

## THERMALLY-CONTROLLED COLOR GRADIENT FOR FOSSILS AND ASSOCIATED SEDIMENTS: IMPLICATIONS FOR PALEOECOLOGY.

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Regional study of Middle-Late Ordovician and Middle-Late Devonian carbonate and siliciclastic deposits in the northern Appalachian foreland basin reveals a prominent pattern of eastward-darkening of marine mudrocks and associated fossils. Exoskeletons of certain trilobite genera transform from a saddle brown coloration in southern Ontario exposures to black and near-black in central and eastern New York. Similar eastward darkening of mudstones and argillaceous carbonate units is observed to be covariant with conodont color alteration (C.A.I.) values across this same region. This pattern is coupled with other lines of evidence for eastward increases in heat-of-burial for strata across New York State, indicating that the darkening is linked to this control. Laboratory heating of thermally "cold", light-colored samples shows that this process can be simulated under controlled conditions. The darkening of fossils and mudrocks probably occurs due to thermal maturation of organic matter within these materials.

Darkening of certain fossiliferous mudrock facies from color values as high as N 7.5 at a C.A.I. of 1.0 to those of N 2.5 at C.A.I. of 3.5 has important implications for paleoecological interpretations. Where obvious fossil-rich beds are absent and field work cursory, it might be tempting to infer a shelf-to-basin transition in the up-rank direction where none exists. Where skeletal packstone and grainstone beds are common in thermally mature deposits it is possible that intervening dark-colored shales may be erroneously interpreted as basinal, organic-rich (black) shales and the grain-supported beds as turbidites, when, in fact, such beds are shallow-shelf tempestites. We believe that similar value gradients should be present wherever local or regional heat-flow anomalies or differential burial patterns are developed. Foreland basins bordering orogens should contain such gradients and workers must be alert to this illusory color effect when working on complex facies in such settings. It is probable that many paleoenvironmental judgments may have been colored by misinterpretations of this type.