

## Animated history of Avalonia in Neoproterozoic – Early Palaeozoic

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### Abstract

Current debate regarding the configuration and breakup history of the late Precambrian supercontinent Rodinia has focused on the development of Grenville-aged orogenic belts and the evolution of Neoproterozoic passive margin sequences. However, supercontinent amalgamation and breakup also have profound tectonic effects on the evolution of continental margins that continuously faced oceans as the supercontinent assembled and dispersed. This evolution is commonly recorded by exotic terranes along the continental margin. For Rodinia, these would include exotic terranes within the Appalachian, Caledonide and Variscan orogens that are interpreted to have evolved along an active margin of Neoproterozoic Gondwana. Isotopic data indicate that some of these peri-Gondwanan terranes originated from ca. 1.2 to 1.0 Ga juvenile crust within a Panthalassa-type ocean that surrounded Rodinia and became accreted to the Gondwanan margin by 650 Ma. Other terranes, however, formed along this margin by recycling ancient Gondwanan crust.

These interpretations require specific relationships with Gondwana that can be tested against the paleomagnetically constrained movements of Laurentia and Gondwana from ca. 800-500 Ma. Problematically, Amazonia is unconstrained paleomagnetically, and there is a lack of reliable paleomagnetic data from Laurentia between 720 and 615 Ma. In addition, some models favour a high latitude for Laurentia around 570 Ma whereas others favour a low latitude. To these two models we apply two approaches, which we present in four animations. The first approach assigns the minimum movement to Laurentia and Gondwana required to satisfy the paleomagnetic data and examines the relationship between this motion and the contemporaneous tectonothermal evolution of the peri-Gondwanan terranes. The second again satisfies the paleomagnetic data but in time periods where there is no data Laurentia and Gondwana are permitted to migrate in a fashion that would make them compatible with the tectonothermal history of peri-Gondwanan terranes. The available paleomagnetic data from both West and East Avalonia, although not of high quality, show systematically lower paleolatitudes than predicted by these models. Hence, a suggestion from both approaches is that either Laurentia had a more complicated movement history between 720 and 615 Ma than is currently constrained by the available data, or the configuration of Laurentia – W.Gondwana – Avalonia on many reconstructions is incorrect. Although the Laurentia – W.Gondwana fit shown in this paper is constrained by the abundant Neoproterozoic paleomagnetic poles for Laurentia and Baltica, several tests of this configuration, including the correlation between Dalradian Scotland and the Peruvian Arequipa massif and the discovery of the Neoproterozoic Marañon belt in the northern Andes, have failed to provide conclusive proof.

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