

Cyanobacteria Boring Limestones in Freshwater Settings - Their Pioneering Role in Sculpturing Pebbles and Carbonate Dissolution

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Abstract:

In freshwater lakes and rivers, cyanobacteria from the family Leptolyngbyaceae bore into limestone pebbles by dissolving carbonate at the tips of their 3–8 μm -thick filaments. They penetrate over 1 mm into the rock, with the highest concentration of borings near the surface, producing micrometric debris. This loose material is easily removed by environmental forces such as wave action, pebble grinding, or insect larvae scraping the surface while building protective cases.

Once an insect case is abandoned, it decays, exposing the underlying rock for recolonization by boring cyanobacteria. This cyclical process creates sculpted surfaces, as insect larvae prefer settling in existing depressions where they are better protected and can access suspended food more easily. In these depressions, larvae of byssate bivalves like *Dreissena polymorpha* may also establish themselves. As they grow, these bivalves further remove loosened carbonate from the rock surface and contribute to further structuring the pebble surface.

Thus, boring cyanobacteria play a crucial pioneering role in reshaping limestone pebbles by converting a hard substrate into a more accessible surface for subsequent colonization and by animals. This multi-phase bioerosion process results in sculpted pebbles and contributes significantly to carbonate dissolution. Preliminary estimates suggest that these processes could lead to the absorption of approximately 0.5–0.8 kg of CO_2 per square meter per year, underscoring their ecological significance.