GYPSUM IN MODERN KAMCHATKA VOLCANIC HOT SPRINGS AND THE LOWER CAMBRIAN BLACK SHALE: APPLIED TO THE MICROBIAL-MEDIATED PRECIPITATION OF SULFATES ON MARS. Angélica Angles[1], Min Tang[1] and Yi-Liang Li[1]. [1]Department of Earth Sciences, The University of Hong Kong, Pok Fu Lam, Hong Kong. (aangles@hku.hk, mintang@hku.hk, yiliang@hku.hk).

Modern hot springs are reachable natural laboratories for astrobiological studies considering their similarity to those environments in which life arose on Earth and the other planets.

Crystal habits of gypsum (e.g. size and morphology) formed in hydrothermal environments and the varied crystal habits formed with microbial mediation may provide crucial information for the understanding on the processes of mineral deposits occurred on Mars, as it preserves information on the structure and evolution of a microbial community. The findings may offer valuable clues, as well as an important mineralogical database to the search for mineral records of microbial life on Mars.

Gypsum shows very little variation in its chemical composition, however, it exhibits variations in its crystal habits. This mineral may precipitate in several environments, but is one of the most common minerals that precipitate in hydrothermal springs. In this study we compare the electron microscopic analysed crystal habits of gypsum in the volcanic hot springs on the Kamchatka Peninsula, Russia, with those gypsum crystals observed in Lower Cambrian black shale. In sediments of the Kamchatka hot springs, we observed prismatic, fibrous, prismatic pseudo-hexagonal, lenticular, twinned and tubular gypsum crystals, with crystal sizes ranging from <200 nm to >200 mm. The coexistence of diverse crystal habits of gypsum implies a constant interaction between hot spring geochemistry and the metabolisms of the microbial community. The crystallization of Ca- and Ba-sulfates in the black shale of the Lower Cambrian, which shows similar but less varied morphology, was the result of the alternation by the post-depositional hydrothermal fluids. We suggest that it is not the crystal habits of a single crystal but an assemblage of crystal habits that can only be produced by the long-term precipitation of minerals induced by the microbial activity could be considered a biosignature.

If gypsum precipitated on Mars endured similar interactions between microbial communities and their geochemical environments, the resulting crystal habits could be preserved even better than those on Earth due to the weak geodynamics prevailing on Mars throughout its evolutionary history. Similarly, a mineral composition with an assemblage of different crystal habits could be easily recognized by microscopes, and considered as an indication of possible microbial life on Mars.

[1] Tang, M., Ehreiser, A. and Li, Y. L. (2014). Gypsum in modern Kamchatka volcanic hot springs and the Lower Cambrian black shale: Applied to the microbial-mediated precipitation of sulfates on Mars. *American Mineralogist, 99(10),* 2126-2137.