
Diversification of complex life on the early Earth: the Proterozoic of Arctic Canada as a case study

Corentin Loron^{*1}, Galen Halverson², Robert Rainbird³, Thomas Skulski³, Elizabeth Turner⁴, and Emmanuelle Javaux⁵

¹Department Geology and UR Astrobiology, University of Liège – Belgium

²McGill University – Canada

³Geological Survey of Canada, Ottawa – Canada

⁴Harquail School of Earth Sciences [Sudbury] – Sudbury, Ontario P3E 2C6, Canada

⁵Department Geology and UR Astrobiology, University of Liège – Belgium

Abstract

The Proterozoic Eon is a crucial time in life history on Earth. During the Mesoproterozoic Era (1600-1000 Ma), the evolution of eukaryotic micro-organisms and their biological innovations (e.g. predation, multicellularity, photosynthesis) led to the diversification of major lineages, within redox stratified environments. These innovations, pursued and enhanced in the Neoproterozoic (1000 – 542 Ma), defined and shaped Life, as we know it, in the Phanerozoic. Two successions, located in northwestern Canada, have provided significant insights on the early evolution of eukaryotes. The Dismal Lake Group and Shaler Supergroup record an important diversity of organic-walled microfossils in marine and estuarine environments, spanning over more than 1800 million years of Earth history. The assemblages are rich in ornamented, acanthomorphic (process- bearing vesicles) and multicellular eukaryotes, and preserve the oldest reported evidence for eukaryovory. The recent discovery of 1-0.9 Ga multicellular fungi in the Shaler Supergroup suggests an earlier origin for the common ancestor of fungi and metazoans. Future research questions include: how was their taxonomy and diversity influenced by ecological interactions or biological innovations? How do these assemblages compare with recent discoveries from similar-age rocks in China, India, the U.S. and Africa? Can we complete previous diversity estimates and patterns of diversification for Eukaryote diversification during Proterozoic? And finally, what are the possible biological affinities of these eukaryotes? Exceptionally well preserved, organic-walled microfossils from the Shaler Supergroup and Dismal Lakes Group open a window on life in the Proterozoic, that will considerably improve the understanding of early eukaryote evolution. More broadly, this case study permits to test hypotheses regarding the causes and pattern of diversification of complex life on a rocky habitable planet.

References

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*Speaker

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