Constraining carbon sources and growth of microbialites in Pavilion Lake, BC using ^{14}C

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The morphologically varied freshwater carbonate microbialite structures in Pavilion Lake, B.C. Canada represent an opportunity to investigate the processes leading to their formation and potential associated biosignatures that will contribute to our understanding of geo-microbe interactions and to our ability to interpret the geologic record. A primary question in such systems is determination of the primary carbon sources and cycling. In some systems, such as Mono Lake, carbonate structures are proposed to be the result of abiotic precipitation due to supersaturation resulting from groundwater-surface water mixing. Alternatively, modern stromatolites such as those in Shark Bay and the Bahamas are proposed to form via significant biological influence using bulk DIC.

Determination of the $\Delta^{14}C$ of dissolved inorganic carbon (DIC) sources and mid-depth microbialite carbonate demonstrated that microbialite carbonate was significantly depleted in $\Delta^{14}C$ with respect to bulk surface water indicating either contributions of geologically derived carbon or significant time since precipitation. Assuming surface carbonate was recently precipitated, comparison to local and regional groundwater $\Delta^{14}C$ indicates that regional $\Delta^{14}C$ depleted groundwater DIC sources provide 12% of carbonate carbon.

$\Delta^{14}C$ of the detrital wood sample resulted in an estimated constant growth rate of 3 to 6 cm/thousand years, approximately double a previous U/Th based estimate.

The $\Delta^{14}C$ of a deep water carbonate sample was highly depleted indicating that either groundwater was making a larger contribution to this carbonate or that this carbonate was precipitated significantly earlier than the mid-depth carbonates.

Modeling marine Carbon and Phosphorus cycling during Cretaceous Oceanic Anoxic Events

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Phosphorus (P) is a key nutrient and may control rates of primary productivity and organic carbon (C) burial in the oceans. Changes in phosphorus (P) availability thus may have played an important role in the initiation, formation and termination of Cretaceous oceanic anoxic events (OAEs). Besides redox-dependent changes in the recycling efficiency of sediment P, as deduced from elevated organic C/total P ratios in black shales, the marine P cycle can be affected by variations in sealevel, oceanic circulation and chemical weathering.

In this study, we use a model for the coupled marine cycles of P and C to examine the relative role of these various factors in determining changes in P availability and organic C burial during OAEs. We focus on OAE-2 (~94 Myrs BP; 500 kyr duration) and specifically study (1) possible triggers for the OAE, such as enhanced weathering and reduced oceanic circulation, (2) factors leading to its termination and (3) the relative role of the continental shelves and open ocean.