The effect of chemical interactions between seawater and riverine particles on the carbonate chemistry in the Gulf of Mexico

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The effects of heterogeneous, chemical reactions between riverine particles and dissolved cations in seawater have been extensively studied [e.g. 1, 2, 3]. However, the effects of these reactions on the coastal carbonate cycle have received surprisingly little attention. To study these effects, we sampled and analyzed water from a coastal transect that extended from the particle-laden plume of the Brazos River to the open waters of the northern Gulf of Mexico. Our data show that within the area of encounter between the pristine seawater and the particulate plume, the dissolved inorganic carbon (DIC) and the total alkalinity (TA) were substantially (~ 300 μmol kg^{-1}) lower than the values expected from conservative mixing. Nutrient and physical data show that neither biological nor physical proccesses could account for this deviation from conservative mixing behaviour, suggesting that chemical reactions rapidly removed DIC and TA from the seawater. This is corroborated by laboratory experiments, in which the seeding of seawater with particles from the Brazos induced a decrease in DIC and TA.

The primary mechanisms that could induce the observed changes of TA and DIC are heterogeneous $CaCO_3$ precipitation and alteration of clay minerals. Our data show, that although these mechanisms have been overlooked in the context of carbonate chemistry, they are important factors in the coastal carbon cycle.

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