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The role of microbial mats in "Ediacara-style" preservation

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Earth's earliest fossils of complex macroscopic life are recorded in Ediacaran-aged siliciclastic deposits as exceptionally well-preserved three-dimensional casts and molds, known as "Ediacara-style" preservation. Ediacara-style fossil assemblages commonly include both macrofossils of the enigmatic Ediacara Biota and associated textural impressions attributed to microbial matgrounds. The ubiquity and complexity of these textures associated with the Ediacara Biota are distinct from environmentally analogous (i.e., sandy and shallow marine) younger successions [1] and have bolstered hypotheses that matgrounds played a fundamental role in the ecology and evolution of early animals. Here, we explore the role of carpeting microbial mats in Ediacara-style preservation, combining an experimental approach with a detailed characterization of molecular mechanisms of fossilization. We performed controlled decay experiments including cyanobacteria, green algae, and marine invertebrates under Ediacaran seawater conditions (i.e., high dissolved silica (DSi)) to assess the role of organic substrates in silica precipitation. DSi concentration was observed to decrease with time, coincident with the precipitation of silica nano- and microspheres onto microbial mat and macroorganism surfaces, as confirmed by SEM-EDS and FTIR analyses. Potentiometric titration analyses indicate that silicification is closely tied to the density of particular silica-reactive organic functional groups in the tissues and cells of the experimental organisms. Moreover, DSi drawdown appeared to be enhanced in experiments in which mat-forming microorganisms were present. Our results provide evidence that 1) soft tissues can rapidly silicify under conditions characteristic of Ediacara seawater and form coherent molds in sandstones, offering a mechanistic explanation for the fossilization of Earth's earliest animal communities and 2) microbial mats not only played a significant role in the ecology and evolution of early animals but also in their exceptional fossilization.

References

[1] Pflüger, F. & Gresse, P.G. (1996) *Sedimentary Geology 102*, 263-274.