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Chemostratigraphic tools for regional correlations – application to Early Triassic of the Sverdrup Basin

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Summary

Changes in global, biogeochemical cycles through time leave distinct signatures in the rock record. These can form characteristic trends that allow correlation of stratigraphic units in a manner similar to well log correlation. Chemostratigraphy can provide a valuable tool to supplement more traditional stratigraphic methods, particularly in poorly fossilferous rock units.

The Late Permian – Early Triassic chemostratigraphic record reveals several geochemical proxies that have utility in stratigraphic correlation. Redox sensitive trace metals can track global changes in ocean anoxia through time. Also, variations in the marine carbon pool, affected by fluctuation in the global biogeochemical cycles, imparted distinct signatures in both the organic and inorganic carbon records through the Early Triassic that are correlatable on a global scale.
We studied two locations in the Sverdrup Basin: 1) the uppermost Permian to lower Griesbachian record at Buchanan Lake, eastern Axel Heiberg Island, and 2) the Lower Triassic record at Smith Creek (stratotype of the Smithian sub-stage) on Svartfjeld Peninsula, northern Ellesmere Island, Nunavut. The results show that the organic carbon isotope record from NW Pangea closely corresponds to major fluctuations in the inorganic carbon records from the Tethys, indicating truly global perturbations of the carbon cycle occurred during this time. Geochemical proxies for anoxia are strongly correlated with carbon isotopes, whereby negative shifts in $\delta^{13}C_{org}$ are associated with shifts to more anoxic to euxinic conditions, and positive shifts are related to return to more oxic conditions. These trends likely reflect perturbations to global biogeochemical cycles related to recurrent volcanism during the prolonged recovery period from the Latest Permian extinction.