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Spatial and size distributions of intact and core glycerol dialkyl glycerol tetraethers in suspended particulates

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We investigated the size and spatial distributions of intact and core glycerol dialkyl glycerol tetraethers (GDGTs) in suspended particulates at different depths from the western North Pacific to understand how GDGTs start to sink in the water column, and what sedimentary TEX86 reflects.

Three different intact GDGTs, mono-hexose (MH), di-hexose (DH), and hexose, phosphohexose (HPH) GDGTs were detected. Concentrations of intact and core GDGTs at all three locations are vey low in the surface water, increase downward and are maximized at 200 m in the twilight zone. There was significant difference in the relative abundance of MH, DH, and HPH GDGTs between the euphotic and twilight zones, which is attributed to the difference of genotypes of Thaumarchaeota.

Intact and core GDGTs were detected in both the 0.2?1.0 micron and >1.0 micron fractions. In the euphotic zone, a significant portion of intact GDGTs were contained in the >1.0 micron fraction. This suggests that either the GDGTs produced by free-living Archaea were quickly incorporated into a larger particle, or GDGTs were produced by attached Archaea. The proportion of intact GDGTs in the >1.0 micron fraction was higher in subarctic than subtropical sites, suggesting that large phytoplankton such as diatoms plays a role in the formation of intact GDGTs in larger particle. The epipelagic (euphotic zone) GDGTs can effectively sink downward and be delivered to sediment. However, some part of mesopelagic (twilight zone) GDGTs exists in the large size fraction. This suggests that mesopelagic GDGTs also potentially contribute to sinking particles.

The TEX86 values of core and intact GDGTs were different in the same sample; the TEX86 decreased in the order of DH, core, and MH GDGTs. Similar depth profiles of TEX86 of intact and core GDGTs in both 0.2?1.0 micron and >1.0 micron fractions suggests that most GDGTs in suspended particulates did not originate from the surface water but was produced on site. The TEX86 values of core GDGTs in the twilight zone are much higher than expected from in situ temperature, suggesting that mesopelagic Archaea have a different TEX86 response to temperature, which was also pointed by Zhu et al. (2013).

Keywords: TEX86, GDGT, Suspended particulates, POM, proxy