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現世沿岸海洋の水柱における古細菌の膜脂質と DNA の分布
Distributions of archaeal membrane lipid and DNA within the modern coastal shallow marine water column

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TEX86 thermometry, based on the number of cyclopentane moieties in the glycerol dialkyl glycerol tetraether (GDGT) lipids of membranes of Crenarchaeota, has been utilized as a paleotemperature proxy for the last ten years (Schouten et al., 2002 and others). This proxy was derived from an empirical relationship between annual mean sea surface temperatures and TEX86 values of core top sediments (Kim et al., 2008). This empirical relationship has been subsequently supported by the results of incubation experiments of marine Crenarchaeota (Wuchter et al., 2004; Schouten et al, 2007). Based on analyses of particulate organic matter from the modern open ocean, the membrane lipids preserved within core top sediments were biosynthesized at about 100 m deep within a water column (Wuchter et al., 2005). The distributions of isoprenoid chain produced within a water column are finally preserved within deep sea sediments (Takano et al, 2010). However, because this proxy has been developed and designed for open ocean settings, applicability of this unique proxy to the shallow coastal ocean, which can be easily affected by the anthropogenic climate change, is still uncertain.

Here we present abundances and distributions of archaeal membrane lipids within the water column at Beppu bay in the Seto Inland Sea. Beppu bay is an archetypal silled basin of 70 m depth, with bottom water that are decoupled from the surface water in summer, producing anoxic conditions in the bottom water. The abundance of GDGTs in the anoxic water mass was considerably higher than those of the oxygen rich water mass. Nonetheless, low particulate organic carbon content in the anoxic water mass indicates that the excess concentration of GDGTs implies in situ biosynthesis rather than accumulation of organic matter settled from the overlying oxygen rich water mass. Calculated TEX86 values from these lipids show a significant positive correlation with the in situ water temperatures observed, confirming the appropriateness of this proxy for shallow coastal ocean paleothermometry. On the other hand, at least two different genotypes were identified from archaeal DNA distributions within the water column. One genotype identified in samples recovered from water depth greater than 30 m was not found in samples recovered from the very shallow water, implying GDGTs in deeper water are synthesized by the different genotype than those found in the surface water.

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