New source-to-sink paradigms: how to reconcile deepwater seismic stratigraphy and geochronological observations from the Shelburne Sub-basin with current scaling relationships for fan run-out-lengths

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The Upper Cretaceous stratigraphic succession (Logan Canyon Formation) in the deepwater portion of the Scotian Margin has been described as a shale-prone interval with few sandstone units. However, seismic mapping shows that channelization is ubiquitous across the margin, even though there are variations in the frequency and distribution of sedimentary pathways. Identification of this variability plays an important role in determining sandstone presence and its potential reservoir distribution along the Nova Scotia margin.

Only a few wells penetrated the Logan Canyon Formation in this region, and most of these penetrations reported shale-prone intervals with some thin-bedded sandstone. A regionally extensive mapping exercise allowed us to identify broader areas of channelization in the offshore Scotian Margin that reach the outboard region of the salt domain. These observations suggest these turbidite systems were penetrated in the bypass zone in the upper part of the slope, and thus potential exists to encounter deepwater sandstones in more distal parts of the system.

Source-to-sink understanding is increasingly critical as exploration pushes into frontier and/or unexplored basins, yet there are few examples or method-of-analysis for studying source-to-sink relationships in ancient systems. This work documents a clear example of added uncertainty in ancient systems when fan run-out lengths from the Upper Jurassic and Middle Cretaceous intervals do not scale to drainage areas. Lithological fractionation, paleoclimate, and changes in hypsometry are playing a key role controlling the fan run-out lengths. Provenance studies support source-area discrimination and insights on headwater uplift ages. This work documents and provides an integrated workflow for source-to-sink analysis in ancient systems.

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