

## Supplementary information:

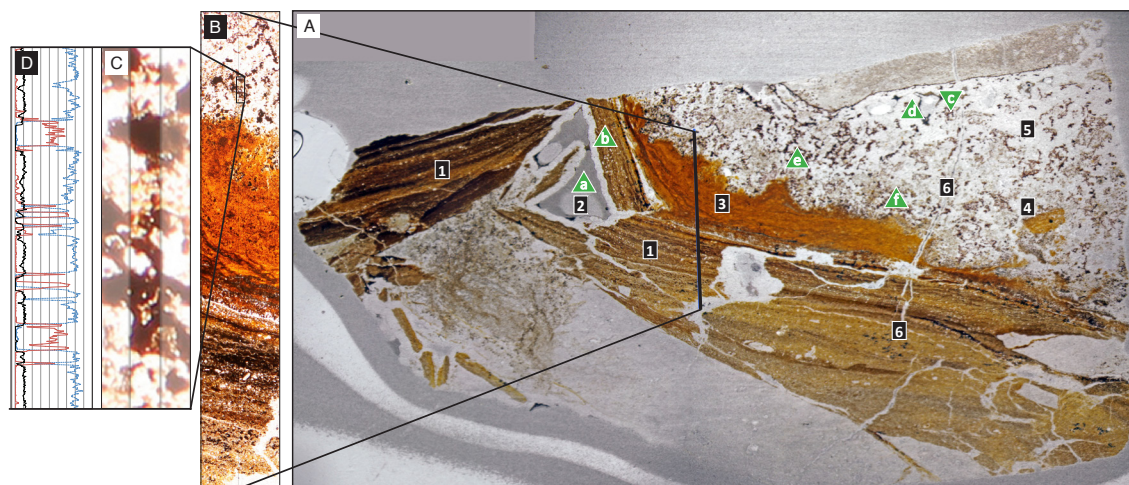


Figure DR1. Panel A: Thin section of Jhamarkotra phosphate rock. The brown laminated apatite (1) sustained breakage that left cracks and an apatite-lined vug (2) and appears to have caused ductile deformation of the orange apatite layer (3) before that layer solidified and later sustained breakage – a piece of which (4) can be seen in the clear apatite area (5). A conspicuous crack (6), lined in quartz, transects the brown, orange and clear apatite fractions. The microfossils are found in the clear apatite fraction. Triangles on thin section show location of spot analyses by electron microprobe. (a) = empty vug; (b) white vug lining and dark material bridging the vug lining = apatite; (c) small void = empty; (d) small void lining = quartz; (f) and (g) filaments = iron oxide in apatite. Panel B: Enlargement of electron microprobe analysis transect. Panel C: Enlargement of microfossil-containing portion of transect. Panel D: Microprobe elemental analysis showing that filaments are high in iron (red) and low in phosphorus (black) and calcium (blue, dotted line). Graph maximum count = 1800.

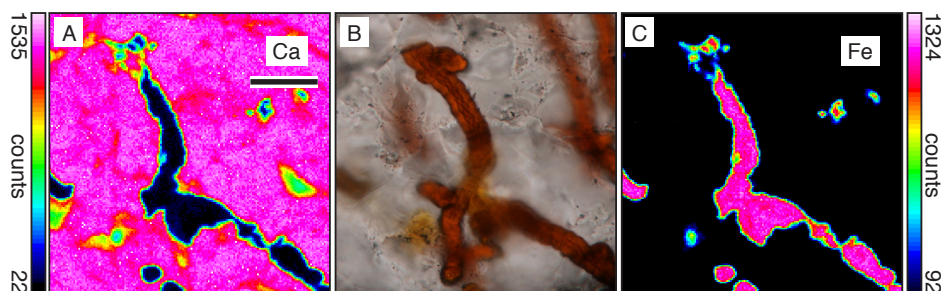


Figure DR2: Electron microprobe analysis establishes that the filaments comprise iron oxides within an apatite matrix. Panel A shows high calcium in the surrounding apatite  $[\text{Ca}_5(\text{PO}_4)_3\text{F}, \text{OH}]$  matrix, and panel C shows iron in the filaments. An optical photomicrograph of the same area is shown in panel B. Note that the optical image is focused beneath the surface, while the microprobe maps portray surface data. Scale bar: 10  $\mu\text{m}$ .

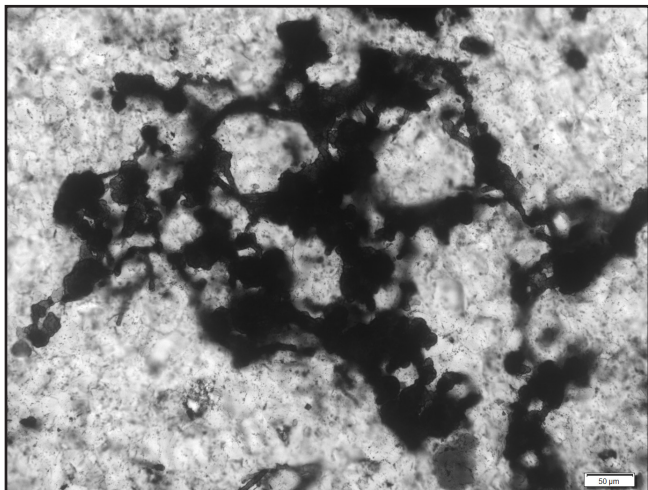
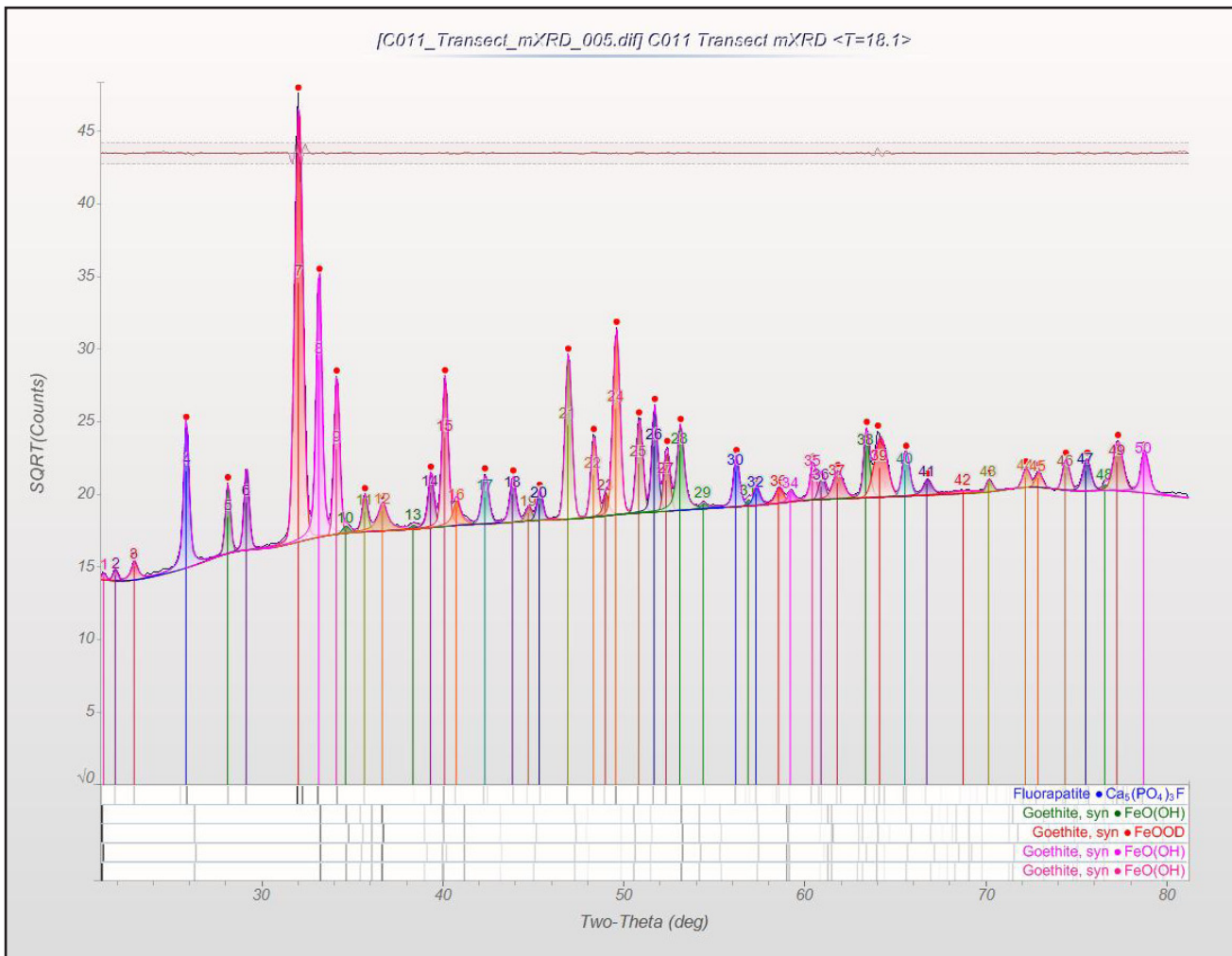


Figure DR3 (at left): Microphotograph showing the 'rosette-like' habit exhibited by some of the microfossils. Scale bar: 50 microns.

Figure DR4 (below): Micro-XRD spectrum obtained from site of a microfossil, showing fit of peaks to goethite standards.



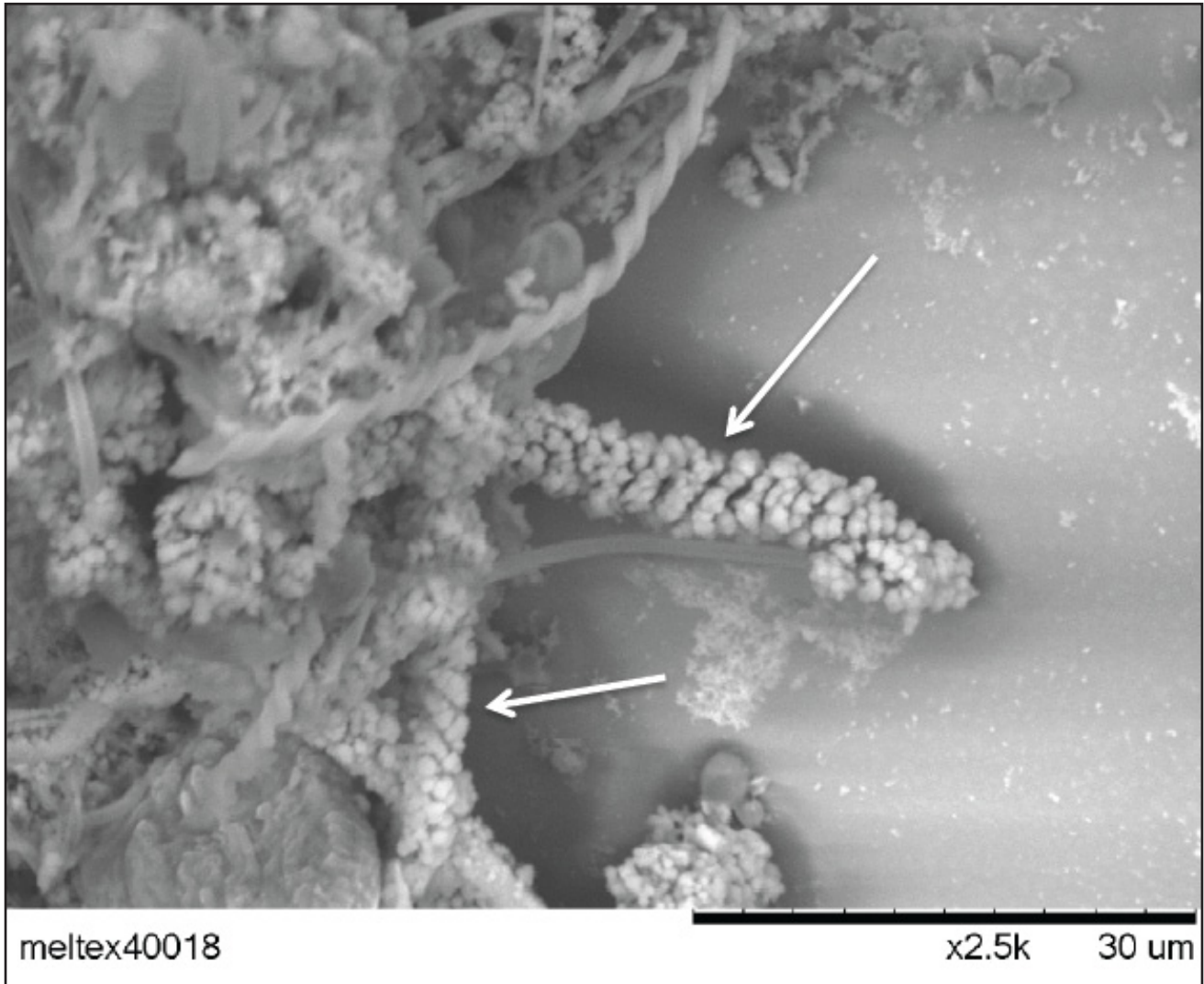


Figure DR5: SEM image of iron-oxidizing filaments from the modern, arrows show twisting *Gallionella* stalks with precipitate overgrowth of diameters similar to those of our microfossils. Image courtesy of Dan Jones (unpublished.)

