ORGANIC MATTER DISTRIBUTION IN SURFICIAL SEDIMENTS FROM WESTERN ALBORAN SEA

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Abstract

In order to address the question of whether there is a pelagic-benthic coupling in the western Alboran Sea, we studied the distribution of organic matter, proteins, carbohydrates, chlorophyll and phaeopigments in the surface sediments of this area. The distribution of these variables was compared with the oceanographic features in the overlying water column. The results suggest the existence of a pelagic-benthic coupling in this zone.

Keywords: Alboran Sea, Sediments, Upwelling, Organic matter

Introduction

In the marine environment the coupling between pelagic and benthic systems is an issue to growing interest in recent years (1). Benthic activity in marine areas is dependent on phytoplankton production in the overlying water column. Observations in the western Alboran Sea indicate biological and geochemical structures in the water column that appear to be associated with the local circulation pattern (2). This pattern is influenced by both the inflowing Atlantic jet through the Strait of Gibraltar, which follows a wave-like path towards the east (3; 4), and local winds. The Atlantic jet creates a geostrophic front and leaves an area of divergence between the front and the continental shelf, promoting the upwelling of nutrient-rich deep Mediterranean water. This upwelling produces an increase in the primary productivity in this area (2). Moreover, the frequent local SW winds induce periodic upwelling events along the coast of Málaga (5), providing higher productivity in the coastal area. In this study we address the question of whether the enhancement in productivity associated with these oceanographic features has consequences for the benthic ecosystem underneath.

Material and methods

The sampling was carried out in January 2000, on board the R/V "Odon de Buen". Sediment samples were taken at 23 stations located along 6 different transects which ranged from 13 m to 540 m depth. Chlorophyll a (Chla), phaeopygments (Phaeo), organic matter (OM) and its biochemical composition: proteins (PRT) and soluble carbohydrates (sCHO) were determined in sediment samples. A CTD profile was carried out at each station.

Results

The circulation pattern observed during the cruise showed the influence of the Atlantic front in the area under study (Fig.1).

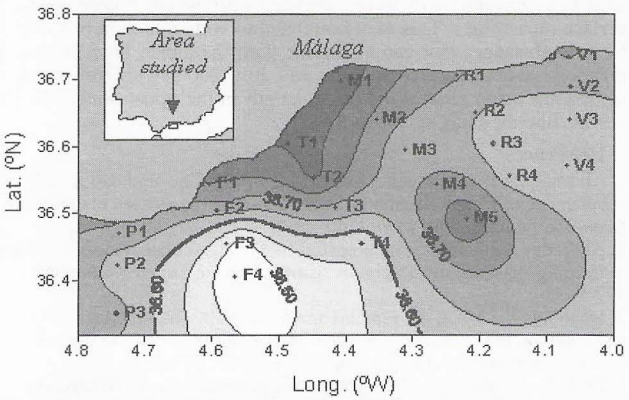

Figure 1. Area of study. Distribution of salinity at 10 m depth. The black solid line separates Atlantic (S<36.6 PSU) from Mediterranean waters.

The position of the front is indicated by the isohaline of 36.6 PSU. Higher salinities were observed near the coast due to upwelling of deep Mediterranean water. Moreover, the high values of salinity found at station M5 suggest a cyclonic circulation.

Overall, the organic matter (OM) content in sediments, and its constituents PRT and sCHO, showed higher values in the coastal stations of transects T and M, and in most of the offshore stations. (Figure 2). Those are the stations influenced by coastal upwelling and the front respectively. The organic matter distribution in the oceanic stations appeared to show the same wave-like pattern as that observed in the Atlantic jet. The OM content ranged from 0.9% at the station R1 (a coastal station out of the influence of the upwelling) to 6.2% at the station P3 (most-influenced by the front).

sCHO concentrations ranged from 0 to 220 μg/g. sCHO showed a similar distribution to the OM although the maximum values were found

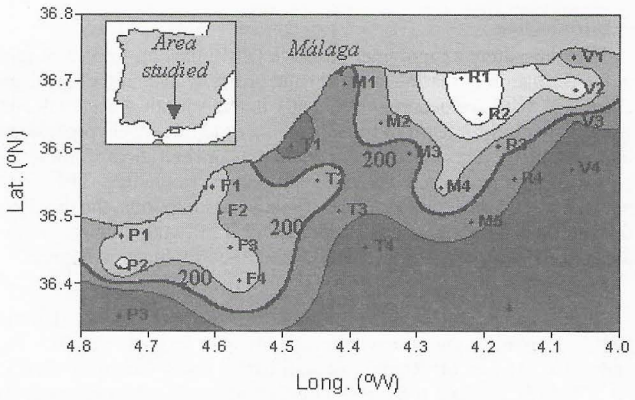

Figure 2. Distribution of proteins in surface sediments (µg/g). (Solid lines show the concentration of PRT=200 (µg/g).

slightly displaced towards the West. The sCHO maxima encountered in transect T may be explained not only by the presence of the coastal upwelling, but also by terrestrial imputs by the Guadalhorce river. The minimum was found at station R1.

PRT distribution in surface sediments showed a similar pattern to that observed for OM: high values in the zone influenced by the upwelling and in the oceanic stations affected by the front. The highest protein concentrations were observed at station P3 (>410 μg/g). There were also high concentrations of proteins in the deeper stations of the transect V (V3, V4) suggesting again the wave-like path of the Atlantc jet.

In generall, Chlorophyll a (Chla) concentrations in sediment were very low. The higher values were found in the coastal stations and in the westernmost oceanic station, P3. Station R3, also displayed high values. The distribution of phaeopigments (Phaeo) showed the maximum values in the coastal stations of transect T probably due to OM inputs from the river.

The high values observed for all the organic matter constituents studied at station P3, despite its notable depth (540 m), could be explained by the strong influence of the front. The enhancement of productivity associated with the front would be reflected in a larger vertical flux of phytodetritus to the sea floor at this station. The low values in OM, PRT and CHO in sediments of the eastern area (transect R, especially R1) reflect the oligotrophy of the overlying waters, which are out of the influence of the front. Despite the low values of OM constituents at R1, that station displayed a high Chla/Phaeo ratio. This high ratio may be due to benthic microalgae biomass, since R1 is only 13 m depth. The results of this preliminary study strongly suggest the presence of pelagic-benthic coupling in this area.

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