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From bank to basin: carbon isotope chemostratigraphy and redox geochemistry of co-eval carbonates and shales of the Middle-Upper Devonian Ramparts and Canol formations, Mackenzie Valley, N.W.T.

Cecilia R. Endriga[1], Pavel Kabanov[2], Erik A. Sperling[1]
Stanford University[1], Geological Survey of Canada Calgary[2]

Summary

The Middle to Late Devonian formations (Horn River Group) in the subsurface below the Mackenzie Plain of the Northwest Territories and in outcrops of the adjoining Laramide Cordillera record global anoxic events during this time interval, in addition to being one of the few places in the world where the geochemistry of co-eval shallow-water carbonates and basinal shales can be directly compared. Deposition of the Horn River Group on the continental shelf of Laurentia along its north-western margin started in the latest Eifelian and terminated in the late Frasnian upon transition to a distal foreland-basin type setting marked by deposition of the siliciclastic-rich Imperial Formation. The Horn River group consists of three formations: the Hare Indian, Ramparts, and Canol, wherein the Ramparts Formation carbonate banks developed adjacent to Canol Formation organic rich shales. These basinal shales ultimately overstepped Ramparts carbonate banks recording their drowning under anoxic waters. This 'bank and basin' paleogeographic setting allows us to compare geochemical signals from these two lithological records to global and regional trends in biotic diversity, petroleum generation, and paleoceanography. This study combines $^{13}C_{carb}$ measurements from the Ramparts Formation with $^{13}C_{org}$, iron speciation, TOC, and trace metal data from the Canol Formation. These redox geochemical data point to variably euxinic-to-ferruginous bottom water conditions during the deposition of basinal shales, while high pyrite to highly reactive iron ratios in the shales directly above the Ramparts carbonate banks demonstrate euxinic conditions during the drowning event. Ongoing study of carbon isotope stratigraphy and conodont biostratigraphy will help improve correlations between the bank and basin. This stratigraphic framework will provide a remarkable natural laboratory to understand paleoceanography in the Devonian of Northwest Canada, as well as the geochemical signals contained in coupled carbonate and shale records.