Terrestrial life and environmental heterogeneity within the Late-Mesoproterozoic Nonesuch Shale

TIMOTHY M. GALLAGHER[1]* AND NATHAN D. SHELDON[1]

[1]University of Michigan, Dept. of Earth & Environmental Sciences, Ann Arbor, MI 48109, USA
(*correspondence: tgallag@umich.edu)

The Mesoproterozoic era is thought to be a time of relative environmental stability when compared to the Paleo- and Neoproterozoic. While the marine carbon cycle and pO_2 of the atmosphere may have been stable, the biosphere was far from quiescent at this time. For example, stromatolites reached their peak abundance during the Mesoproterozoic [1]. Beyond a dynamic marine biosphere, there is evidence that microbial life was also diversifying in freshwater terrestrial environments by the Late Mesoproterozoic [2].

The Midcontinent Rift System of the Great Lakes region in North America was formed ~1.1 Ga ago, was never deeply buried, and with only limited evidence for post-burial alteration, is an appealing archive to use to examine terrestrial life and environments. Previously, microbially induced sedimentary structures have been documented in floodplain deposits [3,4]. Here, we expand the range of environments examined by focusing on the Nonesuch Formation, which is comprised of organic-rich siltstones and shales and is thought to have been deposited in a lacustrine setting [5].

Both outcrop and drill-core records of the Nonesuch Formation from Michigan and Wisconsin were examined to test the hypothesis that the Nonesuch Formation in Michigan and Wisconsin may have been deposited in distinct basins separated by a topographic high [6], similar to modern rift lakes in East Africa. Organic carbon isotope and trace metal data indicate spatial variability in microbial diversity, environmental heterogeneity, and redox during the Late Mesoproterozoic.

[1] Noffke and Awramik (2013) *GSA Today* **23**, 4-9 [2] Strother, *et al* (2011) *Nature* **473**, 505-509 [3] Wilmeth, *et al* (2014) *Geobiology* **12**, 99-108 [4] Sheldon (2012) *SEPM Special Publication* **101**, 153-162 [5] Elmore, *et al* (1989), *Precambrian Research* **43**, 191-213 [6] Suszek (1997) *GSA Special Paper* **312**, 195-210