Methanotrophy in a subtropical, tidally influenced wetland: Rates and effects of electron acceptors

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Wetlands have been considered to represent a major natural source of methane emission, intensifying greenhouse effect. Despite in situ methanogenesis sustained by organic degradation, methanotrophy also plays a vital role in controlling the exact quantity of methane release to the atmosphere. As wetlands constantly experience disturbances of anthropogenic and biological activities, tidal inundation, and plant development, rapid elemental turnover would enable various electron acceptors available for methanotrophy. The potential rates, effects of electron acceptors and the population compositions involved in methane transformation in wetland sediments need to be further explored. In this study, sediments recovered from tidally influenced, mangrove covered wetland in northern Taiwan were analysed to investigate the distribution of methanotrophy and methanotrophic rates in the presence of various electron acceptors. Our results demonstrated that while aerobic methanotrophy was confined at or near surface sediments, anaerobic methanotrophy was dynamically positioned and seemed to be controlled by the redox gradient and sulphate cycling. The potential rates of aerobic methanotrophy surpassed those of anaerobic methanotrophy by orders of magnitude. Anaerobic methanotrophy was stimulated w/o the presence of various electron acceptors. Overall, the ultimate control on methane oxidation and emission is complicated by the interplay between oxygen penetration, sulphate reduction, methanogenesis, methanotrophy, and anaerobic sulphate production modulated by tidal influence.