Determining historic extent of seagrass (*Zostera marina*) cover in Virginia's coastal bays

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The environmental degradation of the Chesapeake Bay and its neighboring coastal areas has been linked with explosive population growth and subsequent increases in agriculture and urbanization of the region. In the coastal bays of Virginia, numerous efforts have been made to restore seagrass (*Zostera marina*) meadows. As a result of large-scale, seed-based restorations in South Bay (2001) and Hog Island Bay (2007), *Z. marina* has come to dominate portions of these bays.

In this study geochemical proxies are used to determine the historic extent of seagrass within Virginia's coastal bays. Sedimentary cores were collected from sites with different historical records of seagrass cover, including areas with no seagrass, reseeded seagrass, or naturally occurring seagrass. Carbon and nitrogen isotope analyses were conducted on freeze-dried, acidified samples and used as proxies of the sources of the organic matter; sediments dominated by seagrass contained organic matter more enriched in ^{13}C relative to autochthonous algal and plaktonic marine materials. Peak ^{137}Cs activity and overall inventory were used to infer the relative age of sediments.

Several features are apparent from the preliminary characterization of marine sediments from these locations. The reseeded areas of South Bay and Hog Island Bay have a similar antithetical relationship between TOC (total organic carbon) and $\delta^{13}C$ values in the topmost 15 cm of the sediment core; as the TOC increases the $\delta^{13}C$ values become more depleted, suggesting that in those samples, seagrass provides only a minimal contribution to the preserved organic matter. Additionally there are large sections of the cores, at approximately 20 cm depth within the cores taken from South Bay, that have significantly lower TOC; this could be a result of the period without seagrass cover. The site with a natural seagrass meadow in Hog Island Bay is unlike any of the other sites analyzed: TOC increases from 0.2% at the surface to 1.2% at the bottom of the core, while $\delta^{13}C$ values range from -17.7‰ at the surface to -24.3‰ at depth. This pattern suggests an increased accumulation of ^{13}C depleted organic material in areas with prolonged seagrass cover. Results from this study may be able to be used to infer the spatial extent of the historic seagrass and guide future restoration projects.

Iron Oxidizing Bacteria: Influence of Calcium and Magnesium on Growth Rates

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Occurring in wells, pipework, and in natural groundwaters, the oxidation of ferrous iron is a partly abiotic-, partly biotic-induced process.

Whilst chemolithoautotrophic bacteria, such as *Gallionella* spp. rely solely on ferrous iron oxidation as energy source, other heterotrophic organisms, *Lepthothrix* spp. for example, can apply their ability to catalyze ferrous iron oxidation. Furthermore, their ability to oxidize iron is nearly all of what is known about these bacteria, save for some findings made by studies concerning their requirements (carbon metabolism [1, 2], Mn oxidation [3], O_2, pH [4]). But knowledge regarding other their nutritional or habitat needs or other requirements is still scant.

The study established that calcium and magnesium concentrations influence *Gallionella* sp. and *Lepthothrix discophora* growth, as concentrations of these two cations vary over a wide range in natural groundwaters and are routinely analyzed. Therefore, the results from the kinetic approach based on laboratory experiments can be compared with Ca and Mg concentrations in waters. A large data base of literature values, combined with own measurements of waters with high ferric iron precipitation rates, where these organisms have been detected, has been used.

Ca and Mg concentrations in culture media were made to undergo variations over a range covering typical natural groundwaters values (Ca: 0.6-150 mgL^{-1}, Mg: 0.12-24 mgL^{-1}). Using optical density and TOC measurements as well as light microscopy, growth rates and maximum cell densities of the model organisms were determined in batch culture. Lowering the two cations corresponding to values in soft natural groundwater reduced both the growth rates and maximum cell densities. Growth occurred even at low nutrient concentrations.

The two organisms used in this study grow more slowly under natural conditions than in artificial culture medium, even at sufficient Ca and Mg concentrations.

Other factors evidently inhibit the growth of the two model organisms more than Ca and Mg do. In very soft groundwaters though, Ca and Mg concentrations, among other factors, may lead to reduced growth rates of *Gallionella* sp. and *Leptothrix discophora*.

[1] Kämpfer et al. (1995) *Water Res* **29**, pp 1585–1588
[2] Hallbeck, Pedersen (1991) *J Gen Microbiol* **137**, pp 2657–2661
[3] El Gheriany et al. (2009) *Appl Environ Microb* **75**, pp 1229-1235
[4] Eggerichs et al. (2011) *20th Int. Symp. on Environ. Biogeochemistry. Conference Proceedings* p. O72