

### **Grenville, Appalachian, and Atlantic tectonics in eastern Canada: the Harry Hibbs Effect**

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Multiple ocean opening-closing cycles along the same seam is called the Harry Hibbs Effect, honouring a famous Newfoundland accordionist. In eastern Canada, the Precambrian Grenville Orogen, the Paleozoic Appalachian Orogen, and the modern Atlantic continental margin are all parallel and divisible into parallel zones that express their origins through successive Wilson cycles; the Precambrian Uranus, the Paleozoic Iapetus, and the modern Atlantic cycles, respectively.

Analyses of the Atlantic margin and Appalachian miogeocline are complementary. Rifting and passive margin stages of the Atlantic margin have counterparts in the Appalachian miogeocline, including the important breakup unconformity that separates the rifting stage from the drifting stage of continental margin development. Outboard terranes of the Appa-

lachian Orogen were accreted during Iapetus closing in the Ordovician and Silurian.

The Grenville Orogen lacks contemporary stratigraphy. Apart from a few younger groups and plutons in the southeast, almost all its rocks were metamorphosed and deformed previous to Grenville Orogeny. Deep seismic reflection surveys confirm surface observations that the orogen is asymmetric, one-sided and consists of southeast dipping crustal-scale imbricates bounded by northwest directed, broad ductile thrust zones. These are underlain by a basal crust-penetrating thrust expressed at the surface as the Grenville Structural Front. Latest analyses distinguish an Exterior Thrust Belt, divided into a parautochthon and allochthon, and an Interior Magmatic Belt. Comparisons with the Appalachian Orogen

give some insight into Grenvillian orogenic phases and rationalizes its orogen-parallel belts.

Some offsets of the Atlantic margin mimic boundaries between Paleozoic lower crustal blocks or Grenville features. The Paleozoic Dover Fault projects into the Charlie Gibbs Fracture Zone. The Grenville Structural Front is expressed in

the Atlantic margin offset at the Cartwright Arch and its seaward prolongation into the Cartwright Fracture Zone. Zigzag, orthogonal shapes of rifted continental margins controlled the shapes of the ensuing Grenville and Appalachian collisional orogens. Examples of ancestral controls are common.