Mapping the distribution and spatial patterns of microbialites in Great Salt Lake, Utah (USA) from satellite imagery

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The shores of Utah's hypersaline Great Salt Lake (GSL) are lined with patchy microbialite reefs that host productive microbial communities and may be actively growing. However, radiocarbon dating has given ages of 2.7-12.7 ka. During this period, lake level varied by as much as 12 m and climate varied substantially from the Younger Dryas into the Holocene. Highly variable lake levels over the growth history of single microbialites challenges the interpretation of microbialite mounds as a shoreline facies. Much is unknown about the GSL microbialites, including their true spatial distribution in modern GSL. Verifying microbialite locations typically requires direct access, limiting their direct mapping to accessible shoreline sites. Understanding the spatial and bathymetric distribution of GSL microbialites will aid the interpretation of lacustrine microbialite facies in paleoenvironmental reconstructions. In this project, we attempted to systematically map shoreline and lake interior microbialite reef areas in the South Arm of GSL via satellite imagery, including Landsat images from 2016-2020, and 3.7 m resolution images from Planet Explorer. During summer months, microbialites are distinguishable as dark (due to the photosynthetic surface microbial community) polygonal features that contrast with the brighter benthic substrate (primarily ooid sand). Multiple time series images for each location distinguished stationary microbialite mounds from mobile dark microbialite rip-up clasts. Shallow microbialite reefs cover approximately 165 km 2 of the near-shore lake bed. In addition, exposed, bleached microbialites along the GSL shoreline are visible as white polygonal shapes, and were found to cover a region of approximately 44 km 2 . Suspected lake-interior microbialite regions were identified as dark, non-migrating zones on the lake bed. These regions are difficult to verify due to inaccessibility and satellite imagery limitations. The total mapped South Arm microbialite area is approximately 210 km 2 , and the area may be much greater if the suspect lake-interior zones are included. The map we have developed correlates positively with prior mapping attempts by Vanden Berg (based on Google Earth imagery; 2019) and Baskin (based on sonar mapping; 2014).

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