

## Iron-mineralized microfossils from the great oxygenation event

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Gunflint-type microfossils form similar assemblages in different environments, associated with variable minerals (oxides, sulfides, carbonates), and are debated as oxygenic photosynthesizers, or Fe- or S-oxidizing bacteria [1-3].

Here, we report a new Gunflint-type assemblage of carbonaceous microfossils associated with siderite and Fe-oxides, from a black chert nodule associated with a thin banded iron formation from the ca. 2.45–2.21 Ga Turee Creek Group, Western Australia. This silicified microfossil assemblage, dominated by filaments, represents benthic microbial mats. We document five morphotypes of filamentous microorganisms with optical microscopy combined with Scanning Transmission Electron Microscopy on Focused Ion Beam sections of microfossils. Taphonomic transformations and primary taxonomic features are distinguished by the organic micro- to nanostructures. Three out of five filamentous morphotypes are intimately associated with both Fe-oxides and siderite. The strongly positive  $\delta^{56}\text{Fe}$  values (+1.43 ‰) of Fe-bearing carbonates indicate that the microbial mats have originally been encrusted by Fe(III) oxides and may thus represent Fe-oxidizing bacteria. Siderite is likely the product of the oxidation of organic matter in the filaments coupled with the reduction of Fe(III) biominerals, through either microbial or abiotic thermal processes. The filaments display striking similarities with those from the immediately overlying pyrite-bearing carbonate rocks that are interpreted as S-oxidizing bacteria. This suggests that benthic filamentous bacteria adapted their metabolism to the drastic chemical changes during the Great Oxygenation Event.

[1] Schopf *et al.* (2015) *Proc Natl Acad Sci U S A.* **112**. [2] Planavsky *et al.* (2009) *Earth Planet. Sci. Lett.* **286**, 230-242. [3] Wacey *et al.* (2013) *Proc Natl Acad Sci U S A.* **110**.