LARGE PLANKTONIC MICROFOSSILS PRESERVED IN A DEEP WATER FACIES OF THE 2.52-GA-OLD GAMOHAAN FORMATION, SOUTH AFRICA. A. D. Czaja[1], J. T. Osterhout[1], and N. J. Beukes[2] [1]Department of Geology, University of Cincinnati, Cincinnati, OH, 45221-0013, USA, adrew.czaja@uc.edu, [2]Paleoproterozoic Mineralization Research Group, Department of Geology, University of Johannesburg, Auckland Park, South Africa.

Introduction: Although the evidence of life in the Archean Eon (>2.5-Ga-ago) is well established, even back to ~3.5 Ga [1], the known diversity of fossil microorganisms (microfossils) is low relative to more recent periods of Earth history. This study presents evidence for large (up to ~300 µm diameter) spheroidal planktonic microorganisms preserved in a deep water facies of a Neoarchean carbonate platform.

Materials and methods: Microfossils reported here were collected from a black chert unit in the upper part of Gamohaan Formation of the Kaapvaal Craton, South Africa, near the town of Kuruman [2]. The chert unit sits a few meters above a tuffaceous bed dated at 2,521 Ma [3].

Specimens were located in thin sections of chert by transmitted light microscopy. Fossils were found to be compressed perpendicular to bedding, so both transverse and plan view sections were made to fully understand the taphonomy of the fossils (Fig. 1). Selected specimens were imaged using confocal laser scanning microscopy to confirm their morphology. The kerogenous nature of the fossils was confirmed by use of Raman spectroscopy.

Results and discussion: The fossils studied (e.g., Fig. 1) range in size from ~60 to 300 µm in diameter (median: 125 µm). The fossils are preserved as solitary (non-colonial) compressed kerogenous spheroids within a finely laminated black chert unit. The fossils display folding patterns typical of compressed flexible-walled spheroids (Fig. 1A), similar to many Proterozoic acritarchs and spheroidal fossils from the Mesoarchean [4]. This compression is likely the result of both loss of turgor pressure within the microorganism upon death and compaction of the sediments prior to lithification. The latter cause is evidenced by draping of laminations around the fossils (Fig. 1B).

A cascade of evidence (including morphological, geochemical, and taphonomic) indicates that the structures preserved in this unit are biogenic in origin. The solitary nature and originally spherical morphology of the fossils suggests they were planktonic organisms that settled into the deep basin where the host sediments were deposited. Based on their size and planktonic nature, it is possible that these fossils represent the remains of oxygen producing cyanobacteria, an interpretation consistent with the large number of geochemical studies that provide evidence for at least localized ocean oxygenation at this time (e.g., [5–8]).

References: [1] Schopf J. W. (2006) *Phil. Trans. Royal Soc. B*, *361*, 869–885. [2] Klein C. et al. (1987) *Precambrian Res., 36*, 81–94. [3] Sumner D. Y. and Bowring S. A. (1996) *Precambrian Res., 79*, 25–35. [4] Javaux E. J. et al. (2010) *Nature, 463*, 934–938. [5] Anbar A. D. et al. (2007) *Science, 317*, 1903–1906. [6] Wille M. et al. (2007) *GCA, 71*, 2417–2435. [7] Kendall B. et al. (2010) *Nature Geosci., 3*, 647–652. [8] Czaja A. D. et al. (2012) *GCA, 86*, 118–137.

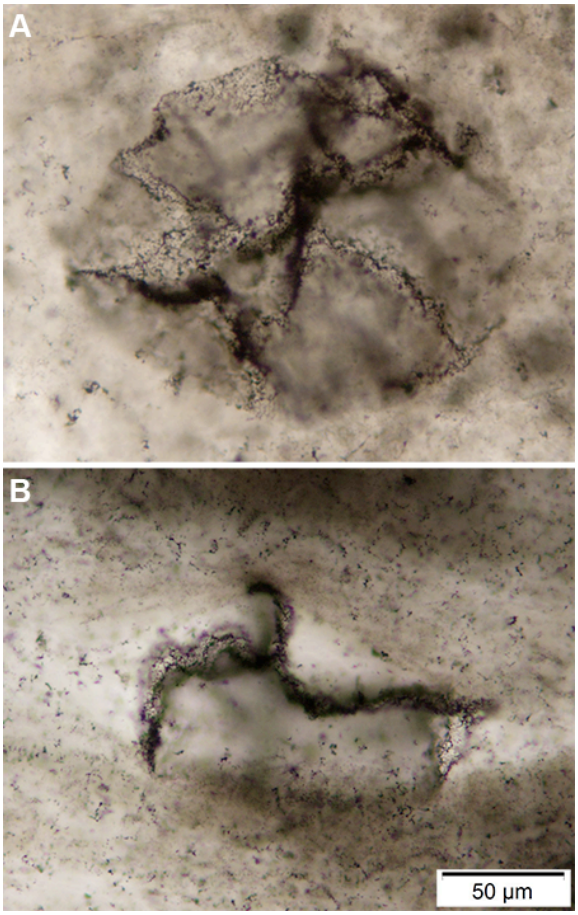

Figure 1. Spheroidal microfossils preserved in a black chert unit of the Gamohaan Fm. A) Compressed sphere viewed in a bedding plane section. B) Similar compressed sphere viewed in transverse section. Fossils were located in thin section and photographed using transmitted light. Scale bar in B applies to both panels.