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# Distributions of mesophilic archaeotal membrane lipids and $TEX_{86}$ thermometry in the modern enclosed shallow coastal anoxic basin

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It is widely accepted that atmospheric carbon dioxide concentration is rapidly increasing over the last 200 years. Global average surface temperature has been increased by 0.74 ˚C in the last 100 years. While a large number of studies have also documented the annual sea surface temperature (SST) and global mean sea level rising, global warming effect on enclosed coastal seas, such as Seto Inland Sea or Chesapeake Bay, is less understood. Since ecosystems of those shallow coastal basins would be severely altered in the near future, we need to gather and understand archives of climate change and ecosystem responses in these few hundred years. In this point of view, Beppu Bay in Seto Inland Sea would provide one of archetypal records, because sediments in Beppu Bay yields exquisitely preserved fish scales indicative of a historical record of macro faunal abundance[1)].
On the other hand, since systematic and precise instrumental SST data for 200 years are very scarce in Seto Inland Sea, we need to use a certain SST proxy for identifying the past SST records. However, paleothermometry in the shallow coastal basin is quite difficult because carbonate microfossils typically used for paleotemperature proxies are practically absent in the shallow ocean. On the contrary, organic compound based paleo-temperature proxies, such as $TEX_{86}$, can be utilized even in the shallow coastal sea. However, since $TEX_{86}$ thermometry has rarely been used for such shallow marine sediments, applicability of $TEX_{86}$ in the coastal ocean is still uncertain.

Here we test potential ability of $TEX_{86}$ paleothermometry in shallow coastal anoxic basin. We collected particulate organic matters (POM) from the water column of Beppu Bay (∼70m deep) at every 10 m. We collected an additional sample at the depth showing chlorophyll maximum. Then the vertical depth profile of glycerol dialkyl glycerol tetraethers (GTGTs) distribution within the anoxic and oxygen-enriched water columns was determined. We also calculated $TEX_{86}$ values, which were compared with the in situ measurements of water temperatures.

Total GDGTs abundance within the water column shows very unique distribution. Though total GDGTs abundance in the oxygen-enriched surface and subsurface waters are almost constant, it is significantly increased in the anoxic bottom water. Because Beppu Bay is an archetypal restricted basin in Seto Inland Sea, cooler stagnant and anoxic water masses have been developed at bottom of Beppu Bay. Because the depth showing abrupt increase of total GDGTs is well correlated with the depth of oxic/anoxic boundary within the water column, it is assumed that GDGTs production is enhanced in the anoxic water mass. In fact, calculated $TEX_{86}$ temperatures of the samples collected in the cooler anoxic bottom water are cooler than those in the warmer oxygen-enriched surface and subsurface waters. Moreover, those $TEX_{86}$ derived temperatures correlate with the in situ measurements of water temperatures. Therefore we believe that $TEX_{86}$ temperatures are representative of true water temperatures at Beppu Bay.

1) Kuwae et al. (2008) International symposium ‘Effect of Climate Change on the World’s Oceans’.