

# From Gondwana to Pangea: genesis of West Avalonian silicic igneous rocks from Neoproterozoic to Late Ordovician by repeated partial melting of the lower crust

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Avalonia is a terrane that originated along the Gondwanan margin in the Neoproterozoic but was transferred to Laurussia in the Paleozoic. Its many episodes of igneous activity include ensialic arc-related magmatism along the Gondwanan margin in the late Neoproterozoic, translation along that margin in the Cambrian and separation from Gondwana in the Early Ordovician. The application of MELTS modeling demonstrates that some of the Neoproterozoic to Middle Ordovician silicic rocks of the West Avalonia in the Antigonish Highlands, Nova Scotia, can be derived by equilibrium partial melting of lower crustal lithologies, as represented by exposed mafic granulites and orthogneiss, at a pressure of 0.8 GPa and  $fO_2 > FMQ$ . The chief difference between the model conditions is the water content. The Neoproterozoic rocks can be derived by ~35% partial melting of a hydrous source (i.e.,  $H_2O = 3$  wt.%) whereas the Cambrian rocks can be derived by ~15% melting of comparatively dry source ( $H_2O = 0.5$  wt.%). Similarly, the Middle Ordovician rocks can be generated by high amounts of melting (i.e., ~50%) of a hydrous source (i.e.,  $H_2O = 5$  wt.%) whereas the Late Ordovician rocks require a relatively dry source. The difference in melting conditions is consistent with their tectonic setting as the Neoproterozoic and Middle Ordovician rocks were generated at an arc setting whereas the Cambrian and Middle Ordovician rocks are characteristic of rocks from an extensional setting. The results show that the same crust underlay the Antigonish Highlands from its origin along the Gondwanan margin, to its rift and drift towards Laurussia.