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Most Ancient Evidence for Life in the Barberton Greenstone Belt: Microbial Mats and Biofabrics of the ~3.47 Ga Middle Marker Horizon

Keyron Hickman-Lewis^{1,2*}, Barbara Cavalazzi^{2,3}, Frédéric Foucher¹ and Frances Westall¹

¹CNRS Centre de Biophysique Moléculaire (CBM), Rue Charles Sadron, 45071 Orléans, France

²Dipartimento di Scienze Biologiche, Geologiche e Ambientali (BiGeA), Università di Bologna, Via Zamboni 67, 40126, Bologna, Italy

³Department of Geology, University of Johannesburg, PO Box 524, Auckland Park 2006, Johannesburg, South Africa

*Contact: keyron.hickman-lewis@cnrs-orleans.fr

Abstract

The Middle Marker, or 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. Herein, we describe a range of carbonaceous microstructures in this unit which bear resemblance to phototrophic microbial biofilms, biosedimentary structures, and interpreted microfossils in contemporaneous greenstone belts from the Early Archaean. Post-depositional iron-rich fluid cycling through these sediments has resulted in the precipitation of pseudo-laminated structures, which also bear resemblance, at the micron-scale, to certain microbial mat-like structures, although are certainly abiogenic. Poor preservation of multiple putative microbial horizons due to coarse volcanoclastic sedimentation and syndimentary fragmentation by hydrothermal fluid also makes a conclusive assessment of biogenicity challenging. Nonetheless, several laminated morphologies within volcanoclastic sandstones and siltstones and coarse-grained volcanoclastic sandstones are recognisable as syngenetic phototrophic microbial biofilms and microbially induced sedimentary structures, therefore, the Middle Marker preserves the oldest evidence for life in the Barberton greenstone belt. Among these biosignatures are fine, crinkly, micro-tufted, laminated biofilms, pseudo-tufted laminations and wisp-like carbonaceous fragments interpreted as either partially formed biofilms or their erosional products. In the same sediments, lenticular objects, which have previously been interpreted as *bona fide* microfossils, are rare but recurrent finds whose

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