Biomarker pigment divinyl chlorophyll a as a tracer of water masses?

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The ecological preferences of different phytoplankton types drive their temporal and spatial distributions, reflecting their dependence on certain temperature ranges, light levels, nutrient availability and other environmental gradients. Hence, some phytoplankton taxa can be used as water mass tracers (biotracers).

In order to determine the biotracers of targeted Adriatic water masses, eight sampling campaigns have been conducted in the southern Adriatic (Albanian shelf, May 2009) and the middle Adriatic (November 2011, February, March, May and August 2012, February and July 2013) (Fig. 1. & 2.). The surveyed area is greatly influenced by the Levantine Intermediate Water (LIW) and East Adriatic Current (EAC). The warm and saline LIW represents a part of the EAC and enters the Adriatic from the Ionian Sea spreading northwards at the intermediate level, usually at depths between 200 and 600 m, with the core from 200 to 400 m. The spatial and temporal distribution, as well as the phytoplankton community composition was investigated in relation to the encountered environmental parameters (temperature (TEMP), salinity (SAL), density (Sigma-T), nitrates (NO3), nitrites (NO2), ammonia (NH3), silicates (SiO2) and phosphates (PO4)). A combination of several taxonomical techniques, flow cytometry (FC) and high-performance liquid chromatography (HPLC) pigment analysis, allowed us to investigate phytoplankton community composition across all size fractions.

Fig. 1. Oceanographic surveys and sampling points: 1 - Albanian shelf, May 2009; 2 - Middle Adriatic, February and July 2013; 3 - Telštica bay, middle Adriatic, October 2011, February, March, May and August 2012.

The overall phytoplankton spatial distribution demonstrated high patchiness. However, in certain seasons, divinyl chlorophyll a (dvlchla) a pigment specific for the prokaryote Prochlorococcus, was found in high concentrations below 50 m – the portion of the water column in which LIW was frequently detected. The presence of Prochlorococcus was confirmed by flow cytometry, corroborating its important role in the formation of the deep chlorophyll maximum (Fig. 2. & 4.).

Based on these results, we hypothesize that the picophytoplanktonic prokaryote Prochlorococcus, that is easily detectable in the water column owing to its specific pigment structure, can be used for tracing Levantine Intermediate Water in the Adriatic.

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