

Collaborative Research: Graptolite Biogeography, Paleo-GIS, and Evolutionary Dynamics of Early Paleozoic Zooplankton.

Deep-time perspectives on climatic and oceanographic change are critical for understanding the long-term controls on environmental processes. This is particularly the case for the “tipping points” that lead to episodes of climatic extremes, events that are often associated with episodes of profound biodiversity change. The spatial and temporal distribution of planktic organisms has proven to be critical to the reconstruction of climatic and oceanographic conditions during the Mesozoic and Cenozoic. The oldest geological period for which there is a diverse and abundant record of zooplankton is the Ordovician, and that record is provided by graptolites.

Our objectives in this research are two-fold. First, we are going to analyze the changing biogeographic distribution patterns in graptolites from the Middle to Late Ordovician Period using newly developing global databases, ecological modeling, and paleo-GIS techniques. Graptolite spatial distribution patterns should help us understand the relationship between ancient ocean structure, climate, and zooplankton biogeography. Second, we are interested in answering some specific questions about the relationship between geographic range and species longevity. Do species with large geographic ranges last longer in Earth History than those with small ranges – does range provide a buffering effect to extinction? What is the directionality of the relationship – is range dependent upon duration or vice-versa? Is geographic range a heritable species-level character, and if so, what does this tell us about macro-evolutionary processes?

Although our study will focus on the Ordovician and Early Silurian biosphere and its interconnections, the questions we propose to pursue – how range area and spatial patterning of faunas affect or respond to changing environmental history and species evolutionary dynamics – are fundamental questions that biologists and paleobiologists are pursuing across our traditional disciplinary boundaries of taxon, age, and conceptual approach.