

# **Regional and Global Patterns of Organic Matter Reactivity and their Influence on Carbon Turnover in Marine Sediments**

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The degradation of organic matter (OM) in marine sediments is key to understanding carbon cycling in the past, present, and future. While the potential controls on OM reactivity are increasingly well understood, their relative significance and the way in which they interact to control OM reactivity remains difficult to quantify. As a consequence, no framework currently exists to predict OM reactivity, and thus OM degradation dynamics, in global marine sediments.

In an attempt to address this knowledge gap, we inversely fit a 1D early diagenetic model to 14 sets of organic carbon and sulfate depth profiles and 392 diffusive oxygen uptake (DOU) measurements. Our analysis shows that OM reactivity is highly variable and a function of the whole depositional environment. Nevertheless, clear regional patterns in reactivity emerge. High reactivity is associated with conditions that either reduce exposure to pelagic degradation (phytodetrital aggregates, fronts, mesoscale eddies, ice edge effects, gravity driven mass flow) or directly limit pelagic degradation (oxygen minimum zones, low temperature), while low reactivity is associated with conditions that enhance the exposure to degradation (remoteness from continental margins, slow sinking and deep water). Based on our results we derive a first global map of benthic OM reactivity. This map is then used to drive a global diagenetic model with the aim of establishing global organic carbon budgets and benthic-pelagic exchange fluxes.