



A mathematical model for estimating the reactivity of marine organic matter via measured oxidant consumption rates

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We present a mathematical model with which the reactivity of organic matter in marine sediments can be estimated from consumption rates of the oxidants (e.g. O_2 , SO_4^{2-}) used by bacteria for the degradation process. In the classical approach, a first order rate constant is determined which best fits the degradation of organic matter and which is used to characterize the reactivity of the organic material Berner (1964). More sophisticated, Boudreau and Ruddick (1991) considered the organic matter to be composed out of an 'infinite' number of fractions with different first order reactivities. Their so called reactive continuum model is the basis for our classification procedure.

Our method is tested with measured sulfate reduction rates from different study sites. With these depth profiles and measured sediment accumulation rates we determine the reactivity distribution of the organic material reaching the sediment surface.

Furthermore, this reactive continuum model is helpful with another problem. In several studies, it was demonstrated by Bo Barker Jørgensen (e.g. Jørgensen (1978)) that vertical profiles of sulfate reduction rates (SRR) can be approximated by a simple power law function of the form $SRR(z) = A z^{-b}$, where z represents the depth measured from sediment surface and A and b are free parameters. Up to now, it is unclear, how this good performance of these power law functions can be explained. We close this gap by demonstrating, that these rate profiles can be deduced under certain assumptions from the reactive continuum model of Boudreau and Ruddick (1991).