Diagenetic effects and fluid flow along erosional boundaries and unconformities in the Triassic Wolfville Formation at Rainy Cove, Nova Scotia, Canada

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Rainy Cove lies along the south shore of the Minas Basin on mainland Nova Scotia. Outcrops along the beach preserve fluvial barforms and channel deposits of the Wolfville Formation, a member of the Fundy Group. The Triassic Wolfville sandstones lie unconformably over the steeply dipping metasedimentary rocks of the Carboniferous Horton Group. Within the Wolfville Formation, there is a hierarchy of erosional surfaces and unconformities separating lithofacies packages. These range from barform surfaces marking small reactivations in fluvial sedimentation to an intra-Triassic unconformity that incises 10 m into previously deposited barforms. The infill is a multi-storied channel complex demonstrating several episodes of cut and fill. Previous research on the Wolfville Formation has not investigated these erosional surfaces. Heterogeneities in porosity and permeability along erosional boundaries could create preferential pathways, baffles, or barriers to fluids in the subsurface. The objective of this study is to investigate diagenetic variance across the erosional boundaries and the potential impacts on fluid flow. Measured sections from the outcrop describe the lithofacies changes across the surfaces, and handheld gamma ray scintillometer/spectrometer measurements record changes in radioactive mineral content to supplement lithologic observations. The Wolfville Formation at this location is a coarse-grained, subangular to angular red sandstone that is well cemented with carbonate. Petrographic analyses of samples above and below bounding surfaces show that the sandstones have undergone varied paragenetic processes including burial cementation, limited mechanical compaction, partial dissolution of unstable feldspars and cements, and alteration. Cements tend to be sparry and void filling, which is characteristic of the phreatic zone. Some samples also show bladed grains or thin cement rims. Dull cathodoluminescence of the cement suggests formation in a burial environment with higher Fe/Mn ratio, and zoning of some cement crystals indicates multiple phases of diagenesis. Presence of pore-filling cement impedes fluid flow within lithofacies packages, which may create preferential pathways along the varied erosional surfaces.

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