

First evidence of denitrification vis-à-vis monsoon in the Arabian Sea during the last 10 million years

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The new results based on the samples retrieved during the International Ocean Discovery Program (IODP) Expedition 355 yield the first record of denitrification vis-à-vis South Asian Monsoon intensity since Late Miocene (the past 10 million years) in the Eastern Arabian Sea [1]. In the Arabian Sea, South Asian monsoon-induced high surface water productivity coupled with poor ventilation of intermediate water results in strong denitrification within the oxygen minimum zone (OMZ). Denitrification results in N₂O production, which is a greenhouse gas that is ~300 times more powerful than CO₂. The balance between nitrogen fixation and its release through N₂ production is key to carbon assimilation by primary production and CO₂ regulation from the atmosphere. Despite the significance of denitrification, no long-term record of its evolution spanning the past several million years existed till now in the Eastern Arabian Sea. This study shows that the South Asian Monsoon was persistently weak from ~10.2 to 3.1 million years ago; it did not intensify at ~8 million years ago in contrast to the previous hypothesis. During the last 10 million years, the first evidence of denitrification and South Asian Monsoon intensification was at ~3.2–2.8 million years ago that coincided with the Mid-Pliocene Warm Period (MPWP), which was a period of global warmth with CO₂ levels (400 ppmv) similar to the present. Thereafter, the South Asian Monsoon declined for the next ~1.8 million years concurrent with the Northern Hemisphere Glaciation. The modern strength of the South Asian Monsoon and the OMZ where denitrification is a permanent feature in the Arabian Sea was attained at ~1.0 million years ago.

[1] Tripathi et al. (2017) Sci. Rep. 7, 43056.