Are shoreline microbialites a true reflection of lake history; a case study from Western Canada

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Abstract: Shoreline and nearshore microbialites are often a valuable archive of terrestrial paleoenvironmental and paleoclimate information. Since these shallow water features usually do not extend into deep water and may be strongly influenced by localized biogeochemical processes, discrepancies may be expected in the basin history as interpreted from offshore sediments versus the microbialite stratigraphy. Manito Lake, located in the northern Great Plains of western Canada, provides an excellent opportunity to compare these records. Manito Lake (52 degrees 45'N; 109 degrees 43'W) is a large, perennial, deepwater saline lake located at the boundary between the prairie grasslands and aspen parkland ecozones about 200 km northwest of Saskatoon, Canada. Water level decreases over the past several decades have exposed a discontinuous belt of well-lithified, laminated carbonate microbialites, hardgrounds, and large biothermal structures that were deposited in relatively shallow water during the late Holocene. Mineralogical, geochemical, isotopic and morphological studies of these nearshore carbonates, combined with detailed (super 14) C dating, reveal a complex lake level history, with multiple transgressions and regressions, changes in trophic status and water chemistry over the past 2200 years. The fine grained, organic-rich offshore sediments from Manito Lake are also finely laminated, but are dominated by siliciclastics with relatively minor endogenic carbonates and evaporates. Fluctuations in C:N, delta (super 13) C, and delta (super 15) N of the organic matter, and the mineralogy and stable isotope geochemistry of the endogenic carbonates suggest changes in trophic status and brine chemistry during the past several millennia that are comparable to those interpreted from the nearshore sediments. However, both sets of records contain critical information that cannot be readily interpreted from the other.