Look into the nitrogen cycle at the northern South China Sea on the glacial-interglacial time scale

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Nitrogen cycle, as one of the most important elemental cycles on earth, plays an important role in global climate change through associated microbial activities including nitrogen fixation, ammonification, and denitrification. Here, we tried to reveal the relationship and interactions between nitrogen cycling processes and environmental changes on the glacial-interglacial time scale using a combination of various lipids biomarkers in the northern South China Sea. Both alkenone- and archaeal lipids-based seawater temperature proxies are used to constrain the thermal condition, which showed a typical glacial-interglacial pattern. For the first time, the C_5 Heterocyst glycolipids (HGs) from diatom-symbiont species of cyanobacteria, a specific biomarker of nitrogen fixation (NF), was recorded in the present deep-sea sediment core covering the last glacial period which covaried with alkenone-derived primary productivity and the thermocline depth. Two potential archaeal ammonia oxidation proxies, GDGTs-[2]/[3] and TEX_{86} of monohexose-intact polar GDGTs, were presented without glacial-interglacial patterns but covaried in general. Although C_5 HGs-derived NF and GDGTs-derived archaeal ammonia oxidation revealed diverged patterns, an enhanced NF and weakened archaeal ammonia oxidation trend was observed, indicating an intimate interaction between each other. Moreover, a decreasing NF was observed during termination I, which challenges the previous work based on $\delta^{15}N_{foram}$.