LIPID COMPOSITION OF SUSPENDED AND SINKING PARTICLES COLLECTED BY SEDIMENT TRAPS IN THE GULF OF TRIESTE DURING JUNE 1995

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Abstract

Organic carbon and lipid class composition were determined for suspended and rapidly sinking particles in June 1995 in the Gulf of Trieste, Adriatic Sea. Analyses of lipids were carried out by chromarod thin-layer chromatography with flame ionization detection in order to give insight into stuctural components of biomembranes from living organisms, metabolic energy reserves and compounds originating from the breakdown of glycerides in dying cells and detritus. Lipids/organic carbon ratio and lipid class distribution patterns showed large variations between the two types of investigated particles. Lipid composition of suspended and sinking particles suggested that trap material did not reflect an aggregation of small-size suspended particles at this time of year.

Key-words : carbon, particle flux , Adriatic Sea

Introduction

The coupling between production of matter in the upper ocean layers and accumulation in sediments is mainly related to fast-sinking particles such as aggregates and fecal pellets. The efficiency of this coupling is highly significant for the flux of organic matter to sediments. The organic matter flux, identified as part of the biological pump for CO_2 in the ocean, represents a primary potential source of energy for the deep pelagic and benthic food webs (1-3). Among various compounds lipids, although representing a minor fraction of the total analysable organic carbon, play a key role because of their energetic value which has often been recognized for pelagic and benthic organisms. In the framework of the Paloma programme (Production and Accumulation of Labile Organic Matter in the Adriatic), one of our objectives was to give insight into processes of formation of fast sinking particles and into knowledge of lipids associated with the flux of organic matter in the water column. Thus, a chemical study of various types of particulate material was performed in the Gulf of Trieste in Summer 1995 (see Fig. 1). We present here data dealing with: 1) a comparison of lipids associated with surface suspended particles collected by filtration of seawater, and fast sinking particles collected by drifting sediment traps; 2) an estimation of fluxes of various lipid classes throughout the water column.

Material and methods

All samples were collected from the semi-enclosed, shallow Gulf of Trieste in the Northern part of the Adriatic Sea (Fig. 1). The Gulf of Trieste has a surface area of about 600 km^2 and a maximum depth of 25 m. The most important source of freshwater along with allochthonous nitrogen is the Isonzo River, with high interannual variability in discharge and consequent phytoplankton blooms (4).

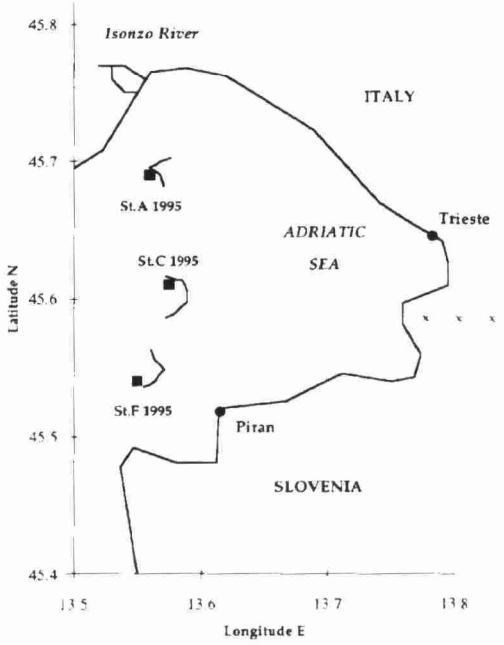

Fig. 1 : The Gulf of Trieste. Location map of sampling sites and trajectories of the drifting sediments traps (June 1995).

Double, gimballed cylindrical sediment traps, 573 mm high, 72 mm wide, equipped with a vane, were deployed in a drifting mode in June 1995 at 5 and 9 m (trajectory around station A), at 5 and 12 m (trajectory around station C) and 5, 9, 12 and 16 m (trajectory around station F), (Fig. 1). Drifting time was about 12 hours. Prior to deployment, traps were filled with seawater from the actual sampling depth to avoid contamination from surface water without addition of any preservative. Upon retrieval of the drifter, the content of each couple of traps was collected and thouroughly mixed before subsampling. Organic carbon and inventory of biological material (phyto- and micro-zooplankton and fecal pellets) were also determined on sediment trap material (5).

Simultaneously to the trap deployment, CTD profiles were recorded along the trajectory of the drifting traps, water samples were taken at several depths for analyses of nutrients, POC and PON (6), and large volume water samples were collected respecting ultra-clean conditions by *in situ* pumping (20 l) and filtered on board through 0.7 μm pore size Whatman GF/F filters to obtain suspended particles for further lipid analyses.

Lipids were extracted by the one phase solvent mixture methanol-water-chloroform procedure (7). Total lipid extracts were analysed for lipid classes by thin layer chromatography with the flame ionization detection (TLC-FID) Iatroscan technique which is sensitive and quantitative for each lipid class with internal calibration (8).

Results

The drifting trajectories are given in Figure 1. During June 1995, which was characterized by heavy rain fall previous to the experiment and consequent massive discharges from the Isonzo River, the traps were deployed three times in the plume close to the river mouth (A), in the centre of the gulf (C) and close to the coast of Slovenia (F).

Temperature decreased steadily from the surface (21-25°C) to the bottom (13-15°C). The vertical profiles of salinity reflected the discharge of Isonzo River. Closest to the river mouth (A), salinity increased sharply from about 21 to 34 from the surface to 3 m depth. In the centre of the gulf (C) salinity increased from about 23 (in surface) to 33 (at 10 m). In the south (F), salinity was higher and the increase was smaller, 31 (in surface) to 37 (at 10 m).

Phosphate concentration was low (0.01 to 0.14 mM). Ammonia ranged between 0.1 to about 2.5 μM (usually lower than 0.5 μM in the upper 10 m) and increased in the lower part of the water column. Nitrate concentrations were low in the bottom water, ranging from 0.4 to about 1.4 μM and increased towards the surface. Concentrations > 100 μM were recorded in the river plume 6. Silicate varied between 0.4 and more than 30 μM in the surface layer.

Concentrations of particulate organic carbon (POC) and lipids of suspended particles were highly variable during the sampling cruise. POC varied from 207 μg/l at 1 m at station C, up to 628 μg/l at station A (at 1 m), whereas lipid concentrations varied from 32.6 μg/l at station A (at 10 m), up to 139 μg/l at station A in surface water. Thus the percentage of organic carbon associated with lipids varied in the range 14.3 - 37.2, with an average of 25.5 (n = 10).