Total alkalinity flux at seagrass meadow estimated by eddy covariance and pore water profiles in sediment

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Ocean acidification decreases the pH of seawater and the saturation state of minerals, and carbonate sediment dissolution could be more sensitive to ocean acidification than calcification by reef organisms (Eyre et al. 2014). Particularly in seagrass-carbonate sediment, it has been suggested that both abundant labile organic matter and wide redox range would increase pCO_2 in sediment, and total alkalinity (A_T) flux from sediment to water column caused by Mg-calcite dissolution would also increase. Here, we measured sedimentary dissolved oxygen (DO) and carbonate profiles in a seagrass area of Shiraho coral reef, Ishigaki Island, and A_T flux at the sediment-water interface was estimated using eddy covariance (EC). Almost half of the sediment was Mg-calcite derived from foraminifera and its Mg content was 16.4 mol%. Analysis of the sedimentary DO and Oxidation-Reduction Potential (ORP) profiles at night indicated that O_2 was depleted deeper than at least 4 mm and sulfate reduction could occur. While pore water A_T and dissolved inorganic carbon values increased with depth, pore water saturation state of aragonite was constant at a value of ~ 2.3 during the entire nighttime. On the other hand, the calculated nighttime A_T flux from sediment to water column was 0.9–3.2 mmol m^{-2} hr^{-1} though seawater in water column was oversaturated with respect to Mg-calcite. This would be caused by Mg-calcite dissolution and bacterial sulfate reduction, and A_T flux from sediment to water column would increase further by ocean acidification.

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