GEOCHEMISTRY OF PARTICULATE MATTER IN THE OTRANTO STRAIT AND THE IONIAN SEA

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Abstract

The geochemistry of major and trace elements in particulate matter (PM) from the Otranto Strait and the Ionian Sea has been studied in the framework of INTERREG-II project. Chemical elements form three groups related to detrital aluminosilicates, biogenic activity, oxyhydroxides and organic matter. Elemental distribution patterns largely follow the PM concentration that was found elevated in shelf surface waters as well as over the Greek continental slope and the Otranto Strait seafloor. PM originating in the rivers flowing in the Ionian Sea is transported toward the Adriatic Sea through the eastern part of Otranto Strait.

Keywords: geochemistry, particulates, Otranto Strait, Ionian Sea, Eastern Mediterranean

Introduction

The aim of the present communication is to provide information about the levels of major and trace elements in particulate matter (PM) of the Otranto Strait and the Ionian Sea, and moreover to evaluate elemental transport processes from the continental shelves to the Ionian Basin. Apart from a recent study on the distribution patterns of major elements in the Adriatic Sea and the Otranto Strait [1], the geochemistry of PM in the Ionian Sea had not been studied in the past. This work is part of the INTERREG-II project and presents preliminary data on the geochemistry of twenty major and trace elements determined in PM.

The Otranto Strait links the Adriatic Sea and Ionian Sea; it is about 75 km wide and maximum depth is ~780 m (Fig. 1a). The Ionian Sea can be identified as the region between Sicily and western Greece; maximum depth in the area under investigation is about 2000 m. Samples were collected along two transects: the first was located in the Strait of Otranto, and the second at the south of Kerkyra (Corfu) and Paxoi Islands in the Ionian Sea (Fig. 1a).

Methods

Combined CTD/Light transmission casts were made at 11 stations during the first INTERREG-II cruise (14-27 February 2000) on board R/V Aegaeo. Water samples were collected and filtered through membrane filters (for details see [2]) that were used for the determination of particulate matter concentration (PMC). Total elemental composition (Mg, Al, Si, P, S, Cl, K, Ca, Ti, Ba, V, Cr, Mn, Fe, Ni, Cu, Zn, As, Sr, and Pb) of the PM was determined by X-ray spectrometry at the laboratories of PMEL/NOAA [3]. Particulate organic carbon (POC) and nitrogen (PON) were analyzed by combustion methods in a CHN elemental analyzer [4].

Resulsts

On the Otranto Strait transect higher PMCs are observed: (i) in the upper 200 m of the water column, the higher PMCs (0.13-0.19 mg/L) originating in the Greek continental shelf and decreasing westwards; (ii) in mid-waters (400-600 m; PMC: 0.17-0.25 mg/L), where PM is probably detached from the steep slope; and (iii) in a zone 100-200 m thick, over the seafloor at water depths between 600 and 1000 m, which is most likely the result of surface sediment resuspension (PMC: 0.15-0.22 mg/L). Chemical element interrelations were studied with respect to their spatial distribution patterns, the correlation coefficient matrix and factor analysis scores. The majority of the elements determined (Mg, Al, Si, P, K, Ca, Ti, V, Cr, Mn, Fe, As, and Pb) follow the distribution patterns of the PMC. These elements are the constituents of terrigenous aluminosilicates, represented by Al (Fig. 1b). Sr and partly Ca are biogenous constituents and show relatively elevated concentrations in the upper waters where biological activity takes place (Fig. 1c). Similar patterns are observed for Ni, but its behavior remains unclear. Cu, Zn and Fe concentrations are higher in the particles resuspended from the Greek continental slope and probably represent a metal oxyhydroxides phase. Particulate organic carbon (POC) varied between 0.71 and 3.83 μmol/L and along with S and a part of the metals, forms an organic-related phase.

On the Ionian Sea transect surface waters (0-200 m) show higher PM concentrations (PMC: 0.2-0.3 mg/L). The geochemistry of all elements follows this prevailing pattern indicating the detrital origin of the particles (Fig. 1d). Elemental concentrations decreased constantly with depth, whereas resuspension over the slope was not identified. Element interrelations were similar to the Otranto Strait phases: lithogenic, biogenous, oxyhydroxides and organic. POC varied between 0.59 and 3.32 μmol/L, and was grouped with S and some metals.

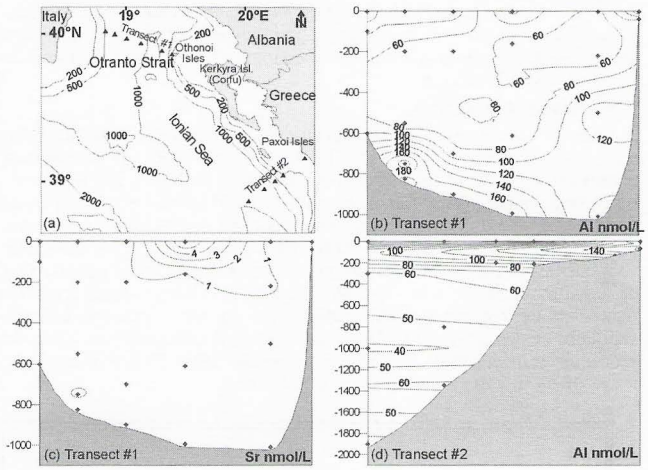

Figure 1 a : Location map, sampling stations and general bathymetry; b : distribution of particulate Al (nmol/L) at thz Otranto Strait; c : distribution of particulate Sr (nmol/L) at the Otranto Strait; and d : distribution of particulate Al nmol/L) at the trasect south of Kerkyra Isl.

Discussion and conclusions

Particulate matter originating in the western Greek mainland occupies the surface waters of the continental shelf and supplies the Ionian Sea with detrital aluminosilicates represented by Al (Fig. 1d). This material, following the general cyclonic circulation [5] is transported to the north, along the coastline, and enters the Adriatic Sea through the Strait of Otranto. PM is also entrained in the water column from sediment resuspension occurring over the eastern slope and seafloor of the Otranto Strait. However, elevated elemental concentrations in the latter area may be related to the presence of deep Adriatic water [5], which is rich in Al [1]. Significant outflow of PM from the Italian shelf has been reported [1], but was not detected, possibly due to the distance of the stations from the Italian coast.

References

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