04LEC-01. A THRIVING PROTEROZOIC BIOSPHERE AT THE RISE OF ATMOSPHERIC OXYGEN: EVIDENCE FROM THE ca 2.3 Ga TUREE CREEK GROUP, WESTERN AUSTRALIA

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The Paleoproterozoic Turee Creek Group of Western Australia was deposited at 2.45–2.2 Ga, across the critical interval when levels of atmospheric oxygen first began to rise, the atmosphere cooled, and glaciogenic deposits were first widely preserved in the rock record. It is unique in representing a continuous depositional record across the Great Oxidation Event and being well preserved at low metamorphic grade. Near the top of the group (immediately post GOE), a 600 m thick unit of dolomite preserves both shallow water stromatolitic facies and deep water dolarenites and dololutites, as well as a thin units of shale and ferruginous rocks. Deeper water units contain layers and nodules of black chert, emplaced after rock deposition and the formation of dolomite concretions but prior to diagenetic compaction.

Shallow water dolomites contain thick sequences of interbedded columnar, domical, and stratiform stromatolites, in addition to thick sections (30 m) with thrombolytic-textured microbialite. An unusual stromatolite form has a “Christmas-tree” like appearance with horizontal, slightly upward-curving branches that somewhat resemble the branching patterns of Jacutophyton. A unit of mm-scale bedded jasper and quartz on the flanks of a large (30 m) teepee structure contains vertically-oriented filamentous microstructures resembling Frutexites.

In the deeper water part of the succession, black cherts contain a variety of kerogenous microfossils. Black chert from dololutite contains predominantly filamentous microbes and relatively rare, non-filamentous, microfossils that together comprise a mesh of interlaced microbial filaments that clump and wrap around elliptical domains of clear silica. The most abundant microfossils in these samples are broad, septate filaments having elongate cells (~5 µm wide and ~8 µm long); medium- (~2.5 µm-wide) and narrow- (~1.5 µm-wide) diameter filaments composed of beadlike cells; and very narrow filaments, <1.0 µm in breadth. The broadest of these exhibit well-preserved transverse cell walls. Distinctive features of the Turee Creek filaments compared with fossilised shallow-water stromatolitic assemblages are their exceptional length (many hundreds to over a thousand microns in length), and their interlaced web-like fabric, which has not previously been reported from the geological record. This assemblage is interpreted as a sulfuretum.

Cherts from more ferruginous layers contain a distinct assemblage consisting of rare filaments, more common, spherical bodies, and very fine filamentous forms (20 µm long x 1 µm wide) in weakly radiating bundles. Spherical bodies are 50–100 µm in diameter and characterised by inner body with a honeycomb texture of kerogen surrounding clear (cell?) domains, all of which is surrounded by a spherical rind of very fine-grained silica containing thin strands of kerogen with branching outer tips that emanate out from the inner kerogenous body. The outer rind of fine silica suggests the presence of a very thin, outer wall to the structures.

Many of the microfossils and structures described here are similar to forms from younger Proterozoic rocks, but are older by at least 400 Ma and indicate that the Proterozoic biosphere – including possibly, eukaryotic life – was established soon after the GOE.