

*Surveys Branch, New Brunswick Department of Natural Resources,
Fredericton, New Brunswick E3B 5H1, Canada*

The Sisson Brook W-Mo-Cu deposit, situated in west-central New Brunswick, is hosted by Cambrian-Ordovician volcanic and sedimentary rocks of the Miramichi and Tetagouche groups. These have been intruded by the Early Devonian Howard Peak diorite-gabbro, Nashwaak Granite, a felsic dyke swarm spatially associated with mineralization, and a distinctive younger porphyritic dyke. This study focuses on classifying and petrogenetically characterizing the felsic units, based on their petrology and major- and trace-element geochemistry.

Petrophysical and lithogeochemical research has identified three types of felsic units in the vicinity of the deposit. The Nashwaak Granite is light pinkish grey, medium- to coarse-grained, and locally slightly foliated. Biotite is abundant (20%) in these samples with accessory zircon, apatite, monazite, magnetite, and ilmenite. This group has low Zr/TiO₂ (0.04 to 0.07), high K₂O (4.24 to 6.58 wt. %), A/CNK (>1.1), molar K₂O/Na₂O ratio (>1), Zr/Y (>3), (La/Yb)_N (2.35 to 31.9), and a high Fe/(Fe + Mg) (0.68 to 0.78).

The second felsic unit is a cross-cutting granitic dyke swarm ranges from a few centimetres up to 12 m wide. These unfoliated dykes are light greenish grey, medium- to coarse-grained, and typically have sharp boundaries that are locally irregular. Biotite (5%) coexists with apatite, pyrrhotite, and titanite. They are broadly characterized by high Zr/TiO₂ (0.06 to 0.19), low A/CNK (<1.1), molar K₂O/Na₂O (<1), Zr/Y (<4), and (La/Yb)_N (<7). They are ferroan with Fe/(Fe + Mg) up to 0.9.

The granite porphyry dyke is the third felsic unit, and yielded a concordant U-Pb zircon age of 364 ± 1.3 Ma from drill hole SSN-26. Phenocrysts consist of approximately 23% plagioclase (up to 1 cm), 10% quartz (up to 7 mm), 8% biotite (up to 0.03 mm), and 7% K-feldspar (0.2 to 1.0 cm). This porphyry dyke has low Zr/TiO₂ (0.03), A/CNK (0.99 to 1.05), molar K₂O/Na₂O (<1), medium Zr/Y (6.62), and medium (La/Yb)_N (8.91). Overall, the biotite compositions found within the three felsic groups are similar with slightly elevated Al contents and moderate Fe numbers. Plagioclase crystals are predominantly albitic with minor orthoclase, whereas the K-feldspars have a minor anorthite component.

All these granites were formed in a volcanic-arc environment (evolved I-type) and probably originated from infracrustal rocks contaminated by upper crust. These magmas have oxidized characteristics (*f*O₂ between 10⁻¹³ and 10⁻¹⁶), were emplaced at low pressures (An-Ab-Or diagram, <2.5 kbar) and low temperatures (*T*_{Zr} <800°C), and contain at least 6% wt. water (Holtz's P-T diagram). The *f*HF/*f*HCl ratio of the fluids, calculated from biotite EPMA analyses, are higher than typical porphyry Cu deposits, similar to W-related porphyry systems, and lower than porphyry Mo deposits. The formation of these granites is related to tectono-magmatic activity in the Canadian Appalachians in Early to Late Devonian time.

**Mineralogical, petrological, and petrogenetic
analysis of felsic intrusive rocks at the Sisson Brook
W-Mo-Cu deposit, west-central New Brunswick**

W. ZHANG¹, D. R. LENTZ¹, K. G. THORNE²,
AND C.R.M. McFARLANE¹

1. Department of Geology, University of New Brunswick, Fredericton,
New Brunswick E3B 5A3, Canada <wei.z@unb.ca> 2. Geological