Sequential hyperextension, continental faulting, and the evolution of drainage systems, southeastern Canadian margin

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Provenance studies based on multiple techniques, together with deposited sediment volumes, are used to estimate relative proportions of sediment supplied from major source areas and to assess how regional faulting and uplift controlled sediment supply to the Scotian Basin. Most Jurassic sediment supply was derived locally from small rivers draining the Appalachians of Newfoundland, Nova Scotia, and Maine. Through the Tithonian to Barremian, the influence of far-travelled detritus from Labrador and New Brunswick became increasingly important, interrupted in the Aptian by a major tectonic diversion of sediment supply, and followed in the Aptian to early Cenomanian by increased supply from Labrador.

Some major tectonic changes on the actively extending margin of the Grand Banks, such as Tithonian onset of rifting, Berriasian culmination of rifting in the south and Hauterivian in the north, are recognised in the Scotian Basin and its hinterland. Other major events in the Scotian Basin, particularly in the Aptian and early Cenomanian, appear related to subtle vagaries in river pathways. Reactivation of late Paleozoic faults in the Early Cretaceous played an important role in enlarging drainage basins and changing river courses. In particular, during the Aptian the main Sable River was probably diverted westward to deposit the McMurray Formation in Alberta.

The separation of Europe and Greenland from eastern Canada migrated progressively northward through the Cretaceous. The Aptian–Albian boundary is marked by a significant anticlockwise change in extension direction and the propagation of sea-floor spreading north of the Charlie Gibbs Fracture Zone. In the northern Appalachians, crust to the south was influenced by hyperextension along the Iberia–Goban–Porcupine and Newfoundland margin, but farther north there was only limited rifting. We evaluate whether it was mantle processes related to Tethyan subduction, or crustal processes related to hyperextension that led to dextral strike-slip reactivation of the old Paleozoic lineaments in the continent.

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