Drivers of redox changes in diverse basins of the Gulf of California: Alfonso, La Paz, and Pescadero

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Oscillations of water column chemistry (especially dissolved oxygen) in coastal marine basins and open seas are controlled by a complex interplay among circulation, climate, productivity, and sea level variability, which can also bear anthropogenic impacts. The underlying marine sediments are capable of recording such changes but often in dissimilar ways as a function of the specific characteristics of each basin and the microbiologically mediated overprints that occur during settling and burial. In this study we tackle these issues by following the transformation pathways of various paleoproductivity and paleoredox indicators (e.g., Mo, Ni, V, U, detailed Fe speciation, and C and S concentrations and isotope ratios). We emphasize solid-phase and pore-water geochemistry from sediment cores collected in contrasting but neighboring suboxic and anoxic marine basins of the southern Gulf of California: silled Alfonso, OMZ-influenced La Paz, and OMZ upwelling-enhanced Pescadero. We focus on a high-resolution reconstruction of the last centuries but with millennial-scale perspectives that extend as far as 80 kyr BP. Our results show that during the late Pleistocene and throughout the Holocene several paleoredox shifts occurred, caused by variations in relative sea level and productivity, which are expressed differently on the Pescadero slope and Alfonso Basin. During the last deglaciation and accompanying abrupt warming around 11 kyr BP, Mo in Pescadero gradually increased from 3.7 to 35.1 mg/kg, along with similar trends for U (4.4 to 12.5 mg/kg). This change was not registered as abruptly in Alfonso, where Mo and U varied from 8.2-14.3 and 10.3-15 mg/kg, respectively. In the longer record from Alfonso, Mn, V and U tracked global sea level, with the lowstands recorded as high U intervals (23 mg/kg) representing anoxia around 25 and 75 kyr BP, as well as potential euxinia during the Mousterian Pluvial evidenced by the highest Mo reported (57.6 mg/kg).