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Late Devonian Magmatism and W–Mo–Cu Metallogeny at the Sisson Deposit in central New Brunswick, Northern Appalachians, Canada

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Siluro–Devonian post-accretionary granitoids of the New Brunswick segment of the Northern Appalachians host one of Canada's most significant polymetallic tungsten–molybdenum provinces, with direct relevance to national and global critical mineral supply chains. This potential has recently been underscored by the referral of the Sisson W–Mo–Cu project to Canada's Major Projects Office, reflecting its strategic importance in positioning Canada as a secure supplier of tungsten and molybdenum for domestic and allied industries. The Sisson Brook deposit is characterized as a low-grade, large-tonnage, structurally controlled, granitoid intrusion-related W-Mo vein stockwork deposit with measured and indicated resources of 387 Mt (0.067% WO_3, 0.021% Mo), making it one of the largest defined tungsten deposits in North America.

Across central New Brunswick, more than 80 Mo–Sn–W–Bi±Li greisen and vein-style occurrences are spatially associated with Devonian granitoids, such as the 380 Ma W–Sn–Mo–Be–F Burnthill Mine and Falls Creek Mo±W deposits, hosted by the Burnthill and Dungarvon granites, respectively, and the Sisson Brook deposit, underscoring the exceptional metallogenic fertility of this post-accretionary magmatic province. Geochronological and lithogeochemical data indicate that mineralization in the Burnthill Brook area formed during two closely spaced Neoacadian magmatic–hydrothermal pulses at ca. 380 Ma and 378 Ma. Re–Os molybdenite ages from Sisson Brook (ca. 378 Ma) overlap with the younger Burnthill event but are significantly younger than the adjacent ca. 420 Ma Nashwaak Granite and ca. 430 Ma Howard Peak Granodiorite. This relationship indicates that Sisson Brook mineralization was driven by concealed Late Devonian magmatism at depth, which supplied metalliferous fluids to the hydrothermal system.

Shared W–Mo vein-stockwork mineral assemblages, overlapping mineralization ages, and the presence of multiple exogranitic occurrences collectively point to a common magmatic source in the region. The Burnthill and Dungarvon granites, together with Sisson Brook, are now recognized as exposed margins of a regionally extensive Middle–Late Devonian intrusive complex, informally termed the Peaked Mountain Batholith. Comparable in scale and age to the Cornubian Batholith of southwest England, this framework defines a highly prospective ~300 km² magmatic footprint that remains underexplored due to limited exposure and restricted access.

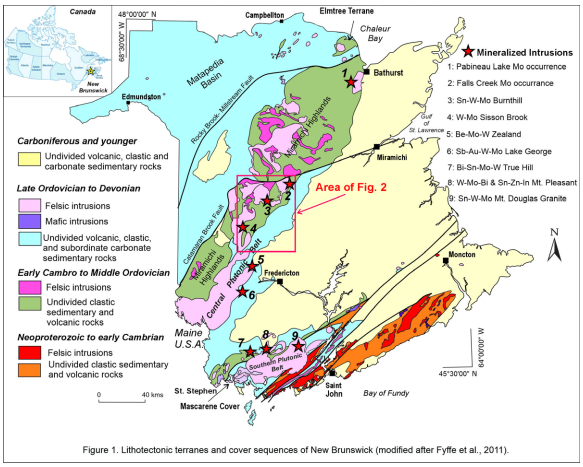


Figure 1. Lithotectonic terranes and cover sequences of New Brunswick (modified after Fyffe et al., 2011).

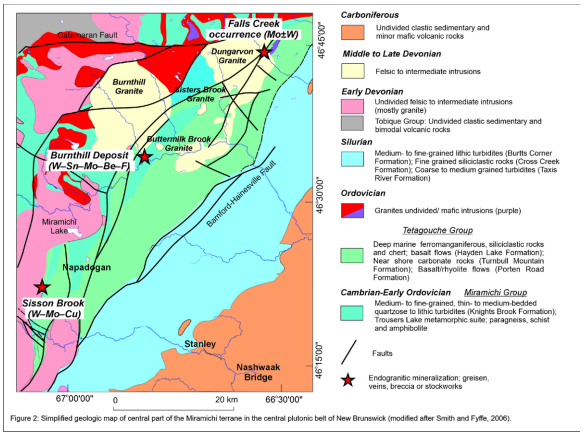


Figure 2: Simplified geologic map of central part of the Miramichi terrane in the central plutonic belt of New Brunswick (modified after Smith and Fyffe, 2006).