Development and Utilization of Geochemical Correlation Techniques for Advanced Stratigraphic Control in the Charlie Lake Formation, British Columbia, Canada

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The Upper Triassic (Carnian) Charlie Lake Formation occurs extensively in outcrop and subsurface in northeastern British Columbia, Canada. It is a thick (up to 350 m), primarily unfossiliferous, heterolithic succession of mixed siliciclastic, carbonate, and evaporitic rocks. Historically, these rocks have been interpreted to represent coastal sabhka or arid back barrier depositional environments.

Examined reservoir lithologies in this interval include dolomitic mudstone / siltstone beds (interpreted as diagenetically enhanced cyanobacterial laminites) and thin (1-6 m) sandstone intervals (interpreted as aeolian dunes). The lateral extent of these dune-prone intervals and the nature of the dune fields have been the source of considerable disagreement due to inconsistencies in regional correlation and poor well control. Difficulties in regional correlation have arisen from the non-marine nature of this unit (and a concomitant lack of biostratigraphically useful fossils), and the presence of numerous unconformities and diastems. Consequently, the integration of traditional methodologies (well log correlations, core analysis, and petrography) with detailed whole rock geochemical data, provide a framework within which more accurate correlations can be made. Preliminary analyses have allowed for development of a detailed, internally consistent stratigraphic framework within the study area and have allowed for subdivision of the study interval into a series of synchronous slices.

Through geochemical analysis, it becomes apparent that three distinct, non-random, dune-prone intervals occur within the Charlie Lake Formation study area; all three being associated with late highstand system tract conditions. The lowest of these three units is assigned to the Artex Member. This interval was deposited during an interval of rapid shoreline progradation to the west. The dunes are preserved in a series of shore-parallel lows formed as ephemeral lakes and lagoons that were abandoned during migration of the shoreline to the west. Two more dune-prone intervals have been identified, in the medial and upper Charlie Lake Formation. The use of an integrated approach for stratigraphic correlation relying heavily upon whole-rock geochemical analyses and correlation, has allowed for development of predictive facies models in these dune-prone intervals.