distribution is sandy in the northern area and muddy in the southern area of the ridge, both areas are separated by a central elevation with several volcanic outcrops, and 2) the carbonate character of sediments especially in the central area (Fig. 2).

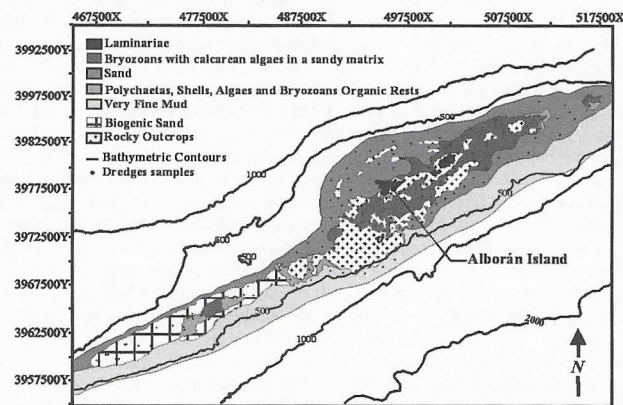


Fig. 2. Surficial sedimentary pattern on the Alboran ridge northeastern segment

There are a clear transition southwards from sands to carbonate sediments and to fine muds. Although it can be appreciated small rock outcrops in the northeastern sector and several volcanic outcrops around the Alboran island in the central sector of the studied area. Carbonates are constituted by bryozoans and calcarean algae mixed with sands located in an elliptic area SW-NE directed and placed 100 m depth, however in the southwestern sector they are biogenic sands (polychaetes, algae and bryozoans rests) and rodoliths containing the same organic rests. The origin of this sedimentary pattern have to be related with the interaction between the Alboran ridge as a barrier against the Atlantic surficial water masses controlling its flow. The southern flank remains leeward of this hydrodynamic regime and should develop an "island effect" that should favour a highly productive pelagic and benthic ecosystem, as well as a cascade contribution of biogenic and mud sediments on the southern area.

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