

Most ancient evidence for life in Barberton: microbial mats from the 3.472 Ga Middle Marker horizon

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Setting: The 3.472 Ga Middle Marker, or chert horizon H1 of the Hooggenoeg Formation, is the oldest sedimentary horizon in the Barberton greenstone belt and one of the oldest sedimentary horizons on Earth[1]. We have discovered a range of carbonaceous microstructures in this unit which bear strong resemblance to photosynthetic microbial biofilms and biosedimentary structures in contemporaneous greenstone belts from the Early Archaean[2] and interpret them as such.

Biosignatures: Although an assessment of biogenicity for such ancient objects is challenging, several laminated morphologies – fine, crinkly, micro-tufted, laminated biofilms, pseudo-tufted laminations and wisp-like carbonaceous fragments – within volcanoclastic sandstones and siltstones and coarse-grained volcanoclastic sandstones are readily identifiable as syngenetic, likely photosynthetic, microbial biofilms and microbially induced sedimentary structures; therefore, the Middle Marker preserves the oldest evidence for life in the Barberton greenstone belt[2,3].

Archaean Ecosystems: The Middle Marker preserves an ancient record of epibenthic microbial communities flourishing and declining concomitantly with a waning volcanic cycle, an environment upon which they depended and through which they endured. One is able to make close comparisons between environment- and ecosystem-level characters of the Middle Marker horizon and other Early Archaean cherts (Josefsdal, Buck Reef, and stratiform Apex), suggesting that shallow-water, platformal, volcanogenic-hydrothermal biocoenoses were major microbial habitats throughout the Palaeoarchaean. This greatly assists the reconstruction of ancient geosphere-biosphere co-evolution.

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[1] Lanier, W.P., Lowe, D.R., 1982. *Precambrian Research* **18**, 237–260.

[2] Hickman-Lewis, K., Cavalazzi, B., Foucher, F., Westall, F., accepted, *Precambrian Research*.

[3] Hickman-Lewis, K., Westall, F., Cavalazzi, B., in press. In Van Kranendonk, M.J., et al. (Eds.) *Earth's Oldest Rocks* 2nd Edition, Elsevier, Amsterdam.