MORPHOLOGICAL AND GEOCHEMICAL DIVERSITY OF DEEP WATER MICROFOSSILS FROM THE 2.52-GA-OLD GAMOHAAN FORMATION, SOUTH AFRICA. J. T. Osterhout[1], A. D. Czaja[1] and N. J. Beukes[2] [1]Department of Geology, University of Cincinnati, Cincinnati, OH 45221-0013, USA (osterhjt@mail.uc.edu) [2]Paleoproterozoic Mineralization Research Group, Department of Geology, University of Johannesburg, Auckland Park, South Africa.

Introduction: The upper section of the Gamohaan Formation of the Transvaal Supergroup, South Africa, was deposited in a relatively deep marine basin paleoenvironment dominated by finely laminated contorted algal mats. Overall, this unit represents a deepening-upward sequence, and is stratigraphically positioned between the overlying Kuruman Iron Formation and the large stromatolitic Campbellrand carbonate sequence below [1-2]. The age of the upper Gamohaan Formation is primarily constrained by a tuffaceous bed with an age of 2,521 ± 3 Ma [3] that lies a few meters below the black chert unit from which samples were collected for this study.

Filamentous microfossils have previously been identified from the uppermost unit of the Gamohaan Formation, the Tsineng Member [2], but none have been reported from lower portions. Microfossils of the Tsineng Member have been characterized as benthic, mat-forming cyanobacteria preserved in finely banded chert. In contrast, the microfossils of this study are present lower within the Gamohaan Formation and exhibit paleobiological evidence consistent with an autotrophic, planktonic affinity.

Results: Samples for this study were collected from two stratigraphically correlated localities separated by ~80 km. Both sets of samples contain a morphologically diverse set of organic-walled filamentous, spherical, and sub-spherical microfossils (Fig. 1). The microstructures are observed in petrographic thin sections with structural walls separating them from the surrounding matrix. The kerogenous composition of the microfossils is supported by Raman spectroscopy, and their 3-D morphology confirmed via confocal laser scanning microscopy.

The specimens studied exhibit a wide variety of microbial morphologies and size ranges (<50 μm to >300 μm; Fig. 1). The microfossils are preserved along bedding planes and show taphonomic features such as folding, wrinkling, and degradation of organic walls. These characteristics are consistent with a biological origin for the observed microstructures. Geochemical analyses of molecular structure, organic elemental ratios, and carbon isotope compositions are reported here and support a biological interpretation of the structures as well as help to differentiate the various components of the ecosystem.

Conclusions: It is interpreted that the microfossils of the Gamohaan Formation studied here represent solitary planktonic microorganisms that settled out of the water column (Fig. 1A–C) and were deposited in deep water sediments along with autochthonous algal mat-like structures (Fig. 1D). Following burial and silicification, the organisms were ultimately preserved in finely laminated chert beds.

These fossils are the remains of a thriving ecosystem that existed around the time of significant atmospheric and ecological change (the Great Oxidation Event). As such, they can tell us about the diversity and evolution of life at this critical time in Earth history.

References: [1] Beukes N. J. (1987) *Sed. Geol., 54*, 1–46. [2] Klein C. *et al.* (1987) *Precam. Res., 36*, 81–94. [3] Sumner D. Y. and Bowring S. A. (1996) *Precam. Res., 79*, 25–35.

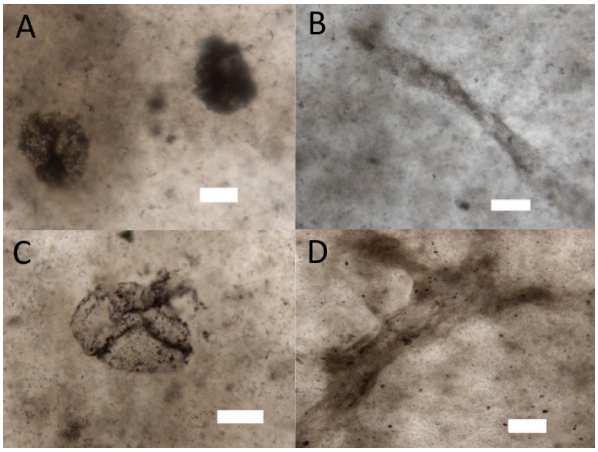

Figure 1. Representative microfossils from the upper Gamohaan Formation. (A) Small spheroidal microfossils. (B) Filamentous microstructure showing taphonomic folding. (C) Large spheroidal microfossil with folding and distortion of organic walls. (D) Amorphous biofilm-like structure composed of kerogen. Scale bars: (A) 20 μm (B, C) 50 μm (D) 100 μm.