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AVALON, AN EXOTIC APPALACHIAN-CALEDONIDE TERRANE OF WESTERN SOUTH AMERICAN PROVENANCE

J. Duncan Keppie
Department of Mines and Energy, P.O. Box 1087, Halifax, Nova Scotia, Canada, B3J 2X1

It has been common practice to correlate the Avalon with northwest Africa using the Late Proterozoic geological record and the assumption that relative motions across Iapetus and the Atlantic were orthogonal. However, the Avalon Composite Terrane is defined by a distinctive Cambrian-Ordovician lithostratigraphic sequence that contains an unique Avalonian fauna. This contrasts with the Cambrian-Ordovician lithostratigraphy of northwest Africa, Iberia and France which contains a Tethyan fauna, archeocyathid limestones and the Armorican quartzite. Using the lithostratigraphic definition, the Avalon Composite Terrane is restricted to the eastern margin of the Appalachians from Boston (Massachussetts) along the eastern Maritime seaboard to eastern Newfoundland reappearing in southeast Ireland, Wales, English Midlands and the northern margin of the Variscides in continental Europe.

The geological record of Avalon Composite Terrane in Maritime Canada consists of: (1) a basement of unknown age; (2) intrusion of syenite at 1172+135/-73 Ma; (3) a Middle Proterozoic shelf sequence (George River = Green Head groups); (4) Middle Proterozoic deformation and high grade metamorphism at 918 + 78/-179 Ma; (5) Late Proterozoic volcano-sedimentary sequences developed in a volcanic arc complex, that contain detrital zircons with concordant U-Pb ages of 610-630 Ma, 1000 Ma, 1160-1200 Ma, 1520-1550 Ma, 1835 Ma, 1950-2000 Ma and 2600 Ma; (6) a Cambrian-Ordovician overstep sequence containing Avalonian fauna deposited in a transpressive environment characterizing the last stages of convergent tectonism; and (7) a Silurian-Early Devonian shelf sequence containing a Rhenish-Bohemian fauna.

The ca. 1 Ga tectonothermal event is absent in northwest Africa, Iberia and France. However, the combination of 500-600 Ma (Brasiliano orogens), 900-1100 Ma (Sunsas orogen), 1250-1450 Ma (Rhondonian orogen),

1500-1750 Ma (Jurena-Rio Negro orogen), 1900-2250 Ma (Maroni-Itaciaunas orogen) and 2600 Ma events found in the southwestern Guyana craton and in the Arequipa Massif of coastal Peru may be the provenance of the Avalon. Avalonian fauna have been recorded from the Cambrian in Columbia and Rhenish-Bohemian fauna are known in the Silurian of the Merida Andes. Thus this region may provide a better source for the Avalon Composite Terrane.

Silurian paleomagnetic data suggest that northwest South America collided with eastern North America at this time (Fig. 1). During this collision the Avalon suffered escape tectonics producing sinistral shearing along the Appalachians and was transferred from South to North America. The remarkable similarity of the Late Proterozoic-Ordovician miogeoclinal sequence in San Juan region of western Argentina with eastern Laurentia (including the Hawke Bay event and North American fauna) suggests the possibility that San Juan is an exotic terrane derived from eastern North

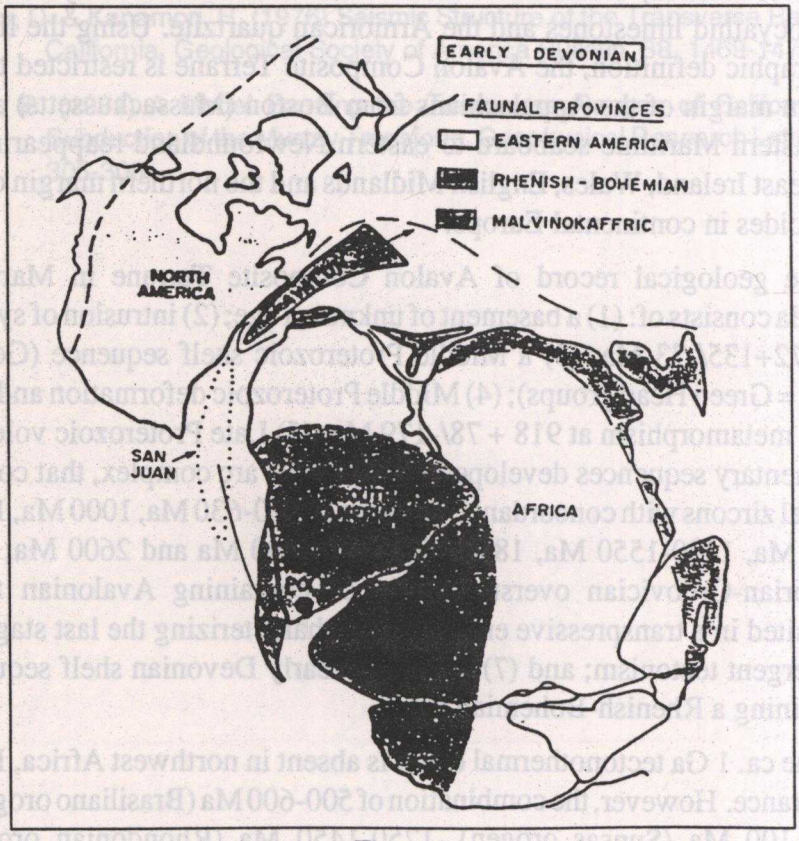

Figure 1

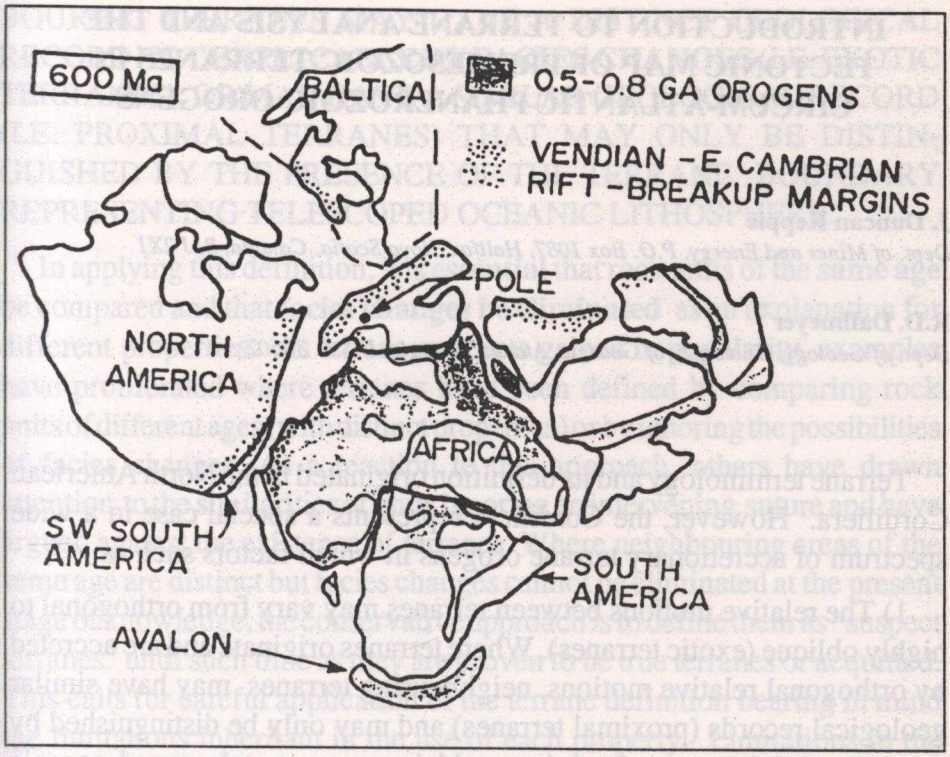

Figure 2

America. It is inferred that the San Juan terrane suffered complimentary escape tectonic and transferrence from North to South America during the Silurian collision.

Late Proterozoic paleomagnetic data provide little constraint on the various Pangean reconstructions proposed for this time. Opposing Late Proterozoic-Cambrian passive margin sequences bordering Iapetus exist in eastern Laurentia and in Gondwana from north Africa through Arabia and along northern India to western Australia. A Late Proterozoic reconstruction using these passive margin sequences places western South America adjacent to a paleo-Pacific ocean (Fig. 2). This may provide an explanation for the synchroneity of Late Proterozoic-Cambrian rift-drift tectonics in Iapetus and convergent tectonics from western South America through Antarctica to Australia. These incongruent sequences are nor juxtaposed across the Appalachians with the Avalon representing an exotic terrane. The Cambrian-Ordovician accretion of terranes in the eastern half of the Appalachians with the Avalon suggests that these terranes arrived in the Appalachians along with the Avalon.