DOWNWARD PARTICLE FLUXES IN A SUBMARINE CANYON OF THE NORTHWESTERN ALBORÁN SEA: THE GUADIARO SUBMARINE CANYON.

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Abstract

Total mass flux (TMF) within the Guadiaro canyon and its western adjacent slope showed an important seasonal variability, ranging more than two orders of magnitude. Two peaks of downward mass fluxes occurred in winter coinciding with events of increasing Guadiaro River discharge. Particle fluxes in the open slope showed a similar variability and were slightly higher than fluxes measured at the same depth within the Guadiaro channel, indicating common sediment transfer processes within and outside the channel. During the autumn-winter period, the lithogenic content was high and relatively constant while during the spring-summer period the opal and organic carbon content increased both in magnitude and variability. Peaks of biogenic constituents were associated to biological blooms.

Keywords: Downward particles fluxes, Guadiaro canyon.

Introduction

Spatial and temporal studies of downward particle fluxes have been carried out in several continental margins of the world. The main objective of these studies has been the understanding of the continent-ocean sediment transfer and its role in the marine biogeochemical cycles, especially that of carbon. Direct observations of the temporal variation of the organic carbon fluxes in the Alborán Sea are scarce, despite the important role that this area has in the Mediterranean Sea.

Material and method

Five Technicap P.P.S/3 sediment traps (1) were deployed in three mooring lines inside and outside a submarine canyon system of the north-west Alborán continental margin, in the framework of the FLUXALB Project (Fig. 1): The Guadiaro canyon and open slope moorings were deployed at 592 and 720 m depth respectively and were equipped with one sediment trap each one installed 25 m above bottom. The Guadiaro channel mooring was deployed at 692 m depth and included three sediment traps installed at 135, 500 and 667 m depth respectively. The overall duration of the deployment was 12 months (from November 1997 to October 1998).

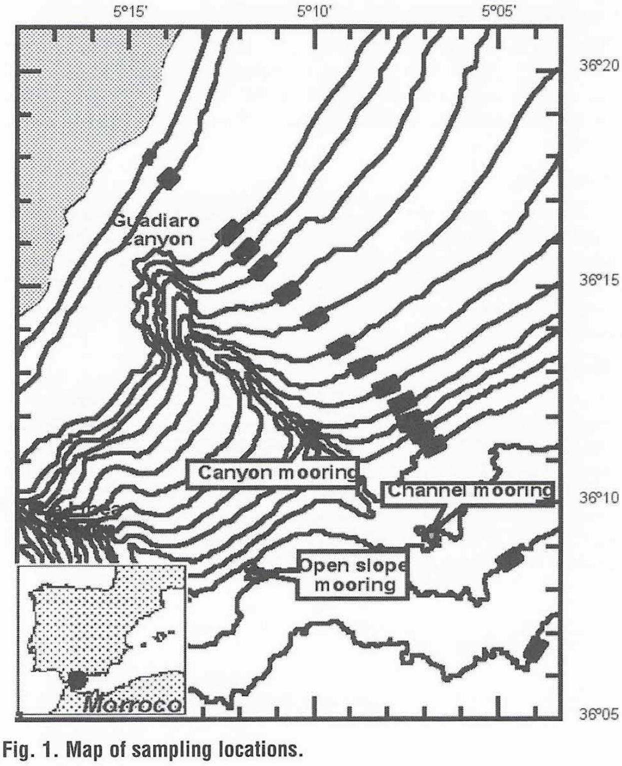

Fig. 1. Map of sampling locations.

Subsampling and TMF were estimated according to the method described in (1). The total carbon (TC) and nitrogen were determined by a LECO CN 2000 analyser. The inorganic carbon (IC) was obtained by acid digestion (HCL 6M) in a LECO CC-100. The difference between the (TC) and (IC) is defined as the organic carbon (OC). Biogenic silica (opal) content was obtained using a wet-alkaline extraction with sodium carbonate (2).

Result and discussion

TMF showed an important variability ranging more than two orders of magnitude (from 101,3 mg m^{-2} d^{-1} to 27397.7 mg m^{-2} d^{-1}). The OC content ranged from 1.38 % (in mid May, 1998) near the bottom in the canyon site to 8.11 % (May, 1998) near the surface at the channel site. The temporal evolution of OC content and TMF revealed an opposite trend. The higher OC content were measured during spring and summer, when the TMF was lower. The lowest opal content (1.77 %) corresponded to late December 1997 in the slope site, whereas the high opal content (12.93 %) to late June 1998 at mid depth at the channel site. The opal content increased in spring and summer, showing the maximum values between June and August, except near the bottom, where it increased mainly in August.

In the water column, particle fluxes in the Guadiaro canyon system showed an increasing trend with depth. Near the bottom, the downward particle fluxes decreased drastically from the canyon site to the channel site indicating either sedimentation of particulate matter within the canyon or along-slope particle dispersion outside the canyon before reaching the channel area. Near the bottom and at mid depth, the main TMF increases were related with increases of the river discharge. Storms events alone were not related with TMF increases. During May-June 1998, high fluxes (27.4 g $m^{-2}d^{-1}$) were recorded in the canyon site, which appear to be associated with resuspension processes caused by internal waves (3). The high near-bottom fluxes recorded in the western adjacent open slope are related either with inputs overflowed from the Guadiaro channel and/or from the adjacent submarine canyons besides those transported along slope directly from the shelf.

The downward particle fluxes reflected clear seasonal variation with maximum values in winter and minimum in summer and autumn. TMF variability is very similar near the bottom and intermediate depth, indicating near-bottom lateral particle transport and suspended particles detachments along the canyon. Near the surface (135 m) the flux variability differs from the other studied levels and there are only simultaneous high particle fluxes in November and December coinciding with the flood and stormy season.

The temporal distribution of the constituents had also a clear seasonal character. During the autumn-winter, the lithogenic content and the total mass fluxes were high and relatively constant at all the studied levels (near-bottom, intermediate and near-surface depths) as a consequence of the lateral transport and particulate matter detachments from the continental shelf and slope.

During spring and summer the content of biogenic constituents increased due to phytoplancton blooms and lower inputs of terrigenous constituents. Higher content of biogenic constituents corresponded to low TMF. However, whereas the higher OC contents were recorded near the surface, the higher opal contents were found in near-surface, intermediate and near-bottom waters indicating perhaps a better preservation of biogenic silica during settling in the water column.

References

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