DISTRIBUTION OF PHOTOSYNTHETIC PIGMENTS IN THE PLUME OF THE RHONE RIVER

Senka TERZIC[1], Marijan AHEL[1], Jean-Jacques NAUDIN[2] & Gustave CAUWET[2]

[1] Center for Marine Research Zagreb, Ruder Boskovic Institute, Zagreb, Croatia
[2] Group. de Recherches "Interactions Continent-Ocean", Lab. Arago, Banyuls s/Mer, France

Chlorophyll and carotenoid pigments are useful biomarker compounds for studying various biological processes in the marine environment. They proved to be especially helpful for providing additional information about the chemotaxonomic composition of phytoplankton as well as about formation and degradation of the phytoplankton biomass (BARLOW *et al.*, 1993). However, as opposed to a number of reports on phytoplankton dynamics in oceans by using pigments as biomarkers there seem to have been only limited number of such studies in estuarine, coastal and shelf areas (DENANT *et al.*, 1991). In such areas, additional nutrient inputs by rivers were shown to have a strong impact on phytoplankton dynamics resulting often in an enhanced standing stock of phytobiomass. The aim of this paper is to investigate the build-up of the phytoplankton biomass in the freshwater plume of the Rhone River (France). Chloro-phyll and carotenoid pigments were deter-mined according to a modified HPLC method by Mantoura and Llewellyn (BARLOW *et al.*, 1993). Briefly, water samples (2 L) were filtered through 47 mm Whatman GF/F filters and immediately frozen until analysed. Frozen filters were extracted in 4 mL 90% acetone and analysed using a gradient reversed-phase HPLC system equipped with both spectrophotometric and spectrofluorimetric detectors and dual channel data collection and integration. Chlorophylls and carotenoids were detected by absorbance at 440 nm while detection of phaeopigments was performed with a fluorescence detector using an excitation wavelength of 420 nm and emission at 672 nm. Sampling was performed in the framework of a Lagrangian experiment, aiming at studying the development of organic matter in the Rhone estuary, between 11th and 21st November 1993 (Fig. 1). Water samples for pigment analyses were collected at four different depths in the top 10 m of the water column. The experiment was undertaken on four different days, between 8^{00} a.m and 17^{00} p.m. in exact time intervals of 60-120 minutes (stations A-F). Concentrations of photosynthetic pigments in the Rhone estuary during the experiment showed a strong spatial and temporal variability (790-10800 ng/l of Chl *a*). Signatures of phytoplankton composition indicated that diatoms were the most abundant class as reflected by a pronounced predominance of fucoxanthin (fuc) over other accessory pigments (Fig. 2). Low concentrations of 19'-hexanoyloxy-fucoxanthin (hex) and chlorophyll b (Chl *b*) detected in the samples suggested a rather low contribution of Prymnesiophytes and green algae to the total phytobiomass. Moreover, comparatively low concentrations of phaeophorbides and phaeophytins (< 250 ng/l) were indicative of the freshly formed phytoplankton biomass, still mainly unaltered by grazing or other degradation processes. Distribution of photosynthetic pigments on vertical profiles in the freshwater plume of the Rhone estuary (Fig. 2) revealed a very dynamic behaviour of the phytobiomass as a consequence of the strong response to the input of riverborne nutrients, in particular nitrate. However, the concentration maxima of photosynthetic pigments were not observed at the surface, characterised by the lowest salinities and consequently the highest nitrate concentrations, but in the subsurface layer (1.5-3 m) characterised by salinities between 30-35‰ and much lower nitrate levels. This suggested that phytoplankton biomass was predominately of marine origin. Thus, the salinity range below 25‰ was probably the limiting factor which precluded a stronger build-up of marine diatoms in the uppermost layer. The diatom peaks observed on the vertical profiles can be interpreted as a compromise between the nutrient supply from the top of the water column and salinity tolerance of marine phytoplankton. The profiles similar to those presented in Fig. 2 were observed only during relatively calm weather conditions which allow the system to maintain stratification over the time periods required for a build-up of the phytobiomass.

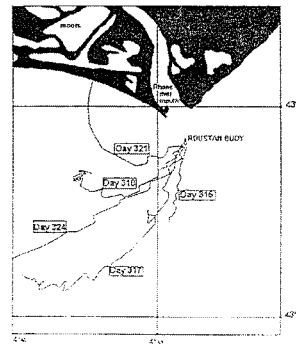

Fig. 1. Map of the Rhone estuary with indicated trajectories followed during sampling on 5 different days.

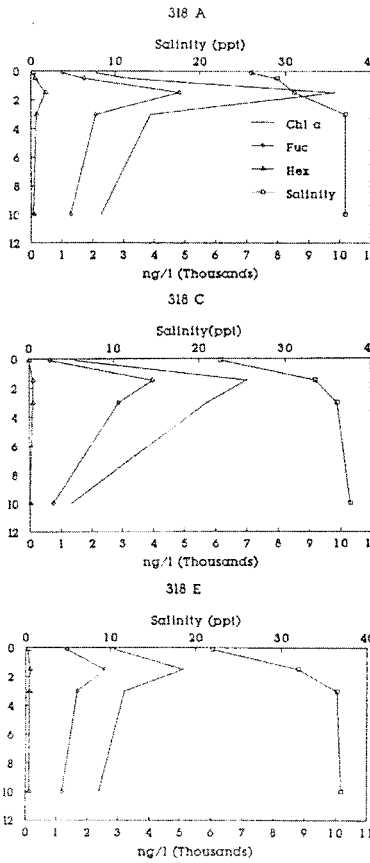

Fig. 2. Vertical profiles of chl *a* and two accessory pigments in the Rhone estuary (Day 318 see Fig. 1)

REFERENCES

BARLOW R.G., MANTOURA R.F.C., GOUGH M.A. and FILEMAN T.W., 1993. Pigment signatures of the phytoplankton composition in the northeastern Atlantic during the spring 1990 diatom bloom. *Deep-Sea Res.* II, 40 : 459-477.

DENANT V., SALIOT A. and MANTOURA R.F.C., 1991. Distribution of algal chlorophyll nad carotenoid pigments in a stratified estuary: the Krka River, Adriatic Sea. *Mar. Chem.*, 32 : 285-297.