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COASTAL ECOLOGY OF CRENARCHAEOTA AS DETERMINED BY LIPID AND CARBON ISOTOPIC LABELLING STUDIES

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It is thought that non-extremophillic Crenarchaeota comprise up to 20% of all marine prokaryotes (Karner et al., 2001). Depending on their cell abundance and growth rates Crenarchaeota could strongly impact nitrogen and carbon cycling where they are found in quantity since evidence supporting their use of ammonium derivatives as an energy source and inorganic carbon species for biomass accumulation is mounting (Könneke et al., 2005; Wuchter et al., 2006). To trace their occurrence in nature, a specific glycerol dialkyl glycerol tetraether (GDGT) derived from the membrane lipids of Crenarchaeota, crenarchaeol, can be quantified using HPLC-MS. Whether or not we can use this biomarker to trace the functional *activity* of these organisms remains a question to be addressed through comparisons between biomarker abundances and ecological surveys of functional genes, gene expression, community structure and direct cell counts. Besides archaeal isoprenoidal GDGTs, branched GDGTs, thought to be produced by anaerobic soil bacteria, are often found in coastal environments

In this study we determined concentrations of both archaeal and bacterial GDGTs in North Sea water sampled between October 2003 and March 2005 using HPLC-MS. An unexpected co-variation resulted between crenarchaeol and bacterial GDGTs (Figure 1) suggesting that at least a proportion of the lipids share a common source, i.e. sediment particles derived from land or *in situ* sea water. Suspended particulate matter measured over this time course showed a gradual seasonal oscillation, much smaller in magnitude than the observed seasonal spike in lipid biomarker concentrations. Thus, it seems more probable that some of the “terrestrially-derived” bacterial GDGTs are actually being produced in the North Sea. Consistent with this possibility is the correspondence of seasonal lipid fluctuations with that in local nutrient concentrations. We will investigate this topic further over the coming months by analysing the 16S rDNA and functional gene concentrations of the crenarchaeota. In addition we will continue the time series with a focus on the intact phospholipids related to the archaeal and bacterial GDGTs.

Crenarchaeota also appear to be functional on land as well as in the sea. Their role in sedimentary environments is supported by evidence that Crenarchaeota may predominate among ammonia-oxidizing prokaryotes in terrestrial soils and exist in estuarine sediments. Since little attention has been paid to their possible role in sedimentary carbon cycling, a second objective of the present research is to investigate the potential role of crenarchaeota in benthic carbon flows. We will analyse ^{13}C incorporation into crenarchaeotal membrane lipids in sediments of intertidal mudflats in the Scheldt Estuary from a 1-month *in situ* labeling experiment. Initial measurements from unlabelled sediment show relatively high concentrations of crenarchaeol. Further investigation will determine if these lipids are indeed derived from active Crenarchaeota populations living in the coastal sediments.

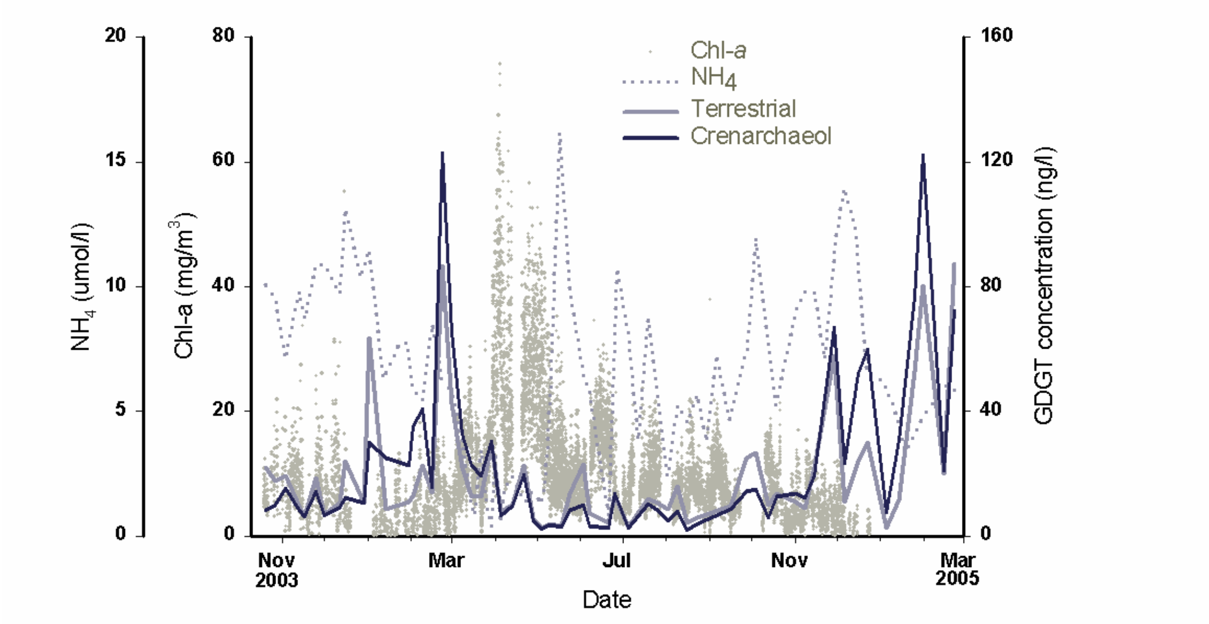

Figure 1. Time course measurements of crenarchaeol and presumed terrestrially-derived branched glycerol dialkyl glycerol tetraether (GDGT) concentrations in North Sea waters from mid-October 2003 until end-February 2005. High abundance of GDGTs correspond with decreasing ammonia and increasing nitrate concentrations in winter and low abundance of chlorophyll-*a*.

REFERENCES

Karner, M.B., DeLong, E.F., Karl, D.M., 2001. Archaeal dominance in the mesopelagic zone of the Pacific Ocean. Nature 409, 507-510.

Könneke, M., *et al.*, 2005. Isolation of an autotrophic ammonia-oxidizing marine archaeon. Nature 437, 543-546.

Wuchter, C., *et al.*, 2006. Archaeal nitrification in the ocean. Proceedings of the National Academy of Sciences 103, 12317-12322.