Nutrients Concentrations in the Southern Adriatic Sea

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In the Southern Adriatic Sea nutrients were measured during thirteen cruises from 1974 - 1990, at four profiles and twenty stations, from Vis Island to Otranto strait, about three expeditions per session were performed. Standard oceanographic parameters were also measured (transparency - Secchi disc, temperature, salinity, dissolved oxygen and pH).

All parameters were measured by standard oceanographic methods recommended by Strickland and Parsons (1975).

The region is under northern Adriatic cold water influences, mainly in the western part of the basin, and warm Mediterranean water influences in Central and Eastern part of the basin. Morphology of the basin enables existence of cyclonic current gyre with prevailing NE currents and Eastern coast, and SE currents at west Italian coast.

Orthophosphate and total phosphorus concentrations are smaller than in some other regions (less than 0.1 and 0.2 mol/m^3), and some exceptions at nearshore stations can be explained by local influences (Bojana run-off and smaller rivers at Italian coast).

Average nitrogen concentrations do not exceed 2 mol/m^3, mainly existed as nitrate, indicated highly oxidative region.

Orthosilicate concentrations are in similar range as nitrogen, with some exceptions, due to clastic region river run-off. In any case, the ratios (AOU : Si : N : P = -276 : 0.8 : 1.1 10.03) were significantly different from oceanic Redfields stoichiometric model (AOU : Si : N : P = -276 : 15 : 16 : 1, Redfield,1963), and those calculated for the Northern Adriatic (AOU : Si : N : P = -276 : 21 : 7 : 0.45, Degobbis, 1990). In this ratios extremelly low concentrations of phosphorus, nearly to the limits of the method, must not be neglected. Interestingly, differences in ratios due to seasons or depth variations are not noticeable.

It seems that phytoplankton assimilated more nitrogen than phosphorus, because of its relative enrichment in south Adriatic waters. Probably, phosphorus is the main limiting factor of bioproduction in the whole Adriatic Sea.

Nutrient budget in the South Adriatic is not quite clear, because of rare current measurements on main profiles, especially in advective outflowing North Adriatic waters and inflowing Mediterranean waters.

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Very High Values of the Nitrate/Phosphate Ratio (>30) in the Subsurface Layers of the Western Mediterranean Sea

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For a long time the Mediterranean Sea has been known as an area with lower nutrient concentrations (Mc Gill 1961) and higher nitrate/phosphate ratio (N:P) than the adjacent Atlantic Ocean. While Atlantic waters show N/P close to the Redfield's ratio of 16:1 (Redfield *et al.*, 1963), mediterranean values are recognized higher than 20:1 (Mc Gill, 1965). This discrepancy is probably due to assimilation-regeneration processes inside the Mediterranean Basin. Previous works have shown that difference in N/P disappears if all the forms (inorganic and organic) of nitrogen and phophorus are taken into account (Coste *et al.*, 1988).

The present study gives greater insights on mediterranean N:P values obtained in Western Mediterranean Sea and Atlantic waters near the Strait of Gibraltar from several recent cruises during which intensive nutrient analyses have been performed (Mediprod IV, Mediprod V, Mediprod V2, Prolig II cruises): 1/ Modified Atlantic waters, noted by salinity lower than 38.0, keep N:P ratio close to 17:1 during their eastward transport along the Algerian coast, while nitrate and phosphate are consumed. 2/ In the same area, typical Mediterranean waters (salinity higher than 38.0) are characterized by a mean N:P of 21:1, in accordance with previous works (McGill, 1965). 3/ In the whole western basin and on several seasons (november 81, june 85, june 86, march 87) the vertical distribution of the N:P ratio can exhibit very high values (often higher than 30).

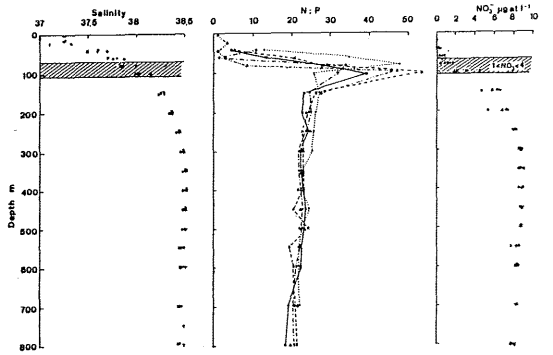

Figure 1: Vertical distributions of salinity, nitrate and N:P ratio observed along the Algerian coasts in March 1987 (Mediprod V2 cruise).

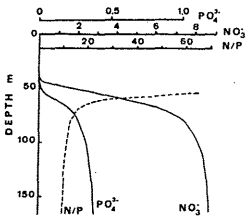

Figure 2: Exemple of continuous profiles of nitrate, phosphate and N:P ratio obtained in the Ligurian Sea during the Prolig 2 cruise.

Along the Algerian coast, a subsuperficial maximum with high N:P values is due to the presence of atlantic surface water with N/P even lower than 16:1 because of nutrient consumption by phytoplankton (Ketchum *et al.*, 1958; Fig. 1). In the northern basin, values do not present subsuperficial maximum but decrease regularly from the surface layer. The levels where N:P are higher than 30 are in the 50-150 m depth range with salinity around 38.10-38.20 and oxygen saturation about 80-85 %. Explanation of this feature has to be attributed to a phosphacline deeper than nitracline (Fig. 2) as opposed to observations in stratified oceans (Herbland and Voituriez, 1977). From T-S diagrams it can be deduced that the interested waters are originated by mixing of surface waters and Winter Water as represented by a temperature minimum. T-S diagram analysis shows that levels with high N/P values are characterized by nitrate and phosphate concentrations lower than those deduced from mixing alone. Involved waters have been interested by biological processes with a net gain for nutrient assimilation.

It must be mentionned that, in oceanic areas, uptake of nitrate is generally thought to be more rapid than uptake of phosphate, whereas phosphorus tends to be regenerated more rapidly than nitrogen (Mc Gill, 1965). Thus, mediterranean waters seem to be interested by biological processes in such a way that phosphate is more rapidly assimilated and/or nitrate is more rapidly regenerated, confirming a severe phosphorus limitation.

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