Fossil Microbial Communities Preserved Within Chemical Sediments of the Ferriman Group, Labrador Trough, Canada

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Chert and iron formation from the Ferriman Group (ca. 1.88 Ga) of the Labrador Trough, Canada, contain an exceptional assemblage of fossil bacteria and biofilms. Analysis of lithofacies in a well-defined stratigraphic framework suggests that these microbes were restricted to suboxic, shallow-water environments where they are preserved as three-dimensional chert and sedimentary apatite (francolite) casts. Microfossil morphologies include sphere-, rod-, and filament-shaped bacteria, however, filamentous forms are the most common. Filamentous forms envelop reworked chert and Fe-oxide grains. Secondary electron imaging of freshly broken surfaces shows filaments are similar in size and shape to modern bacteria; filaments vary between 0.5 and 5 μm wide and reach tens of μm in length. They occur individually or as biofilm fragments cemented by authigenic hematite and magnetite. Stable carbon isotope ($\delta^{13}C$) values from associated organic matter vary between -37.4 and -19.9‰ and fall within the range that primary producers fractionate carbon. The filamentous morphology, similar mat-forming behavior, and paleoenvironmental conditions where these fossils lived closely resemble traits of modern Fe-oxidizing bacteria such as *Gallionella* and *Leptothrix*. The close association between these fossil microbes and iron oxides within the Ferriman Group support the widely held view that Fe-oxidizing bacteria may have aided the precipitation of iron formation. Our data, however, also suggest that such benthic bacterial precipitation was likely environment specific, occurring in shallow settings with abiotic precipitation processes.