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Unravelling diagenetic versus primary geochemical signals in microbialites from the Upper Cambrian and Lower Triassic of the western U.S.

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Although macroscopic features of stromatolites have received extensive study, less research has focused on lamination-sale geochemical differences to investigate the impact of diagenesis on geochemical signals. Here we report preliminary results from temporally and diagenetically distinct microbialites from the western U.S.

Lower Triassic stromatolites from the Moenkopi Formation, Nevada consist of alternating dark and light brown laminations. Lighter layers have lower Sr/Mn (~2), lower $\delta^{13}C$ (avg. -1.5 ‰ VPDB), elevated quartz, and increased porosity. Darker layers show higher $\delta^{13}C$ (avg. +0.4 ‰ VPDB), higher Sr/Mn (~7), an absence of quartz, and lower porosity. Darker laminations exhibit a narrower range of uranium (avg. 4.2 ppm, sd. 0.4 ppm) while lighter laminations exhibit a lower but broader range (avg. 3.5 ppm, sd. 2.4 ppm). Early cementation of the darker layers likely led to decreased porosity and decreased diagenetic alteration. Lighter layers contained significantly higher and more variable thorium. Elevated thorium and quartz suggest that lighter layers were formed under increased ambient sedimentation and decreased microbial mat activity, which also led to lower $\delta^{13}C$ via decreased mat photosynthesis. Lighter layers contained elevated cobalt, suggesting a detrital source. In contrast, both sets of layers exhibited comparable nickel, suggesting sourcing from the dissolved inventory in seawater.

Stromatolites from the Notch Peak Formation, Utah are entirely dolomitic with alternating dark brown and black layers. $\delta^{13}C$ is uniform between layers and fall between 0.3‰ and 0.9‰ VPDB. Sr/Mn is also uniform (~0.5). Uranium is uniformly low, with darker layers exhibiting slightly higher abundances (avg. 1.6 ppm, sd. 0.9 ppm for dark, avg. 0.8 ppm, sd. 0.2 ppm for lighter). Similar primary lithologies likely resulted in comparable effects of dolomitization in both sets. Thorium is uniformly low, suggesting low detrital input in these microbialites. Cobalt and nickel abundances are also uniformly low, which likely resulted from a combination of low detrital input and dolomitization.

Although preliminary, our results highlight the impact of primary lithology on diagenetic alteration of microbialites and the impact of diagenesis on paleoenvironmental proxies in microbialites. Further study of lamination-scale geochemistry will allow for a better understanding of paleoenvironmental conditions of microbialite formation and preservation.