Nutrient fluxes in a hypoxic marine environment of East Mediterranean

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The quantification of nutrient benthic fluxes provide vital information on the biogeochemical functioning of marine sediments and the understanding of global ocean nutrient budgets. The study area, Elefsis bay, is a shallow (32m maximum depth), polluted, semi-enclosed marine area of the Eastern Mediterranean Sea. Periodic hypoxic conditions occur every year in late summer.

In order to estimate the exchange rates of nutrients, laboratory incubation experiments were conducted in two different seasons, under well oxygenated water column conditions (February 2012) and at hypoxic conditions (oxygen in the bottom layer 24.35 μmol/L, September 2012). In February, during incubation, oxygen (DO) was driven to depletion after 45 hours and the consumption rate was estimated as -20 $mmol*d^{-1}*m^{-2}$. At DO levels <30 μmol/L, nitrate concentration decreased while phosphate and ammonium increased, indicating that denitrification may act as a controlling mechanism. The release of ammonium and phosphate in hypoxic conditions suggests that sediment could act as a source of nutrients to the overlying water column. In September, the chamber was inadvertently oxygenated (DO 114 μmol/L) and then driven to hypoxic conditions (60 μmol/L) in ~9 hours. Oxygen and nitrate concentration followed a common distribution pattern. As DO increased, nitrate also increased, probably through nitrification process, followed by denitrification as the incubation continued and oxygen consumed.

Nutrient porewater profiles in February showed that ammonia and phosphate concentrations increased below 2 cm, suggesting oxygen consumption at the above layer. At the horizon 5-6 cm, inorganic and organic phosphorous increased significantly, imlying that particle bound phoshorous might released. Ammonium concentration in February increased downcore, while in September remained at the same levels at 2-12 cm horizons, indicating a non steady condition typical of coastal sediments. We are currently investigating further an intreaging subsurface nitrate maxima below the oxygen penetretation zone which might indicate active nitrification in the absence of oxygen.