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# Experimental Tests of Micro-concretion Nucleation in Porous Media: A Laboratory Analog for Formation of Hematite Concretions on Mars

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We present the results of diffusion experiments in combined glass bead and gel media that produced silver chromate precipitates under a variety of conditions. Precipitates took various forms including finger fluid fronts, rhythmic (Liesegang) bands, and mm-size spheroidal "concretions". The silver chromate spherules produced in our experiments are morphologically similar to spheroidal HFO "mini-concretions" that are commonly found in the Jurassic Navajo Sandstone, Utah (USA), which are considered a terrestrial analog for the hematite concretions ("blueberries") discovered at Meridiani Planum, Mars (Chan et al. 2004, Nature). Like the Utah and Martian concretions, the spherules formed in our experiments exhibit a self-organized distribution, lack of an obvious macro nucleus, and ability to form "twin" morphologies. In all cases, the spheroidal precipitates nucleated under diffusion-controlled conditions, and some growth occurred although advection was not present. Other forms of precipitate such as periodic banding and fluid fronts were produced in our experiments as well, which also resemble types of iron mineral precipitation that are observed in the Navajo Sandstone, although thus far only spheroidal self-organized precipitates are seen on Mars. The presence of self-organized precipitates in the Utah and Martian environments most likely resulted from nucleation in a diffusion-controlled environment, and the specific morphology of iron oxide precipitates in porous and permeable systems is likely determined by chemical and physical parameters of the fluid environment in which they precipitated. Although the chemical conditions in our precipitation experiments are obviously very different from what would be expected in the Navajo Sandstone or on Mars, we show in this work how the morphology of self-organized mineral precipitates in a porous/permeable medium is affected by specific physical and chemical parameters.