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Alkalinity and CO2 fluxes in a tropical seagrass meadow

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Total alkalinity (TA) production in vegetated coastal systems is considered a putative sink for atmospheric CO_2, due to the increase in the seawater buffer capacity when TA is produced in excess of DIC. Much of the TA generated in these habitats is derived from the reduction of NO_3 and Fe, but in oligotrophic tropical waters dominated by carbonate sediments, these sources of TA may be minimal. To address this uncertainty, we measured a suite of sediment-water fluxes (SO_4, N_2, TA, DIC, DOC, etc) in a tropical and calcifying seagrass meadow, allowing us to identify the biogeochemical processes responsible for TA generation and consumption. We placed this information into the context of water-air CO_2 exchange, which was measured by atmospheric eddy covariance. Net N_2 fluxes indicated that denitrification was a negligible TA source in this oligotrophic seagrass meadow, which at times was net N_2-fixing. Instead, sediment-water TA fluxes were dominated by the balance between SO_2 reduction, H_2S oxidation, and carbonate dissolution/precipitation. Air-water CO_2 exchange was small and variable, reflecting the highly-buffered seawater chemistry and oligotrophic nature of this seagrass meadow.

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