PRESERVATION OF A 2.4 GA ECOSYSTEM IN THE KAZPUT FORMATION OF THE TUREE CREEK GROUP, WESTERN AUSTRALIA.

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The upper Kazput Formation stromatolitic carbonate reef system is packed with numerous different microbialites [1]. Here, we report on highly diverse microfossil assemblages preserved in black chert units in the deep-water facies of this system, interbedded with shale, ironstone and finely bedded dololutite (Fig. 1). Two distinctive black chert units, nodular and bedded, each contain different consortia of microfossils. The nodular chert contains a variety of cellularly preserved filamentous forms [2], relatively large spherical aggregates of cells and very fine filament rosettes (each filament being ~0.4 µm wide by 20-30 µm long), all inferred to be living in-situ, in the deep-water setting. In contrast, the bedded chert consists of well-rounded organic grains, interpreted as eroded microbial mat fragments washed down from the shallower-water setting (Fig. 1). These microbial grains contain unicells in a range of sizes (4-25 µm) in addition to degraded filaments that are morphologically similar to shallow-water Gunflint microfossils [3]. Significantly, the rounded organic grains are coated by thin microbial biofilms, indicative of post-depositional microbial activity.

The precipitation of silica in both the nodular and bedded chert is inferred to be rapid, occurring either on the seafloor or during early diagenesis. In outcrop, the less competent shale and ironstone layers bend around the chert nodules, indicative of pre-compaction silicification [4, 5]. Early silicification is also supported by the preservation of fine structures, individual cells and communities in life array that consist of long filamentous microfossils alternatively aligning horizontally and vertically (Fig. 2) [5, 6, 7]. The most likely mechanism for the early precipitation of the silica in both nodular and bedded chert is a change in pH, caused by the metabolic activity of the microbes [4, 5, 7], although more work needs to be carried out to further assess this hypothesis.

Chert is an excellent preserver of microscopic life because of its fine crystal structure, very low porosity and chemical and physical stability. In the case of the Kazput cherts, the early and rapid precipitation of silica has preserved a snapshot of a diverse array of organisms from both shallow and deep-water facies, giving insight into the environment on Earth 2.4 billion years ago. This research has implications for the search for, and analysis of, fossilized microbial life preserved on both the early Earth, as well as Mars.

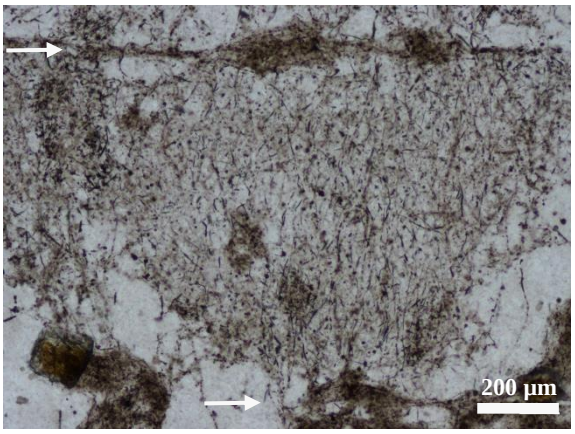

Fig. 2: Life array; filaments oriented both vertically and horizontally (arrows).

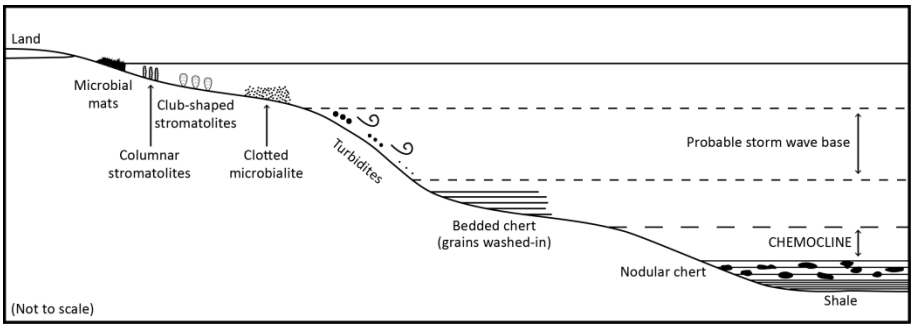

Fig. 1: Model of upper Kazput Formation environment.

References: [1] Barlow E. et al. (2016) *Geobiology, 14(4),* 317-343. [2] Schopf J. W. et al. (2015) *PNAS, 112(7),* 2087-2092. [3] Strother P. K. and Tobin K. (1987) *Precambrian Res., 36(3),* 323-333. [4] Banks N. G. (1970) *Geol. Soc. Am. Bull., 81,* 3033-3048. [5] Schopf J. W. and Blacic J. M. (1971) *J. Paleo., 45(6),* 925-961. [6] Ruff S. W. and Farmer J. D. (2016) *Nat. Commun., 7,* 13554. [7] Dupraz C. et al. (2013) *Geobiology, 11,* 527-548. [7] Perry E. and Lefticariu L. (2014) In *Treatise on Geochemistry* (Second Edition), Oxford: Elsevier, 113-119.