

Anaerobic oxidation of methane coupled to iron reduction (Fe-AOM) associated with iron, sulfur and carbon cycles in anoxic sediments

PEI-CHUAN CHUANG*, VERENA B. HEUER, KAI-UWE HINRICHS, MATTHIAS ZABEL

MARUM – Center for Marine Environmental Sciences,
University of Bremen, Bremen, Germany
(*correspondence: pchuang@marum.de)

The detection of anaerobic oxidation of methane (AOM) and the release of dissolved ferrous iron (Fe^{2+}) below the sulfate-methane transition zone (SMTZ) have been explained by two mechanisms: 1) AOM coupled to iron oxide reduction (Fe-AOM) and 2) re-oxidation of downward-diffusing dissolved sulfide with iron oxides in a cryptic sulfur cycle which induces iron-mediated AOM coupled to sulfate reduction (SO_4 -AOM) in the methanogenic zone. Recent studies indicate that Fe-AOM could depend on the sediment accumulation rate [e.g., 1, 2]. Another important criterion may be if the geochemical system is in transient vs. steady state. To examine these two scenarios, we use a new adaptation to an already successfully used numerical transport-reaction model. As a reference data set for our simulations, we use analytical results from a sediment core, which has been recovered from about 1270 m water depth in the southern Black Sea.

The objective of this study is to gain deeper insights into the coupling between iron, methane and sulfur dynamics in aquatic sediments. What are the main factors controlling the interacting reactions and processes associated with Fe-AOM and iron-mediated SO_4 -AOM?

[1] Egger *et al.* (2015) *Environ. Sci. Technol.* **49**, 277-283.

[2] Rooze *et al.* (2016) *Limnol. Oceanogr.* **61**, S267–S282.