The geological development of the Humber and Western Dunnage zones: the Wilson Cycle and much more

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The Humber and Dunnage Zones provide a spectacular record of the Wilson Cycle, involving Late Precambrian to early Paleozoic opening and closing of the proto-Atlantic or Iapetus Ocean. The Humber Zone constitutes the ancient western continental margin to the ocean. The evolution of the zone involved initial rifting of its Grenvillian basement during the latest Precambrian with associated rift-facies sedimentation and volcanism, followed in the Early Cambrian by the establishment of a passive continental-margin shelf, slope and basin sequence. Passive continental-margin sedimentation was terminated at the end of the Early Ordovician by the emplacement of an imbricate thrust stack (Taconian allochthons) over the shelf. This event caused drowning of the shelf and the establishment of a deep-water foreland basin which was infilled by sediment derived from the advancing thrust sheets. The lower slices of the thrust stack consist of rocks from the nearby continental margin. The highest slices of the allochthons consist of ophiolite suites and represent fragments of the Dunnage Zone which have been thrust over the miogeocline.

The Dunnage Zone has traditionally been viewed as vestiges of the Iapetus Ocean accreted onto the North American margin during the Taconian orogeny. Ophiolites, interpreted as fragments of the Iapetus mid-ocean ridge crust and mantle, were considered to represent the oldest rock units in the zone, and associated volcanic and sedimentary sequences were inferred to represent younger island arc assemblages developed on the Iapetus crust. Recent geochemical and geochronological data indicate a more complex history in which the ophiolites invariably formed in a supra-subduction zone environment associated with older island arc sequences.

Although the Wilson model has proved remarkably durable in explaining the early Paleozoic character and evolution of the Newfoundland Appalachians, major problems remain in understanding the mid-Paleozoic and later history of the orogen. For example: the timing, character and distribution of the Silurian Salinic versus the Devonian Acadian orogenic events in the Humber and the western Dunnage Zones remain unresolved; and did the driving mechanism for the mid-Paleozoic rock units and associated orogenic events evolve in an environment of continued oceanic subduction or continental collision (Iapetus open or closed)?