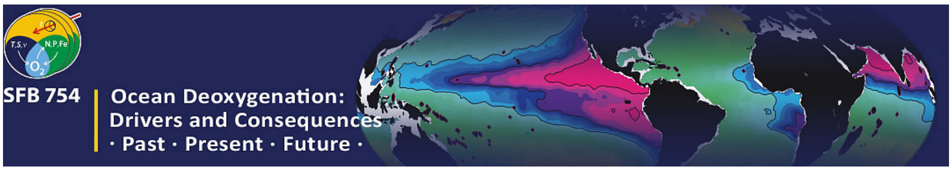

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The formation of nitrite-accumulating layers in the oxygen minimum zone of the Eastern Tropical South Pacific

In coastal upwelling regions, high surface productivity leads to high export and intense remineralization consuming water column oxygen. This, in combination with slow ventilation, creates oxygen minimum zones (OMZ) in eastern boundary regions of the ocean, such as the one off the Peruvian coast in the Eastern Tropical South Pacific (ETSP).

The OMZ is uniquely characterized by a layer of high nitrite concentration coinciding with water column anoxia. Sharp oxygen gradients are located above and below the anoxic layer (upper and lower oxyclines). Thus, the OMZ harbors diverse microbial metabolisms, several of which involve the production and consumption of nitrite. The sources of nitrite are ammonium oxidation and nitrate reduction. The sinks of nitrite include anaerobic ammonium oxidation (anammox), canonical denitrification, nitrite oxidation to nitrate and dissimilatory nitrite reduction to ammonium. The distribution of nitrite in the water column showed a two-peak structure. A primary nitrite maximum (up to 0.5 μM) was located in the upper oxycline. A secondary nitrite maximum (up to 10 μM) was found in the anoxic layer. Previous incubation experiments showed that, within the layer of the secondary nitrite maximum, *in situ* nitrite production rates are equivalent to consumption rates within measurement error. Thus the formation of nitrite maximum layer within the OMZ remains poorly understood.

A high resolution regional biogeochemical model (ROMS) was applied to decipher the origin and the evolution of nitrite-accumulating layer in the ETSP-OMZ. The formation of primary nitrite maximum in the upper oxycline is the result of ammonium oxidation exceeding nitrite oxidation. The low nitrite concentration at the oxic-anoxic interface is because of net nitrite consumption rates. The net production of nitrite at the coastal waters results in the accumulation of nitrite, which is transported offshore by mesoscale eddies on a time scale of months, forming a stable secondary nitrite maximum in the anoxic layer. Thus, physical and chemical processes shape the nitrite distribution in the Eastern Tropical South Pacific oxygen minimum zone.

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