VERTICAL HYDROCHEMICAL STRUCTURE OF THE WESTERN BLACK SEA AREA IN 2007 – 2008 PERIOD

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Abstract
The western part of the Black Sea is highly influenced by major rivers input. Through different periods its vertical hydrochemical structure varies in response of the hydrological conditions and the anthropogenic influence. The study is an attempt to estimate the stability of the chemical parameters content in the water body of the region in two seasons – early spring (cold upper layer waters) and late summer (well expressed termocline).
Keywords: Nutrients, Oxygen, Black Sea, Vertical Profile

Methods
The study is based on data obtained during the seasonal cruises (October 2007 and 2007 and April 2008) with RV "Akademik" in western Black Sea area. The samples are collected from 9 stations using Rosette Seabird system on the following depths: 1, 10, 25, 50, 75 and 100 m, depth of thermocline location and DCM and depths corresponding to σ = 15.0, 15.2, 15.4, 15.8, 16.0 and 16.2. The hydrological parameters are measured by Seabird CTD System. The hydrochemical parameters analyses are accomplished by standard methods [1].

Results
Hydrology. In October the Upper Mixed Layer (UML) is located in the water column beneath surface with temperature 18.5 – 20.3 °C and density (σθ) about 10.5 – 12.2. The thermocline is located in the depth range of 29 – 35 m and the Cold Intermediate Layer (CIL) – in 60 – 100 m. The thermohaline structure in April is typical for early spring without expressed thermocline. The upper surface layer is characterized with low temperature in range 9.3 – 11.2 °C and density 13.0 – 13.9.

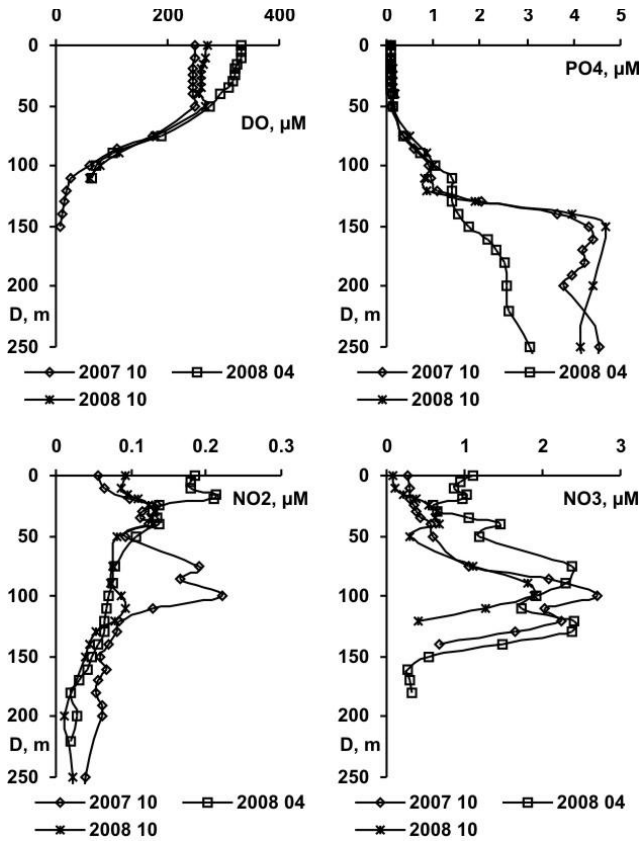

Fig. 1. Filtered vertical distribution of DO, PO4, NO2 and NO3

Dissolved gases. High oxygen content in April (360 µM) (Fig. 1) corresponds to highest Oxygen Saturation (OS) in surface waters due to hydrological conditions. In CIL DO vertical distribution follows the same pattern for each season – decreasing gradient from about 250 µM to the redox zone. H2S is detectable from depths > 120 – 140 m. Its increase becomes steeper below 150 m (σθ > 16.0 – 16.2) (Fig. 1). The depth of the upper anoxic waters could be considered deeper for the distant stations but is not irregular during last decade [2].

Nitrogen. Surface, UML and CIL (oxygenated waters) NH4 concentrations are relatively low (0.5 µM). From σθ = 16.0 (135 – 145 m) its concentrations increase down to the anaerobic zone. NO2 and NO3 concentrations in UML in the end of summer are lower due to biochemical exhaustion and the NO2 maximums in the thermocline and in the oxycline are well expressed (Fig. 1). The maximum NO3 concentrations (~ 96 – 120 m, σθ = 15.4) does not exceed 3 µM, which is less than the values detected during summer (> 5 µM) [3, 4] in the same region. Nitrates disappear at σθ = 16.0 – 16.2 as it has been observed elsewhere [5, 6]. The Total Nitrogen (TN) varies around 10 µM and is its content is relatively higher in April.

Phosphorous. PO4 content is low down to CIL both in warm and cold seasons. In CIL an increase is initiated with an upper maximum of 1.4 µM in April and 0.8 µM in October at σθ = 15.5 and minimum at σθ = 15.9 where the oxycline is located. The second maximum of 4 – 5 µM in the warm season is found at σθ = 16.25 (150 – 160 m) (Fig. 1).

Silicates. SiO2 distribution is characterized by significant increase down to σθ = 16.0 (Fig. 2). In UML its content varies in range 2 – 7 µM. The measured lower concentrations possibly are due to phytoplankton growth during both seasons in the euphotic zone. SiO2 concentration in near shore stations (coastal waters) is 2 times higher than in deep zone surface waters [7].

Suspended matter is higher in the upper layer – 0.7 - 1.0 mg/l and decreases steeply in the beginning of CIL. In thermocline SM is normally lower in the colder season.

Conclusions
– The vertical hydrochemical structure in Western Black Sea is generally specified by the hydrological conditions of the water column;
– The anoxic zone appears relatively low (140 – 150 m), the NH3 distribution, the NO2 specific variations and the NO3 reduction are well expressed, considering undisturbed stratification and hydrochemical stability of the water column in the investigated period;
– PO4 deeper maximum in October is specific for the warm part of year due to mineralization of the increased organic matter;
– The measured surface lower concentrations SiO2 are possibly due to phytoplankton growth during both seasons in the euphotic zone.

Acknowledgements
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