**Different cyanobacterial communities share same functions in microbialites**

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Bacalar Lagoon (BL) is part of a geological fault in the Yucatan Peninsula extending over 40 km. To this date, BL is considered the site with the highest occurrence of freshwater microbialites in the world (Gischler et al. 2008; Beltrán et al. 2012; Centeno et al. 2012; Johnson et al. 2018). Cenote Azul (CA) is a 90 m depth sinkhole, it has 200 m in diameter and is separated from BL by 100 m. Recently, microbialites have been described in CA up to 30 m in depth (Yanez-Montalvo et al., 2021). Both BL and CA are oligotrophic fresh water karst systems connected by the same subterranean flow. Although BL and CA share similar hydro geochemical characteristics, they have differential biological components, including fish, aquatic mites, zooplankton and different prokaryotic communities (Montes-Ortiz & Elías-Gutiérrez, 2018; Perry et al., 2019; Yanez-Montalvo et al., 2021). Cyanobacteria have been described to be important in the genesis of microbialites because they trap and bind detritus actively and passively precipitate carbonates (Dupraz et al., 2009; Chagas, 2016).

In this work, the cyanobacterial components of microbialites from BL and CA (Quintana Roo, Mexico), were characterized by a polyphasic method. BL microbialites were studied along a longitudinal gradient (north to south) while CA microbialites along a depth gradient (5-30 m). Culture-dependent techniques, along with 16S amplicon sequencing and shotgun metagenomics were used. The molecular data was validated with microscopic observations from field samples, cultures and descriptions from previous works. BL and CA microbialites showed differential cyanobacterial composition attributed to nutrient and light concentrations. Both sites exhibited previously unknown taxa of Cyanobacteria. CA was dominated by an unknown Chroococcales cyanobacterium, while BL was dominated by Nostocales. Interestingly, no differences were found in the cyanobacterial communities at the metabolic/function level.

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