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How the Eastern South Pacific Oxygen Minimum Zone (OMZ) off Chile is maintained in the modern ocean?

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Oxygen Minimum Zones (OMZs) in the present ocean represent persistent traces of the primitive anoxic ocean in which the life appeared. Influenced by both climatic changes and environmental perturbations, the OMZs could extend during the next 100 years as a response to increasing anthropogenic activities. The physical and biogeochemical processes maintaining the OMZs in the oxygenated ocean remain poorly quantified.

The Eastern South Pacific OMZ off Chile was documented on three areas characterized by different carbon biomasses and productivities. Four cruises and one year of monitoring off Chile were carried out between 2000-2002 using low O_2 (detection limit of 0.5-1 μM and reproducibility of 1.4 μM) adapted analytical technique and sampling strategy. The North (21˚S) and Center (30˚S) areas allow to determine open and cross-shore OMZ, and the Southern area (36˚S) to point out the seasonal OMZ variability over the continental shelf.

The Chilean OMZ appears as intense (core with $O_2 < 1$ μM) than the OMZs found in the Arabian Sea and off Peru, and represents 11% and 2% of the Southeastern Pacific and the global OMZs areas, respectively. However, the Chilean OMZ is much shallower, intercepting the euphotic layer and allowing simultaneous aerobic, anaerobic, photic and aphotic biogeochemical processes. These potential coupled processes could be the key of a remineralization twice as large as found in the oxygenated ocean. The strong oxycline of the OMZ, a layer with intermittent active O_2 consumption 3 times higher than in the core, is proposed as the engine maintaining locally the OMZ. The active biogeochemical O_2 consumption is favoured in the open ocean, and on the shelf in spring and fall. The intense local remineralization could contribute to the

OMZ maintaining from 25% to 50%, but its preformation needs a regional dynamical transport of O_2-impoverished subsurface waters. These results call for a proper characterization and extension evaluation of all OMZs, with measurements adapted to the ultra low O_2 concentrations and including the oxycline role.