Influence of Manila clam (*Ruditapes philippinarum*) aquaculture on the partitioning of organic carbon oxidation coupled to sulfate- and iron reduction in the sediments of the Keunso Bay, Yellow Sea

S.-H. KIM[1,2], S.-U. AN[2], W.-C. LEE[3], J.S. LEE[1], J.-H. HYUN[2*]

[1]Korea Institute of Ocean Science & Technology, 385 Haeyang-ro, Yeongdo-gu, Busan 49111, Republic of Korea

[2]Hanyang University, 55 Hanyangdaehak-ro, Sangnok-gu, Ansan, Gyeonggi-do 15588, Republic of Korea

[3]National Fisheries Research and Development Institute, 216, Gijanghaean-ro, Gijang-eup, Buasn 46083, Republic of Korea

(*Correspondence: hyunjh@hanyang.ac.kr)

Although it represents the third highest production (4,228,594 tonnes in 2016) in global shellfish aquaculture, little is known about the effects of Manila clam (*Ruditapes philippinarum*) aquaculture on the sediment biogeochemistry. We investigated the rates and pathways of anaerobic organic carbon (C_{org}) oxidation in highly bioturbated (HB) sediments by the *R. philippinarum* aquaculture and poorly bioturbated (PB) sediments in the Keunso Bay, Yellow Sea. As a result of increasing solute exchange through reworking and irrigation activities, anaerobic C_{org} oxidation rates at HB (38.8 mmol m^{-2} d^{-1}) were about twice as high as that at PB (26.8 mmol m^{-2} d^{-1}). Microbial Fe(III) reduction pre-dominated C_{org} oxidation pathway at HB, comprising 55–76% of total anaerobic C_{org} oxidation, whereas sulfate reduction was a dominant anaerobic C_{org} oxidation pathway at the PB, accounting for 50–92% below 2 cm depth. Despite of higher anaerobic C_{org} oxidation rates at the HB, concentrations of NH_4^+, PO_4^{3-}, oxalate extractable iron ($Fe(II)_{(oxal)}$) and total reduced inorganic sulfur (TRIS) were 2–3 fold lower at the HB than at the PB. Conversely, Concentrations of reactive $Fe(III)_{(oxal)}$ at HB exceeded that of PB by a factor of 2. Overall results demonstrated that bioturbation by Manila clam enhanced re-oxidation processes of metabolites in the sediment, and thus prohibited sulfate reduction and promoted $Fe(III)_{(oxal)}$ reduction, which ultimately provides environmentally endurable conditions from the deposition of organic matter in the intertidal sediments.