Late Neoproterozoic plutons in the southern Cobequid Highlands, Nova Scotia, Canada: Field relations, petrology, and petrogenesis

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The Cobequid Highlands of northern mainland Nova Scotia form an enigmatic part of Avalonia in the northern Appalachian orogen. Historically the Cobequids have been divided into two blocks separated by the Rockland Brook Fault, the Jeffers block to the north and the Bass River block to the south, although the position of the boundary in the east (Mount Thom area) is uncertain. This study focuses on known or inferred Late Neoproterozoic plutons (Frog Lake, Debert River, Gunshot Brook, and McCallum Settlement) in the main Bass River block, (between the Rockland Brook and Cobequid faults) and does not include plutons in the east (Mount Thom area) which appear to be both older and younger than Late Neoproterozoic. The Debert River, Gunshot Brook, and McCallum Settlement plutons include diorite, tonalite, granodiorite, granite, and alkali- feldspar granite. In contrast, the Frog Lake pluton consists of heterogeneous, variably mylonitic bodies of diorite, gabbro, and locally tonalite which are scattered throughout the southwestern part of the study area. Eight previously reported U-Pb (zircon) ages for samples from the Debert River, Gunshot Brook, and McCallum Settlement plutons range from ca. 575–612 Ma. However, not all of the published analyses are concordant and these plutons may be more similar in age than previously suggested. Hornblende from a dioritic body of the Frog Lake pluton yielded a previously published $^{40}Ar/^{39}Ar$ age of 622 ± 3 Ma, suggesting that it is older than the other plutons. Mylonitic granodiorite in Economy River yielded a previously published U-Pb (zircon) age of about 734 Ma, suggesting that it may be related to the ca. 750 Ma Mount Ephrairn Plutonic suite in the eastern highlands. Plagioclase in gabbroic and dioritic samples from the Frog Lake and McCallum Settlement plutons has labradorite compositions, whereas more granitic samples are less calcic. Amphibole is classified as calcic and mainly of magnesio-hornblende to actinolitic composition. Biotite compositions are consistent with those of biotite formed in calc-alkalic suites. New whole-rock chemical data from 54 samples, together with previously published data for about 55 additional samples, suggest that the dioritic to granitic units of the Debert River, Gunshot Brook, and McCallum Settlement plutons are a co-genetic calc-alkaline suite rocks formed in a subduction-related Andean-type continental margin. However, some of the dioritic samples from the Frog Lake bodies have higher Ti, V, and FeOt/MgO ratios, and display tholeiitic trends, indicating that they may not be genetically linked to the calc-alkaline suite.

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