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Aquatic and Sedimentary N-Isotope Dynamics in the Danube Delta Front

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The North-Western Black Sea Shelf Region suffered from severe eutrophication in the past decades, mainly due to increased nutrient loads of the Danube River, the most important contributor of freshwater to this brackish sea. It is yet unclear whether the Black Sea shelf is at present on the way to recovery due to a recent decrease in nutrient discharge from the Danube River.
During 2 cruises in summer and spring 2013 in the Danube River Delta/Black Sea transition zone, we analysed dissolved nutrients, and nitrate (and oxygen) isotope signatures in nitrate, suspended particulate matter, surface sediment and a sediment core from the shelf. Our rationale was two-fold: Firstly, we aimed to investigate N turnover and nutrient dynamics in the present Black Sea Shelf region to assess the effect of contemporary nutrient loads of the River Danube, and secondly, we wanted to compare these findings to the past situation as captured in the sediment record.
Our data indicate intense draw-down of river-borne dissolved silica and phosphate in the transition zone, up to nutrient depletion in mesohaline waters in summer. Surprisingly, nitrate concentration follows a conservative mixing line. Despite this apparent conservative mixing of river nitrate with marine water, nitrate isotope trends confirm the importance of biological nitrate assimilation in the water column. Moreover, the relative enrichment of O to N isotopes in nitrate, following an unexpectedly steep slope of 2, suggests that this uptake cannot only be due to phytoplankton activity, which usually plots along a slope of 1. We accordingly investigated the potential effects of different nitrate turnover processes and specifically nitrate regeneration on its isotopic composition.
Furthermore, notwithstanding significant nutrient input via benthic nutrient recycling, the N-isotope trend of sediment cores furthermore seems to provide a first hint towards improved water quality in the Danube Delta Front Region, possibly due to recently decreased nutrient loads of the Danube River.