**Geo-biological study of anaerobic microbialites as analogues of Precambrian microbialites**

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Here we will present the discovery of microbialites collected at relatively high depths in two alkaline Mexican lakes (i.e. Lake Alchichica and Lake Atexcac). At these depths, the waters columns of lakes Alchichica and Atexcac record seasonal anoxic conditions. A working hypothesis is that in the basaltic crater lakes, deep anoxic waters have high concentrations of dissolved transition metals such as Fe, Mn and these might be trapped by growing microbialites.

To know if these organo-sedimentary structures record in depth the variations of oxygenation and redox potential detected in the water column, the geochemistry of the lakes and the mineralogical composition of the microbialites were studied. In Lake Alchichica, three different carbonate phases were evidenced by x-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FTIR), including aragonite -CaCO3, hydromagnesite -4(MgCO3)(Mg(OH)2).4H2O and huntite -CaMg3(CO3)4. Interestingly, the distribution of these phases shows a depth dependent profile with the huntite only occurring in the deepest samples. In Lake Atexcac, microbialites were composed mostly of aragonite and a poorly crystalline magnesium silicate phases identified as kerolite –(Mg,Ni)3Si4O10(OH)2.nH2O. In that case, deep microbialites did not show major mineralogical differences compared to shallower ones. Bulk chemical analyses of the deep microbialites of both lakes by ICP-AES and ICP-MS surprisingly showed no enrichment in transition metals such as iron or manganese in the microbialites sampled below the oxycline. Furthermore, a decrease in dissolved calcium and iron was detected at depth in the water column of Lake Atexcac, while a downward increase in phosphorus and orthosilicic is observed along the water column of Lake Alchichica. We will discuss the possible origins of these trends. Moreover, the Mg/Ca versus CO32- ratio of Lake Alchichica deep solutions suggests a potential control of the lake water chemistry by amorphous calcium carbonate.

Overall, we will discuss the respective roles of biology and environmental conditions on the geochemical and mineralogical control of microbialite composition.