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Growth, preservation, and biological implications of cuspate microbial forms: Mesoproterozoic Dismal Lakes Group, Arctic Canada

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Offshore facies of the Sulky Formation, Mesoproterozoic Dismal Lakes Group, arctic Canada, preserve microbialites with unusual cuspate morphologies. Cuspate microbialites grew below wave base, in water depths of several tens of meters, and are correlative with high-relief conical stromatolites that comprise the September Lake Reef Complex. These deep-water microbialites consist of thin, ridge-like vertical supports that are draped by concave-upward sub-horizontal elements, resulting in substantial framework void space. Growth morphologies are preserved by a combination of *in situ* precipitation of microsparitic carbonate within microbial elements, followed by thick isopachous coatings of marine cement.

Here we present a model for growth of these deep water microbialites, as well as an analysis of environmental conditions of growth and lithification, that includes: (1) upward growth of ridge elements under low-oxygen and potentially light-limited conditions; (2) development of sub-horizontal, buoyantly supported draping elements; (3) initial lithification of organic elements during microbial degradation; and (4) marine cementation of both intact and collapsed microbialites. Microbialite morphology suggests vertical growth dominated by motile filamentous microbes with draping laminae formed by a distinct microbial community.

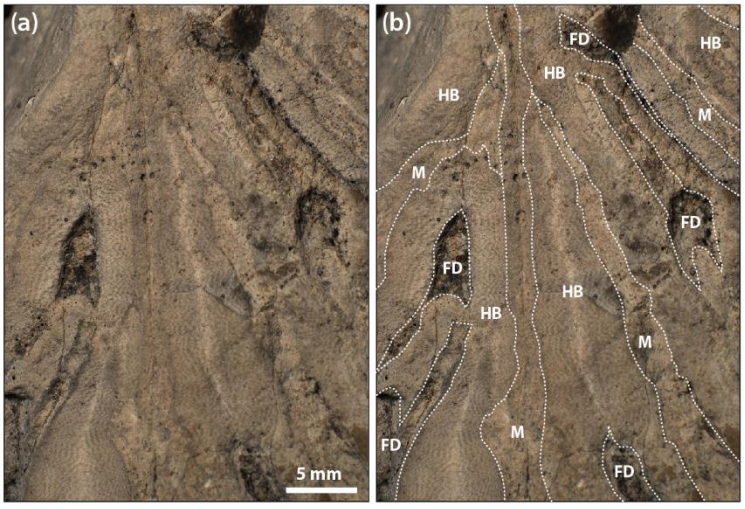

Figure 1. (a) Details of Dismal Lakes cuspate microbialite; distinct phases shown in (b). M = microbialite; HB = herringbone carbonate cement; FD = ferroan dolomite.

Cuspate microbialites of the Sulky Formation are similar to those found in offshore facies of Neoarchean carbonate platforms and to unlithified cuspate microbial forms in ice-covered Antarctic lakes and sink-hole environments of the Great Lakes. In each case, microbialite growth is associated with biologically limiting conditions (e.g., light, chemical gradients), suggesting that cuspate growth morphologies represent the biological behavior of distinct microbial mat communities under resource-limited environmental conditions.