Neodymium isotope variability of the Pacific Ocean in the Holocene and last glacial maximum

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Being volumetrically the largest water mass and most enriched in nutrients, Pacific deep water stores the largest amount of carbon in the Earth's surface system today. Previous studies suggest deep Pacific was probably an even larger carbon stock during the last glacial maximum. But what role the Pacific ocean circulation played in regulating atmospheric CO_2 change from the LGM to modern is not well constrained yet. Neodymium isotopes of ferromanganese oxide coatings precipitated on planktonic foraminifera are a valuable water mass tracer for paleoceanographic reconstruction. In this study, 56 new Nd isotopic compositions of planktonic foraminifera from core-top sediments throughout the Pacific are presented as well as 35 LGM Nd isotopes.

The core-top foraminiferal εNd results closely match the proximal seawater data, indicating that planktonic foraminifera coatings can give a reliable record of bottom water Nd isotopes in the Pacific. Also the comparison between the core-top and LGM εNd isotopes supports a slower glacial Pacific overturning circulation at different depths and regions. During the LGM, the deep Southwest Pacific cores saw a more radiogenic glacial εNd compared with the core-top values probably due to the reduced North Atlantic Deep Water propagation to the Pacific through Antarctic Circumpolar Current. However, the Eastern Equatorial Pacific cores between 1~2.4 km had consistently lower LGM εNd values which might suggest a reduced influence of more radiogenic North Pacific Deep Water return flow. Taken together, the temporal variability of Nd isotopes shows that glacial-interglacial Pacific ocean circulation changes might be more complex than previously thought.