

Mineralogical control on methylo trophic methanogenesis and implication for cryptic methane cycling in marine surface sediment

KE-QING XIAO, OLIVER W. MOORE, DR. PEYMAN
BABAKHANI, PHD, LISA CURTI AND CAROLINE L.
PEACOCK

University of Leeds

Presenting Author: k.q.xiao@leeds.ac.uk

Minerals are widely proposed to protect organic carbon (OC) from degradation and thus promote the persistence of OC in soils and sediments, yet the link between mineral adsorption and retardation of microbial remineralisation is often presumed and a mechanistic understanding of the protective preservation hypothesis is lacking. Here we show that methylamines, the major substrates for cryptic methane production in marine surface sediment, are strongly adsorbed by marine sediment clays, and that this adsorption significantly reduces their concentrations in the dissolved pool (up to 40.2 ± 0.2 %). We show for the first time that the presence of clay minerals slows methane production and reduces final methane produced (up to 24.9 ± 0.3 %) by a typical methylo trophic methanogen -*Methanococcoides methylutens* TMA-10. Near edge X-ray absorption fine structure spectroscopy shows that reversible adsorption and occlusive protection of methylamines in clay interlayers are responsible for the slow-down and reduction in methane production. Our data indicate that mineral-OC interactions strongly control methylo trophic methanogenesis and potentially cryptic methane cycling in marine sediments.