

MICROBIAL PHOSPHONATE METABOLISM AND  
THE AEROBIC PRODUCTION OF METHANE

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## **Abstract**

Methane is a potent greenhouse gas, and its increasing burden on the Earth's atmosphere continues to affect global climate change. Despite this, the methane budget source terms are poorly constrained. This study addresses the "Oceanic Methane Paradox", which focuses on surface ocean methane fluxes to the atmosphere. Specifically, this research focuses on the degradation of methylphosphonate, which leads to the aerobic production of methane. Chapter 1 experiments targeted heterotrophic bacteria in natural open ocean microbial assemblages in the North Pacific Subtropical Gyre. Chapter 2 experiments were performed in batch culture mode with the diazotroph *Trichodesmium*. Results showed that both heterotrophic bacteria and *Trichodesmium* rapidly consumed methylphosphonate, which lead to the aerobic production of methane. These results may help to resolve the "Oceanic Methane Paradox." Further, this pathway is inextricably linked to carbon, nitrogen, and phosphorus cycles, including additional greenhouse gases such as carbon dioxide and nitrous oxide.