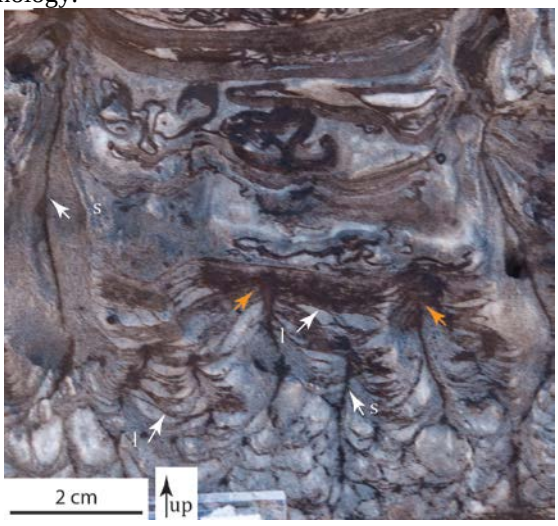
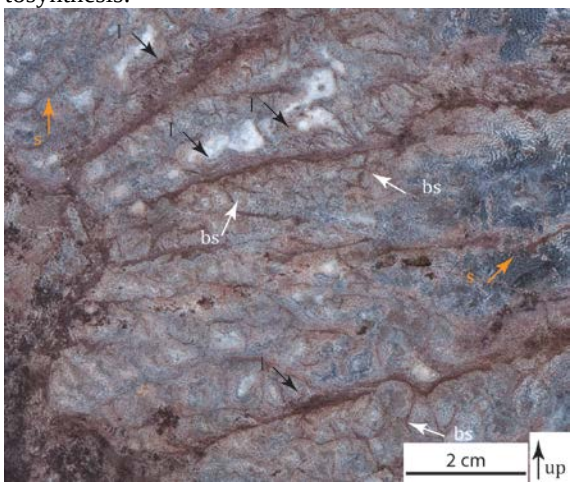
RECREATING MICROBIAL ECOSYSTEMS OF THE LATE ARCHEAN. M. Juarez Rivera[1] and D. Y. Sumner[2], [1]School of Earth and Space Exploration, Arizona State University, 781 E. Terrace Mall, Tempe, AZ 85287 (mjuarez4@asu.edu), [2]Earth and Planetary Sciences Department, University of California, Davis, One Shields Avenue, Davis, CA 95616.

Introduction: Microbialites are important deposits for studying early Earth ecosystems. The morphology in the millimeter- to meter-scale structure of some microbialites can be used to understand the microbial communities that created them even when all microbial cells have degraded [1-3]. Archean fenestrate microbialites from the Gamohaan Formation, South Africa, display complex morphologies that are distinctly microbial [4]. Two of the most complex textures consist of cuspate and plumose microbialites. Whereas plumose microbialites are not generally represented in the rock record, cuspate microbialites have been reported from several sites.

Motivation: The morphology of cuspate microbialites has been suggested as a marker for phototaxis and possibly oxygenic photosynthesis [5-6]. If cuspate structures were created exclusively by oxygenic cyanobacteria, their appearance and distribution would greatly improve our understanding of the rise of oxygen on Earth. However, other growth models for cuspate structures have been proposed, including the upward growth of supports due to random gliding and entanglement of filamentous communities [5, 7] or due to chemical gradients rather than phototaxis [8]. Thus, it is important to fully understand the microbial processes giving rise to this intricate microbialite morphology.



Using the growth orientation and relationships between the microbialite components of cuspate and plumose microbialites we show that their growth can be reconstructed in terms of three microbial communities with distinct growth forms. Our new growth model for cuspate microbialites suggests that the outward and sometimes downward growth of supports is not consistent with growth towards light, instead diffusion-limited growth is most likely. Caution is suggested when using cuspate microbialites as markers for photosynthesis.



Left Laminae (l) drape from supports (s) to create fenestrate cuspate microbialites [4]. Changes in cuspate microbialite occur as the number of supports decrease and the thickness of laminae groups increase towards the top of each bed. Orange arrows point to supports that end under groups of laminae. **Top** Cuspate microbialite. Supports that grew on inclined surfaces grew horizontal to near-horizontal. Outward and sometimes downward growth of supports is not consistent with growth towards light.

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