

STUDIES OF SEDIMENTATION OF  
PHYTOPLANKTON AND ORGANIC  
MATTER IN THE GULF OF FINLAND  
(BALTIC SEA)

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Seasonal cycle of hydrography, phytoplankton succession and sedimentation of organic matter has been studied in the coastal area of SW Finland in 1988 and 1992. The sampling site represents the sea zone of open Gulf of Finland, although affected by the coastal water masses and the proximity of the archipelago. Seasonal course of phytoplankton production and succession as well as sedimentation were typical for the coastal boreal regions. Mass balance for the spring and summer periods is presented and the possible sources of error on sedimentation measurements (e.g. advection, resuspension, phytoplankton migration, preservation) are discussed.

THE BEHAVIOUR OF ORGANIC  
MICROPOLLUTANTS (PCBs, PAHs)  
IN THE RHINE ESTUARY, THE  
NETHERLANDS.

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The North Sea is a sink for many anthropogenic compounds. The presence of some of these compounds in the North Sea has resulted in adverse effects on biota. Examples are the reduced reproduction success of Harbour seal in the Wadden Sea (due to Polychlorinated Biphenyl (PCB) pollution), and liver tumours in flounder (due to Polycyclic Aromatic Hydrocarbons, PAHs). A recent budget study for PCBs and PAHs showed that for the North Sea, rivers are the second most important source, next to the atmosphere. To evaluate reduction measures, current loads should be known with sufficient accuracy.

Published data on micropollutant loads from rivers to the sea often neglect estuarine particle-trapping mechanisms. This way, the actual loads may often be over-estimated, while pollution problems of the estuaries are not recognised. Processes such as sedimentation of riverine suspended particulate matter (spm) and import of marine spm have a major influence on the resulting estuarine output of, e.g., spm-associated organic micropollutants. In this paper attention is given to the 'filter function' of estuaries, with particular reference to the behaviour of dissolved and particulate PCBs and PAHs during mixing in the Rhine estuary.

Dissolved and particulate fractions were

collected using a high-speed centrifuge. Accordingly, 'dissolved' is in this paper defined as the fraction containing free PCBs and PAHs, and compounds adsorbed on DOC, colloids and small, low-density particles. 'Particulate' is the fraction that is retained by the centrifuge.

Generally, PCB and PAH concentrations were highest at the fresh water end member, and decreased seaward. All dissolved compounds behaved conservatively (correlation coefficient  $r$  of linear regression of concentration versus salinity: 0.82-0.99;  $p < 0.01$ ). All spm-associated compounds in the estuary showed slight removal in 1988 and 1989, while an increase in the particulate PCB and PAH (i.e., Fluoranthene) concentration was observed in the lower salinity range in 1990. As a measure of marine organic carbon,  $\delta^{13}\text{C}_{\text{POC}}$  showed an almost linear increase between the fresh and salt water end members (-29.13 to -20.88 per mille).

The estuary showed evidence of general removal of particle-associated PCBs and PAHs. The fractional loss within the estuary, referred to the river input flux ranged from -0.11 to 0.22, which corresponds well with the calculated fraction of terrestrial/riverine particulate organic carbon that escapes the estuary:  $< 40\%$  (based upon the  $\delta^{13}\text{C}$  pattern) The very short residence time of the estuary (5-11 days) probably propagates this relatively small particle retention.

Compared with the inputs that were published earlier, this study shows that the input is probably smaller (as group total (i.e.,  $\Sigma\text{PCB}$ ,  $\Sigma\text{PAH}$ ), as well as the sum of individual components). The amount of these micropollutants that is carried from the rivers to the North Sea is reduced - up to ca. 20-40%, as compared with the older data.

CHEMISTRY OF ATMOSPHERIC  
PARTICULATES OVER THE  
NORTHEASTERN MEDITERRANEAN

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In recent years it has become increasingly apparent that transport via the atmosphere is an important route by which material natural and anthropogenic are delivered to the sea surface. In regional seas close to the major sources of atmospheric particulates, atmospheric transport and deposition is an important task both for the understanding of biogeochemical processes in the marine environment and changes in atmospheric composition and climate. In this respect, the northeastern Mediterranean Sea presents a classical example, receives atmospheric particulates from natural sources like Saharan and Middle East deserts. The man made inputs are very different, because from the economic point of view the nations that bound the basin are very different (from industrial to agricultural).

An atmospheric national project has been designed to provide time series data set on the concentrations, the sources and the air/sea fluxes of trace metals (Al, Fe, Mn, Co, Cr, Ni, Ca, Na, Mg, V, Zn, Pb and Cd). In order to provide a continuous atmospheric collection tower is occupied at Lat 36 33.64 and Long 34 15.18 between August 1991 and December 1992. Total 24 hr aerosol samples are being collected by a standard General Metal Works Hi-vol sampler.

Analysis of trace metals are performed by utilizing GBC-906 model computer controlled atomic absorption spectroscopy.

In synthesis, the elements chemistry of particulate over the northeastern Mediterranean can be described in terms of mixing of urban and crust rich components. The temporal variability of concentration and fluxes of trace metals is completely related with the governing meteorological processes such as wind flow and precipitation patterns. The results of this study will provide first data ever set for the characterization of atmospheric particulates of the North Eastern Mediterranean region. It will be also possible to evaluate the fluxes of trace metal reaching the mediterranean hence to estimate the amount of new production. The magnitude of new production due to atmospheric input is much more important than the production due to upwelling which only occurs in the vicinity of Rhodes Gyre. It was possible to show that event base Saharan desert soil pulse loads is an essential contributor of marine ecosystem. Such event base synoptic scale events is also found to act as a buffering agent for the European origin acid rain.

# INVESTIGATION OF HIGH TEMPERATURE CATALYTIC OXIDATION AS A METHOD FOR THE DETERMINATION OF DISSOLVED ORGANIC CARBON -

"Still Crazy After All These Years"???

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Dissolved organic carbon (DOC) is the largest reservoir of organic matter in the ocean and is comparable in magnitude to the global atmospheric inventory of CO<sub>2</sub> (600-660 Giga Tonnes Carbon). Doc is variously involved in: regulating ocean-atmosphere exchange processes; primary production; fuelling heterotrophic respiration; advective carbon fluxes; oxygen budgeting; trace metal and nutrient biochemochemical cycling; partitioning of micropollutants; and reconciling discrepancies in alkalinity determinations.

Intercomparison experiments in the late 1980's, between a new high temperature catalytic oxidation (HTCO) system, using 3% platinised alumina, and classical wet oxidation and/or ultraviolet photo-oxidation (UV) techniques indicated that traditional methods may have underenstimated marine DOC concentrations by as much as 400%. My Ph.D. research programme was based upon the development and application of HTCO to the determination of DOC in natural waters; under the auspices of the UK Biochemochemical Ocean Flux Study (BOFS) programme.

Since revival of the oceanographic community's interest in DOC, there has been considerable research effort directed

towards verification of the HTCO methodology. However, initial programmes were largely uncoordinated beyond the individual laboratories, and this, coupled with a number of unforeseen difficulties in replicating what is essentially a simply configured analytical system has led to a degree of confusion and the development of a number of rumours as to relative merits of HTCO versus traditional techniques, the overall accuracy and applicability of the technique. Whilst matters may be clearing up for those more closely concerned, there still appears to be misunderstanding within the scientific community at large.

Through this paper I should like to clear the air. But, is that possible? Firstly, I shall aim to give a BRIEF contemporary history of DOC analysis. This will be followed by a description of those aspects of laboratory work which have proved problematical, and subsequent development of knowledge arising from this. Initially a major effort was directed towards verification of various catalysts, but more recently the issues of contamination and blank determination have been of increasing importance. Investigations using both HTCO and UV techniques have contributed towards understanding of the relative importance of these matters to precise and accurate determination of DOC. Illustrations of DOC distributions in estuarine and oceanographic waters will be presented to demonstrate the importance of appropriate sample handling and data treatment to the interpretation of determined concentrations.

Finally, I should like to explain the current status of DOC analysis and what holds for the future.

# PRODUCTIONAL PROCESSES IN THE OPOSSUM SHRIMP POPULATIONS IN THE CURONIAN LAGOON

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Extensive acclimatization work started in early sixties in the Kaunas reservoir caused infiltration of Ponto-Caspian relict fauna via Nemunas river to the Curonian lagoon of the Baltic sea. As a result two of three introduced opossum shrimp species (namely *Paramysis lacustris* and *Limnomysis benedeni*) became common in the lagoon, making up to 60% of biomass in some biotopes. Third species, *Hemimysis anomala*, successfully acclimatized in the Kaunas reservoir, in the Curonian lagoon found only occasionally. Curonian lagoon is the northern areal boundary for the last two species. Three years populational dynamics and ecology observations were carried out. As a result of computer aided cohort analysis techniques life cycles of three species (including autochthonous marine species *Neomysis integer*) were determined. Populational length/size growth curves were calculated. Productivity and P/B coefficients dynamics were modelled. Ecology and life cycle adaptations according to production/destruction processes in the lagoon were discussed.