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Multi-proxy reconstruction of marine inorganic carbon chemistry in the Benguela Upwelling System during the last 25 ka

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Studies on upwelling intensity during the last glacial cycle in the Benguela Upwelling System offshore Namibia show contrasting signals, indicating an incomplete understanding of regional changes. We investigate the evolution of the inorganic carbon chemistry during the last deglaciation in a sediment core from the Walvis Ridge to improve our understanding of upwelling and its association to CO_2 outgassing. Cold waters brought to the surface from depth has high dissolved inorganic carbon (DIC) content, which causes an initial increase in pCO_2 and a decrease in pH and carbonate saturation at the sea surface. Concurrently, the nutrient supply of the upwelled waters and the efficiency of the biological carbon pump provide an important constraint on the reduction of surface pCO_2. This implies that upwelling rate and nutrient utilization together determine CO_2 outgassing. To accurately reconstruct these processes in the Namibia upwelling region, we apply different CO_2-system proxies, such as the boron isotopic composition ($\delta^{11}B$) in the foraminifera shell, the ratio of boron to calcium (B/Ca), and the carbon isotopic composition ($\delta^{13}C$) of alkenones. This multi-proxy approach allows the independent reconstruction of parameters of the carbonate system and thus quantification of the complete inorganic carbon system. Along with these proxies for the CO_2 system, the $\delta^{13}C$ of planktic and benthic foraminiferal shells will be analyzed to evaluate efficiency of the carbon pump and its role in CO_2 outgassing over the last 25 ka.