Exploring the influence of the Southern Ocean on nitrogen isotope dynamics in the equatorial Pacific during the last 25,000 years

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The nutrient characteristics of western equatorial Pacific (WEP) thermocline waters are important because they fuel primary production locally and across the Pacific basin via the Equatorial Undercurrent (EUC). Here we will present water column profiles of $\delta^{15}N$ and $\delta^{18}O$ of nitrate from the SE tip of the Philippines, off Mindanao, and north of Papua New Guinea (PNG) that imply different subsurface water masses in the northern and southern WEP, respectively. The relatively elevated $\delta^{15}N$ values in the southern WEP thermocline owes primarily to the vertical flux of high- $\delta^{15}N$ material at the southern edge of the equatorial upwelling. The nutrients for the equatorial upwelling, in turn, are provided by the EUC, which is shown to be influenced significantly by southern hemispheric processes that begin with Southern Ocean overturning.

These differences in modern-day $\delta^{15}N_{nitrate}$ are also reflected in the distribution of $\delta^{15}N$ in down core sediment records, with generally higher values south of the equator and lower values to the north. Some of the largest amplitude increases in $\delta^{15}N$ during the last glacial-interglacial transition, and highest early Holocene values globally, are observed in the WEP south of the equator. This is surprising because this ocean region is far removed from areas of active water column denitrification commonly understood to show large swings in $\delta^{15}N$ on these time scales. We will discuss possible scenarios to explain (a) the overall high $\delta^{15}N$ values south of the equator, off PNG, and (b) the more or less constant offset observed during the last 25,000 years between these records off PNG and $\delta^{15}N$ variability off Mindanao, just north of the equator in the WEP.