Influence of Southern Ocean Intermediate water on the South Pacific's thermocline during the last ˜500 Ka

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The Southern Ocean Intermediate Waters (SOIWs), such as Subantarctic Mode Water and Antarctic Intermediate Water, transport climatic signals from high to low latitudes and ventilate the thermocline in the Southern Hemisphere Gyres. Reconstructions of the SAMW-AAIW in the South Pacific suggest substantial spatial variability in their advection to lower latitudes during the last glacial, but the SOIWs' impact on the South Pacific Gyre's thermocline beyond the last glacial cycle is largely unknown.

Here, we present ˜500 ka multiproxy records of Mg/Ca ratios, clumped isotopes and stable oxygen isotope, measured on sea surface and thermocline-dwelling planktic foraminifera from the center of the SPG. The local salinity and Mg/Ca-temperature at the sea surface is relatively stable (˜10 ºC) throughout the record. However, the dual proxy-based thermocline temperature records show two distinct climatic intervals. Prior to 300 ka, the conditions were cold and fresh, with average temperatures of ˜4 ºC. Thereafter (<300 ka), the thermocline of the SPG became warmer and saltier, with average temperatures of ˜8 ºC.

The SOIWs variability in the Pacific basin have been traditionally linked to the Southern Westerlies Winds. However, the evolution of the subsurface-temperature and -salinity substantially differs from the glacial-interglacial variability (position and/or intensity) of the Southern Westerlies Winds. We discuss several possible mechanisms that could lead to this enigmatic shift in our thermocline temperature and salinity records.

Keywords: Mg/Ca, Planktic Foraminifera, Intermediate waters, Stable isotopes