Diversification of early life: microfossils of the c. 2.4 Ga Turee Creek Group, Western Australia

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A structurally isolated ridge, ~10 km long, of shallow water stromatolitic dolomite and deeper water dololutites in the Kazput Formation of the c. 2.4 Ga Turee Creek Group, Western Australia, contains a unique assemblage of well-preserved kerogenous microfossils within thin beds and nodules of very fine-grained black chert. The nodular chert unit consists of a 2-4 m thick package of finely bedded grey shale, which grades up into thinly bedded dololutite. At this gradational transition, the black chert is found in the form of nodules (15-25 cm wide by 5-12 cm high). Above this unit, thinly bedded dololutite is interbedded with black chert layers, 2-10 cm thick, which extend for 10's of metres along strike [1].
Results from mapping and petrography indicate that this is an in-situ microfossil community, comprised of: 1) long, thin filamentous microfossils 10-20 µm wide by 200 µm long, 2) relatively large spherical aggregates of cells, ~55-120 µm in diameter, and 3) clusters of very fine filaments, <1 µm wide by ~25 µm long. The very fine filaments are often clumped together, radiating out from the edge of kerogenous films, towards areas of clear silica (Figure 1a). They are also observed attached to the spherical aggregates and degraded larger filaments, suggestive of microbial heterotrophy [2].

a. Results from Raman Spectroscopy show all three microfossil types are kerogenous, affected only by relatively low temperature metamorphism (~200-300°C). Using a range of analytical techniques, including X-ray micro-CT and Nano-SIMS, this study will compare and describe the morphology and isotopic composition of the microfossils, as well as provide insight on the community structure.
b. The tangled nature of the large filamentous microfossils and distribution of the fine filaments demonstrate this is a well-preserved, in situ community from a deep water (non-phototrophic) setting, most likely a sulfuretum [3]. These newly discovered microfossils are preserved immediately after the Great Oxidation Event (GOE) and thus may provide new information on the evolution of life across the rise of atmospheric oxygen.

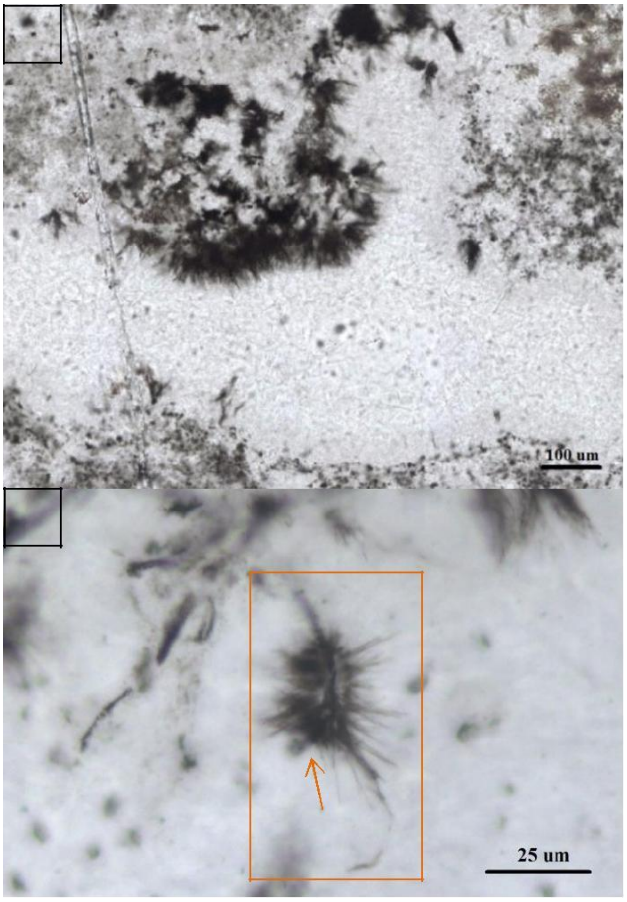

Figure 1: a) Clumped filaments along edge of kerogenous film, radiating out into area of clear silica. b) Very fine clumped filaments (arrow) attached to a larger filament.

References:

[1] Barlow E et al. (*in press*) Geobiology
[2] Wacey D et al. (2013) PNAS 110(20): 8020-8024
[3] Schopf JW et al. (2015) PNAS 112(7): 2087-2092.