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# How was the Iapetus infected with subduction

John Waldron (1), David Schofield (2), J. Brendan Murphy (3), and Chris Thomas (2)

(1) Earth & Atmospheric Sciences, University of Alberta, Edmonton, Alberta, Canada, (2) British Geological Survey, Columbus House, Greenmeadow Springs, Cardiff, Wales, UK, (3) Earth Sciences, St. Francis Xavier University, Antigonish, Nova Scotia, Canada

The history of the Iapetus Ocean is the archetype for the "Wilson cycle". The most poorly understood part of the Wilson cycle is the transition between ocean opening and ocean closing. It is often assumed that subduction is initiated by subsidence of old, cold ocean floor at passive margins. However, in the best modern analogue, Atlantic margins formed at ∼180 Ma are still passive, suggesting that some other mechanism is required to initiate subduction.

In most tectonic reconstructions of the Appalachian-Caledonide orogen, the continental blocks (Laurentia, Baltica, and Amazonia – West Africa), which separated to form the Iapetus during the breakup of Rodinia, are the same three continents that subsequently collided during closure, making the Iapetus a test case for models of subduction initiation. The margin of Laurentia underwent protracted rifting from ∼615 Ma to at least 550 Ma, and perhaps later. The earliest "drift" successions on the Newfoundland margin are as young as ∼515 Ma. Subduction, recorded by arc volcanics preserved in the orogen, began relatively early in the history of the new ocean at ∼515-505 Ma, and the earliest collisional events are recorded almost simultaneously in peri-Laurentian and peri-Gondwanan microcontinents around 490-480 Ma. However, the stable passive margin of Laurentia survived until after 470 Ma before being converted to an active margin. Closure of the ocean between Avalonia and Laurentia was complete by ∼425 Ma.

These relationships are difficult to reconcile with a classic Wilson cycle in which subduction is initiated by inversion of an extensional margin. It is much more likely that closure was initiated at a subduction zone migrating westward into the Iapetus, analogous to the eastward Mesozoic-Cenozoic entry of the Caribbean and Scotia plates into the Atlantic realm. This process was probably initiated at a transform boundary between the "internal" ocean formed during the breakup of Rodinia, and "external" Panthalassan lithosphere, and progressively "infected" the Iapetus with subduction. This model may help to explain: the initiation of subduction and the early closing of the Iapetus; the timing and distribution of the earliest collisional events; the isotopic character of some Iapetan ophiolites; and the distribution of peri-Gondwanan terranes in the orogen.