MULTIDECADAL TO MILLENIAL CHANGES IN PRODUCTIVITY AND OXYGENATION IN THE MAIN PERUVIAN UPWELLING ZONE SINCE THE LATE PLEISTOCENE

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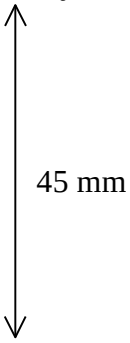
Mud-belts containing laminated or near-laminated sedimentary sequences exist in the central Peruvian continental margin beneath the oxygen minimum zone (12 – 14°S, 150 – 400 m), an area where upwelling-favorable alongshore winds are active year-round. The sediments here are dominated by siliceous and phosphatic biogenic remains, organic matter aggregates and lithogenic particles. Sediment cores collected in these belts record past climatic and biogeochemical conditions associated to the Peruvian upwelling system, providing decadal or even sub-decadal time-resolution for the reconstruction of past variabilities. We have examined paleorecords of past productivity and oxygenation in these continental margin sediments since the Last Glacial Maximum (0 – 22Ky BP), as inferred from stratigraphy (absence of bioturbation), geochemical and isotopic proxies, the latter for the past millenium.

Laminated sequences are best preserved for the LGM, the Bolling/Allerod period, the early Holocene and the last millennium. In these sequences, the Mo:Al ratio, a proxy for anoxic conditions in the sediments is higher, suggesting an intensification of the oxygen minimum zone. Here also siliceous sedimentation is dominant and carbonate preservation is enhanced, perhaps due to a combination of higher productivity and higher alkalinity in the sediments. For the past millennium, multiproxy records indicate a less intense OMZ and lower productivity during the Little Ice Age.

There is a correspondence between the periods of high (low) lithogenic input and low (high) siliceous productivity with global/Northern Hemisphere cool (warm) climatic conditions since the deglaciation. The main mechanism driving this behavior for the Peruvian upwelling system appears to be the southward/northward migration of the ITCZ, modulating the inland precipitation and the alongshore wind field off Peru. Nevertheless, recent studies in



other eastern boundary upwelling systems suggest that local land-sea pressure gradients under hemispheric warming or cooling modulate upwelling and biological productivity, which may contribute to oxygen depletion over the continental margins at these time-scales. In general, our understanding of atmospheric forcing on productivity and oxygenation during this time-span has been improved, but the role of subsurface to deep-water circulation and water mass formation driving these changes is still poorly understood.

Keywords: Holocene, Peruvian upwelling, laminated sediments, paleo-productivity, paleo-xygenation