Field relations, structure, and provenance studies of Cambrian rocks in the Saint John area, southern New Brunswick

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Cambrian sedimentary rocks in the Saint John area of New Brunswick are assigned to the Saint John Group, and divided into (from oldest to youngest) the Ratcliffe Brook, Glen Falls, Hanford Brook, Forest Hills, Kings Square, Silver Falls, and Reversing Falls formations. The lowermost four formations are preserved only in fault-bounded slivers along the northern and, to a lesser extent, southern margins of the Cambrian belt in Saint John, and in folds associated with thrusting in the Mystery Lake area. Most of the exposed area of the Saint John Group is intensely folded Kings Square Formation. The overlying Silver Falls and Reversing Falls formations are preserved only locally in synclinal keels. The Ratcliffe Brook Formation is age-equivalent to the Chapel Island Formation in eastern Newfoundland and likely extends back into the Ediacaran Period of the Late Neoproterozoic. Redbeds in the Ratcliffe Brook Formation differ from similar rocks in the underlying Seeley Beach Formation of the Coldbrook Group (equivalent to the Rencontre Formation of eastern Newfoundland) in containing abundant detrital muscovite and less abundant pyroclastic material. New $^{40}Ar/^{39}Ar$ data from the detrital muscovite indicates a maximum age of ca. 620 Ma, and a minimum age of 550 Ma. The depositional age of the upper part of the Ratcliffe Brook Formation is constrained by a U-Pb (zircon) age of ca. 531 Ma from an ash horizon, previously published by Isachsen and others. As originally defined, the overlying Glen Falls Formation consisted of grey to white quartz arenite and overlying black phosphatic and glauconitic quartz arenite. Based on paleontological evidence, only the white quartz arenite is considered to be equivalent to the lithologically similar Random Formation of eastern Newfoundland, whereas the upper phosphatic and glauconitic part is included with the Hanford Brook Formation. Laser ablation MC-ICPMS analysis of 100 detrital zircons from the white quartz arenite in the Glen Falls Formation yielded a nearly unimodal age population with a peak at ~540 Ma, similar to the age of zircon grains in the dated ash unit in the underlying Ratcliffe Brook Formation. The age of the Hanford Brook Formation is constrained to Late Early Cambrian by fossils and also by a U-Pb (zircon) age of ca. 511 Ma from an ash horizon, previously published by Landing and others. The unconformably overlying Forest Hills Formation is mainly shale, equivalent to the Middle Cambrian Chamberlains Brook and Manuels River formations in eastern Newfoundland. The Kings Square Formation consists of interbedded, muscovite-rich, fine-grained sandstone, shale, and siltstone, and is equivalent to the Middle to Upper Cambrian MacLean Brook Group of Cape Breton Island. The overlying Upper Cambrian to lower Ordovician Silver Falls and Reversing Falls formations have been assigned to the Chesley Drive Group by some other workers. Nd isotopic data indicate that the provenance changed during deposition from more juvenile sources in the Seeley Beach, Ratcliffe Brook, and Glen Falls formations to more evolved sources in the Late Cambrian part of the sequence.

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