Methanogenesis 2020: An update

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For a long time, biological methane formation was considered to occur only under strictly anaerobic conditions by organisms from the domain Archaea. However, during the past 15 years evidence has been accumulating that Eukaryotes such as plants, fungi, animals and humans produce methane independent of methanogenic Archaea via pathways in oxic environments that have not yet been fully resolved (Keppler et al., 2009, Wang et al. 2013, Liu et al. 2015, Boros & Keppler 2019).

Furthermore, it was recently shown that both marine and freshwater algae (Klintzsch et al. 2019, Hartmann et al. 2020) do produce methane per se and might contribute significantly to the abundance of methane in oxygen-rich surface waters, commonly known as the “methane paradox”.

Finally, very recently it was demonstrated that Cyanobacteria - members of the third domain of life, i.e. Bacteria - that thrive in terrestrial, marine and freshwater environments are also able to directly produce methane (Bižić et al. 2020) and thus revealing that methanogenesis occurs in all three domains of life.

In this presentation, I will give a brief overview of recent observations of biological non-archaeal methane formation from organisms living in terrestrial and marine organisms. Furthermore, I will discuss potential mechanisms and environmental factors that might control formation of methane in Eukaryotes and Cyanobacteria. From these novel results, it becomes clear that it is essential to study methane formation in all three domains of life to fully understand the global biogeochemical cycle of methane.

References:


Hartmann, J. F., Gunthel, M., Klintzsch, T., Kirillin, G., Grossart, H.-P., Keppler, F., Isenbeck-Schröter,


