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Polychlorinated Biphenyls (PCBs) in the Mediterranean Sea Atmosphere and Seawater

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INTRODUCTION AND OBJECTIVES

The marine environment is subjected to contamination by a wide spectrum of chemicals mainly due to anthropogenic activities. Among these chemicals, persistent organic pollutants (POPs) have gained a lot of attention in the last decades due to their ubiquity in many environmental compartments, and their adverse health effects in biota and humans (induction of enzymes, anti-estrogenic effects, disruption of the endocrine system, immunosuppression, carcinogenicity, reproductive and developmental toxicity, skin disease, and cognitive disorders) [1, 2]. Polychlorinated biphenyls (PCBs) are a family of POPs formed by 209 congeners.

Within the framework of the *IP THRESHOLDS of Environmental Sustainability*[3], two sampling cruises on board of the oceanographic vessel ***B/O García del Cid*** (Figure 1) were performed. The first campaign was executed from Barcelona to Istanbul (June/July 2006) and the second one from Barcelona to Alexandria (May/June 2007). One of the objectives of these campaigns was to understand the current status of the Mediterranean Sea (MS) pollution by POPs and to study their input mechanisms. First results on **PCBs** from the 2006 campaign in the MS atmosphere, water and plankton are presented in this work.

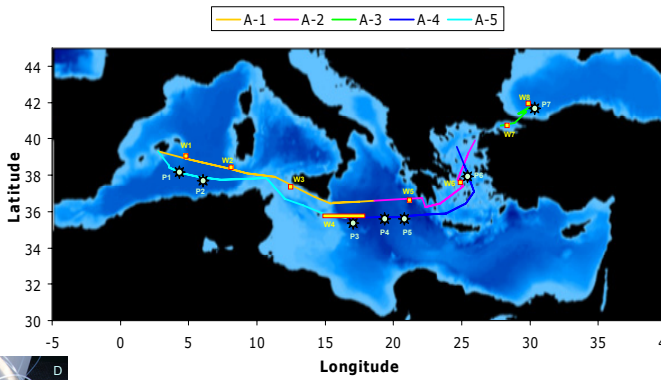


Figure 2. Air sampling transects and selected water and plankton sampling stations performed during the cruise

CAMPAIGN EXECUTION

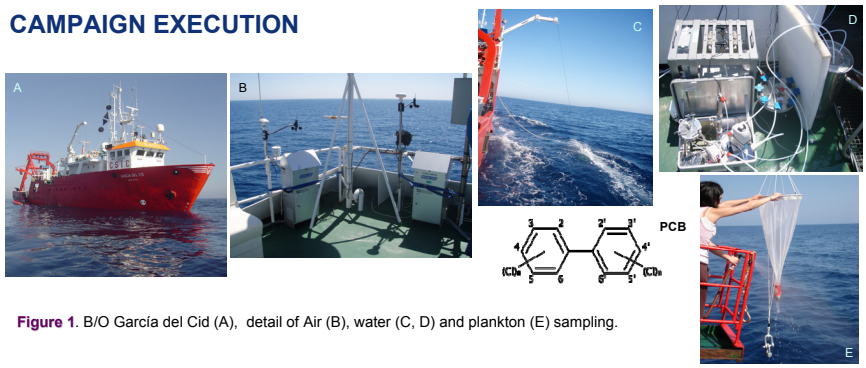


Figure 1. B/O García del Cid (A), detail of Air (B), water (C, D) and plankton (E) sampling.

Air samples: Air (particulate + gas phase) were collected by using two high volume samplers installed on the upper deck of the boat close to the bow (Figure 1, B). The samplers, operating in parallel, were equipped with a wind direction interface that stopped the sampling when wind was blowing from the poop of the vessel in order to avoid possible contaminations from the ship exhausts. Quartz fibre filters (QFFs) were used for air particle phase collection whereas compounds in the gas phase were trapped by using polyurethane foam (PUF) plugs.

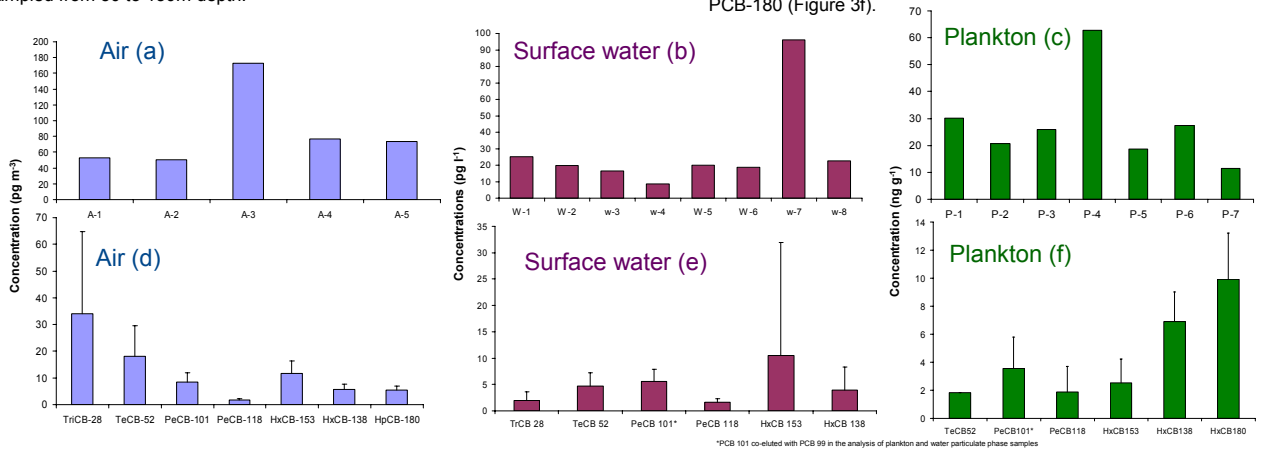
Surface water samples: Water was brought on board by using a continuous pumping system consisting on a steel protected Teflon hose connected to a tow fish that navigated at around 4-5m depth and 2-3 m apart from the boat while travelling (Figure 1, C). A membrane pump was used to suck the sea water and fill in continuously a 50 L stainless steel overflow container (where the sampling lines were inserted to have always fresh water, Figure 1, D). Glass fibre filters (GFF) were used to collect the particulate water phase, whereas compounds in the dissolved phase were extracted by using a polymeric adsorbent (XAD-2).

Plankton samples: Plankton was sampled by using a 50um net (Figure 1, E) at 10m below the deep chlorophyll maximum (DCM). Samples were filtered afterwards by using GFF to eliminate the remaining water. Plankton was sampled from 30 to 130m depth.

RESULTS AND DISCUSSION

∑ 7 PCB Air concentrations (gas + particulate phase) over the MS ranged from **50 to 70 pg m^{-3}**, whereas the sample took at Marmara and Black Seas exhibited a value of **172 pg m^{-3}** (Figures 2, 3a). The higher concentration obtained in the Marmara and Black sea is not surprising due to the higher anthropogenic impact in these systems as well as their enclosed character. Only one study, performed in 1990, reporting PCBs ambient air concentrations in the open MS was found in the literature where a mean value of 330 pg m^{-3} (only gas phase) was reported for ∑40 PCBs[4]. **Surface water concentrations** obtained (particulate phase) varied from **9 to 28 pg l^{-1}** in the Mediterranean . A highest value was measured at the Marmara Sea (**96 pg l^{-1}**) whereas concentration for the Black sea were in this case similar to those in the Mediterranean (Figure 2, 3b). An average value of 27 pg l^{-1} (only dissolved phase) was reported in the studied mentioned above for surface sea water[4]. Regarding **plankton concentrations**, a range of **19 to 63 ng g^{-1}** was obtained for the ∑ PCBs for the MS. The higher value was observed at P-4 corresponding to the Ionian sea. The sample at Marmara sea exhibited a concentration of **11 ng g^{-1}** (Figure 2, 3c).

PCB congener pattern in air was dominated by PCB 28 and PCB 52 (Figure 3d). The higher SD observed for CB-28 in due to the much higher concentration found for this congener at A-4 transect. Regarding water particulate phase pattern, PCB-153 and PCB-101 were found predominant (Figure 3e). The higher SD observed in PCB-153 was due to the much higher concentration of this congener at W-7 site (Marmara sea). This value of PCB-153 is being checked since some analytical interferences in this particular sample may have occurred . Plankton pattern was dominated by PCB-180 (Figure 3f).



*PCB 101 co-eluted with PCB 99 in the analysis of plankton and water particulate phase samples

Figure 3.
∑PCB ambient concentrations, spatial distribution and congener pattern in air, water and plankton along the MS. Air concentrations are gas+ particulate phase, water concentrations are only particulate phase and plankton values are the average of the 7 sampling sites for each congener. PCB congener patterns in air, plankton and water are the average from all sampling sites/transects for each compartment.

References

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Acknowledgements

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