
Evolution of the Iapetus Ocean in the Appalachian-Caledonide orogen: what can we learn from modern continental margins?

JOHN W.F. WALDRON¹, DAVID I. SCHOFIELD², AND
J. BRENDAN MURPHY³

1. *Department of Earth and Atmospheric Sciences, University of
Alberta, Edmonton, Alberta T6G 2E3, Canada*

*<john.waldron@ualberta.ca> ¶ 2. British Geological Survey,
Columbus House, Greenmeadow Springs, Cardiff, Wales CF15
7NE, United Kingdom ¶ 3. Department of Earth Sciences,*

*St. Francis Xavier University, Antigonish, Nova Scotia B2G 2W5,
Canada*

The Appalachian-Caledonide orogen is divided by the Mesozoic-Cenozoic Atlantic Ocean. Both parts of the orogen have been subdivided in zonal and terrane-based schemes, leading to several proposed correlations between the two segments. One significant source of variability is the Mesozoic fit assumed prior to Atlantic opening. Most reconstructions have been based on a 'loose' fit that does not take into account Mesozoic stretching. A more realistic fit taking into account the thinning of the conjugate margins reduces the reconstructed distance between the reconstructed Paleozoic terranes of Newfoundland and Ireland by as much as 50%.

The margin of Laurentia underwent protracted rifting from ~615 Ma to at least 550 Ma, and perhaps later. A Neoproterozoic 'early' Iapetan rift probably developed east of Dashwoods and other peri-Laurentian microcontinents; this was superseded by a western rift between these microcontinents and the Laurentian margin. Analogies with modern oceans suggest that this rift-drift history

would have substantially separated Dashwoods from the Laurentian margin.

Subduction of the Paleozoic Iapetus Ocean began relatively soon after its opening at ~515–505 Ma. The earliest collisional events are recorded almost simultaneously in Laurentian and peri-Gondwanan elements during the Early Ordovician, 490–480 Ma. This suggests that subduction was not initiated at a mature passive margin, a commonly assumed, but non-actualistic part of the 'Wilson cycle'. Closure of the ocean between Avalonia and Laurentia was complete by ~425 Ma.

We propose that Iapetus Ocean closure was initiated at a subduction zone migrating from the adjacent external 'Paleopacific' in a manner analogous to the Mesozoic-Cenozoic capture of the Caribbean plate in the Atlantic realm. This hypothesis may help to explain: the initiation of subduction and the early closing of the Iapetus; the timing of the earliest collisional events; the isotopic character of Iapetan ophiolites; and the distribution of peri-Gondwanan terranes in the orogen.