

## ARSENIC GEOCHEMISTRY IN THE NORTHERN SARONIKOS GULF, GREECE

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## ABSTRACT

Sequential extraction techniques were used for the geochemical fractionation of As in polluted and non-polluted sediments of Northern Saronikos Gulf, Greece. Most of the As concentration in the polluted sediments was found in the "Fe/Mn oxides" and "organic matter/sulfides" fractions, while in the non-polluted sediments, most of the As concentration was found in the "lithogenous" (residual) fraction.

## INTRODUCTION

Northern Saronikos Gulf receives the combined domestic and industrial effluents from the greater Athens area mainly through the Athens Sewage Outfall (ASO). The effluents of a Fertilizer Plant (FP) are also discharged in the same area. Previous investigations (Grimanis et al. 1977, Angelidis et al. 1982) reported high As concentrations in the sediments near the ASO and the FP.

In order to determine the partitioning of As among different geochemical fractions in the sediments, we used a procedure proposed by Salomons and Förstner (1980), utilizing an extraction with acidified hydroxylamine hydrochloride (reducible fraction) which selectively dissolves Fe/Mn oxides, and an extraction with acidified hydrogen peroxide (oxidizable fraction) which dissolves the organic matter and the sulfides present in the sediment. The As remaining in the residue after the extractions should be considered as detrital (residual fraction).

## METHODS

Surface sediment samples from N. Saronikos Gulf were treated with acidified hydroxylamine hydrochloride and acidified hydrogen peroxide. Each subsample taken from the treatment (i.e. reducible, oxidizable and residual fractions) was analyzed for As, using INAA (Grimanis et al. 1977).

## RESULTS AND DISCUSSION

In all stations except Stations 4, 5 and 6, the residual As concentration is relatively constant (17 to 25 µg/g). The sediments at Stations 4, 5 and 6 have high As concentrations in the residual fraction (1150 µg/g, 80 µg/g, and 42 µg/g, respectively), which should be attributed to the solid wastes discharged from the FP during the last few years.

High As concentrations were found in the reducible and oxidizable fractions of the sediments from Stations 5 and 6, near the ASO. The relative partitioning of As in those sediments was: 51% in the reducible fraction, 33.1% in the oxidizable fraction, and only 15.9% in the residual fraction. In the non-polluted sediments, five miles from the ASO, 67.5 to 89.4% of As was in the residual fraction.

In the non-detrital (i.e. the reducible and the oxidizable) fraction of Stations 9, 10, 11 and 12, the As concentrations range from 9.3 to 13.8 µg/g, while in Stations 6, 7 and 8, the As concentrations in the non-detrital fraction are higher (215 µg/g, 61 µg/g, and 47 µg/g, respectively).

It is suggested that the As-rich suspended particles from the ASO/FP effluents are transported west, towards the Keratsini Bay, by a cyclonic movement of the water masses of N. Saronikos Gulf, affecting the non-detrital As concentration of the sediments of the area.

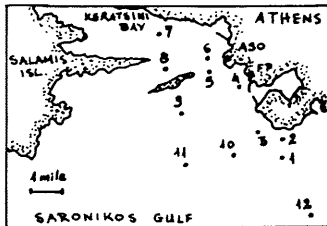


Figure 1.  
Sampling Stations

## CONCLUSION

The geochemical fractionation used shows considerable differences in the partitioning of As between polluted and non-polluted sediments of the Northern Saronikos Gulf.

In the polluted sediments near the ASO, the Fe hydrous oxides and Mn oxides are the most important carriers of As, while the detrital fraction contains the greater part of As in the non-polluted sediments.

There is an influence of the ASO and FP effluents on the non-detrital As concentrations of the Keratsini Bay sediments, which could be attributed to a cyclonic movement of the water masses of Northern Saronikos Gulf.

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## QUALITÉ DE LA MATIÈRE ORGANIQUE EN RAPPORT AVEC LA COMPLEXATION DES MÉTAUX POUR DES SÉDIMENTS PRÉLEVÉS EN BOUT D'ÉMISSAIRES D'EAUX URBAINES USÉES

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**Abstract:** Marine sediments from 3 different sites of the French Mediterranean littoral receiving municipal sewages are studied. The organic substances are extracted, fractionated and analysed. Their potential ability to complex metals are evaluated by polarographic techniques. Fluorescence of extracted humics is measured at different concentrations and pH with the view of their titration in interstitial waters.

Dans le cadre d'une campagne pluridisciplinaire d'étude de l'influence d'apport de polluants terrigènes sur les sédiments marins, plusieurs sites de la Côte d'Azur ont été étudiés.

Cette étude comparative a permis la mise en évidence de différentes qualités de sédiments par rapport au type de rejet et notamment la comparaison des capacités complexantes globales par rapport au cuivre des eaux interstitielles de ces sédiments. (1)

Il semble intéressant de préciser le rôle de la matière organique dans la complexation des métaux et de voir si ce rôle peut être caractéristique d'un type d'émissaire.

Dans ce but nous avons tenté d'analyser les différentes fractions contenues dans la matière organique totale à partir d'échantillons de sédiments.

La matière organique labile (lipides, protéines, glucides) est évaluée par différentes techniques (2). La matière organique complexe est extraite, purifiée et fractionnée en acides fulviques, acides humiques et humines en fonction de leurs solubilités à différents pH par des solvants minéraux. (3)

Le rapport (Matière organique labile/Matière organique complexe) et les potentialités enzymatiques mesurées dans ces deux parties sont liés au degré de transformation de la matière organique en chaque point de rejet. Les analyses élémentaires des différentes fractions de la matière organique permettent de différencier les sites.

Enfin, la mesure de l'intensité de fluorescence (longueur d'onde d'excitation à 370 nm) pour divers étalons d'acides fulviques et d'acides humiques obtenus par extraction chimique est effectuée à différents pH et à différentes concentrations.

Ces résultats permettent une approche du dosage des acides fulviques et humiques présents dans les eaux interstitielles.

Les valeurs obtenues pour quelques capacités complexantes globales par rapport au cuivre de substances humiques remises en solution sont discutées.

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