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Great Salt Lake Microbial Carbonates: Geology Vs. Biology

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ABSTRACT

Great Salt Lake in northern Utah contains a wide variety of microbial carbonate structures, but several questions still exist about their formation and morphology. All currently submerged microbialites in the South Arm of the lake are covered with a green-brown "living" microbial mat. However, several unique morphologic characteristics exist depending on the microbialite's location relative to wave energy, proximity to the shoreline and bedrock outcrops, as well as other factors. For example, larger, taller, and more well-cemented microbial domes tend to occur in higher-energy environments (e.g., north side of Lady Finger Point, Antelope Island), whereas smaller, low- profile, poorly cemented superficial domes are common in sheltered areas (e.g., Bridger Bay, Antelope Island). Petrographic analysis reveals that microbialites in high- energy environments contain a higher ratio of carbonate grains to microbial clots than structures in low-energy environments. In locales far from bedrock outcrops (e.g., Bridger Bay), the microbialites are composed mostly of clots and carbonate rip-ups, ooids, and pellets, whereas structures near steep bedrock cliffs contain significantly more lithic fragments (e.g., Buffalo Point, Antelope Island). In some locations, the microbialites form mushroom- shaped structures, whereas in other areas they develop as long, linear ridges. As research progressed, one significant question remained unanswered: is the morphology of the microbialites only related to geologic/environmental conditions, or do different microbial communities play a role in the variety of microbialite shapes and sizes? To answer this question, microbiologists from Montana State University analyzed the microbial community compositions of the microbialites surveyed in this study using next- generation DNA sequencing techniques. Bottom line, the microbial community across all sampled sites in the South Arm of Great Salt Lake are not significantly different, indicating that geology/environmental variation is the primary driver of microbialite morphology. This new observation has significant implications regarding our understanding of microbialite formation and the interpretation of ancient analogs in the rock record, including microbial reservoir facies.