Geophysical Research Abstracts, Vol. 7, 00548, 2005 SRef-ID: 1607-7962/gra/EGU05-A-00548 © European Geosciences Union 2005



Life on a transgressive rocky shoreline and carbonate platform: 3.43 Ga Strelley Pool Chert, Pilbara Craton, Western Australia

A. Allwood (1), M. Walter (1), M. Van Kranendonk, (2) and B. Kamber (3)

(1)Australian Centre for Astrobiology, Macquarie University, NSW, Australia. (2) Geological Survey of Western Australia, 100 Plain St, Perth, WA, Australia. (3) ACQUIRE Laboratory, University of Queensland, Richards Building, St. Lucia, QLD, Australia. E-mail: aallwood@els.mq.edu.au

The search for life on Mars may well find its closest scientific analogue in studies of Earth's earliest fossil record. The 3.43 billion year old Strelley Pool Chert (Kelly Group, East Pilbara Block) is one of three c.3.5 Ga purportedly fossiliferous units in the Pilbara region of Western Australia that are at the forefront of studies of Earth's oldest fossil record (Lowe, 1980, 1982; Walter et al., 1980; Buick et al., 1981; Awramik et al., 1983; Schopf and Packer, 1987; Hofmann et al., 1999; Van Kranendonk et al., 2001, 2003; Ueno et al., 2001; Brasier et al., 2002; Garcia-Ruiz et al., 2003; Lindsay et al., 2003; Furnes et al., 2004; Tice and Lowe, 2004). The Strelley Pool Chert is a \sim 10-30 m-thick chert-carbonate succession containing well-exposed and widespread synsedimentary conical stromatolite-like structures of possible biologically mediated origin.

We investigate the Strelley Pool Chert along a 20 km-long arc of exceptionally well preserved, ridge-top outcrops centering upon the Trendall locality (Hofmann et al., 1999) in the SW North Pole Dome to investigate possible origins for the putative stromatolites and constrain their depositional environment. Field observations combined with rare earth element (REE) patterns suggest that the Strelley Pool Chert carbonates were deposited on a shallow marine carbonate platform that encrusted and draped rocky shoreline deposits during transgression of previously emergent crust. Stromatolite-like structures on the platform are delineated into seven morphologic 'facies' of probable common origin. New geological, geometric and geochemical ev-

idence show that at least one facies displays characteristics that are inconsistent with their interpretation as purely abiotic chemical precipitates or mechanically-deposited sediments. The observations are most plausibly explained as the product of biologically mediated sedimentation. While those findings cannot be projected to imply that other stromatolite-like structures in the Strelley Pool Chert are also of biological origin, it does make biogenic interpretation of their morphology and geochemistry more plausible. Moreover, the environmental setting excludes current hypotheses for their origin as abiotic hydrothermal vent precipitates (cf: Lindsay et al., 2003). Development of the stromatolitic carbonate platform marked a brief hiatus in the igneous and hydrothermal activity that prevailed during deposition of a >35km-thick volcanosedimentary succession on the Pilbara craton c.3.5 billion years ago. Thus, the fossil record of Earth suggests that life - though it may have arisen earlier and also survived under more extreme conditions -left the first large scale record of its existence during a time when relatively non-extreme, normal marine conditions prevailed. If life on Mars followed a similar development path, the best evidence of that life may be found in such settings.

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