A ~2.4 billion year old microfossil community from the rise of atmospheric oxygen in the Turee Creek Group, Western Australia

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The Great Oxidation Event (GOE) at c. 2.4 Ga forever changed Earth's atmosphere, greatly impacting early life and enabling differentiation and evolution in microbial life.

An approximately 10 km long structurally isolated ridge of stromatolitic dolomite, shale and black chert of the Turee Creek Group, Western Australia, was deposited at c. 2.4 Ga, across the rise of atmospheric oxygen. The stromatolitic dolomites host a variety of first occurrences of microbial textures in the geological record, and black chert hosts a community of well-preserved microfossils. At least three microfossil morphologies have been observed; long (>200um) thin filamentous microfossils, clumps of extremely fine (<1um) filamentous microfossils, and spherical aggregates of cells 80-120um in diameter. The latter form shows significant complexity and may represent the oldest eukaryote on record. These significant discoveries emphasise the chert unit's singularity at this point in the rock record, inviting a study into whether the microfossil morphology diversified as a result of the oxygenated atmosphere, or just the natural progression of evolution.

We will present results from cutting edge analytical techniques to describe, compare and contrast the microfossils, in order to gain more insights into the community structure and relationships between the different microfossils. Petrographic analyses will provide insight into the morphology and spatial distribution of the microfossils, as well as the origin of the host chert. Time of Flight Secondary Ion Mass Spectrometry (ToF-SIMS) and sulphur isotope analysis will be used to determine the C^{12}/C^{13} isotope ratios of kerogenous material and test if abundant framboidal pyrite is of biogenic origin, respectively. Cathode Luminescence (CL) analysis will clarify the order of events of the different phases of crystallisation in the chert.

This community of newly discovered microfossils could give us insights into the diversification of life, possibly as a direct result of, or at least in part of a flow-on response to, the changed atmosphere and surface environment during and immediately post-GOE.