Marine influence and other controls on organic matter preservation in Langsettian, Carboniferous lacustrine source rocks of the Joggins Formation, Nova Scotia, Canada

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The Joggins Fossil Cliffs of Nova Scotia, Canada, represents one of the most continuous exposures (~4.4 km) of a Carboniferous coal basin in the world. Part of this succession is represented by the Joggins Formation, which extends for 2.8 km along the coastal section of the Cumberland Sub-basin. Subsidence from salt-withdrawal deeper in the basin resulted in rapid accommodation to produce 14 well-characterized parasequences. Many of these repeated transgression events, which are composed of fluvial/deltaic mudrocks overlain with bioturbated paleosols and bituminous coal measures, began with the deposition of carbonaceous-rich, freshwater limestone units marking the maximum flooding surface of the shallowing upward interval.

Although the Joggins Formation was deposited ~2500 km inland from the Tethys paleo-shoreline, the basal section contains evidence of marine incursions. This study investigates whether geochemical data can (1) help resolve the temporal extent of these events, and (2) determine what effects marine conditions had on the type and preservation of the organic matter in these prospective source rocks.

Specific emphasis is focused on resolving whether sulfurization of organic matter (SOM) was involved in kerogen formation. This early diagenetic process leads to selective preservation of hydrogen-rich, labile organic matter and thus affects the quality, and to a lesser degree, the richness of organic matter preserved in source rocks. SOM can lead to petroleum generation at shallower burial depths because the less stable sulfur-carbon bonds break at lower temperatures. Forty samples, spanning seven wellcharacterized parasequences extending from the base to the top of the formation, are being analyzed for transition metal and elemental sulfur concentrations using portable X-Ray Fluorescence.

These data will be compared against bulk pyrolysis measurements to evaluate factors controlling the richness, quality, and maturity of the host rock's organic matter. Additional geochemical constrains are also being provided via biomarker-based paleoecological reconstruction using comprehensive two-dimensional gas chromatography. The results of this chemostratigraphic study will be used to calibrate geochemical proxies for the identification of marine influence and SOM in other pre- and postrift basin Carboniferous outcrops and cores in Nova Scotia.

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