Bromination Pathways in Marine Organic Matter Oxidation

ALESSANDRA C. LERI[1]*, LAWRENCE M. MAYER[2], KATHLEEN R. THORNTON[2] AND BRUCE RAVEL[3]

[1]Marymount Manhattan College, New York, NY 10021, USA (*correspondence: aleri@mmm.edu)
[2]University of Maine, Walpole, ME 04573, USA (lmayer@maine.edu, kthornton@maine.edu)
[3]National Institute of Standards and Technology, Gaithersburg, MD 20899, USA (bravel@bnl.gov)

In seawater, bromine (as Br^-) is considered a conservative element. In marine sediments, by contrast, Br is associated with organic carbon [1] through covalent C-Br bonds [2].

We investigated the bromination of phytoplankton detritus, the major precursor of sedimentary organic matter. Isolated membranes from the microalga *Tetraselmis* sp. were subjected to oxidative treatments in seawater, and the organobromine content was measured using a newly developed X-ray spectroscopic procedure [3]. The results show that Br is readily incorporated into algal membranes through a variety of processes involving iron-catalyzed, photochemical, and enzymatic mechanisms (Fig. 1). The bromination results in both aliphatic and aromatic organobromine products, with the latter showing greater stability under continued oxidation. Analysis of sediment trap materials corroborates this stability of aromatic forms.

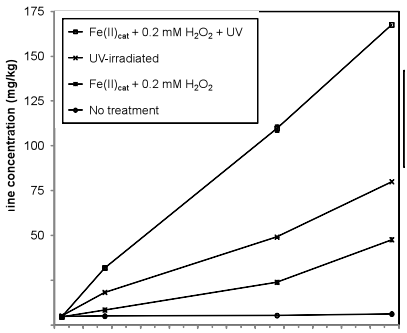

Figure 1: Effect of Fenton-like and photochemical treatments on total organobromine in algal membranes.

These bromination reactions may signal various oxidation stages of marine organic matter and potentially play a role in long-term Br and organic matter cycles.

[1] Mayer *et al* (1981) *Organic Geochemistry* **3**, 37-42. [2] Leri *et al* (2010) *Global Biogeochemical Cycles* **24**, GB4017. [3] Leri & Ravel (2014) *Journal of Synchrotron Radiation*, in press.