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How was the Iapetus Ocean infected with subduction?

John W.F. Waldron[1], David I. Schofield[2], J. Brendan Murphy[3], and Chris W. Thomas[4]

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

[2]*British Geological Survey, Columbus House, Greenmeadow Springs, Cardiff, Wales, UK, CF15 7NE*

[3]*Department of Earth Sciences, St. Francis Xavier University, PO Box 5000, Antigonish, NS Canada B2G 2W5*

[4]*British Geological Survey, Murchison House, West Mains Road, Edinburgh, EH93LA, Scotland*

EXTENDED ABSTRACT

Subduction initiation remains a poorly understood, yet critical, part of the plate tectonic cycle. The early Palaeozoic Iapetus Ocean provides insight into this process by virtue of its short lifespan, apparent simultaneous subduction on opposing margins (e.g. van Staal et al., 1998), and the final assembly of Laurentia, Baltica and Amazonia in an arrangement broadly similar to their original configuration; the overall history of the resulting Appalachian – Caledonide orogen thus matches the "introverted" supercontinent assembly process of Murphy and Nance (2003). Most models assume that subduction was initiated by foundering of mature passive continental margins. We propose an alternative model, in which subduction was initiated at a boundary between the "internal" Iapetus and the "external" paleo-Pacific, analogous to the Mesozoic-Cenozoic development of the Scotia and Caribbean arcs in the modern Atlantic.

In this paper we review the evidence from rifting and subduction initiation and propose that subduction is more likely to have entered the Iapetus following initiation at the boundary with the external paleo-Pacific, similar to the incursion of the Scotia, Caribbean, and Gibraltar arcs into the modern Atlantic. The subduction zone is proposed to have become sinuous and entrained fragments of the Gondwanan margin along its complex sinistral southern boundary causing Monian / Penobscottian deformation. Following Taconian / Grampian collision of part of the subduction system with Laurentia, remaining parts of the Iapetus Ocean were progressively "infected" with subduction (cf. Mueller & Phillips, 1991). The infection of the Iapetus with subduction may explain the early transition from opening to closing, and the complex collage of terranes in the central part of the orogen, many of which were deformed well before Silurian closure. By analogy, the future of the Atlantic may involve subduction propagating from the Caribbean, Scotia, and Gibraltar arcs, leading to collision and orogenesis.

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