Records of br GDGTs based proxies from the South China Sea during the past 500 kyr and the oceanographic implications

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Several proxies based on branched glycerol dialkyl glycerol tetraethers (GDGTs) have been developed to decipher the paleo-environment changes (e.g., soil pH and air temperature) in the terrestrial environment; however, they are rarely used to explore the oceanic environment variation because of the potential terrestrial contribution. Recently, more evidence suggested the dominant in-situ production of the br GDGTs in marine sediment or the bottom water[1,2], providing promising indexes for reconstructing the pH of bottom water. Here, The Ring index of tetraether ($Ring_{tetra}$), the branched isoprenoid tetraether (BIT) index, and the cyclization ratio of branched tetraethers (CBT) index, from core MD01-2392 were derived to evaluate the influence of the terrestrial input and pH, showing apparent glacial-interglacial patterns during the past 500 kyr. Most of the $Ring_{tetra}$ values were lower than 0.4, and the BIT values were lower than 0.3, indicating a minor terrestrial influence. The CBT-derived pH varied between 6.3 and 8 showing unreasonable values because of without a specific marine sedimentary calibration. However, it showed higher values in interglacial periods and lower values in glacial periods, which was consistent with that of the previous report during the past 180 ka [1] except for the marine isotope stage (MIS) 4 and MIS 5 with relatively lower values. The lower pH during glacials could be attributed to the sequestration of CO_2 in the deep waters of the Southern Ocean due to the weakened ventilation. The weakened ventilation will reduce the O_2 of the deep water as well and thus result in a deoxygenation process. Simultaneously, the increased efficiency of the biological pump during glacial periods will further enhance the consumption of the dissolved O_2 in bottom water through the remineralization of organic matters. Our results provide a new scenario for the carbon cycle during the glacial-interglacial time scale.

[1]Dong et al., (2015), Organic Geochemistry 79, 74-82.
[2] Zhang et a., (2020), Global and Planetary Changes 108, 103043.