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COLLOQUIUM SEMINAR SERIES

NEW MULTICELLULAR MARINE MACROALGAE FROM THE EARLY TONIAN OF NORTHWESTERN CANADA

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Photosynthetic eukaryotes are thought to have first evolved in freshwater environments in the early Proterozoic (2500–539 Ma (millions of years ago)) and diversified into marine environments by the Tonian Period (1000–720 Ma). However, early algal evolution is poorly reflected in the fossil record since these cellular level organisms are difficult to preserve. Here, we report newly discovered, millimeter- to centimeter-scale macrofossils from outer- shelf marine facies of the ca. 950–900 Ma (Re-Os minimum age constraint = 898 ± 68 Ma) Dolores Creek Formation in the Wernecke Mountains, northwestern Canada. These fossils, variably preserved by iron oxides and clay minerals, represent two size classes. The larger forms feature unbranching thalli with uniform cells, differentiated cell walls, longitudinal striations, and probable holdfasts, whereas the smaller specimens display branching but no other diagnostic features. While the smaller population remains unresolved phylogenetically and may represent cyanobacteria, we interpret the larger fossils as multicellular eukaryotic macroalgae with a likely green algal affinity based on their large size and presence of rib-like wall ornamentation. Considered as such, the latter are among the few green algae and some of the largest macroscopic eukaryotes yet recognized in the early Neoproterozoic. Together with other Tonian fossils, the Dolores Creek macrofossils indicate that eukaryotic algae, including green algae, colonized marine environments by the early Neoproterozoic Era.

Colloquium Seminar Series

Wednesday, December 1, 2021

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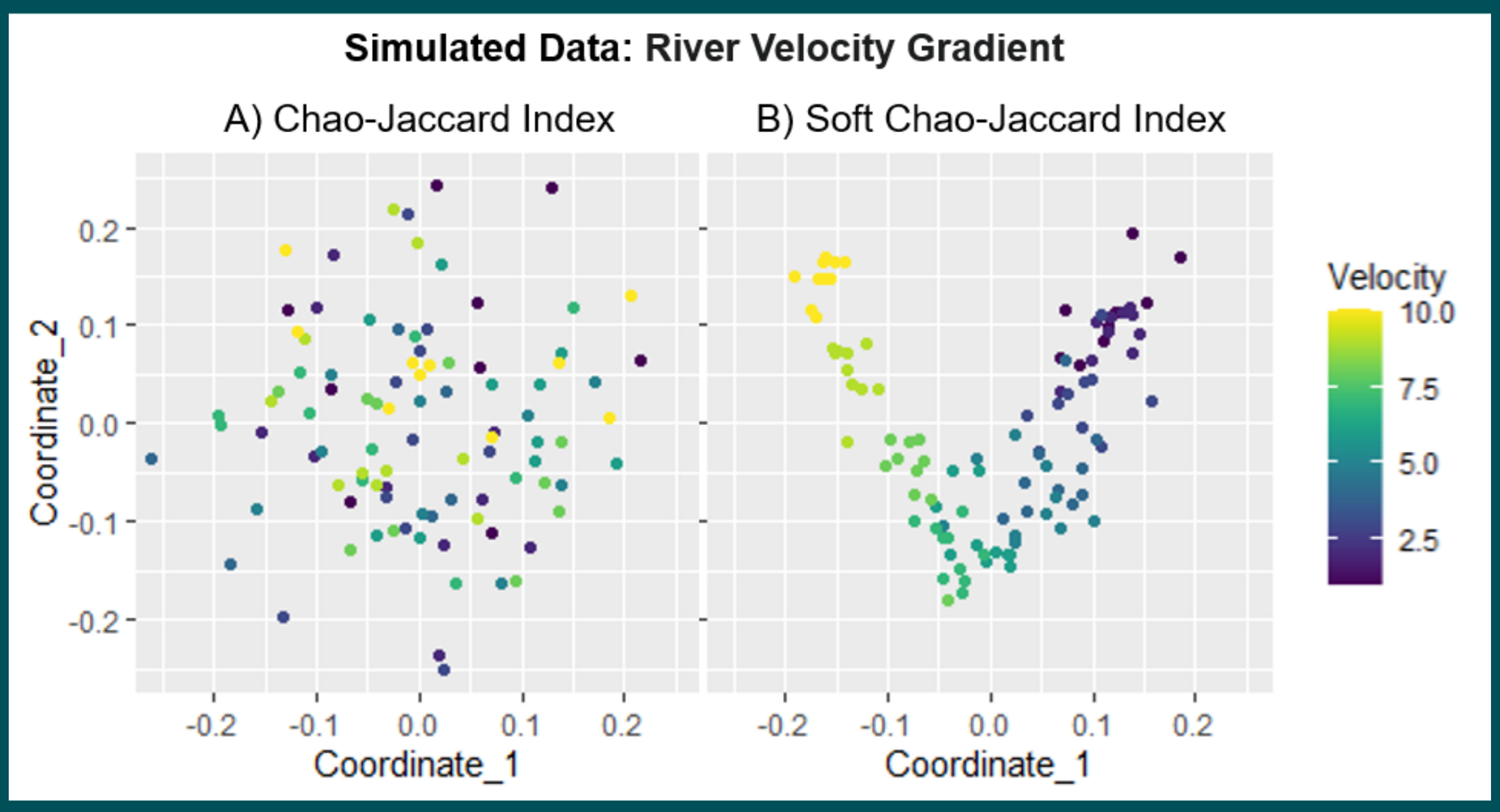
SOFT SIMILARITY AND THE LONG-TERM STABILITY OF ECOSYSTEMS



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Quantitative similarity measures play a key role in nearly all ecological studies, serving as a means for comparing overlap between anatomical traits, entire organisms, and their communities. Despite their ubiquity, many of the most popular similarity measures in use were developed in the early 20th-century – as a result, they incorporate outdated or inaccurate views of what traits are important to emphasize, shifting what constitutes “similar” and thereby altering the patterns which emerge in a given analysis. Here I discuss a new method for quantifying similarity that incorporates far more information than conventional similarity measures. The new index is based on principles of soft set equivalence, a concept derived from fuzzy set theory. By using the new measure in conjunction with classic ordination techniques (e.g., non-metric multidimensional scaling), ecologists and paleontologists can reconstruct complex patterns that would otherwise be completely missed. Here I also discuss how integrating novel measures of ecological similarity into macroevolutionary models can potentially explain some of the most complex patterns in the fossil record. In particular, the observed “decoupling” of the taxonomic and ecological consequences of the “Big Five” mass extinctions is shown to be potentially related to the degree of functional similarity between taxa prior to the onset of the events.

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