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Early Life on Earth : 3.5-3.3 Ga microbial remains from South Africa

Frances Westall1 and Maud Walsh2

1. Centre de Biophysique Moléculaire, CNRS, Rue Charles Sadron, 45071 Orléans cedex 02, France (westall@cnrs-orleans.fr; Tel : +33-238-257912)

2. Department of Agronomy, 104 Sturgis hall, Louisiana State University, Baton Rouge, LA 70803, USA (evwals@lsu.edu)

The Barberton greenstone belt is one of the oldest, well preserved enclaves of ancient rocks on Earth. The volcanic, volcano-sedimentary and chemical sedimentary deposits that are characteristic of this greenstone terrain host a variety of habitats for potential microbial life. Numerous palaeontological investigations of especially silicified sediments from Barberton have been made over the last over the last 40 years but only a few studies have documented strongly probable microbial structures. These include microbial mats (including stromatolites) formed at the surfaces of shallow water to littoral sediments, or portions of shallow water mats redeposited in the sub-wavebase environment (Byerly et al., 1986; Walsh, 1992, 2004; Westall et al., 2001, 2004; Tice and Lowe, 2004), as well as smaller colonies of microorganisms. These strongly probable microbial fossils were preserved by silicification.

Intrepretations as to the kind of metabolism that the microbes used suggest that they ranged from chemolithotrophic to possibly anoxygenic photosynthetic metabolic strategies. The latter is a relatively evolved mechanism for obtaining energy to drive cellular processes. Given the fact that these are amongst the oldest microfossils yet discovered, this implies that these oldest probable microfossils are already far evolved from LUCA, the last universal common ancestor, and that traces of the earlier steps in the origin and evolution of life are missing on Earth (rocks older than 3.5 Ga are too badly metamorphosed to be used in microfossil studies). Such rocks, however, are abundant on our sister planet Mars.

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