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Reconstruction of nitrogen sources during the Mid-Holocene in sedimentary δ15N records in the Danube-influenced Romanian Black Sea Shelf

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The Danube River Black Sea Shelf is subject to river-induced eutrophication, which peaked in the 1970's and decreased since 1990. Absence of nutrient data before 1960's complicate the assessment of early stages of human-induced nutrient input and the evolution of nitrogen sources after the reconnection of the Black Sea with the Mediterranean Sea (∼7,200 BP).
In this study, we aimed to investigate the recent and past nitrogen sources during the last ∼5,000 years in the Danube-influenced northwestern Black Sea Shelf in order to elucidate the evolution of various nitrogen sources. In May 2016 we took sediment cores (20 to 42 cm) at 4 stations along a transect from nearshore to offshore and sliced the cores in 1 cm intervals. We analyzed the organic carbon and nitrogen content, the sedimentary isotopic composition of nitrogen (δ15Nsed) and determined the sediment ages at the offshore station with radiocarbon measurements.
The results show a gradient of different nitrogen sources along the transect from nearshore to offshore. The entire nearshore sediment core, as well as the upper sediment layer of the offshore stations show an anthropogenic nitrogen signal, which likely corresponds to the 1960's eutrophication phenomena. In the offshore sediment core, deeper layers with depleted δ15N values suggest that N fixation was the main N source until ∼3,600 to 3,900 yr BP. Prior to this fixation signal, stable isotope values point towards riverine nitrogen input from the Danube (approx. 5,000 to 5,300 yr BP).
We assume that this early shift reflects the sea level change of the Black Sea: Before the coastline receded, today's offshore station received significant amounts of riverbourne nitrogen, which still is visible in deeper sediment layers.
Overall, our data reflect changing nitrogen sources in the offshore station, capture the sea-level change of the Black Sea, and the shift from a natural fixation-dominated to a riverine / anthropogenic origin of deposited nitrogen in the Danube Delta / Romanian Black Sea Shelf.