
**U-Pb ages and Lu-Hf isotope compositions of magmatic
and detrital zircon in the Mira terrane, Cape Breton
Island, Nova Scotia, Canada**

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Combined laser ablation ICP-MS U-Pb and Lu-Hf isotopic analyses of detrital zircon from Neoproterozoic-Cambrian clastic sedimentary rocks and Neoproterozoic igneous rocks in the Mira terrane provide new insights into Avalonian crustal evolution. Detrital zircon populations younger than 800 Ma were derived from Avalonia, whereas older populations were derived from distal sources in the parent craton. Crustal evolution trends defined by $\epsilon\text{Hf}(t)$ values varying with age predict two long periods of juvenile magma production in the source continent at 1.2–2.2 Ga and 2.4–3.1 Ga with an “age minimum” between these events. Four periods of mixing juvenile and recycled crustal material in continental magmatic arcs are distinguished at 0.5–0.72 Ga, 1.4–1.7 Ga, 1.8–2.2 Ga, and 2.4–2.7 Ga, as well as a weakly represented period of zircon-forming events at ~0.75–1.2 Ga without any input of juvenile crust. These data provide a distinctive overall Hf isotopic signature for detrital zircon in Avalonia which matches closely with the crustal evolution in the Amazonian protocontinent, supporting the original position of Avalonia at the present northern margin of Amazonia.

Avalonian crustal evolution is detected in the younger detrital zircon grains and in zircon from igneous rocks formed in Avalonian-cycle arcs at ca. 680–550 Ma. Positive $\epsilon\text{Hf}(t)$ values suggest strong juvenile input from the mantle and variable mixing with older recycled crust. Most negative $\epsilon\text{Hf}(t)$ values are interpreted to represent recycling of predominantly Mesoproterozoic underlying crust, but likely also some Palaeoproterozoic and Archean crust. Initially in the Late Neoproterozoic – Early Cambrian sediment deposition in the Mira terrane occurred in separated belts. Juxtaposition of these belts likely occurred by strike-slip movement before and during deposition of lower Cambrian clastic sediments in a rift basin over the assembled belts. The youngest detrital zircon population (ca. 517 Ma) is interpreted to represent syn-rift magmatism before separation of Avalonia from Gondwana.