Geophysical Research Abstracts, Vol. 9, 07502, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-07502

Rate, composition and biological utilization of dissolved organic matter from ancient sedimentary rocks in modern aquatic systems

S. Petsch, S. Schillawski
University of Massachusetts Amherst, Amherst, MA USA 01003 (spetsch@geo.umass.edu)

Sedimentary rocks contain the largest mass of carbon on Earth, yet these reservoirs are not well integrated into modern carbon budgets. Ancient sedimentary rocks may potentially contribute to the aged component of DOM and POM pools found in many rivers and to aged POM buried in continental margin sediments. However, the connection between radiocarbon age of DOM and its resistance to chemical and/or biological degradation remains undetermined. Here we describe the release of DOM from ancient, OC-rich sedimentary rocks. Column experiments reveal that kerogen in ancient black shales can generate a sustained source of DOM, with rates comparable to those implied from the depth of oxidation fronts in black shale weathering profiles. ^{1}H-NMR analysis of this DOM indicates a highly aliphatic, carbohydrate-poor material distinct from other natural DOM pools found in rivers, lakes, estuaries and marine systems. Bioavailability assays reveal that this rock-derived DOM is rapidly remineralized by aerobic heterotrophic bacteria and can also be assimilated into microbial biomass. Estimates based on global exposure of shale land area suggest that rocks can potentially provide a considerable portion of global river DOM export. However, facile biodegradation of this shale-derived DOM pool indicates rapid turnover in rivers, transformation of its composition, and removal from dissolved state into aquatic biomass. Dissolution thus provides a mechanism for the conversion of refractory kerogen into labile biomass, linking rock weathering with delivery of aged DOM to rivers and ocean margins.