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MEXICAN MICROBIALITES AS POSSIBLE ANALOGS FOR ANCIENT LIFE SEARCH IN MARS

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In this work we expose the reasons why Mexican microbialites from Alchichica, La Preciosa and Quechulac can be use in analogous experiments to determinate biogenicity in possible Martian organosedimentary structures.

Phosphorus (P) is an essential element for life in every single level. On Earth, phosphorus geochemistry is dominated by rock-water interaction and acid-base chemistry (Falkowski et al., 2008), thus the P bioavailability is limited by its solvation degree on water. Even so, microbial communities have been shown to sequester and store efficiently P in the form of phosphorites (Krajewski et al. 2000). The most prominent deposits occur during the Neoproterozoic (1,000-541 Ma) (Crosby & Bailey 2012). Later stages showed a decline as the population of carbonic microbialites grew, although theres still a phosphorus enrichment within microbialites carbonates (Valdespino-Castillo et al. 2014).

Besides, McKay (1997) proposed that Mars ancient environment, having higher liquid water abundance, warm weather, and a thicker $CO_2 - N_2$ atmosphere, make possible the emergence and develop of life. Additionally, recent studies indicate Mars phosphorus surface concentration is 5 to 10 times higher than Earth and solvation on Mars water was greater than on Earth (Adcock et al. 2013). For this reason, phosphorus has been proposed as a biosignature on Mars (Mojzsis & Arrhenius 1998).

In this work, we determinate the most important features of Mexican lakes Alchichica, La Preciosa and Quechulac (Sigala et al. 2017) and some possible organosedimentary structures found by Opportunity and Curiosity rovers (Rizzo 2020), to know if its possible the analogy between the Mars past conditions and the lake and microbialite formation conditions.

We found some similarities, the first one is that Gillespie Lake Member its believed to been formed in semiarid environment like current conditions on these Mexican lakes. Secondly, the predominance of high Mg/Ca rates on two of these lakes can resemble to ancient Mars lakes and oceans. Thirdly, all these lakes have a wide range of limnological conditions, this means that even if the Mars past conditions were a bit different, they can cover the uncertainty. Finally, only on Alchichica microbialites were found hydromagnesites, this fact is very important because Mars ancient condition just allow the magnesites formation (Niles et al. 2013) thus this is a good analog in the search potential stromatolites on Mars.

In conclusion, microbialites in these Mexican maars have a great relevance in the search of ancient life on Mars because theres similarities as limnological and environmental conditions, geochemical properties, and geomorphological features. Therefore, we suggest performing analogous experiments on these sites that allow standardization in order to determine biogenicity of Martian structures.

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REFERENCES

Adcock, C. T., Hausrath, E. M., & Forster, P. M. 2013, Nat. Geosci., 6(10), 824
Crosby, C. H., & Bailey, J. V. 2012, Front. Microbiol., 3(JUL), 1
Falkowski, P. G., Fenchel, T., & Delong, E. F. 2008, Sci, 320(5879), 1034
Krajewski, K. P., Lesniak, P. M., acka, B., & Zawidzki, P. 2000, Sediment. Geol. 136, 89
McKay, C. P. (1997).Planetary and Interstellar Processes Relevant to the Origins of Life, 263
Mojzsis, S. J., & Arrhenius, G. 1998, J. Geophys. Res. Planets, 103(E12), 28495
Niles, P. B., Catling, D. C., Berger, G., Chassefire, E., Ehlmann, B. L., Michalski, J. R., Morris, R., Ruff, S. W. & Sutter, B. 2013, Space Sci. Rev., 174(1), 301
Rizzo, V. 2020, Int.J. Astrobiol., 19(3), 283
Sigala, I., Caballero, M., Correa-Metrio, A., Lozano-García, S., Vázquez, G., Pérez, L., & Zawisza, E. 2017, Bol. Soc. Geo. Mex., 69(2), 313
Valdespino-Castillo, P. M., Alcántara-Hernández, R. J., Alcocer, J., Merino-Ibarra, M., Macek, M., & Falcón, L. I. 2014, FEMS Microbiol.Eco., 90(2), 504