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Dissolved oxygen and nutrient dynamics in East Mediterranean Sea (Aegean, Ionian and Levantine Seas)

Alexandra Pavlidou and Harilaos Kontoyiannis

Hellenic Center for Marine Research, Institute of Oceanography, Anavyssos, Greece (aleka@ath.hcmr.gr, +302291076347)

Nutrient and Dissolved Oxygen (DO) data were collected from 27 sampling stations in the Aegean, Levantine and Ionian Seas during August-September 2008 within the framework of Sesame Project – Work Package-2, in order to study the DO and nutrient distributions in the East Mediterranean Sea and to describe the oxygen and nutrient content of the different water masses characterizing the study area. The joint analysis of T–S properties and chemical data was used for the better understanding of the different water mass characteristics in the study area.

According to the hydrological data of the study area the following water masses were recognized in the Eastern Mediterranean Basin: in the north Aegean Sea the less saline Black Sea Water (BSW) from the Dardanelles; the isolated bottom water masses with North Aegean Deep Water (NADW) in the deep basins (Athos and Skyros) of the North Aegean with densities as high as 29.5; and the Intermediate Levantine Water (LIW) that spreads northward in the east part of the Aegean. In the Ionian Sea, the Modified Atlantic Water (MAW); the Cretan Intermediate Water (CIW) formed inside the Cretan/Aegean sea substitutes for LIW, exiting from the Western Cretan Arc Straits and spreading into the Ionian; and the Eastern Mediterranean Deep Water (EMDW) which was detected bellow 3200 m down to ∼4000 m. Between LIW and the EMDW the Transition Mediterranean Water (TMW) was detected, at ∼700-900 m depth in the Ionian and the Levantine Seas and at ∼900-1100m in the East Cretan Sea. The Cretan Dense Water (CDW) occupied the layer near ∼2000-2500 m, whereas a weak signature of CDW at ∼1500 m was also found.

Distributions of DO and nutrients in the different water masses of East Mediterranean Sea were highly related to T–S signatures. In Aegean Sea, BSW in the surface layer of the North Aegean Sea was characterized by DO values ∼ 5.9 mL/L; PO_4^{3-}: ∼5.3 nmol/L; NO_3^-+NO_2^-: ∼0.16 μmol/L and SiO_4^{2-}:∼1.4 μmol/L. LIW with DO values higher than 5.1 mL/L and relatively low nutrient concentrations characterized the layer between 50 and 200m. The isolated old near bottom waters of Skyros and Athos Basins had oxygen content less than 4.3 mL/L and high nutrient concentrations (PO_4^{3-}: ∼300 nmol/L). In Cretan Sea, CDW was characterized by DO values between 4.71 mL/L and 4.74 mL/L and rather elevated nutrient concentrations (PO_4^{3-}: >150 nmol/L; NO_3^-+NO_2^-: >4 μmol/L and SiO_4^{2-}:>6 μmol/L) which were lower than the ones recorded at ∼ 1000m, corresponding to TWM. The chemical signal of TMW mass was found in Ionian and Levantine Sea in the layer 600- 1000m with DO ∼ 4.1 mL/L; PO_4^{3-}: 220-240 nmol/L; NO_3^-+NO_2^-: ∼5.6-6.0 μmol/L and SiO_4^{2-}: ∼9.0 μmol/L. Finally, EMDW was characterized by DO ∼4.6 mL/L; PO_4^{3-}: ∼145 nmol/L and SiO_4^{2-}: ∼7.0 μmol/L.

N:P ratios within the deep layer of Mediterranean Sea were calculated between 24 and 27, higher than the theoretical one, whereas in the surface layer N:P ratio was found much higher.

The AOU/DIN ratio was calculated 10.33, which is higher than the theoretical value, indicating that for the same amount of regenerated nitrogen more oxygen is being consumed than is typical for open ocean. Also, the AOU/PO_4^{3-} was much higher than the theoretical value of Redfield for the open ocean, indicating that organic matter requires more oxygen regenerate inorganic phosphorus during its decomposition. Nutrients supply from Sachara dust storms, N_2-fixation rates, DW formation, LIW mass, can be only some of the parameters influence the nutrient stoichiometry in the study area.