

# U/Pb, Re/Os and Ar/Ar dating of the South Mountain Batholith and its Mineral Deposits<sup>1</sup>

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The peraluminous South Mountain Batholith (SMB) of Nova Scotia ranges in composition from least differentiated granodiorite and monzogranite to most differentiated leucomonzogranite and leucogranite. The most evolved fractions host polymetallic (Sn, W, U, Mo, Cu, Zn, Ag, and Mn) mineral deposits. We have attempted to: (i) constrain the age of granite emplacement and its relationship to the ca. 410 Ma Acadian orogeny; (ii) determine the temporal relationship between the different phases of the SMB; and (iii) assess the temporal relationship between SMB emplacement and mineral deposits formation. Here we integrate new age data (U/Pb on zircon and monazite, Re/Os on molybdenite, and Ar/Ar on muscovite) with published Rb/Sr, U/Pb, and Ar/Ar ages to constrain the duration of both magmatic and hydrothermal activity.

Zircon and monazite U/Pb data provide the best estimate of magma emplacement, and the oldest concordant zircon from granodiorite is  $380 \pm 3$  Ma. A leucomonzogranite from the Sn-Zn-Cu-Mo-Ag East Kemptville (EK) deposit has a discordant zircon age of 385 Ma, whereas an albitite from EK yields a monazite age of  $306 \pm 3$  Ma. Muscovite Ar/Ar data provide information on cooling history through the muscovite closure temperature. Single-grain Ar/Ar laserprobe ages for samples from mineral occurrences of the New Ross area (NRA), northeastern SMB, range from 382 to 320 Ma. Plateau ages within this range previously obtained by the incremental heating analysis of bulk separates are now interpreted as mean ages of variably reset muscovite grains. Molybdenite Re/Os data provide an age of mineralization. Samples from two metallogenic areas of the SMB yield the following results: (i)  $376 \pm 3$  Ma (pegmatite from EK) and (ii)  $377 \pm 3$  Ma and  $371 \pm 3$  Ma (aplite/pegmatite from the NRA).

These data, integrated with previous work, suggest that: (1) the age of emplacement for the SMB is  $\sim 380$  Ma, confirming its status as a late-orogenic intrusion in the Meguma terrane; (2) the main phases of hydrothermal activity leading to polymetallic mineralization occurred in close temporal relationship to granite emplacement; and (3) episodic tectonic-thermal-hydrothermal events took place at  $\sim 370$  Ma and  $\sim 300$  Ma, partially resetting the Ar/Ar system.

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