Laboratory Investigations of a Possible Biosignature at Columbia Hills, Mars

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Digitate silica sinter found in the outflow apron of terrestrial hot springs have been found to contain biosignatures of microbial communities, including into the ancient past. In 2007, the Mars Spirit Rover observed opaline silica deposits on Mars, with similar digitate morphology, potentially formed under similar conditions, and possibly under the influence of biology, as on Earth. This has led to the theory that hot springs on Mars may once have sustained microbial life and that Martian digitate silica deposits may be a sign of extra-terrestrial life. In this project, the creation of silica deposits in the absence of microbes was investigated, with the aim of determining whether the Martian digitate silica deposits could have formed in the absence of microbes. Lab experiments aimed to recreate the terrestrial hot spring conditions known to form digitate silica sinter, but without biology, and then analyze the morphology of siliceous deposits formed under wet-dry, and steam-wicking conditions. One experiment involved dripping a sodium metasilicate solution onto heated and non-heated glass slides. A second experiment used an air diffuser attached to a carbon dioxide outlet to simulate the bubbling of natural hot springs splashing the glass slides. Results show that silica sinters formed in ‘hot spring-like’ conditions without biology do not resemble the digitate sinters observed around terrestrial hot springs. This implies that Martian digitate silica sinters could have formed in the presence of microbes and supports the theory that ancient Martian life may have existed in hot springs.

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