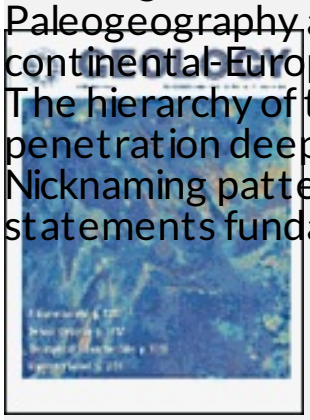

Proto-Avalonia: A 1.2–1.0 Ga tectonothermal event and constraints for the evolution of Rodinia

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Abstract

The Neoproterozoic evolution of Avalonia is thought to have been geodynamically linked to the amalgamation and dispersal of Rodinia. Similar Sm-Nd isotopic signatures for different periods of arc activity suggest that Avalonian basement, or proto-Avalonia, was generated in a series of primitive oceanic island arcs between 1.2 and 1.0 Ga. Because this interval coincides with the amalgamation of Rodinia, proto-Avalonia is inferred to have been located in a Panthalassa-like peri-Rodinian ocean. An early (760–660 Ma) phase of Avalonian arc activity is attributed to renewed subduction in the peri-Rodinian ocean following the breakup of Rodinia, which caused the accretion of Avalonian terranes to the Gondwanan margin by ca. 650 Ma. Further subduction along the margin occurred outboard of these terranes and resulted in the onset of main-phase Avalonian volcanism at 630 Ma. The diachronous cessation of arc magmatism is attributed to ridge-trench collision and the generation of a continental transform. The geodynamic link between Avalonia and Rodinia is analogous to that between the Mesozoic dispersal of Pangea and the tectonothermal evolution of western North America. This event also resulted in the accretion of outboard terranes and in arc-related magmatism that is currently being terminated in a diachronous manner by ridge collision and the generation of the San Andreas transform. The model implies that the Neoproterozoic evolution of Avalonia and other peri-Gondwanan terranes provide important constraints on the tectonic history of a large portion of the Rodinian continental margin.

Index Terms/Descriptors

Avalonia | continental margin | magmatism | mid-ocean ridges | Neoproterozoic | ocean floors | paleogeography | plate boundaries | plate tectonics | Precambrian | Proterozoic | Rodinia | subduction | supercontinents | tectonics | terranes | trenches | upper Precambrian | volcanism

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