

GEOCHEMICAL INVESTIGATION OF SEDIMENTS FROM BARCELONA HARBOR AND OPEN SEA FRONT FOR RAPID ASSESSMENT OF CONTAMINATION

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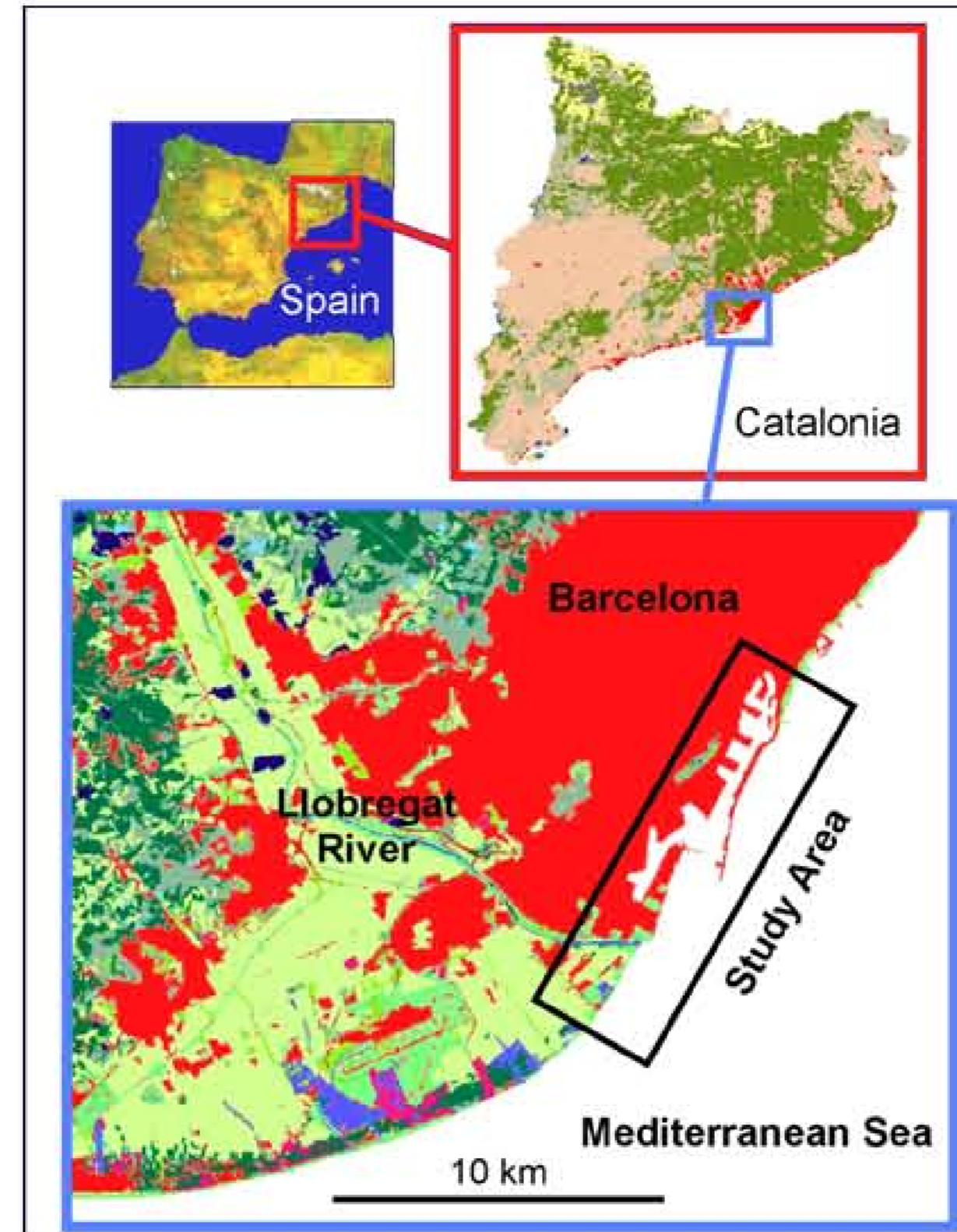
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ABSTRACT

Great port cities have been subject to many decades of environmental degradation, as an unintended consequence of shipping, industrial activity near the water's edge, and non-point urban discharge within the associated watershed. Organic substances form a significant fraction of the potential pollutants in these urban systems, coupled with the elevated concentrations of major & trace elements, often originating as fossil fuels (raw or modified) and the combustion products thereof. As such, analytical methods initially developed for petroleum exploration may be well suited for organic pollution assessment in sediments.

Ten years ago, the environmental quality of the Barcelona harbour and open sea front were analyzed using 12 sediment grab sample sites. The main results highlight an enrichment in C_{org}, S, and P in affected sites, the distribution of heavy metal pollution (Ag, Hg, Pb, Cu, and Zn), and the organic pollution due to detergents (C₁₆-C₁₉ phenylalkanes), petroleum (hopanes, alkylated PAHs), sewage (sterenes, alkylnitriles and alkylamides) and combustion products (parent PAHs). The present sediment environmental quality, after major alterations to the port configuration, with a new mouth and new policies for urban wastewater treatment, should show significant improvement, as has been verified by the coastal water quality assessment.

The rapidity and low cost of sediment analysis by Py-GC/MS makes it a practical tool for the assessment of organic pollution in urban waterways. While absolute quantitation remains difficult, Py-GC/MS data generated in ratio form are amenable to interpretation using multivariate methods and geographic information systems (GIS), providing valuable information for government, industry and public interest groups.



Urban Agricultural Forested

Objectives

Preliminary study of harbor sediment pollution.

Testing rapid analysis for organic contaminants by Py-GC/MS:

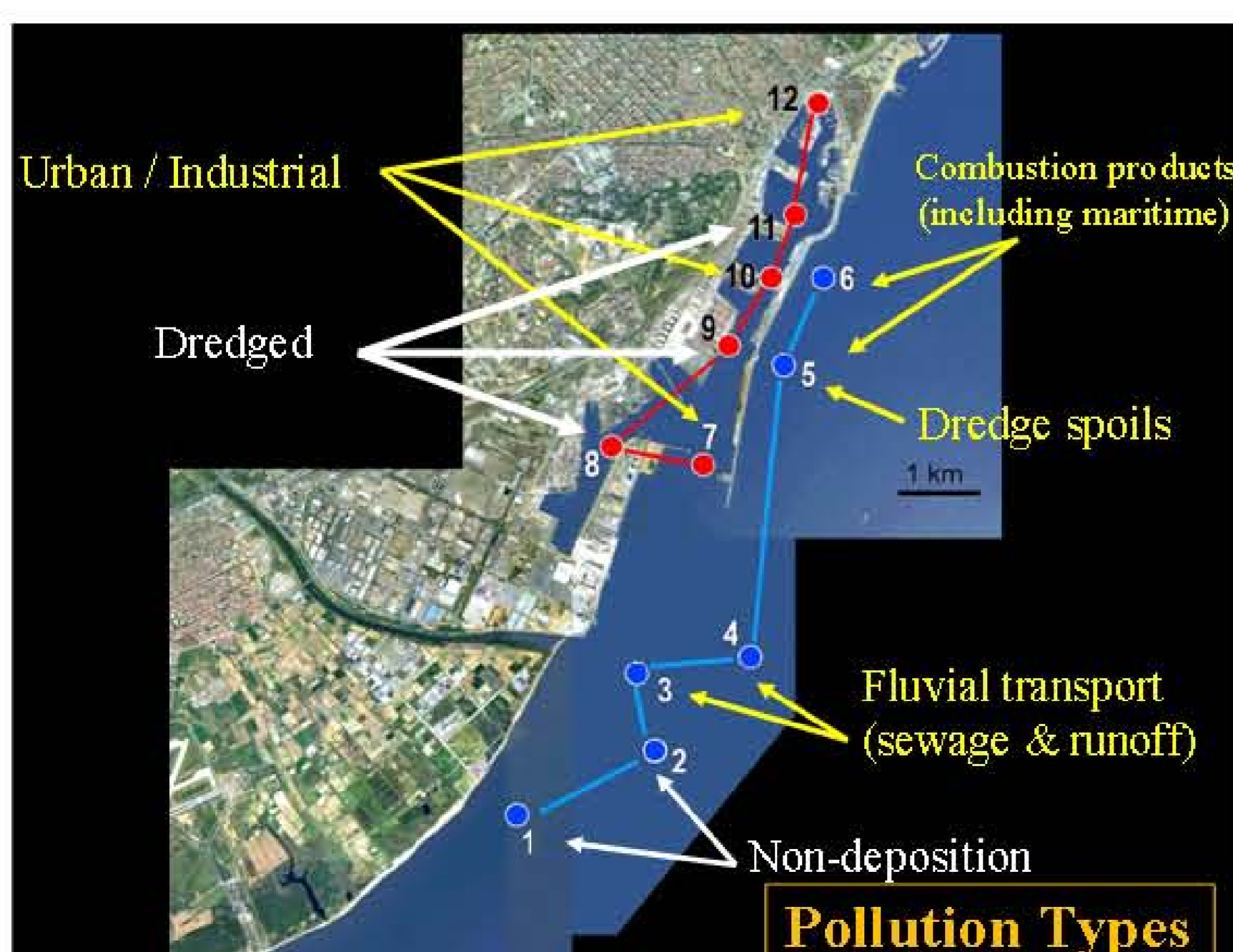
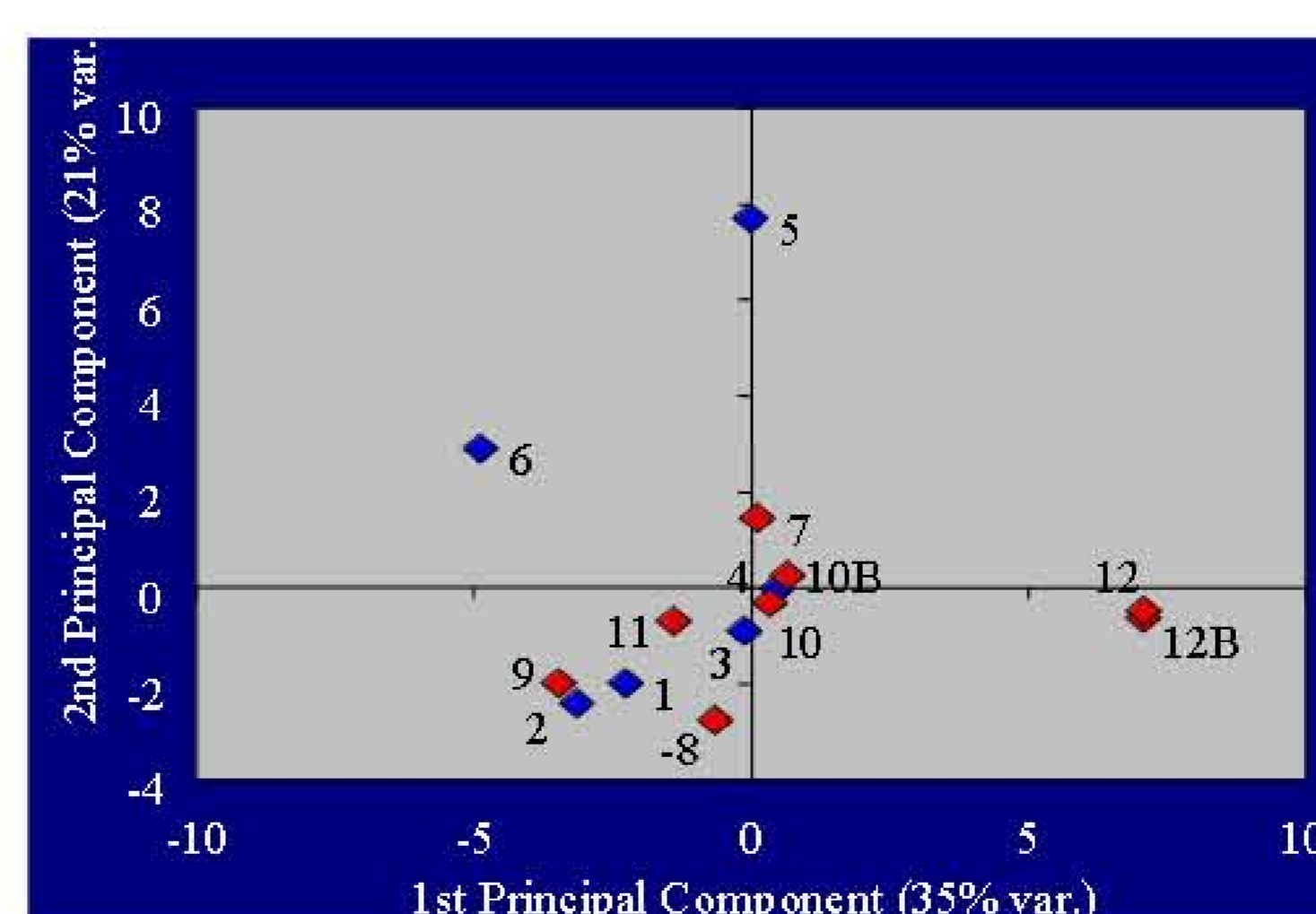
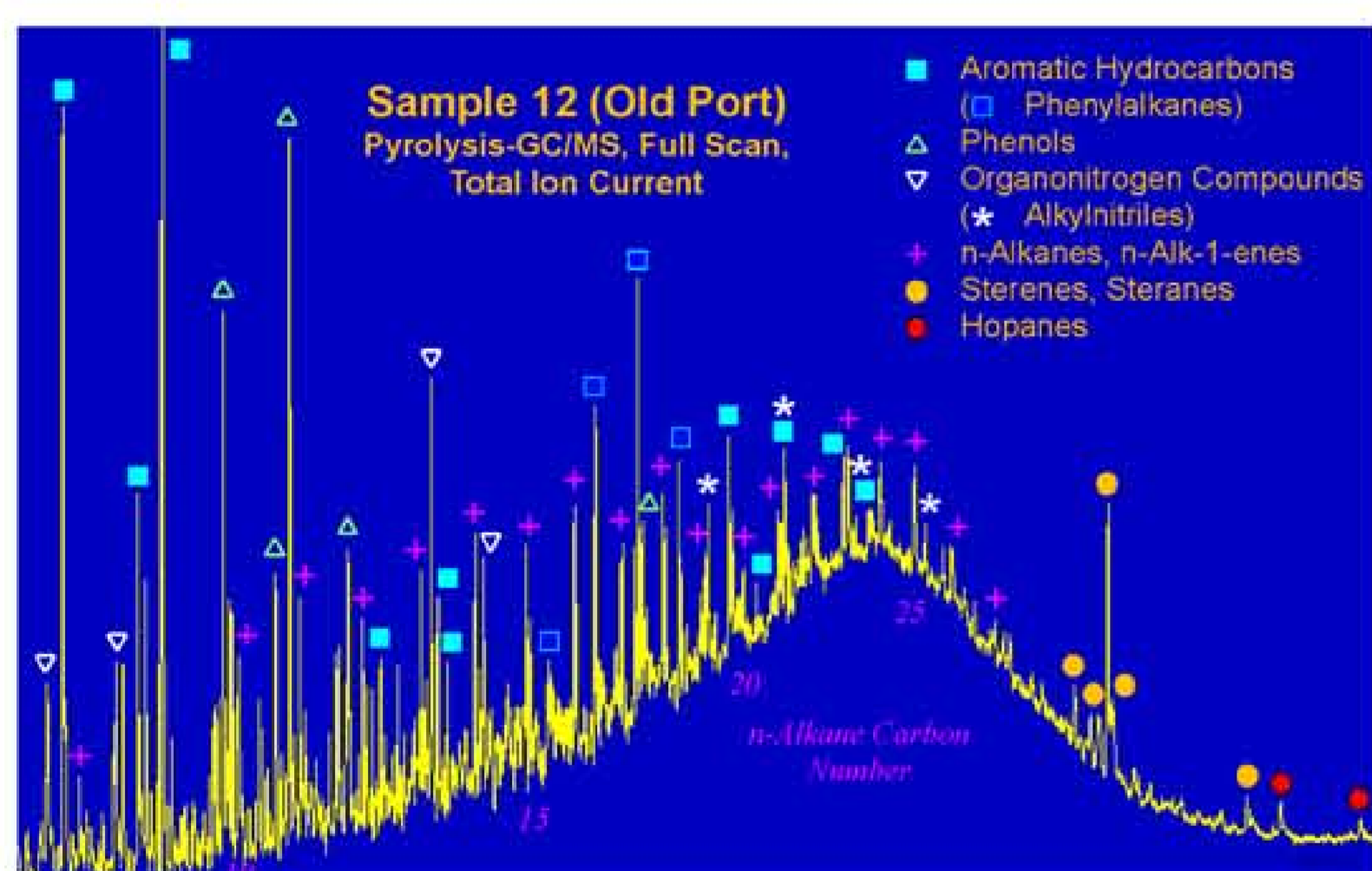
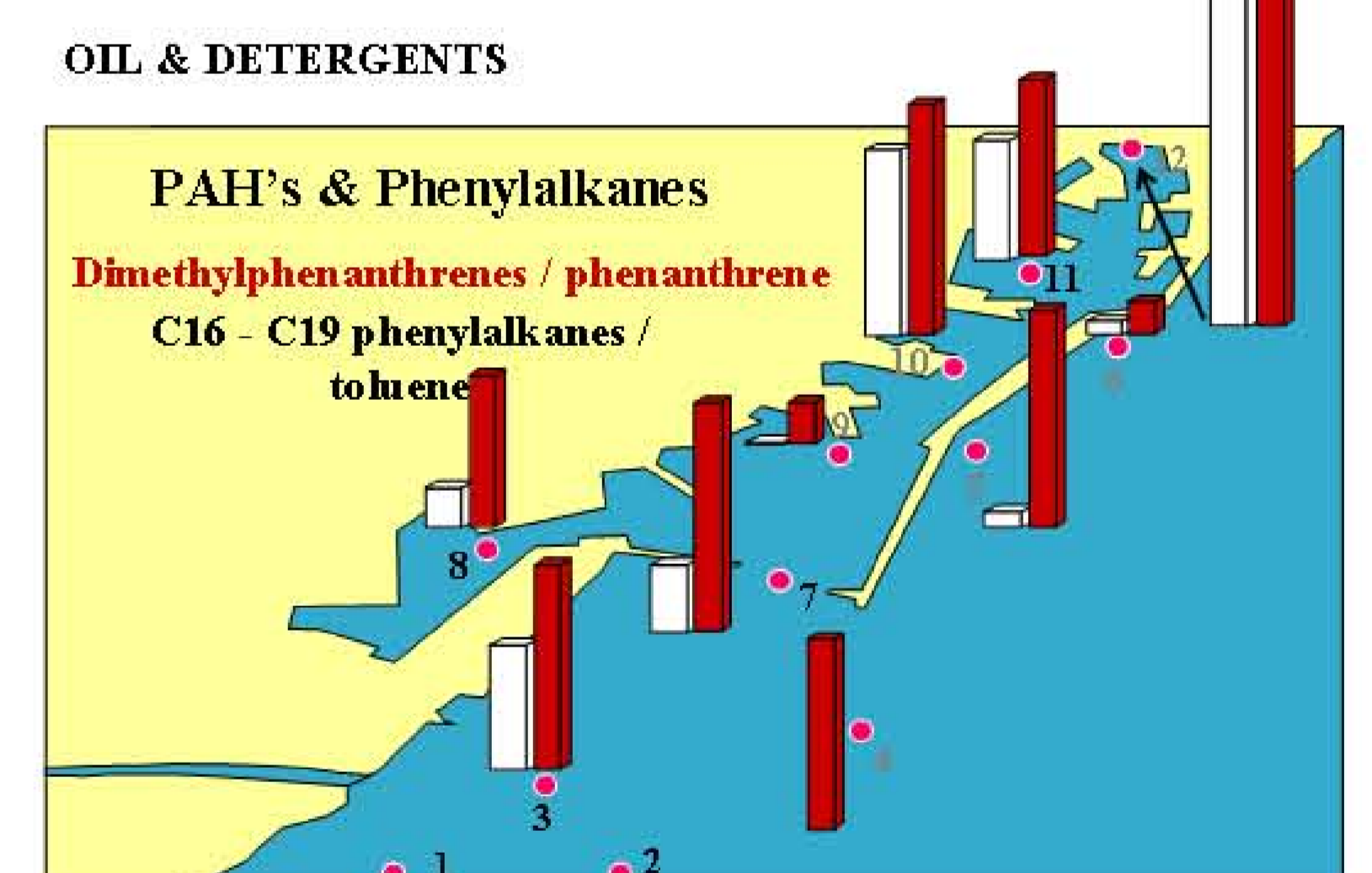
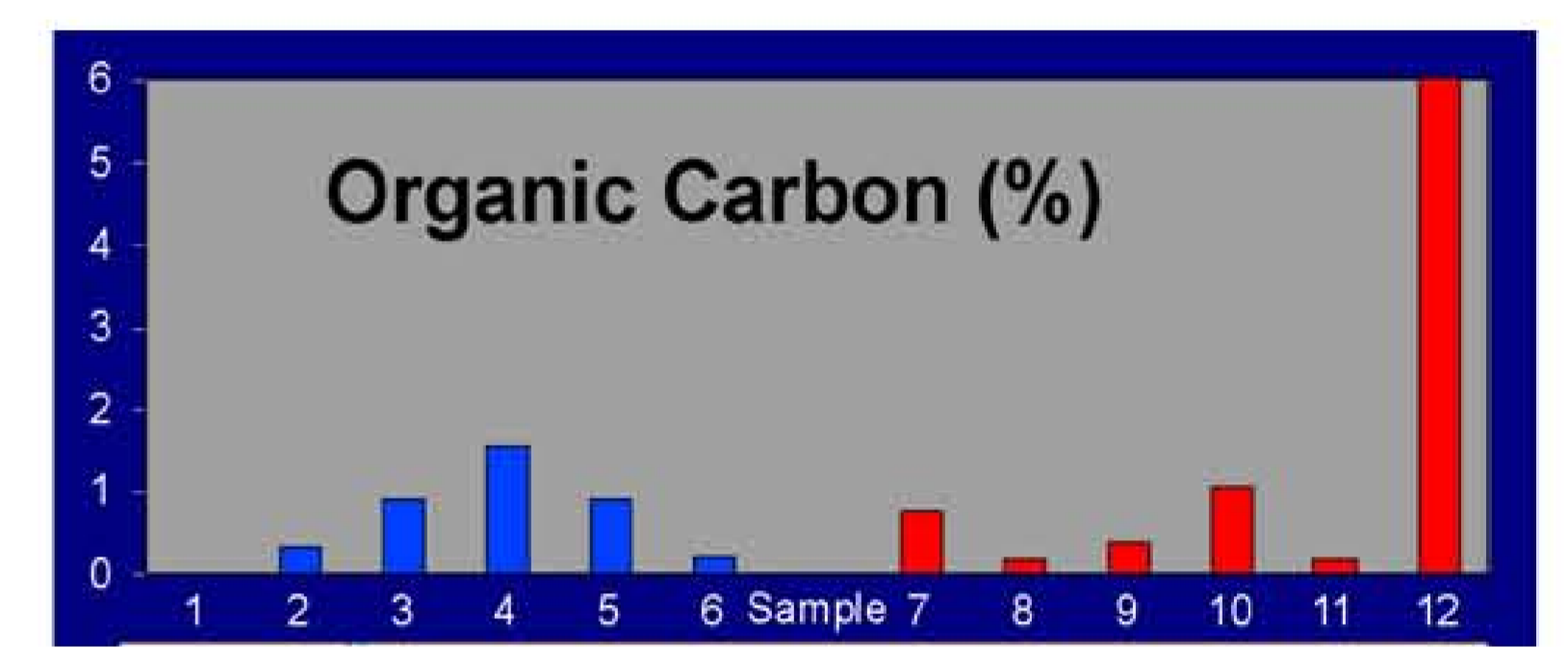
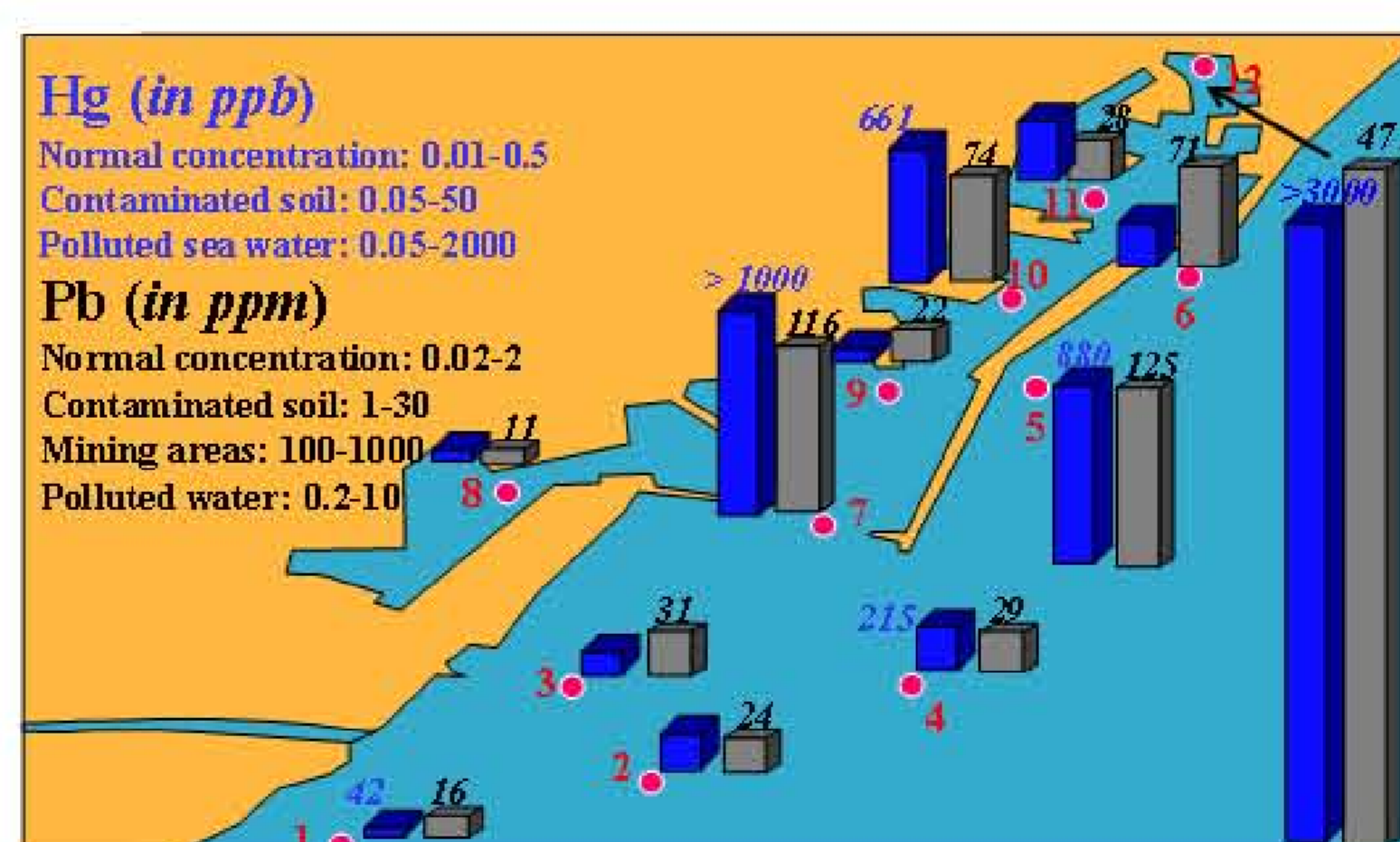
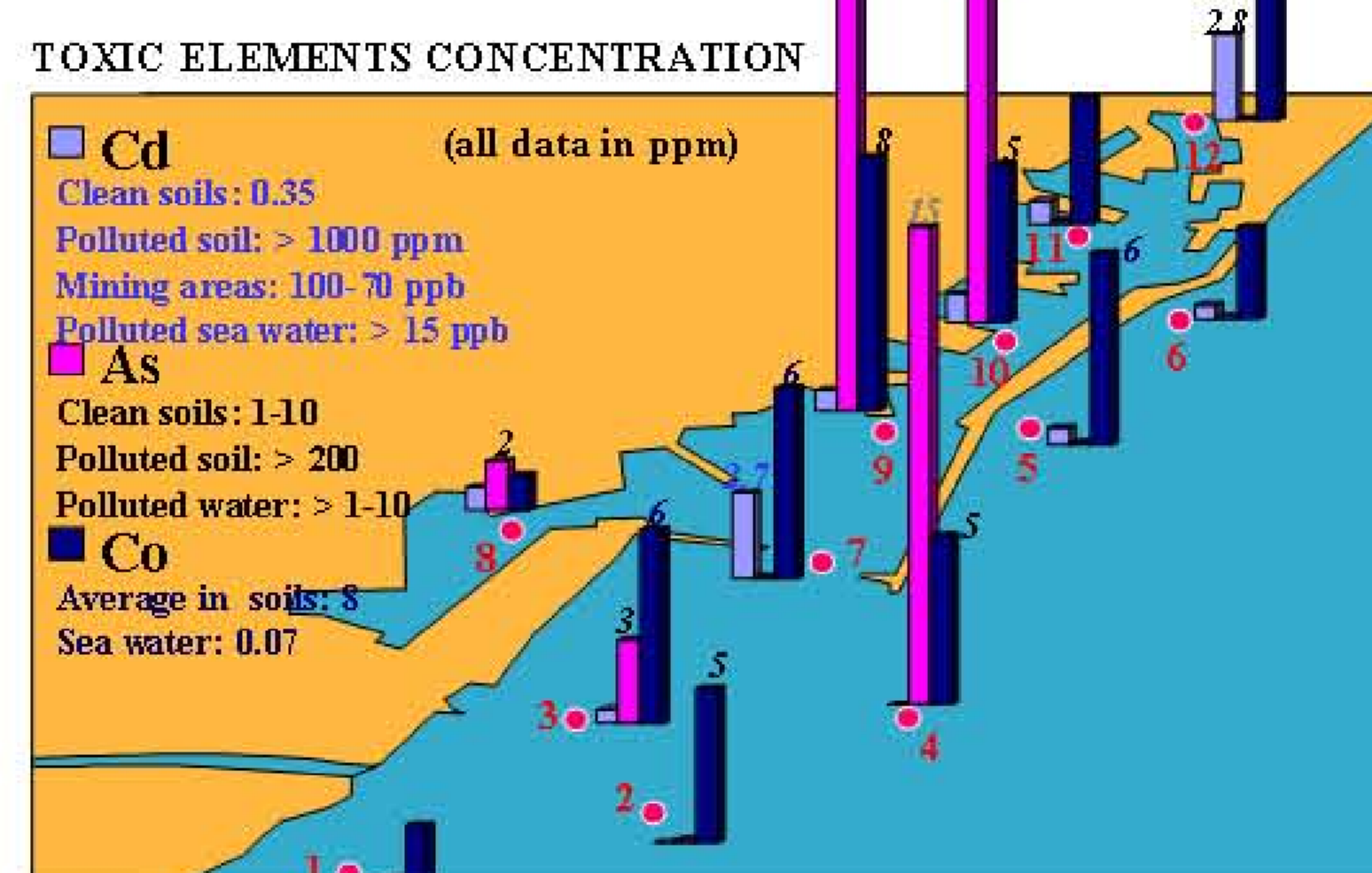
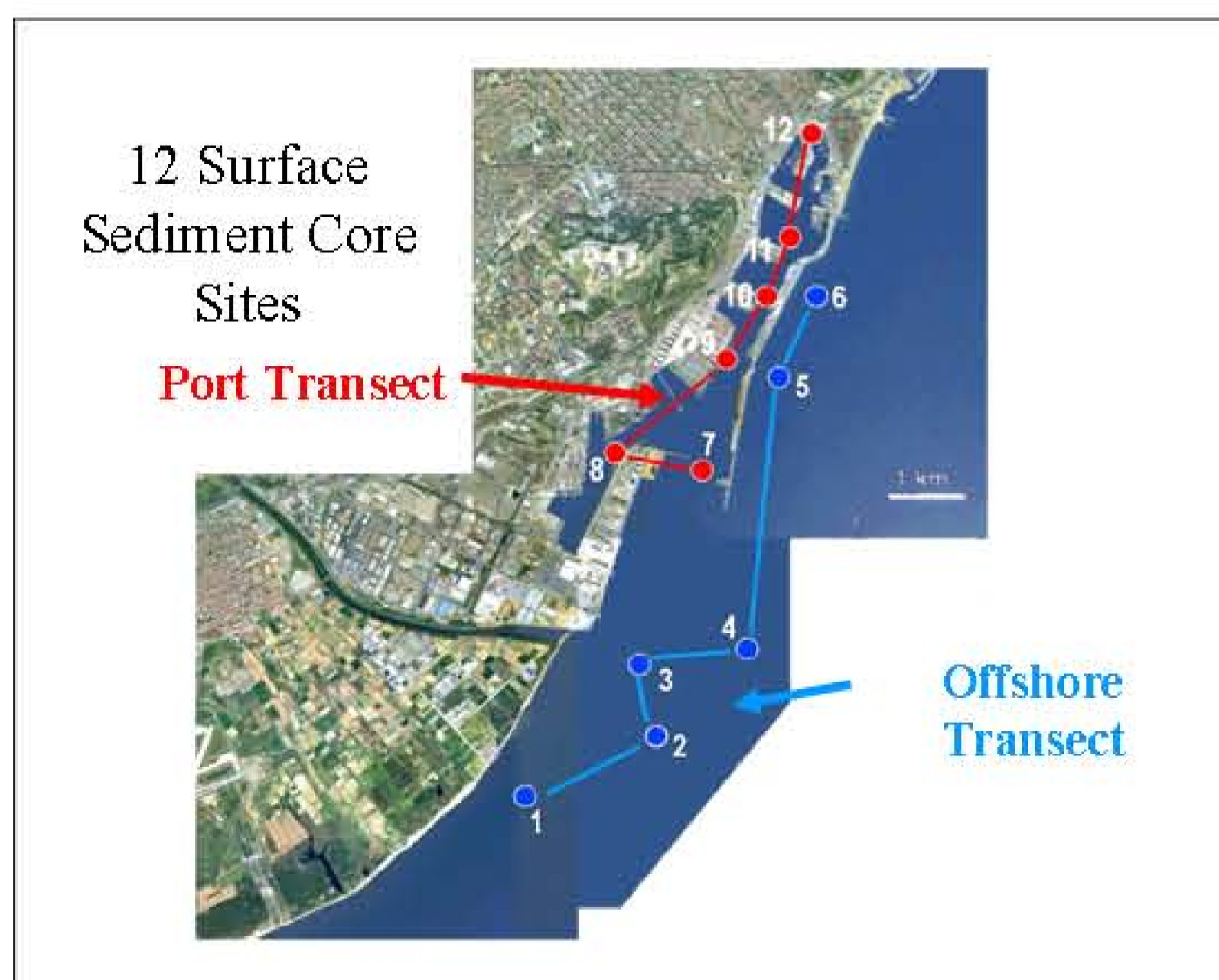
- petroleum
- sewage
- fossil fuel combustion products.

To provide baseline for further study after completion of major modifications to port facilities.

Ultimate goal: High resolution geochemical data set for incorporation in geographic information system (GIS).

Methods

Collection of 12 surface sediment samples and 2 replicates Port & nearby offshore zones
 Molecular organic analysis Pyrolysis-GC/MS of whole, dry sediment
 Elemental analysis Major & trace elements
 Multivariate statistical analysis Principal components



Conclusions

- * Enrichment in C_{org}, S, P at affected sites
- * Heavy metal pollution (Ag, Hg, Pb, Cu, Zn)
- * Organic pollution:
 - detergents (C₁₆-C₁₉ phenylalkanes)
 - petroleum (hopanes, alkylated PAHs)
 - sewage? (sterenes, alkylnitriles, alkylamides)
 - combustion products (parent PAHs)

Observed variations due to:

- Proximity to urban and industrial areas
- Fluvial deposition (sewage and runoff)
- Aeolian deposition of combustion particulate matter
 - industrial, vehicular, maritime
- Removal of polluted sediments by navigational dredging
- Dumping of dredge spoils

Question:

What is the effect of the new port configuration on the distribution of contaminants?

➔ Recommend follow-up study.