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Sedimentary Nitrogen Cycling Over the Western Continental Shelf of India

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Most of the oceanic sedimentary mineralization, to which denitrification makes a very substantial contribution, is believed to occur over the continental margins, but data on sedimentary denitrification rate (SDR) are not available from many important continental margins. Using the acetylene block technique, we have measured for the first time the SDR at depths varying from 29 to 300 m over the western continental shelf of India. The SDR was found to range between 0.17 and 1.45 (avg 0.491) pmole NO_3 cm^{-2} s^{-1}. Extrapolating to the area of the continental shelves the overall SDR in the Arabian Sea is estimated to be between 0.4 and 3.5 (avg 1.33) Tg N y^{-1}. This rate is quite modest and comparable with similar estimates from other areas. The highest SDR was found over the inner shelf region. Although no definite relationship could be established between the SDR and bottom water oxygen concentration, there was a weak inverse correlation between the SDR and bottom water nitrate levels. However, bottom water chemical composition varied considerably. For example, oxygen and nitrous oxide (N_2O) concentrations ranged from 2.7 to 74.8 μM and from 26.2 to 111.9 nM, respectively. These results indicate a highly dynamic system with rapid changes in near-bottom redox conditions. Thus, while the interstitial water chemistry is expected to be controlled by the composition of bottom waters, a one-to-one relationship may not always occur at a given time. Nitrate and nitrite concentrations were higher in surficial sediments and declined with depth indicating losses through denitrification. Porewater nitrate concentrations were lower than those in the overlying water indicating an uptake of nitrate by the sediments. While a net production of N_2O seems to occur at the sediment surface, it is consumed at deeper levels. N_2O production in acetylene amended subsurface sediments varied from 1 to

44 μmoles N_2O l^{-1}. Our results show that denitrification process in sediments is an important but not the dominant sink for fixed nitrogen in all areas.