TERRESTRIAL BIOGEOCHEMISTRY AND CARBON BURIAL PROCESSES IN MESOPROTEROZOIC LAKES OF THE MID-CONTINENTAL RIFT SYSTEM. T. M. Gallagher and N. D. Sheldon, Department of Earth and Environmental Sciences, University of Michigan, 1100 N. University Avenue, Ann Arbor, MI 48109, tgallag@umich.edu.

Although evidence is rare as compared to the marine realm, it has been argued that life in terrestrial environments has been a persistent feature of Earth's history reaching deep into the Archean [1]. Yet, it remains unclear how extensive and abundant the terrestrial biosphere was throughout much of this time. Microfossil evidence from lacustrine deposits suggests that by the Late-Mesoproterozic, microbial life was diversifying and expanding in large freshwater lake systems [2]. The impact of a diverse and abundant terrestrial biosphere remains unclear, but it has been suggested that carbon burial rates in lakes were high enough during the Late Mesoproterozoic that sufficient carbon could be sequestered to contribute to the progressive oxygenation of the Proterozoic atmosphere [3]. However, constraints on atmospheric composition suggest that both pO_2 and pCO_2 were relatively low at this time, which has interesting implication for biogeochemical cycling and specifically organic carbon burial [4,5]. For example, with low enough pO_2, even moderate oxygen production in lakes could have resulted both in them serving as oxygen sources rather than sinks, as well as potentially having dissolved O_2 levels in excess of the atmospheric pO_2.

Terrestrial deposits of the North American Mid-Continent Rift (MCR) offer an opportunity to examine the nature of both the terrestrial biosphere and its biogeochemical impact in tandem [6,7]. The MCR contains the lacustrine Nonesuch Formation as well as contemporaneous fluvial and floodplain deposits [8]. These rocks are well-preserved, and were never been buried very deeply [9], making it possible to examine both inorganic and organic geochemistry.

By examining 6 cores that transect the Nonesuch depositional basin along with outcrops representing the surrounding floodplain, we can better assess the complexity of terrestrial ecosystems during the Late-Mesoproterozoic. TOC and carbon isotope records will be used to characterize the amount and composition of preserved organic carbon. Trace metal and Fe records will be used to reconstruct biogeochemical cycling within this freshwater system in order to understand the role of oxygen and iron in supporting the expansion of the lacustrine biome and in the preservation of organic matter. While the majority of the Nonesuch formation is organic carbon poor (<0.05% TOC), there are discrete intervals of enhanced orcanic carbon accumulation (TOC >0.5%). Redox sensitive trace metals and sulfide similarly accumulate at times of elevated carbon burial, but trace metal accumulations remain relatively low as compared to marine, and underscore distinctions associated with a freshwater system that need to be constrained.

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