

Benthic fluxes indicating uncoupled aerobic and anaerobic processes in the Rhône River prodelta

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Estuarine regions are characterized by high burial and mineralization rates of organic matter (OM) and thus seen as a CO₂-source to the atmosphere. Such benthic processes lead to a release of dissolved inorganic carbon (DIC) and potentially total alkalinity (TA) into the water column. DIC inputs increase bottom water pH, and the release of TA increases their buffer capacity. Sulfate reduction is a dominant process in such organic-rich sediments producing high TA values, but the reoxidation of sulphides lowers the produced TA before it can be transferred into the bottom waters. In September 2015, a benthic chamber was deployed at several stations in the prodelta of the Rhône River (Mediterranean Sea) to measure *in situ* DIC and TA fluxes across the sediment water interface. At the same stations, *in situ* microprofiles of O₂ and main redox species (Mn²⁺, Fe²⁺, soluble organic-Fe³⁺, ΣH₂S, FeS_{aq}) were recorded and sediment cores were taken for pore water extraction and analysis (DIC, TA, SO₄²⁻, CH₄ and Ca²⁺). DIC fluxes (F_{DIC}) reached up to 93 mmol m⁻² d⁻¹ and TA fluxes (F_{TA}) up to 73 mmol m⁻² d⁻¹ close to the river mouth. The intensity of the fluxes decreased offshore. Most of the DIC and TA production results from sulfate and iron reduction. Despite the complete removal of sulfate, no sulphide was detected in porewaters likely due to the precipitation of iron sulphide minerals. As a consequence the sediment becomes a net TA source to bottom waters, limiting the increase of pCO₂ due to DIC produced by respiration, buffering the pH and maintaining high carbonate saturation states.