Taking it to the shelves: Interpreting geochemical and isotopic records from epicontinental seas

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Interpretation of global environmental change during the Paleozoic largely relies on the geologic archive deposited in epicontinental seas, a depositional setting subject to substantial geographic and temporal variability. The typical approach has been to focus on proxies that can be reasonably inferred to be strongly influenced by a global signal; the carbon isotope composition of sedimentary carbonates is a good example. Simple quasi-steady-state assumptions are invoked, the record interpreted as global, and allowances made for the largely unknown local overprint of original isotopic spatial heterogeneity, amplifications or dampings associated with the local response to the global forcing, and diagenesis. Toward that end, the goal of data collection was to generate the "global curve."

Spatially resolved models allow geochemists to put the data back on the map and to interpret them in terms not only of the global forcing but in terms of local response as well. Examples include multi-box models and Earth system models of intermediate complexity (EMICs) applied to problems of carbon cycle perturbation and ocean anoxia. This approach has its shortcomings as well; detailed knowledge of paleobathymetry is lacking amd spatial resolution of global models is inadequate to resolve the shelves.

Case studies demonstrate the encouraging persistence of spatial-temporal patterns of variation that support the utility of and deeper insights derived from a combined approach of box modeling and EMICs to interpreting geochemical records preserved in epicontinental sea deposits.