

U-Pb detrital zircon constraints on the terminal closure of Iapetus

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The Dog Bay Line is a major Silurian terrane boundary in the Exploits Subzone of the Appalachian orogen in Newfoundland. Late Ordovician-Early Silurian rocks (Badger and Botwood groups) northwest of the Dog Bay Line contain detritus sourced exclusively from Laurentia. These groups were deposited on peri-Gondwanan volcanic arc terranes that were accreted to Laurentia in the Middle Ordovician. The Davidsville and Indian Islands groups southeast of the Dog Bay Line have stratigraphic links to peri-Gondwanan terranes and were deposited during the Late Ordovician-Early Silurian upon the peri-Gondwanan margin of Iapetus and were accreted to Laurentia in the Silurian.

A change from Paleozoic-dominated to Meso- and Neoproterozoic-dominated detritus in sequences northwest of the Dog Bay Line is attributed to Ordovician collision and rapid exhumation of peri-Laurentian arc terranes of the Notre Dame Subzone. Uplift related to extensional collapse of these accreted arc terranes re-exposed Laurentian basement which eroded and deposited detritus from the latter into the Botwood Group. Salinic orogenesis resulting from the collision of Ganderia with Laurentia resulted in obduction and erosion of the accreted Victoria and Exploits arcs and deposition of the detritus into a fore-arc basin on Laurentia.

The absence of zircon in the ca. 510–550 Ma and 1550–1600 Ma range northwest of the Dog Bay Line and paucity of ca. 1600–1700 Ma zircons southeast of the Dog Bay Line suggest the presence of a Silurian arm of the Iapetus Ocean that separated Laurentia from peri-Gondwanan terranes of Ganderia and Avalonia. The change in Late Ordovician deep marine turbidites to Early Silurian stable-shelf rocks and non-marine, subaerial sediments east of the Dog Bay Line parallels that on the Laurentian margin and indicates the destruction and subsequent closure of Iapetus. The upper formations of the Botwood Group contain ca. 700–800 Ma zircons that are atypical of Laurentia, but are common in peri-Gondwanan terranes, and suggest that the youngest rocks of the Botwood Group may postdate closure of the Dog Bay Line and transgress the suture as an overlap sequence.

The presence of Silurian orogenesis on both the Laurentian and peri-Gondwanan margins of Iapetus is consistent with the closure of the Tetagouche–Exploits basin and Iapetus Ocean by the Late Silurian. Laurentia and Ganderia subsequently collided, suggesting that rocks along the Dog Bay Line represent the last known occurrence of Iapetus Ocean in the northern Appalachian orogen.