# The butanetriol dialkyl glycerol tetraethers (BDGTs), potential biomarkers for methanogenesis?

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Archaeal tetraether lipids are commonly composed of two biphytanes linked to two glycerol backbones via ether linkages. The biphytanes can display diverse structures while glycerol is considered as the universal backbone for membrane lipid synthesis. However, this assumption was challenged by the discovery of a novel class of archaeal lipids, in which butanetriol substitutes one glycerol unit [1, 2]. These lipids were assigned as isoprenoidal butanetriol glycerol tetraethers (BDGTs) based on MS/MS experiments and the detection of butanetriol following ether cleavage. NMR analysis on the major BDGT revealed the position of the additional methyl group and confirmed the molecular structure.

Environmental distributions of BDGTs were determined in 48 sediment samples from the Mediterranean and Black Sea. Compared to other archaeal lipids, the proportion of the intact polar lipid of BDGTs is higher and their increase with depth suggests *in situ* production of BDGTs below the seafloor. This is consistent with findings from Becker et al. [3] who identified BDGTs as the most abundant lipid type in an isolate of the *Methanomassilicoccales*. Stable carbon isotopic compositions of BDGT biphytanes suggest diverse metabolisms of their producers: in Mediterannean sapropels $\delta^{13}C$ suggests a predominantly heterotrophic source. By contrast, a distinct $^{13}C$-depletion of BDGT biphytanes in Black Sea and Rhone delta sediments, points to either an autotrophic metabolism or to the utilization of compounds associated with a high fractionation factor, such as methanol; both options are consistent with a methanogenic source in these settings. The existence of BDGTs opens numerous questions, notably why and how some microorganisms produce such unusual membrane lipids.

[1] Knappy *et al.* (2014), *Org. Geochem.* **76**, 146–156.
[2] Zhu *et al.* (2014), *Rapid Commun. Mass Spectrom.* **28**, 332–338.
[3] Becker *et al.* (2016) *Appl. Environ. Microbiol.* **82**, 4505-4516.