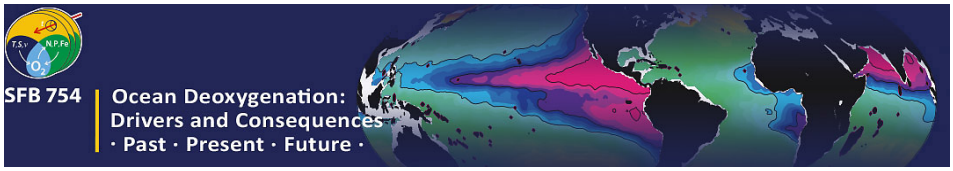

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Nitrogen Removal Across Glacial Terminations in the Eastern Tropical South Pacific

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Our understanding of how marine microbial processes and nitrogen cycling will respond to future increases in atmospheric CO2 and global temperature, as well as ocean acidification and deoxygenation, is very limited. This is largely due to a lack of proxies that can register ocean biogeochemical processes in sedimentary archives during past transitions to warmer climates. We present biomarker (anammox bacteria and phytoplankton) and stable isotope (bulk δ15N) records from sediments underlying the oxygen minimum zone of northern Chile (GeoB15016, 27°29.48′S, 71°07.58′W) that trace variations in microbial nitrogen removal across glacial terminations leading to Marine Isotope Stages 5 and 11. Our results demonstrate that increases in temperature and productivity during glacial terminations (and peak interglacial periods) were associated with enhanced oxygen depletion and nitrogen removal, as evidenced by parallel increases in anammox and denitrification signatures. Notably, whereas a decrease in denitrification and algal productivity was observed during the waning of interglacial temperatures, anammox biomarkers (and thus anammox activity) remained elevated for up to thousands of years thereafter. Our results indicate that heterotrophic denitrifying bacteria is stimulated by changes in organic carbon supply (i.e., enhanced upwelling and productivity), while chemoautotrophic anammox activity occurs as a "background" metabolism when denitrification is less intense. The observed temporal offset between these two bacterial processes indicates differences in their response to variations in ocean circulation, primary productivity and oxygen depletion across glacial-interglacial transitions in the OMZ of the ETSP. We discuss the implications of this offset in terms of past and future projections of ocean deoxygenation and nitrogen removal.

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