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Distribution of phosphorus in the eastern Adriatic Sea sediments (Croatia)

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Phosphorus (P) is very important nutrient for the eastern Adriatic Sea owing to its limiting role in the primary production. Orthophosphate concentrations are low (median HPO42- value: 0.039 μmol dm-3) as a consequence of relatively small number of freshwater inflows and cyclonic circulation of oligotrophic eastern Mediterranean water masses. Due to anthropogenic influence in coastal areas such as bays, estuaries and channel waters, P concentrations increment occurred leading to the formation of trophic gradient from the open sea towards the coast. As marine sediment presents the ultimate sink for particulate organic P from the water column, as well as for inorganic P forms, knowledge about distribution of different sediment P species is of great importance for understanding the burial, diagenesis and environmental geochemical significance of P.
This paper presents results of P distribution at the eastern Adriatic sites of different trophic status (open sea, channel, estuary, semi-enclosed bay under the anthropogenic influence and fish farms) during 2002-2012. In the water column dissolved and particulate inorganic and organic P were analyzed. In all sediments total phosphorus (organic and inorganic P) was determined, while at certain sites beside organic P, inorganic P forms were examined using modified SEDEX methods (P in biogenic – P-FD; authigenic – P-AUT and in detrital apatite - P-DET; phosphorus bound to iron oxides and hydroxides – P-Fe). Various geochemical variables in the water column and sediment (HPO42- concentration, sediment redox potential, granulometric composition, carbonate content, iron, organic carbon and total nitrogen content) were also investigated. Results proved total P concentrations range between 3 and 161 μmol g-1, with highest values at sites under the strong anthropogenic impact including fish farms, estuaries and bay areas. Major inorganic P species in the eastern Adriatic was P-Fe form. Fish debris P species P-FD, prevailed in fish farm sediments. Detrital and authigenic apatite P concentrations were explained by either terrestrial inputs or by internal transformation from other P forms. Statistical analysis among P and geochemical parameters indicated the granulometric composition as a leading differentiation parameter in sediment P species distribution. Statistics also indicated P-Fe importance in the P flux on the sediment water interface due to correlation between orthophosphate concentration in the water column, sediment pore water, redox-potential and iron concentration.