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**GEOLOGICAL SURVEY OF CANADA
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**$^{40}\text{Ar}/^{39}\text{Ar}$ biotite, muscovite, and hornblende ages from the
Cape Smith belt and Superior Craton, northern Quebec**

D.R. Skipton, M.R. St-Onge, and N.L. Joyce

2020



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2020

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ABSTRACT

This Open File presents forty-nine new $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating analyses of biotite, muscovite and hornblende from Paleoproterozoic strata of the Cape Smith belt and Archean orthogneiss of the Superior Craton in northern Quebec, Canada. Geological mapping and sample collection were conducted in the Cape Smith belt and surrounding Superior cratonic basement by the Geological Survey of Canada during 1985-1987 (mapping is summarized in St-Onge et al., 2007). In the portion of the Superior Craton located south of the Cape Smith belt, known as the Minto Block, geological mapping and sample collection were performed by the Geological Survey of Canada in 1961-1963 (Stevenson, 1968) and 1973 (Taylor, 1982). The $^{40}\text{Ar}/^{39}\text{Ar}$ thermochronological analyses presented here were carried out on thirty-two metaplutonic, metasedimentary and metavolcanic samples along a north-to-south transect across parautochthonous and allochthonous units and their bounding crustal structures in order to (i) delineate possible domains with different cooling histories and (ii) provide new insights into the post-collisional history of the Trans-Hudsonian orogenic front. Age determinations were conducted in 2004 at the Geological Survey of Canada Noble Gas Laboratory facility in Ottawa, Ontario, Canada.

REGIONAL GEOLOGICAL FRAMEWORK

The Cape Smith belt is a fold-and-thrust belt of middle Paleoproterozoic supracrustal and magmatic rocks that constitutes the foreland portion of the ca. 1.92 – 1.80 Ga Trans-Hudson Orogen in northern Quebec (Canada). The belt is underlain by the Archean lower-plate Superior Craton (Fig. 1). Specifically, along its southern boundary, the Cape Smith belt is underlain by the ca. 3.0-2.7 Ga Minto Block of the Superior Craton (Percival et al., 1994; Percival and Skulski, 2000), whereas the eastern and northern edges of the belt overlie ca. 3.2-2.7 Ga Superior crystalline basement (Parrish, 1989; St-Onge et al., 1992; 2002). Neoarchean (ca. 2702 Ma) tectonic reworking of the Minto Block produced peak metamorphic conditions of ~530–710°C and 2.7–5.8 kbar (Percival and Skulski, 2000). Post-thermal peak reheating (or cooling) has been interpreted from U–Pb titanite dates of 2686–2633 Ma from the Minto Block, and $^{40}\text{Ar}/^{39}\text{Ar}$ hornblende dates of ca. 2643-2641 Ma have been interpreted as cooling ages (Percival and Skulski, 2000). Beneath the northern boundary of the Cape Smith belt, Superior basement was affected by ca. 2.74-2.73 Ga granulite-facies metamorphism, and subsequent amphibolite-facies overprinting is recorded by ca. 1815-1785 Ma U–Pb titanite ages (Scott and St-Onge, 1995; St-Onge et al., 2006).

Paleoproterozoic continental rift successions of the Povungnituk and Chukotat groups (Fig. 1) were accumulated on the Superior continental margin between ca. 2038-1959 Ma and ca. 1918-1870 Ma, respectively (Parrish, 1989; St-Onge et al., 1992, 2002). Paleoproterozoic supracrustal and magmatic rocks formed outboard of the Superior margin, including the ophiolitic Watts Group (ca. 2000-1995 Ma), the clastic Spartan Group, and ca. 1863-1820 Ma arc plutons of the Parent

Group and Narsajuaq arc; together, these outboard units form the Narsajuaq arc terrane (Fig. 1; formerly known as the Ungava terrane), part of the Trans-Hudsonian upper-plate (Scott et al., 1992; Parrish, 1989; St-Onge et al., 2002).

The Cape Smith belt resulted from the terminal collision of the Trans-Hudson Orogen, between the lower-plate Superior Craton and overlying parautochthonous continental margin units, and the upper-plate Narsajuaq Arc terrane. Early thrusting in the Cape Smith belt occurred between ca. 1830 and 1815 Ma (St-Onge et al., 2006), and comprised south-directed, in-sequence, thin-skinned thrusts that imbricated the Povungnituk and Chukotat groups above the Minto Block (Lucas, 1989). As a result, the continental margin units and underlying ≤ 10 m-thick high-strain zone in the Minto Block were overprinted by greenschist- to amphibolite-facies Barrovian metamorphism at ca. 1820-1815 Ma (St-Onge and Lucas, 1995; St-Onge et al., 2002, 2006). From south to north in the Cape Smith belt parautochthonous cover units, peak metamorphic conditions increased from $\sim 400^\circ\text{C}$ and 6.3 kbar to 575°C and 9.1 kbar, reflecting a southward-tapering thrust wedge geometry (Lucas, 1989; St-Onge and Lucas, 1991, 1995; Bégin, 1992). The subsequent accretion of the Narsajuaq Arc terrane to the lower-plate Superior margin (ca. 1815-1795 Ma) was characterized by thick-skinned, out-of-sequence, south-vergent thrust faults in the Narsajuaq Arc terrane and the Superior continental margin cover sequences. In tandem, the basal décollement of this thrust system formed a high-strain zone in the underlying Superior Craton (Lucas, 1989; St-Onge and Lucas, 1995). The accretion of the Narsajuaq Arc terrane resulted in greenschist- to amphibolite-facies metamorphism (ca. 1820-1785 Ma; St-Onge et al., 2006) of the Narsajuaq Arc terrane and parautochthonous continental margin units, mainly localized in ductile high-strain zones surrounding thrust faults (St-Onge and Lucas, 1991). Additionally, the underthrust Superior Craton was overprinted by amphibolite-facies metamorphism (~ 585 - 720°C , 7.7-9.8 kbar; St-Onge et al., 2000) at (present-day) lateral distances of ~ 20 – 35 km from the basal décollement during ca. 1815-1785 Ma (Scott and St-Onge, 1995; St-Onge et al., 2006).

The Superior cratonic margin and the accreted Narsajuaq Arc terrane were affected by post-orogenic folding during ca. 1760-1740 Ma, including west- to northwest-trending folds and north- to northeast-trending cross-folds (Lucas, 1989; Lucas and St-Onge, 1992). Late- to post-collisional, ca. 1795-1758 Ma pegmatitic leucogranite dykes occur locally, and have been interpreted to result from partial melting of Povungnituk Group clastic rocks at depth (St-Onge et al., 2002).

Petrographic and field evidence indicate that biotite, muscovite and hornblende are fabric-defining minerals, and grew (or recrystallized) during the amphibolite-facies metamorphism (discussed above) that occurred in response to Cape Smith belt fold-and-thrust development. Consequently, muscovite, biotite and hornblende in the belt experienced peak amphibolite-facies temperatures of ~ 400 – 575°C for up to ~ 35 Myr, from ca. 1820 to 1785 Ma.

In high-strain zones in the Superior Craton beneath Cape Smith belt thrusts, the foliation defined by mica (\pm hornblende) has been transposed into parallelism with the metamorphic fabric in overlying thrust cover strata (St-Onge and Lucas, 1995; St-Onge et al., 2002). The ≤ 10 m-wide high-strain zone beneath the basal décollement along the southern edge of the Cape Smith

belt represents the known southern extent of Cape Smith belt-related amphibolite-facies fabrics in the Minto Block. Beyond this, the Minto Block is characterized by a north-striking Neoproterozoic gneissosity.

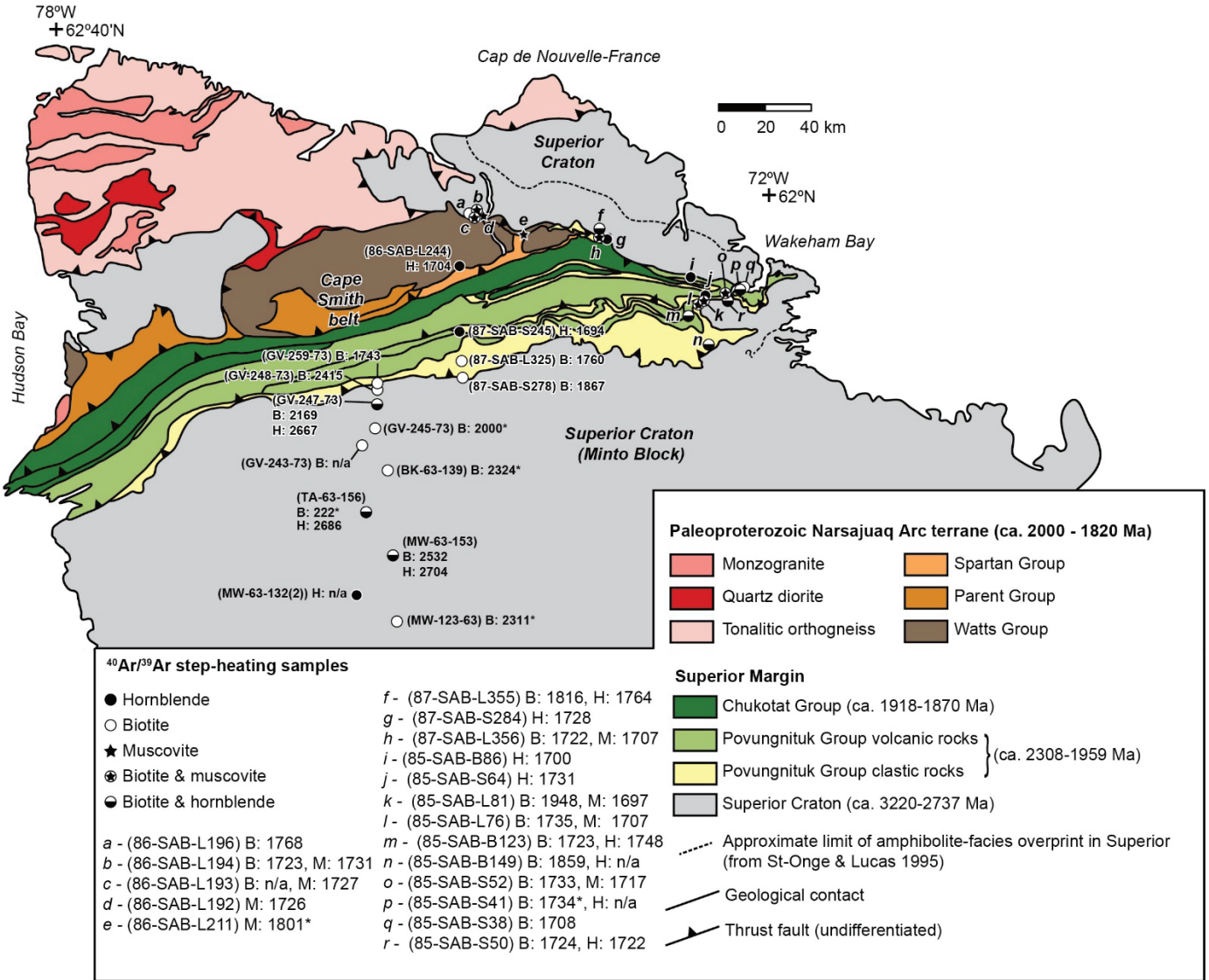


Figure 1: Simplified geological map of the Cape Smith belt and Superior Craton in northern Quebec, Canada (modified after St-Onge et al., 2007), showing the locations of $^{40}\text{Ar}/^{39}\text{Ar}$ samples. Sample numbers are shown in parentheses. Apparent $^{40}\text{Ar}/^{39}\text{Ar}$ ages (in Ma) are indicated next to each sample location, or are given in the figure legend. Ages followed by an asterisk (*) are pseudoplateau ages; all others are plateau ages. B, biotite; H, hornblende; M, muscovite.

⁴⁰Ar/³⁹Ar ANALYTICAL METHOD

Thirty-two samples were processed for ⁴⁰Ar/³⁹Ar analysis of hornblende, biotite and muscovite using standard preparation techniques, including hand-picking of the most pristine, unaltered grains in the size range 0.25 to 0.50 mm. Mineral separates were packed in aluminum foil packets that were loaded into vertical tubes, which were arranged radially within an aluminum can (see Kellett and Joyce (2014) for further details). In cases where multiple mineral phases were targeted from an individual sample, those phases were loaded together in the same packet. Packets of flux monitor PP-20 hornblende (Hb3gr-equivalent) were interspersed among the sample packets in the can. The samples filled two cans, which were irradiated separately (batch numbers: GSC RAD#46 and GSC RAD#48) in the research reactor at McMaster University (Ontario, Canada) in the high flux position 5c for 240 MWh.

Laser ⁴⁰Ar/³⁹Ar step-heating analysis was conducted at the Geological Survey of Canada noble gas spectrometry laboratory (Ottawa, Ontario, Canada). Following irradiation, each grain (aliquot) was loaded individually into 1.5 mm-diameter holes in a copper planchet, which was placed in the sample chamber of a noble gas extraction line and the system evacuated. A Merchantek MIR-10 10W CO₂ laser equipped with a 2 x 2 mm flat-field lens was used to incrementally heat each aliquot in steps of increasing temperature. After each heating step, the released Ar gas was cleaned in the extraction line over getters for ten minutes (to remove nitrogen, oxygen, hydrocarbons, water, hydrogen and other active gases), and then analysed via mass spectrometry.

A VG3600 gas source mass spectrometer equipped with a secondary electron multiplier system was used for isotopic analysis of sample gas following data collection protocols detailed in Villeneuve and MacIntyre (1997) and Villeneuve et al. (2000). Blank measurements were interspersed between aliquots and the running average blank was used to correct data. The ranges of blank values are provided in the footnotes of Appendix 1, together with nucleogenic interference correction factors. Decay constant ⁴⁰K λ_{total} of $5.543 \times 10^{-10}/\text{a}$ and atmospheric Ar composition ⁴⁰Ar/³⁶Ar = 295.5 (Steiger and Jäger, 1977) were used to calculate ages. Error analysis on individual gas-release steps follows the numerical error analysis routines of Scaillet (2000). Corrected argon isotopic data are provided in Appendix 1, and are presented below in step heat age spectra. Each plotted gas-release spectrum contains step-heating data from up to two aliquots per sample, alternately shaded and normalized to the total volume of ³⁹Ar released for each aliquot.

Neutron flux gradients were determined by analyzing the PP-20 hornblende flux monitors included in each sample packet and interpolating a linear fit against calculated J-factor and sample position. As J-factors were calculated using a PP-20 hornblende age of 1072 ± 11 Ma (Roddick, 1983) during the original data reduction in 2004, apparent ages have been corrected to the most recently determined PP-20 hornblende age (1073.6 ± 5.3 Ma; Jourdan et al., 2006) using the software ArAR v1.00 (Mercer and Hodges, 2016). The error on individual J-factors is estimated at $\pm 0.6\%$ (2σ). As the J-factor error is systematic and unrelated to individual analyses, correction for this uncertainty is not applied until calculation of ages from isotopic correlation diagrams (Roddick, 1988).

RESULTS

The new $^{40}\text{Ar}/^{39}\text{Ar}$ biotite, muscovite and hornblende data for the Cape Smith belt and Superior Craton are presented below on a sample-by-sample and mineral basis, and summarized in Table 1. The apparent $^{40}\text{Ar}/^{39}\text{Ar}$ ages are also displayed in Fig. 1. The complete dataset is provided in Appendix 1.

For each sample, the results presented below include the sample location, a short description of the sampled rock, the preferred $^{40}\text{Ar}/^{39}\text{Ar}$ age at 2σ uncertainty levels, the level of confidence in the age interpretation, a brief age interpretation (e.g., cooling age) and the rationale behind the interpretation. All samples analyzed in this report were collected several decades ago. For some samples, detailed rock descriptions could not be located in the Geological Survey of Canada databases and archives; in such cases, the rock description section in the results below is populated by “N/A”. For all other samples, the rock description is derived from original field notes, laboratory notes and (or) thin sections.

A step-heat spectrum plot is provided for each sample, showing all analyzed aliquots. MSWD is defined as the mean square of weighted deviates. Inverse isochron plots are not presented here, as nearly all data are highly radiogenic, plotting on or near the radiogenic $^{39}\text{Ar}/^{40}\text{Ar}$ axis; the reader is referred to the inverse isochron ratios in Appendix 1.

In the following step-heating results, a plateau is defined as three or more consecutive heating steps that comprise greater than 50% of the total ^{39}Ar released and for which the probability-of-fit of the weighted-mean age of the steps is greater than 5% (following the statistical plateau selection criteria of Isoplot v.4.15, Ludwig, 2003). The plateau ages were calculated as weighted-mean ages using the methodology of Isoplot v.4.15 (Ludwig, 2003). For some cases in which no plateau was obtained, a “pseudoplateau” age was calculated from three or more consecutive heating steps that meet the following criteria: (i) they comprise at least 35% of total ^{39}Ar released, with MSWD less than 1.50; or (ii) they are the final heating steps after a “descending staircase” pattern (discussed below) and comprise at least 15% of total ^{39}Ar released, with MSWD less than 1.50; or (iii) they comprise at least 45% of total ^{39}Ar released and yield an age that is supported by a second aliquot, despite having a high MSWD (i.e., biotite sample TA-63-156). For samples that yielded irregular gas release spectra that did not meet the aforementioned criteria for pseudoplateau age determination, no ages are reported.

Integrated (total gas) ages were calculated by weighting all the individual step ages and respective errors by the fraction of ^{39}Ar released. The integrated age is reported for every sample as part of the characterization of the step heat plot, but it does not generally correspond to the reported (preferred) age of the sample.

The $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating results commonly show patterns diagnostic of both Ar loss and excess Ar. Partial Ar loss refers to the removal of a component of daughter $^{40}\text{Ar}^{\text{K}}$ from the mineral, and is represented in many of the Ar release spectra as a “climbing staircase” pattern in the initial, low-temperature steps (McDougall and Harrison, 1999). “Descending staircase” patterns in the initial, low-temperature steps (or throughout the entire age spectrum), and/or unrealistically old

apparent Ar ages, are considered to be diagnostic of excess ^{40}Ar , which refers to $^{40}\text{Ar}^{\text{K}}$ derived from outside the analyzed mineral (Kelley, 2002). Interaction of these two phenomena can produce hump-shape apparent age spectra. An unrealistically old apparent Ar age can also result from inherited Ar, which is the retention of pre-thermal-peak ^{39}Ar due to incomplete resetting of the $^{40}\text{Ar}/^{39}\text{Ar}$ system during metamorphism (Warren et al., 2012). The age interpretations presented below have focused on the portions of step heat spectra that are “flat” or generally homogeneous. For analyses with evidence of significant Ar loss or inclusion of excess Ar, no age interpretation was made.

The nominal closure temperatures of biotite, muscovite and hornblende are $\sim 300^\circ\text{C}$, $\sim 420^\circ\text{C}$ and $\sim 500^\circ\text{C}$, respectively (McDougall and Harrison, 1999; Harrison et al., 2009). However, closure temperature is dependent on several factors, including grain size and cooling rate (e.g., Warren et al., 2012; Skipton et al., 2018). Considering this, as well as the area’s complex geological history and the propensity for Ar loss, excess Ar, and inherited Ar, the age interpretations for this dataset are not always straightforward. The age interpretations presented below are brief, as lengthy discussion is not the intent of this report. It is recommended that the reader consider the data in detail on a sample-by-sample basis and in the context of the geological history of the sampled region.

Cape Smith belt: Povungnituk Group

Sample Number: 85-SAB-B86

Lithology: Metabasite

Mineral analyzed: Hornblende

Age: 1700 ± 16 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.652558

Long: -72.588608

Geologist: Normand Bégin

Sample Description: N/A

Results: Step heating of hornblende yielded a relatively homogeneous gas release spectrum with a plateau age of 1700 ± 16 Ma, which is interpreted as the cooling age of hornblende.

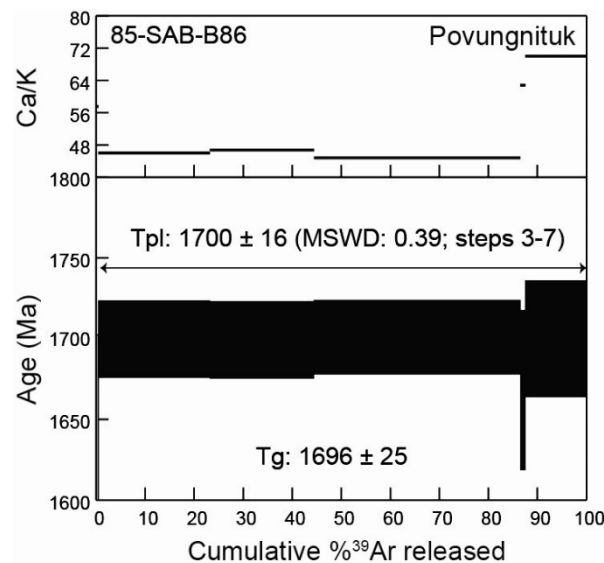


Figure 2: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating hornblende spectrum. “Tpl” and “Tg” refer to plateau age and total gas (integrated) age, respectively, in all figures in this report.

Cape Smith belt: Povungnituk Group

Sample Number: 85-SAB-B123

Lithology: Metabasite

Mineral analyzed: Biotite

Age: 1723 ± 10 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.502619

Long: -72.621864

Geologist: Normand Bégin

Sample Description: N/A

Results: The biotite step heating spectrum exhibits Ar loss in the first ~15% of ^{39}Ar released, followed by relatively homogeneous middle steps that yield a plateau age of 1723 ± 10 Ma. This age is interpreted as the cooling age of biotite.

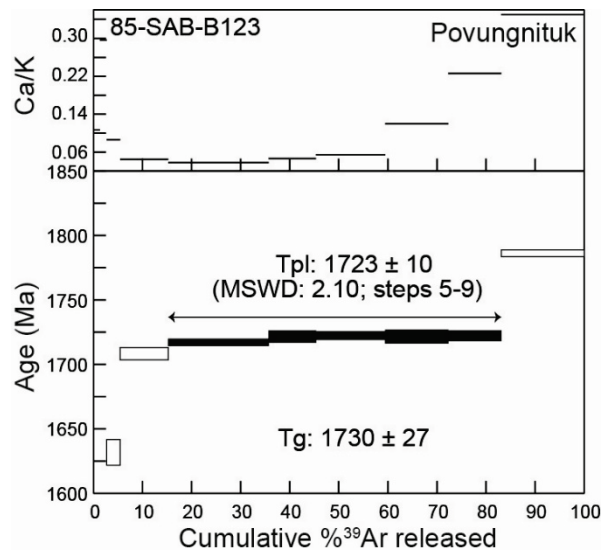


Figure 3: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Cape Smith belt: Povungnituk Group

Sample Number: 85-SAB-B123

Lithology: Metabasite

Mineral analyzed: Hornblende

Age: 1748 ± 16 Ma

Interpretation: Maximum cooling age

Confidence: Medium

Location:

Lat: 61.502619

Long: -72.621864

Geologist: Normand Bégin

Sample Description: N/A

Results: The gas release spectrum of hornblende exhibits an overall downward-stepping pattern, suggesting an excess Ar component. The final gas release step has an elevated Ca/K ratio, suggesting de-gassing of a chemically different phase. The middle steps yielded a plateau age of 1748 ± 16 Ma, which is interpreted as the maximum cooling age for hornblende.

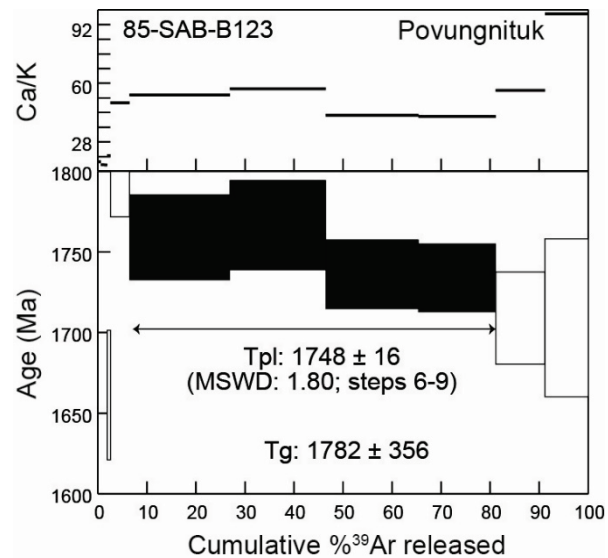


Figure 4: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating hornblende spectrum.

Cape Smith belt: Povungnituk Group

Sample Number: 85-SAB-B149

Lithology: Metabasite

Mineral analyzed: Biotite

Age: 1859 ± 11 Ma

Interpretation: Maximum cooling age

Confidence: Medium

Location:

Lat: 61.377358

Long: -72.451833

Geologist: Normand Bégin

Sample Description: N/A

Results: Step heating of biotite yielded a gas release spectrum with Ar loss in the initial steps, followed by a plateau age of 1859 ± 11 Ma. The low MSWD (0.36) and high % ^{39}Ar (71%) of the plateau age indicate that it can be interpreted with high confidence, although ca. 1859 Ma is an anomalously old biotite date for the Cape Smith belt. Considering the metamorphic grade at the sample location ($\sim 400^\circ\text{C}$), the old date is most likely due to excess ^{40}Ar contamination rather than to incomplete resetting of $^{40}\text{Ar}/^{39}\text{Ar}$ systematics. It is interpreted to represent a maximum cooling age of biotite.

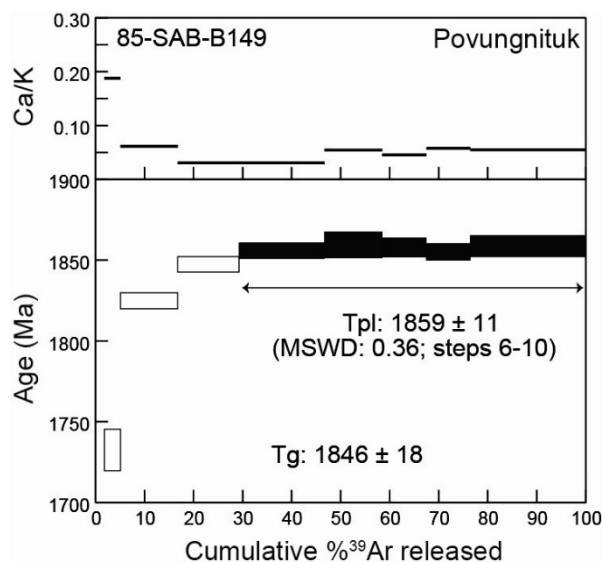


Figure 5: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Cape Smith belt: Povungnituk Group

Sample Number: 85-SAB-B149

Lithology: Metabasite

Mineral analyzed: Hornblende

Age: NO AGE.

Interpretation: N/A

Confidence: N/A

Location:

Lat: 61.377358

Long: -72.451833

Geologist: Normand Bégin

Sample Description: N/A

Results: Step heating of hornblende yielded a highly heterogeneous gas release spectrum with an overall downward age trend in gas release steps, possibly indicating an excess ^{40}Ar component. Note also the heterogeneous Ca/K ratios. No age interpretation is made for this sample.

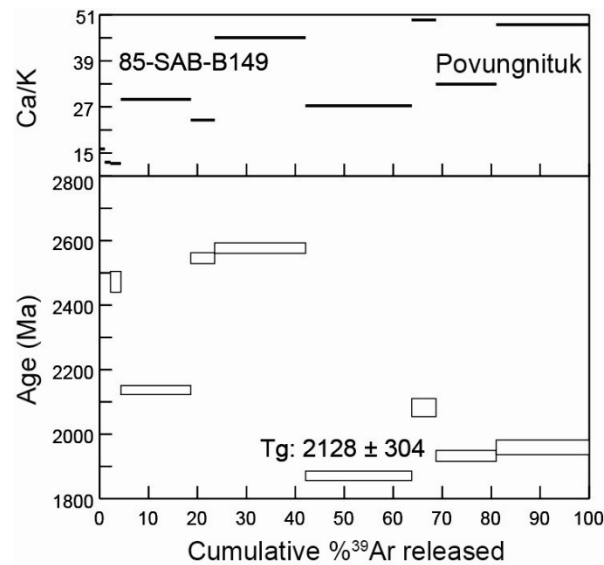


Figure 6: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating hornblende spectrum.

Cape Smith belt: Povungnituk Group

Sample Number: 85-SAB-L81

Lithology: Mafic meta-volcanic tuff

Mineral analyzed: Biotite

Age: 1948 ± 12 Ma

Interpretation: Maximum cooling age

Confidence: Low

Location:

Lat: 61.558689

Long: -72.497822

Geologist: Stephen Lucas

Sample Description: Mafic meta-volcanic tuff with south-verging, asymmetric folds.

Results: Step heating of biotite yielded a plateau age of 1948 ± 12 Ma, with a low MSWD (1.16) and high total % ^{39}Ar (85%). However, the late, high-temperature steps included in the plateau have high uncertainties and correspond to elevated Ca/K ratios, suggesting de-gassing of a non-biotite component. Furthermore, the apparent age of ca. 1948 Ma is significantly older than that of muscovite in the same sample (ca. 1697 Ma, presented below). It is only a few Myr younger than the depositional age of the Povungnituk Group, and is notably older than other biotite dates in the Cape Smith belt. As such, it is considered to reflect significant excess ^{40}Ar contamination, and has little geological significance. At best, it represents the maximum biotite cooling age.

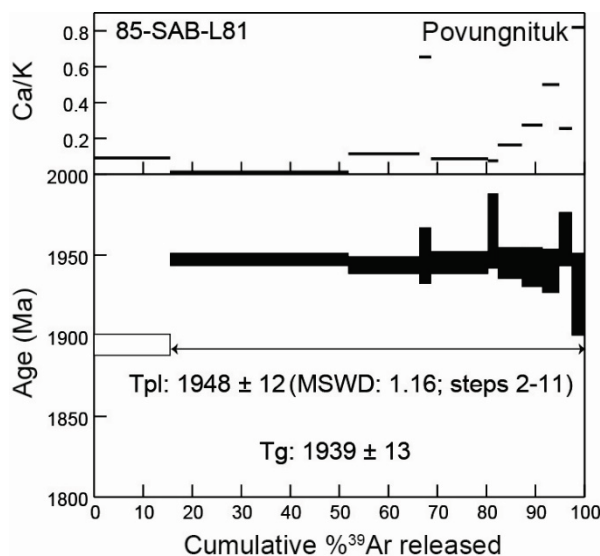


Figure 7: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Cape Smith belt: Povungnituk Group

Sample Number: 85-SAB-L81

Lithology: Mafic meta-volcanic tuff

Mineral analyzed: Muscovite

Age: 1697 ± 10 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.558689

Long: -72.497822

Geologist: Stephen Lucas

Sample Description: Mafic meta-volcanic tuff with south-verging, asymmetric folds.

Results: The gas release spectrum produced from step heating of muscovite exhibits Ar loss in the initial steps, followed by homogeneous steps that define a plateau age of 1697 ± 10 Ma. Comprising 80% of total ^{39}Ar released, this plateau age is interpreted as the cooling age of muscovite.

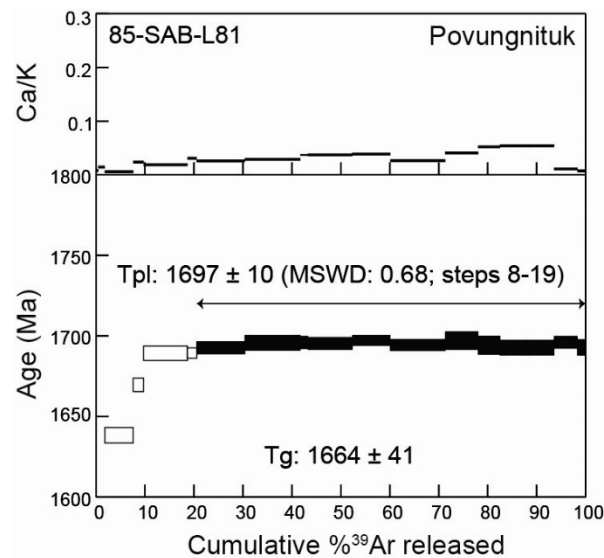


Figure 8: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating muscovite spectrum.

Cape Smith belt: Povungnituk Group

Sample Number: 85-SAB-S41

Lithology: Mafic metasedimentary rock

Mineral analyzed: Biotite

Age: 1734 ± 11 Ma

Interpretation: Cooling age

Confidence: Medium

Location:

Lat: 61.597789

Long: -72.173803

Geologist: Marc St-Onge

Sample Description: Mafic metasedimentary rock containing hornblende, biotite and garnet.

Results: The gas release spectrum from step heating of biotite yielded steps with progressively older ages from ca. 1670 and 1730 Ma, preceded by steps with younger apparent ages that indicate Ar loss. Although no plateau age was attained, the flattest portion of the spectrum defined by the last three steps yielded a pseudoplateau age of 1734 ± 11 Ma, comprising 39% of total ^{39}Ar gas released. This is interpreted as the approximate cooling age of biotite.

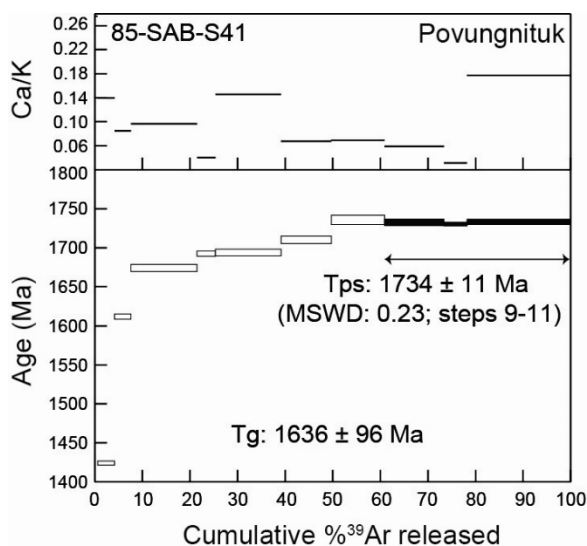


Figure 9: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum. “Tps” refers to pseudoplateau age in all figures in this report.

Cape Smith belt: Povungnituk Group

Sample Number: 85-SAB-S41

Lithology: Mafic metasedimentary rock

Mineral analyzed: Hornblende

Age: NO AGE

Interpretation: N/A

Confidence: N/A

Location:

Lat: 61.597789

Long: -72.173803

Geologist: Marc St-Onge

Sample Description: Mafic metasedimentary rock containing hornblende, biotite and garnet.

Results: The gas release steps from step heating of hornblende have highly heterogeneous apparent ages, all younger than ca. 1300 Ma, and variable Ca/K ratios. Therefore, no geological interpretation is made for this sample.

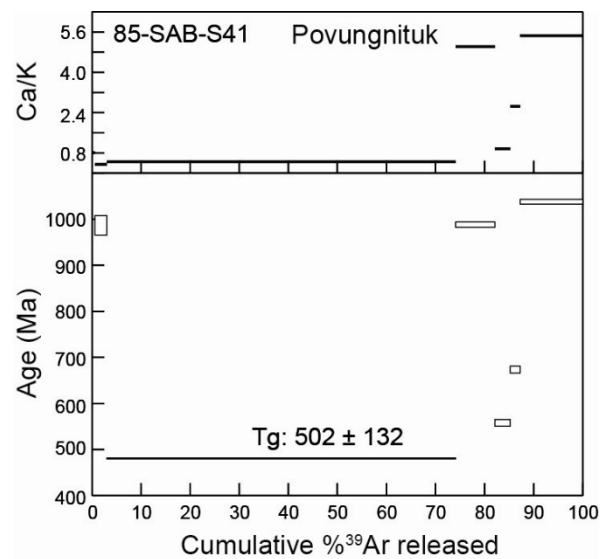


Figure 10: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating hornblende spectrum.

Cape Smith belt: Povungnituk Group

Sample Number: 85-SAB-S50b

Lithology: Semi-pelite

Mineral analyzed: Biotite

Age: 1724 ± 10 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.571478

Long: -72.2784

Geologist: Marc St-Onge

Sample Description: Medium- to coarse-grained, biotite- and hornblende-bearing semi-pelite. Gneissosity defined by 1 mm-to-1 cm-thick quartz-rich bands alternating with biotite+hornblende-rich bands. Garnet occurs locally in outcrop.

Results: The gas release spectrum produced from step heating of biotite has an upward-stepping staircase pattern exhibited by early heating steps, suggesting Ar loss. Subsequent steps are relatively homogeneous, producing a plateau age of 1724 ± 10 Ma, which is interpreted as the cooling age of biotite.

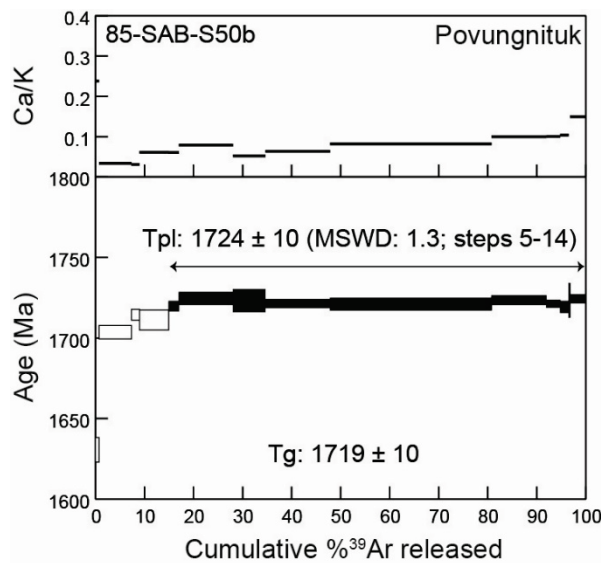


Figure 11: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Cape Smith belt: Povungnituk Group

Sample Number: 85-SAB-S50b

Lithology: Semi-pelite

Mineral analyzed: Hornblende

Age: 1722 ± 11 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.571478

Long: -72.2784

Geologist: Marc St-Onge

Sample Description: Medium- to coarse-grained, biotite- and hornblende-bearing semi-pelite. Gneissosity defined by 1 mm-to-1 cm-thick quartz-rich bands alternating with biotite+hornblende-rich bands. Garnet occurs locally in outcrop.

Results: Step heating of hornblende yielded a gas release spectrum with a “climbing staircase” pattern exhibited by early gas release steps, suggesting Ar loss. Subsequent steps produced a plateau age of 1722 ± 11 Ma, which is interpreted as the cooling age of hornblende.

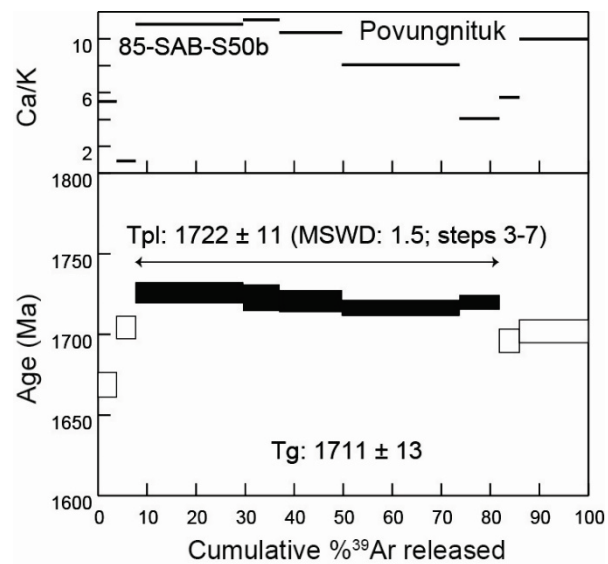


Figure 12: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating hornblende spectrum.

Cape Smith belt: Povungnituk Group

Sample Number: 85-SAB-S52

Lithology: Pelite

Mineral analyzed: Biotite

Age: 1733 ± 10 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.575661

Long -72.278481

Geologist: Marc St-Onge

Sample Description: Pelite containing porphyroblasts of garnet, kyanite and staurolite in a medium-grained matrix comprised of alternating bands of biotite+muscovite and quartz+plagioclase.

Results: Step heating of biotite produced a gas release spectrum with a “climbing staircase” pattern in the early steps, followed by relatively homogeneous steps that yielded a plateau age of 1733 ± 10 Ma. This age is interpreted as the cooling age of biotite.

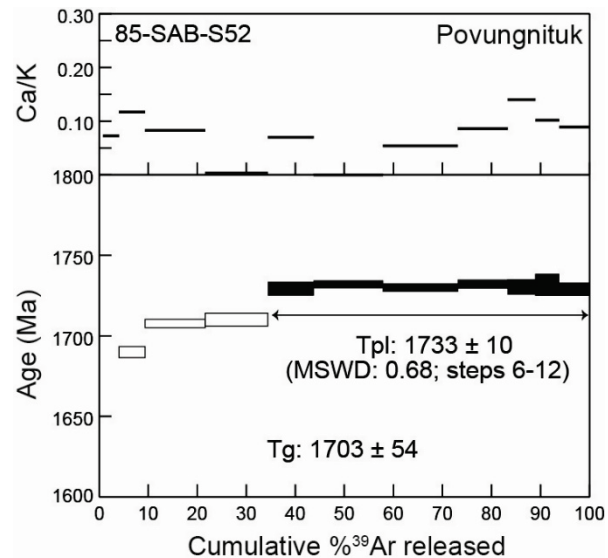


Figure 13: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Cape Smith belt: Povungnituk Group

Sample Number: 85-SAB-S52

Lithology: Pelite

Mineral analyzed: Muscovite

Age: 1717 ± 10 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.575661

Long -72.278481

Geologist: Marc St-Onge

Sample Description: Pelite containing porphyroblasts of garnet, kyanite and staurolite in a medium-grained matrix comprised of alternating bands of biotite+muscovite and quartz+plagioclase.

Results: Step heating of muscovite yielded relatively homogeneous gas release spectrum with a plateau age of 1717 ± 10 Ma, which is interpreted as the cooling age of muscovite.

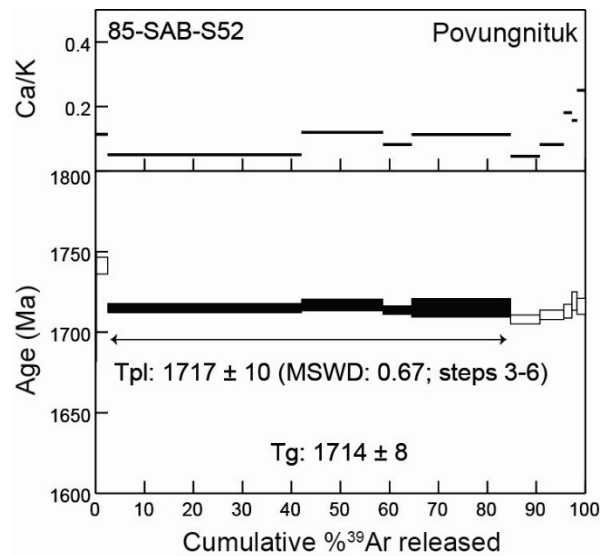


Figure 14: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating muscovite spectrum.

Cape Smith belt: Povungnituk Group

Sample Number: 85-SAB-S64

Lithology: Metabasite

Mineral analyzed: Hornblende

Age: 1731 ± 21 Ma

Interpretation: Maximum cooling age

Confidence: Medium

Location:

Lat: 61.579367

Long -72.472039

Geologist: Marc St-Onge

Sample Description: N/A

Results: Step heating of hornblende yielded a saddle-shaped gas release spectrum, suggesting contamination with excess Ar. The middle steps yielded a plateau age of 1731 ± 21 Ma, which is interpreted as the maximum cooling age of hornblende.

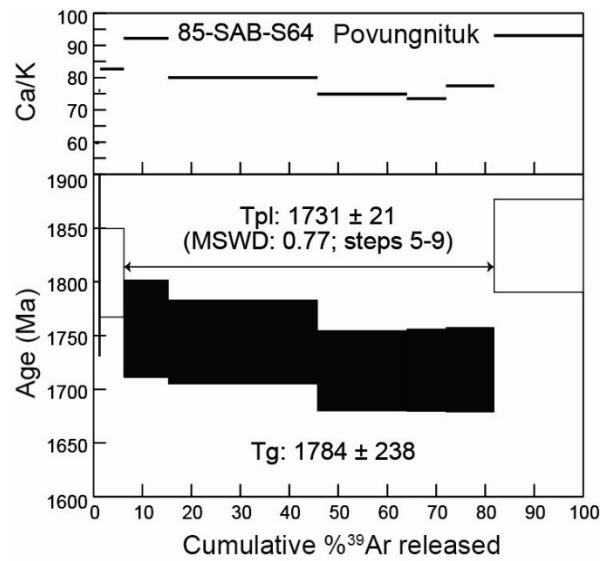


Figure 15: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating hornblende spectrum.

Cape Smith belt: Povungnituk Group

Sample Number: 87-SAB-L325

Lithology: Semi-pelite

Mineral analyzed: Biotite

Age: 1760 ± 11 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.340936

Long -74.48705

Geologist: Stephen Lucas

Sample Description: Fine-grained semi-pelite, with bedding transposed parallel to foliation.

Results: Step heating of biotite produced a gas release spectrum with an upward-stepping pattern for the initial ~45% of ^{39}Ar released, suggesting Ar loss. Subsequent steps yielded a plateau age of 1760 ± 11 Ma, which is interpreted as the cooling age of biotite.

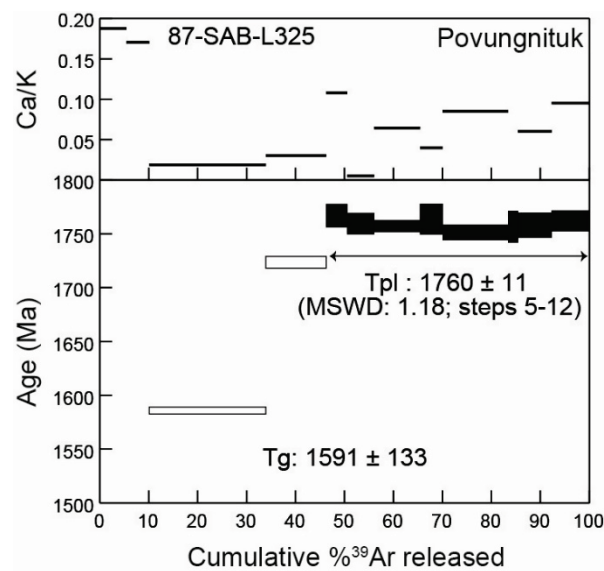


Figure 16: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Cape Smith belt: Povungnituk Group

Sample Number: 87-SAB-S245

Lithology: Mafic metasedimentary rock

Mineral analyzed: Hornblende

Age: 1694 ± 15 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.458375

Long: -74.494944

Geologist: Marc St-Onge

Sample Description: Fine-grained mafic metasedimentary rock containing hornblende and garnet.

Results: Step heating of hornblende yielded a homogeneous gas release spectrum with a plateau age of 1694 ± 15 Ma, which is interpreted as the cooling age of hornblende.

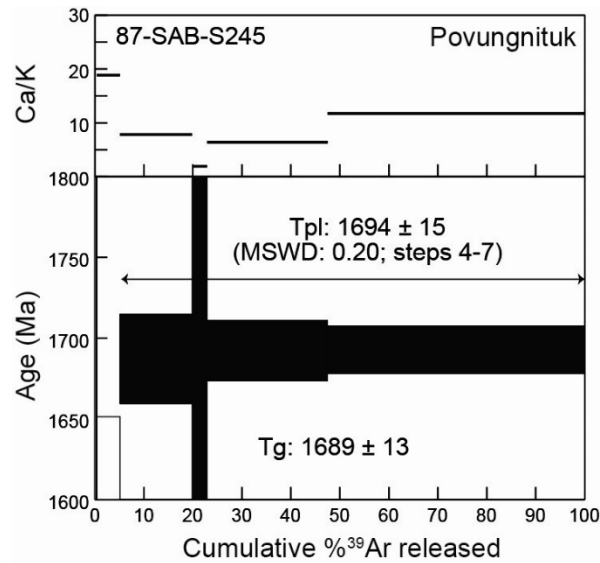


Figure 17: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating hornblende spectrum.

Cape Smith belt: Spartan Group

Sample Number: 86-SAB-L193

Lithology: Quartzite

Mineral analyzed: Biotite

Age: NO AGE

Interpretation: N/A

Confidence: N/A

Location:

Lat: 61.928197

Long: -74.332992

Geologist: Stephen Lucas

Sample Description: Medium-grained, highly strained (mylonitic) quartzite containing muscovite and biotite defining the main foliation.

Results: Step heating of biotite yielded a highly heterogeneous gas release spectrum, precluding a geological interpretation for this sample.

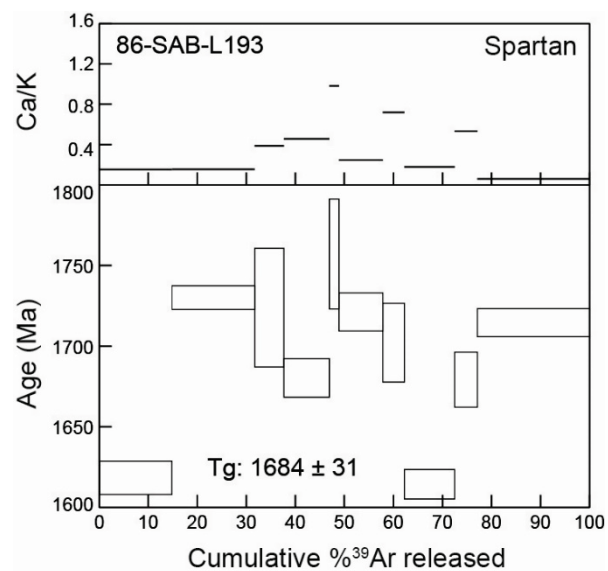


Figure 18: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Cape Smith belt: Spartan Group

Sample Number: 86-SAB-L193

Lithology: Quartzite

Mineral analyzed: Muscovite

Age: 1727 ± 11 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.928197

Long: -74.332992

Geologist: Stephen Lucas

Sample Description: Medium-grained, highly strained (mylonitic) quartzite containing muscovite and biotite, which define the main foliation.

Results: Step heating of muscovite yielded a homogeneous gas release spectrum with a plateau age of 1727 ± 11 Ma, which is interpreted as the cooling age of muscovite.

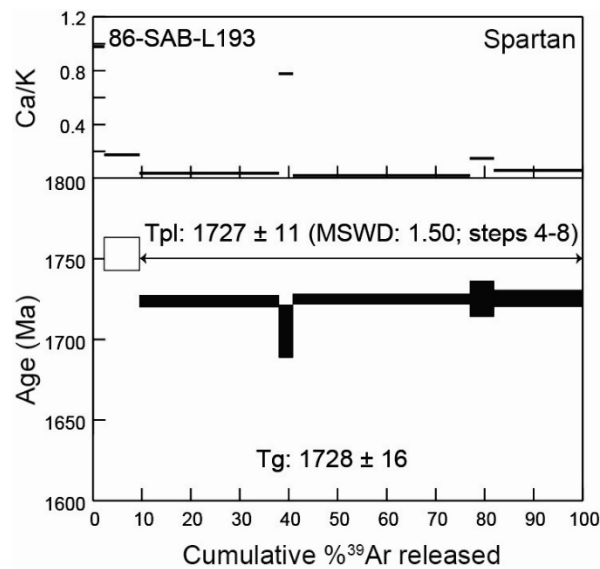


Figure 19: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating muscovite spectrum.

Cape Smith belt: Spartan Group

Sample Number: 86-SAB-L194

Lithology: Quartzite

Mineral analyzed: Biotite

Age: 1723 ± 10 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.929842

Long: -74.332128

Geologist: Stephen Lucas

Sample Description: Medium-grained, highly strained (mylonitic) quartzite containing muscovite and biotite. The main fabric is folded by north-verging folds.

Results: Step heating of biotite yielded a “climbing staircase” pattern in the early (first ~10% ^{39}Ar) gas release steps, suggesting minor Ar loss. Subsequent steps produced a plateau age of 1723 ± 10 Ma, which is interpreted as the cooling age of biotite.

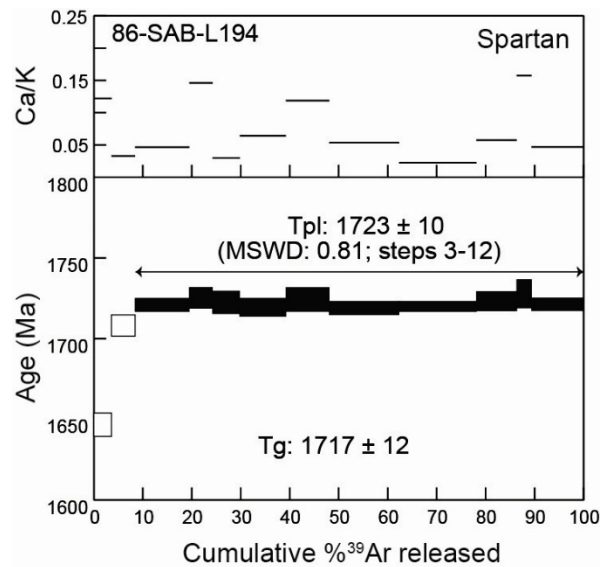


Figure 20: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Cape Smith belt: Spartan Group

Sample Number: 86-SAB-L194

Lithology: Quartzite

Mineral analyzed: Muscovite

Age: 1731 ± 10 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.929842

Long: -74.332128

Geologist: Stephen Lucas

Sample Description: Medium-grained, highly strained (mylonitic) quartzite containing muscovite and biotite. The main fabric is folded by north-verging folds.

Results: Step heating of muscovite yielded a plateau age of 1731 ± 10 Ma, which is interpreted as the cooling age of muscovite.

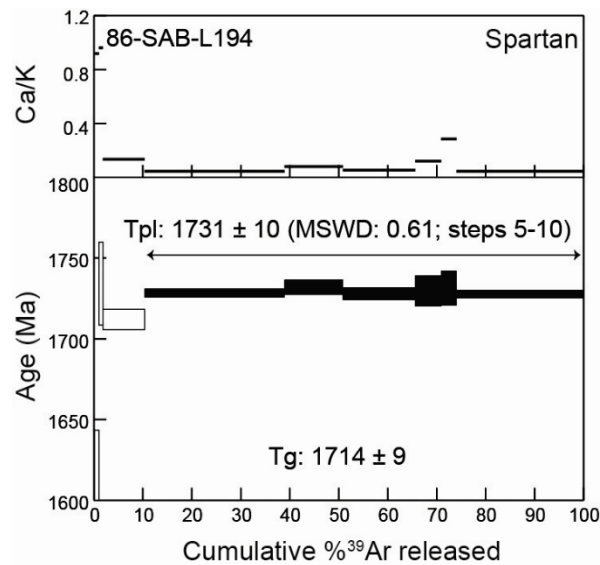


Figure 21: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating muscovite spectrum.

Cape Smith belt: Spartan Group

Sample Number: 86-SAB-L244

Lithology: Metabasite

Mineral analyzed: Hornblende

Age: 1704 ± 14 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.71955

Long: -74.489008

Geologist: Stephen Lucas

Sample Description: Fine-grained metabasite containing hornblende, actinolite and chlorite. Sample was collected from directly above the thrust fault juxtaposing the Spartan Group over the Watts Group.

Results: Step heating of hornblende yielded a plateau age of 1704 ± 14 Ma, which is interpreted as the cooling age of hornblende.

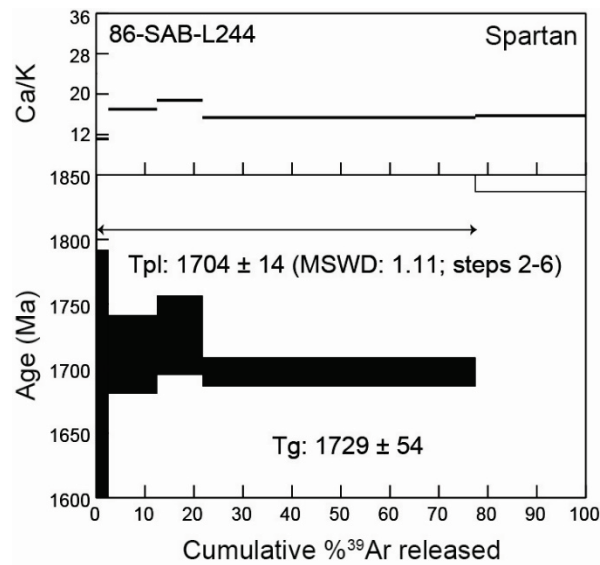


Figure 22: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating hornblende spectrum.

Cape Smith belt: Spartan Group

Sample Number: 87-SAB-L356

Lithology: Semi-pelite

Mineral analyzed: Biotite

Age: 1722 ± 10 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.830725

Long: -73.308378

Geologist: Stephen Lucas

Sample Description: Medium-grained, highly strained semi-pelite from within 3 m of basement-cover contact. Contains well-developed D3 microfolds.

Results: Step heating of biotite yielded a relatively homogeneous gas release spectrum with a plateau age of 1722 ± 10 Ma, which is interpreted as the cooling age of biotite.

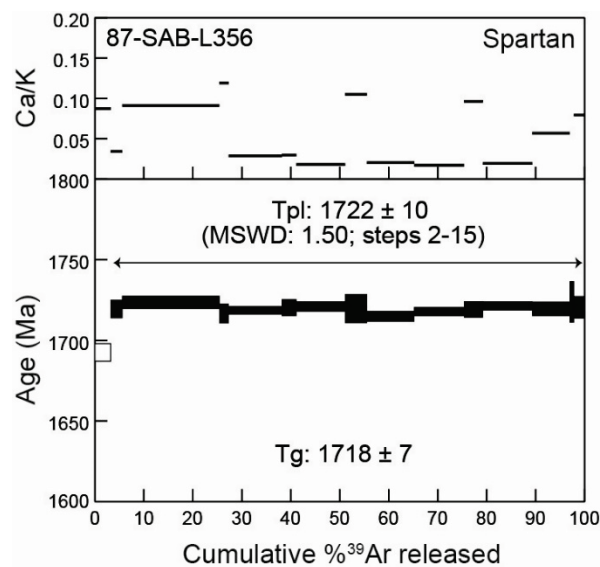


Figure 23: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Cape Smith belt: Spartan Group

Sample Number: 87-SAB-L356

Lithology: Semi-pelite

Mineral analyzed: Muscovite

Age: 1707 ± 10 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.830725

Long: -73.308378

Geologist: Stephen Lucas

Sample Description: Medium-grained, highly strained semi-pelite from within 3 m of basement-cover contact. Contains well-developed D3 microfolds.

Results: Step heating of muscovite yielded a relatively homogeneous gas release spectrum with a plateau age of 1707 ± 10 Ma, which is interpreted as the cooling age of muscovite.

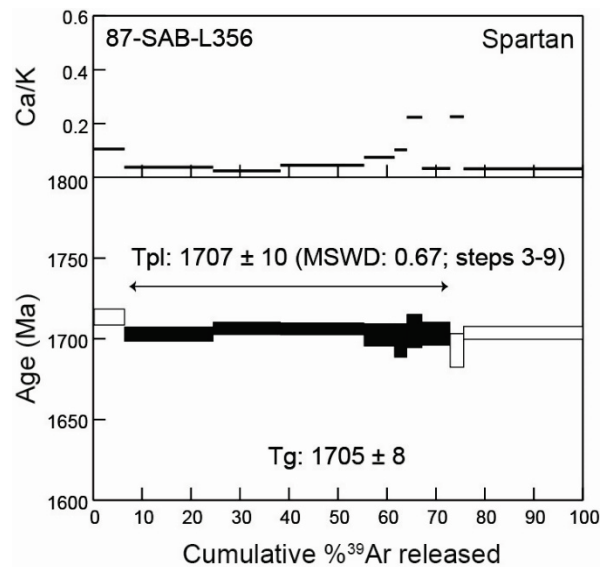


Figure 24: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating muscovite spectrum.

Cape Smith belt: Watts Group

Sample Number: 87-SAB-S284

Lithology: Metabasite

Mineral analyzed: Hornblende

Age: 1728 ± 11 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.816

Long: -73.271861

Geologist: Marc St-Onge

Sample Description: N/A

Results: Step heating of hornblende yielded a homogeneous gas release spectrum with a plateau age of 1728 ± 11 Ma, which is interpreted as the cooling age of hornblende.

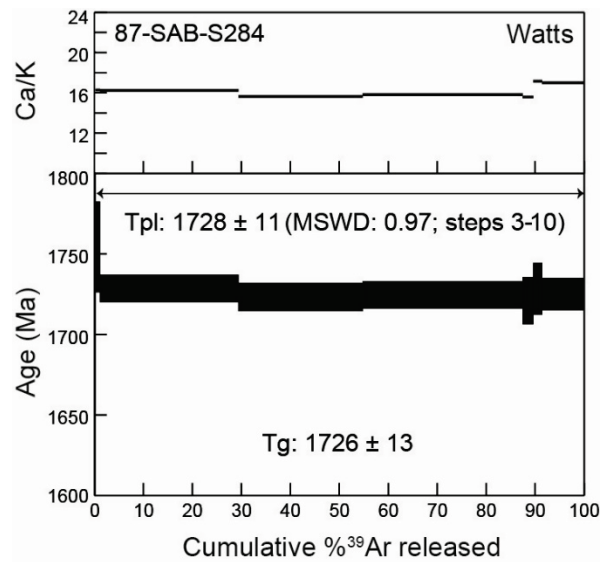


Figure 25: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating hornblende spectrum.

Superior Craton: Minto Block

Sample Number: 87-SAB-S278

Lithology: Granite

Mineral analyzed: Biotite

Age: 1867 ± 11 Ma

Interpretation: Maximum cooling age

Confidence: Medium

Location:

Lat: 61.27645

Long: -74.479861

Geologist: Marc St-Onge

Sample Description: Coarse-grained, biotite-bearing granite. Lacks major foliation.

Results: Step heating of biotite yielded a plateau age of 1867 ± 11 Ma, which is older than the age of Cape Smith belt metamorphism, but significantly younger than Neoproterozoic metamorphism that affected the Minto Block. The age may reflect the cooling age of biotite following Cape Smith belt metamorphism, plus excess ^{40}Ar contamination, or, alternatively, incomplete resetting of $^{40}\text{Ar}/^{39}\text{Ar}$ systematics during Cape Smith belt metamorphism. Therefore, it is interpreted to represent the maximum cooling age of biotite.

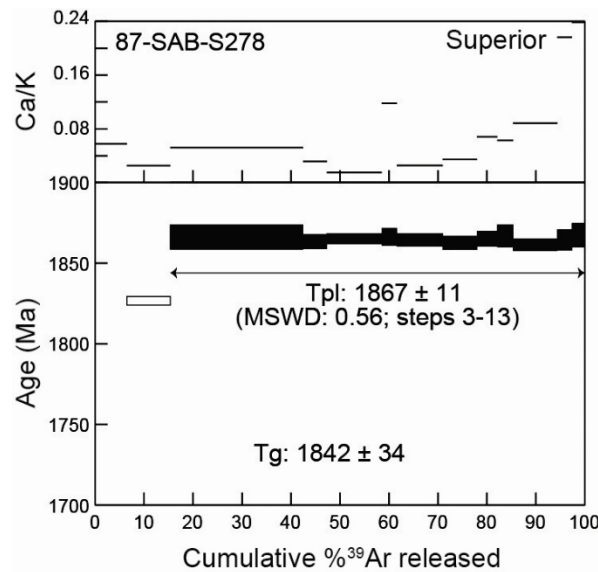


Figure 26: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Superior Craton: Minto Block

Sample Number: BK-63-139

Lithology: Granodiorite

Mineral analyzed: Biotite

Age: 2324 ± 8 Ma

Interpretation: Maximum cooling age

Confidence: Low

Location:

Lat: 60.9001

Long: -75.08913

Geologist: Ira M. Stevenson

Sample Description: N/A

Results: Step heating of biotite yielded a complex gas release spectrum with a “descending staircase” pattern, indicative of excess Ar. The final three steps, which define the flattest part of the spectrum, yielded a pseudoplateau age of 2324 ± 8 Ma, which comprises 16% of the total ^{39}Ar released. Although we have low confidence on this age due to the low proportion of ^{39}Ar and high Ca/K of the steps included in the pseudoplateau, we consider it to represent the maximum cooling age of biotite.

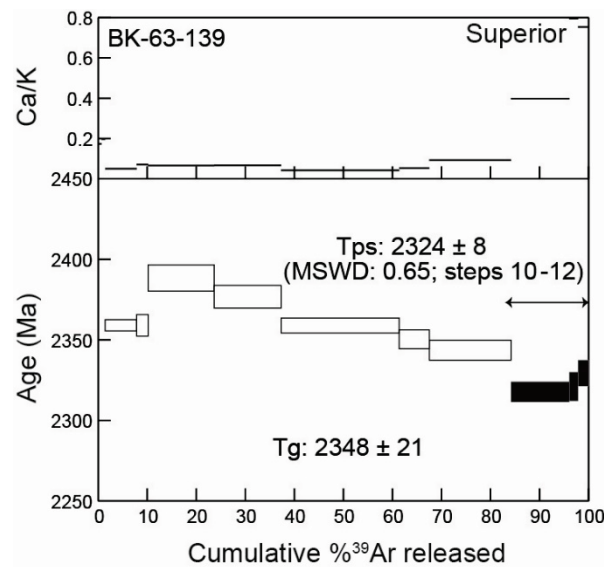


Figure 27: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Superior Craton: Minto Block

Sample Number: GV-243-73

Lithology: Granite gneiss

Mineral analyzed: Biotite

Age: NO AGE

Interpretation: N/A

Confidence: N/A

Location:

Lat: 61.00073

Long: -75.29582

Geologist: Fred C. Taylor

Sample Description: N/A

Results: Step heating of biotite produced a complex, hump-shaped gas release spectrum that precludes an age interpretation for this sample.

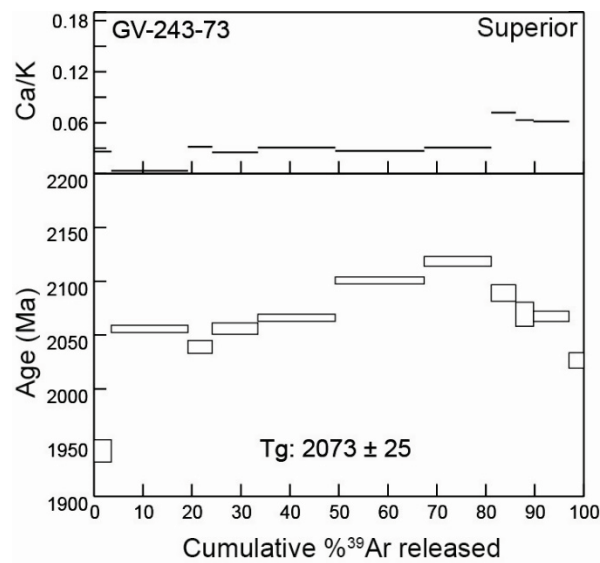


Figure 28: ⁴⁰Ar/³⁹Ar step-heating biotite spectrum.

Superior Craton: Minto Block

Sample Number: GV-245-73

Lithology: Granodiorite

Mineral analyzed: Biotite

Age: 2000 ± 12 Ma

Interpretation: Maximum cooling age

Confidence: Low

Location:

Lat: 61.07004

Long: -75.1927

Geologist: Fred C. Taylor

Sample Description: Medium- to coarse-grained, biotite-bearing granodiorite.

Results: Step heating of biotite produced a saddle-shaped gas release spectrum, suggesting contamination with excess ^{39}Ar . The flattest part of the spectrum (the middle steps) yielded a pseudoplateau age of 2000 ± 12 Ma, comprising 48% of total ^{39}Ar released, with a low MSWD of 1.2. This is interpreted to reflect either (i) the cooling age of biotite following Cape Smith belt metamorphism, plus excess ^{39}Ar contamination, or (ii) the cooling age of Neoproterozoic biotite plus partial resetting during Cape Smith belt metamorphism. As such, it is considered to be the maximum cooling age of biotite.

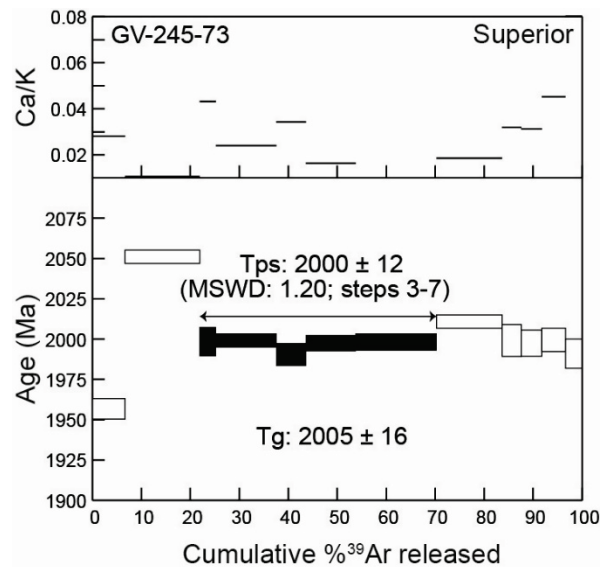


Figure 29: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Superior Craton: Minto Block

Sample Number: GV-247-73

Lithology: Granite gneiss

Mineral analyzed: Biotite

Age: 2169 ± 13 Ma

Interpretation: Maximum cooling age

Confidence: Medium

Location:

Lat: 61.16613

Long: -75.17285

Geologist: Fred C. Taylor

Sample Description: N/A

Results: Step heating of biotite yielded a plateau age of 2169 ± 13 Ma. This is interpreted as either (i) the cooling age of biotite following Cape Smith belt metamorphism, plus significant excess ^{39}Ar contamination, or (ii) the cooling age of Neoarchean biotite plus partial resetting during Cape Smith belt metamorphism. Therefore, it is interpreted as the maximum cooling age of biotite.

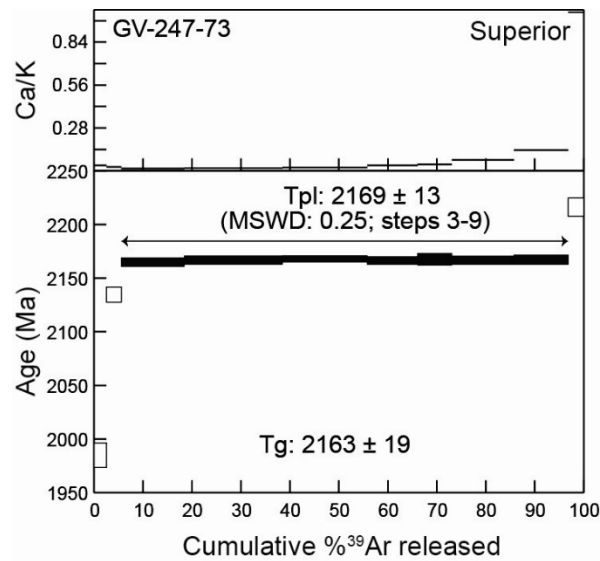


Figure 30: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Superior Craton: Minto Block

Sample Number: GV-247-73

Lithology: Granite gneiss

Mineral analyzed: Hornblende

Age: 2667 ± 17 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.16613

Long: -75.17285

Geologist: Fred C. Taylor

Sample Description: N/A

Results: Step heating of hornblende yielded a plateau age of 2667 ± 17 Ma, which is interpreted as the cooling age of hornblende.

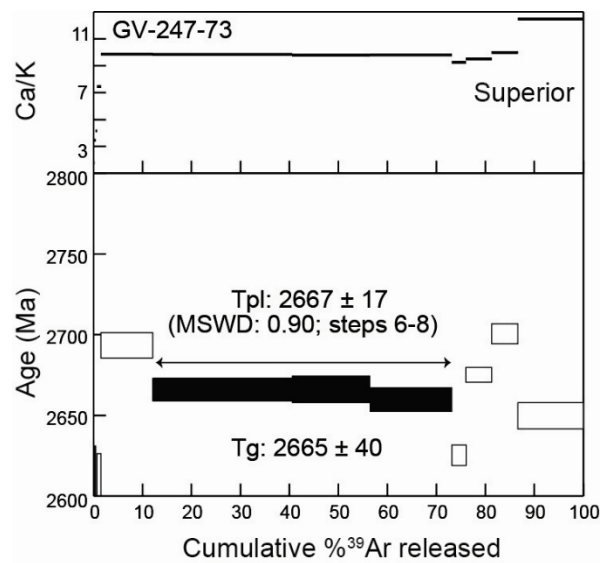


Figure 31: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating hornblende spectrum.

Superior Craton: Minto Block

Sample Number: GV-248-73

Lithology: Granodiorite

Mineral analyzed: Biotite

Age: 2415 ± 15 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.23346

Long: -75.16949

Geologist: Fred C. Taylor

Sample Description: N/A

Results: Step heating spectra for two aliquots of biotite produced plateau ages of 2400 ± 15 Ma and 2415 ± 15 Ma. The preferred age of this sample is considered to be 2415 ± 15 Ma, as it has a lower MSWD and the gas steps included in this plateau age comprise a higher proportion of ^{39}Ar (82%) than those of the other aliquot (75%). The 2415 ± 15 Ma age is interpreted as the cooling age of biotite.

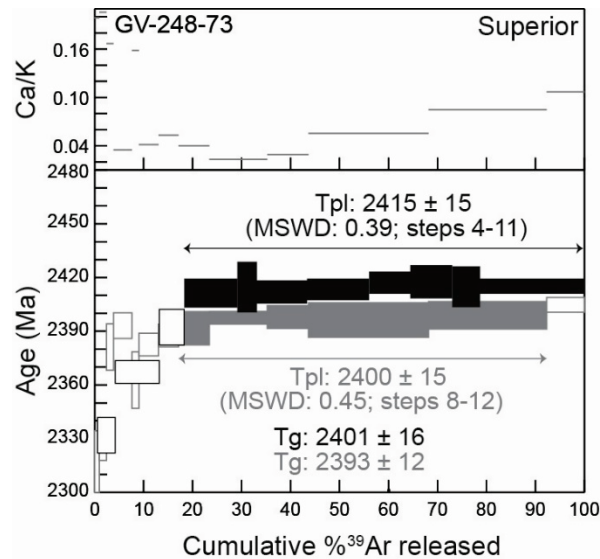


Figure 32: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectra. The data for aliquots 1 and 2 are shown in black and grey, respectively.

Superior Craton: Minto Block

Sample Number: GV-249-73

Lithology: Granodiorite

Mineral analyzed: Biotite

Age: 1743 ± 11 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.25591

Long: -75.16775

Geologist: Fred C. Taylor

Sample Description: N/A

Results: Step heating of biotite produced a gas release spectrum with a “climbing staircase” pattern in early steps (~10% of ^{39}Ar released), suggesting Ar loss, followed by homogeneous steps defining a plateau age of 1743 ± 11 Ma, which is interpreted as the cooling age of biotite.

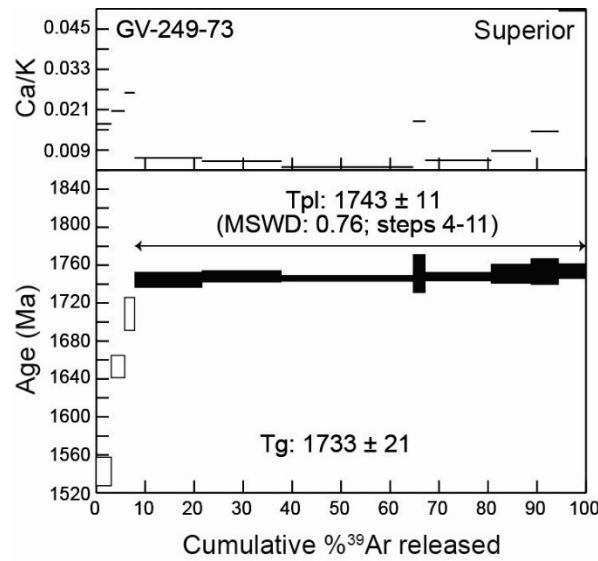


Figure 33: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Superior Craton: Minto Block

Sample Number: MW-123-63

Lithology: Granite gneiss

Mineral analyzed: Biotite

Age: 2311 ± 15 Ma

Interpretation: Cooling age

Confidence: Medium

Location:

Lat: 60.29463

Long: -75.01648

Geologist: Ira M. Stevenson

Sample Description: N/A

Results: Step heating of biotite produced a gas release spectrum with an overall upward-stepping pattern. The last half of the spectrum yielded a pseudoplateau age of 2311 ± 15 Ma, which is interpreted as the approximate cooling age of biotite.

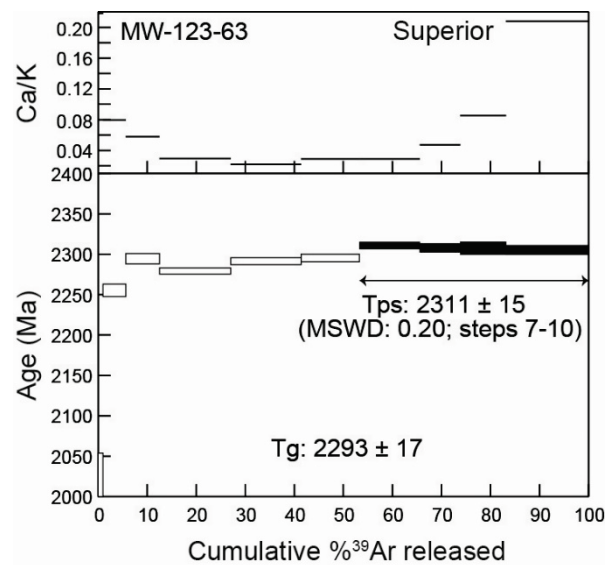


Figure 34: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Superior Craton: Minto Block

Sample Number: MW-63-132(2)

Lithology: Granite gneiss

Mineral analyzed: Hornblende

Age: NO AGE

Interpretation: N/A

Confidence: N/A

Location:

Lat: 60.3971

Long: -75.34259

Geologist: Ira M. Stevenson

Sample Description: N/A

Results: Two aliquots of hornblende both produced heterogeneous step-heating spectra, with neither aliquot attaining a plateau age. Both aliquots exhibit overall downward-stepping patterns, suggesting an excess Ar component. No geological interpretation is made for this sample.

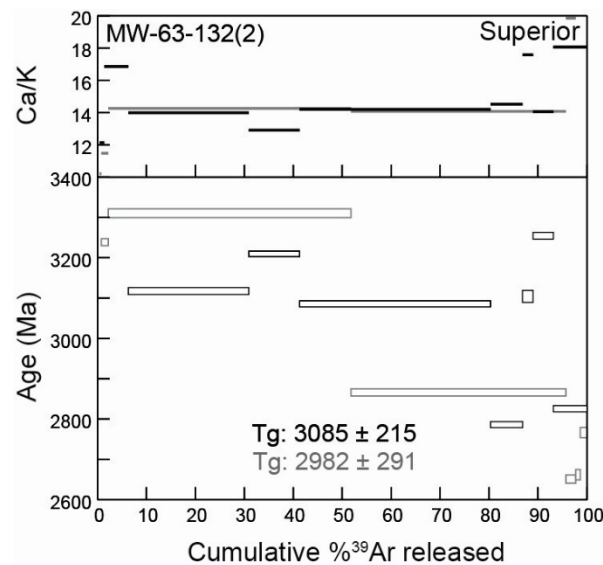


Figure 35: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating hornblende spectra. The data for aliquots 1 and 2 are shown in black and grey, respectively.

Superior Craton: Minto Block

Sample Number: MW-63-153

Lithology: Granodiorite

Mineral analyzed: Biotite

Age: 2532 ± 15 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 60.56033

Long: -75.04738

Geologist: Ira M. Stevenson

Sample Description: N/A

Results: Step heating of biotite yielded a relatively homogeneous gas release spectrum with a plateau age of 2532 ± 15 Ma, which is interpreted as the cooling age of biotite.

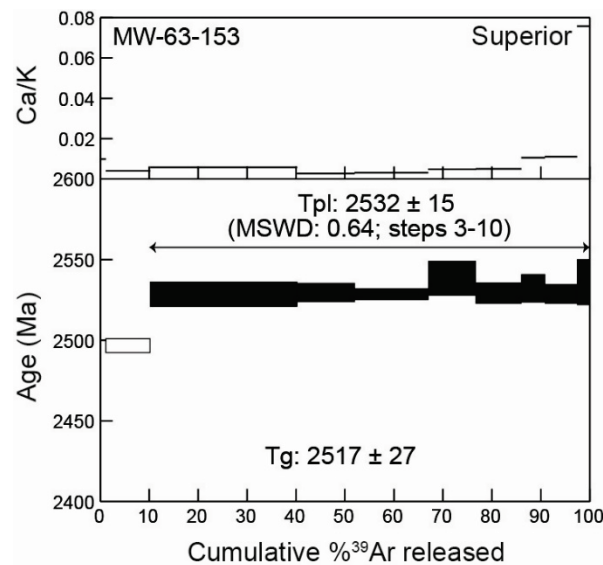


Figure 36: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Superior Craton: Minto Block

Sample Number: MW-63-153

Lithology: Granodiorite

Mineral analyzed: Hornblende

Age: 2704 ± 17 Ma

Interpretation: Crystallization or cooling age

Confidence: High

Location:

Lat: 60.56033

Long: -75.04738

Geologist: Ira M. Stevenson

Sample Description: N/A

Results: Step heating of hornblende yielded a plateau age of 2704 ± 17 Ma. The age may represent the timing of hornblende crystallization during the ca. 2700 Ma metamorphism that affected the Minto Block. Alternatively, it may be the cooling age of hornblende following metamorphism.

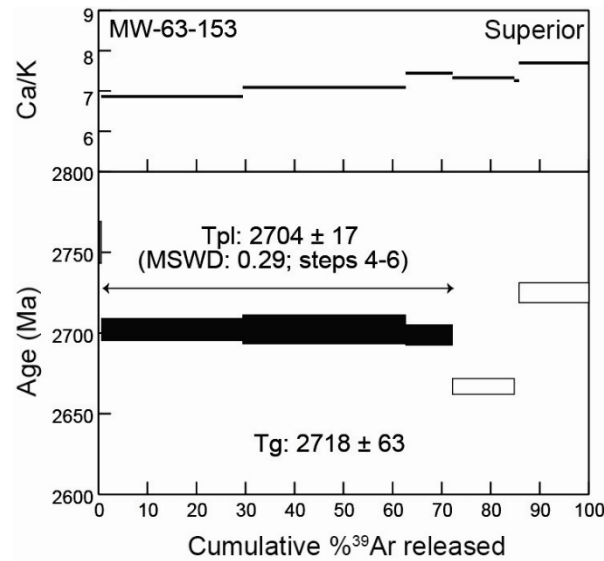


Figure 37: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating hornblende spectrum.

Superior Craton: Minto Block

Sample Number: TA-63-156

Lithology: Granite

Mineral analyzed: Biotite

Age: 2223 ± 17 Ma

Interpretation: Cooling age

Confidence: Low

Location:

Lat: 60.73264

Long: -75.26814

Geologist: Ira M. Stevenson

Sample Description: N/A

Results: Step heating of two aliquots of biotite yielded gas release spectra with young early steps, and the first aliquot produced a hump-shaped spectrum. The first aliquot yielded a plateau age of 2322 ± 14 Ma (MSWD = 0.23; 51% of total ^{39}Ar released). As no plateau age was attained from aliquot 2, a pseudoplateau age was calculated from the middle steps, which represent the flattest portion of the spectrum: 2223 ± 17 Ma (MSWD = 7.2; 46% of total ^{39}Ar released). The pseudoplateau age of 2223 ± 17 Ma (from aliquot 2) is considered the preferred age because the spectrum from aliquot 2 is more homogeneous overall than that of aliquot 1. Additionally, the hump-shaped spectrum of aliquot 1 is indicative of compounded excess Ar and Ar loss, and the final steps of aliquot 1 approach the pseudoplateau age of aliquot 2. The preferred age of 2223 ± 17 Ma is interpreted as the approximate cooling age of biotite.

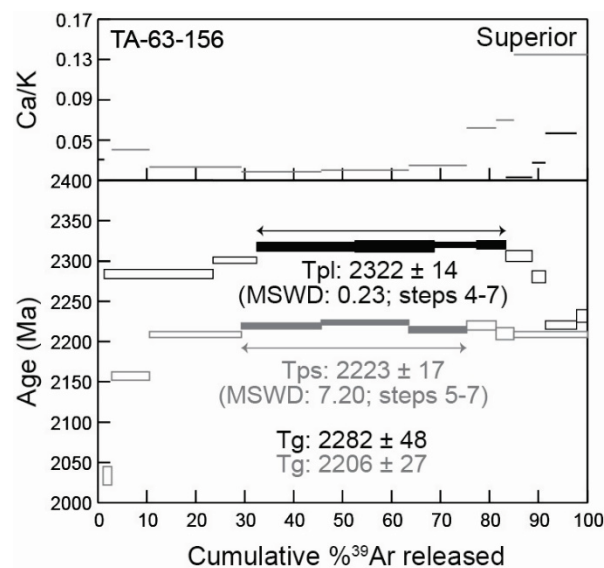


Figure 38: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectra. The data for aliquots 1 and 2 are shown in black and grey, respectively.

Superior Craton: Minto Block

Sample Number: TA-63-156

Lithology: Granite

Mineral analyzed: Hornblende

Age: 2686 ± 17 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 60.73264

Long: -75.26814

Geologist: Ira M. Stevenson

Sample Description: N/A

Results: Step heating of hornblende yielded a relatively homogeneous gas release spectrum with a plateau age of 2686 ± 17 Ma, which is interpreted as the cooling age of hornblende.

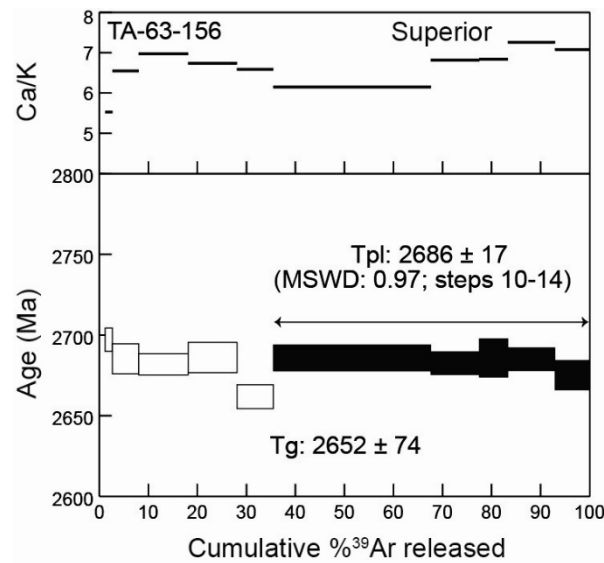


Figure 39: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating hornblende spectrum.

Superior Craton

Sample Number: 85-SAB-S38

Lithology: Quartzo-feldspathic gneiss

Mineral analyzed: Biotite

Age: 1708 ± 10 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.601311

Long: -72.169872

Geologist: Marc St-Onge

Sample Description: Quartzo-feldspathic straight gneiss. Gneissosity is defined by alternating bands of biotite+epidote and quartz+plagioclase-K-feldspar.

Results: Step heating of biotite yielded an upward-stepping pattern in the gas release spectrum, suggesting Ar loss. The last ~60% of the ^{39}Ar released yielded a plateau age of 1708 ± 10 Ma, which is interpreted as the cooling age of biotite.

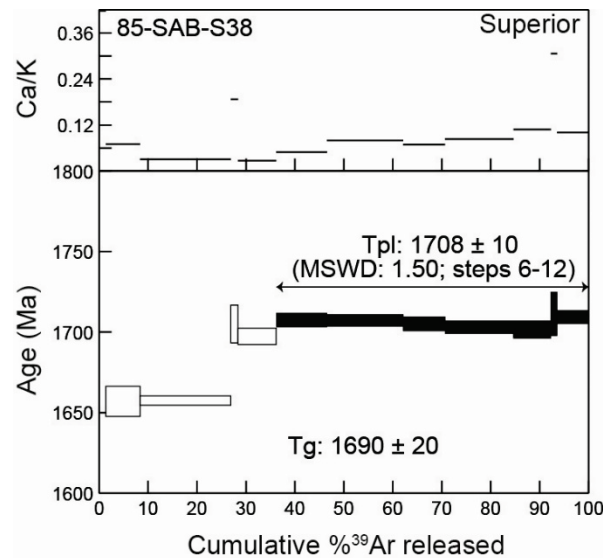


Figure 40: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Superior Craton

Sample Number: 85-SAB-L76b

Lithology: Quartzo-feldspathic gneiss

Mineral analyzed: Biotite

Age: 1735 ± 10 Ma

Interpretation: Maximum cooling age

Confidence: Medium

Location:

Lat: 61.554786

Long: -72.515592

Geologist: Stephen Lucas

Sample Description: Medium-grained, highly strained (mylonitic) biotite-muscovite-garnet granite. Gneissosity defined by alternating mica- and quartz+feldspar-rich bands. Contains garnet porphyroblasts up to 2 mm wide.

Results: Step heating of biotite yielded a plateau age of 1735 ± 10 Ma. A “climbing staircase” pattern exhibited by the early (initial ~15% ^{39}Ar) gas release steps suggests Ar loss, although excess Ar contamination of biotite is implied by the younger apparent age of muscovite from the same sample (ca. 1707 Ma, presented below). Therefore, 1735 ± 10 Ma is interpreted as the maximum cooling age of biotite.

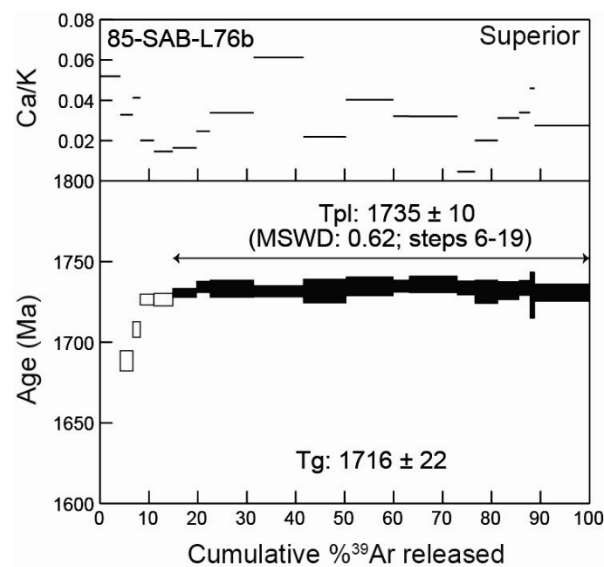


Figure 41: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Superior Craton

Sample Number: 85-SAB-L76b

Lithology: Quartzo-feldspathic gneiss

Mineral analyzed: Muscovite

Age: 1707 ± 11 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.554786

Long: -72.515592

Geologist: Stephen Lucas

Sample Description: Medium-grained, highly strained (mylonitic) biotite-muscovite-garnet granite. Gneissosity defined by alternating biotite+muscovite- and quartz+feldspar-rich bands. Contains garnet porphyroblasts up to 2 mm wide.

Results: Step heating of muscovite yielded a homogeneous gas release spectrum with a plateau age of 1707 ± 11 Ma, which is interpreted as the cooling age of muscovite.

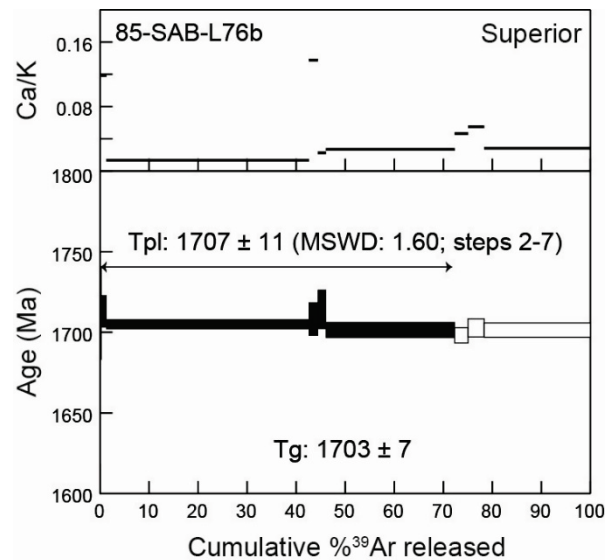


Figure 42: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating muscovite spectrum.

Superior Craton

Sample Number: 86-SAB-L192

Lithology: Tonalite

Mineral analyzed: Muscovite

Age: 1726 ± 11 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.927122

Long: -74.325381

Geologist: Stephen Lucas

Sample Description: Mylonitic, muscovite-bearing tonalite from within 10 m of basement-cover contact. Stretching lineation in the basement is parallel to that in the cover strata.

Results: Step heating of muscovite yielded a homogeneous gas release spectrum with a plateau age of 1726 ± 11 Ma, which is interpreted as the cooling age of muscovite.

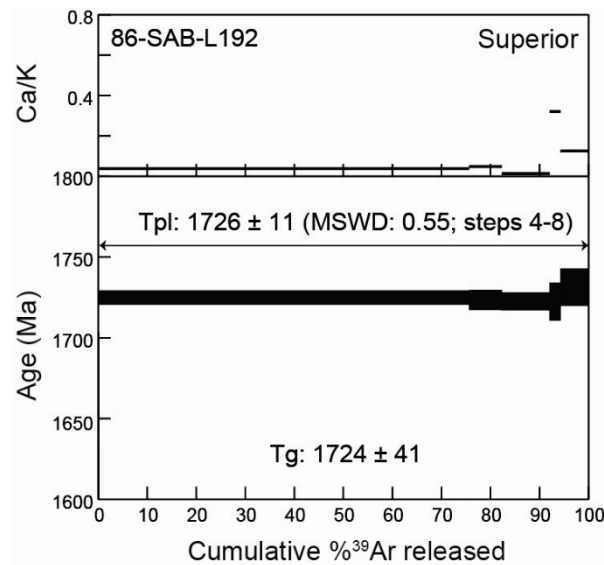


Figure 43: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating muscovite spectrum.

Sample Number: 86-SAB-L196

Lithology: Tonalite

Mineral analyzed: Biotite

Age: 1768 ± 11 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.926606

Long: -74.360133

Geologist: Stephen Lucas

Sample Description: Weakly foliated, coarse-grained, biotite-bearing tonalite from 10 m below basement-cover contact. Contains plagioclase porphyroclasts. Biotite defines the foliation.

Results: Step heating of biotite produced an upward-stepping pattern in the early gas release steps, suggesting Ar loss, followed by a flat spectrum. The latter steps yielded a plateau age of 1768 ± 11 Ma, which is interpreted as the cooling age of biotite.

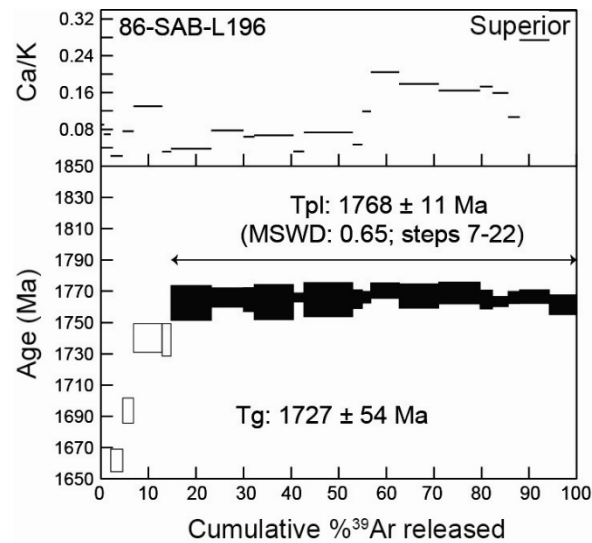


Figure 44: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Superior Craton

Sample Number: 86-SAB-L211

Lithology: Tonalite

Mineral analyzed: Muscovite

Age: 1801 ± 12 Ma

Interpretation: Maximum cooling age

Confidence: Low

Location:

Lat: 61.847689

Long: -73.957658

Geologist: Stephen Lucas

Sample Description: Medium-grained, strongly foliated tonalite from a basement (Superior Craton) thrust slice within the Spartan Group. Gneissosity is defined by alternating ~1 mm-wide bands of muscovite+epidote+chlorite and quartz+plagioclase. Muscovite and chlorite define foliation parallel to gneissosity. Contains 1-2 mm-sized plagioclase porphyroclasts.

Results: The gas release spectrum yielded by step heating of muscovite is comprised of unequal steps with variable apparent ages, and no plateau age was attained. The down-stepping pattern suggests excess Ar contamination. The final three steps yielded a pseudoplateau age of 1801 ± 12 Ma (MSWD = 0.70), which includes 16% of the total ^{39}Ar released. This age is considered to be the maximum cooling age of biotite.

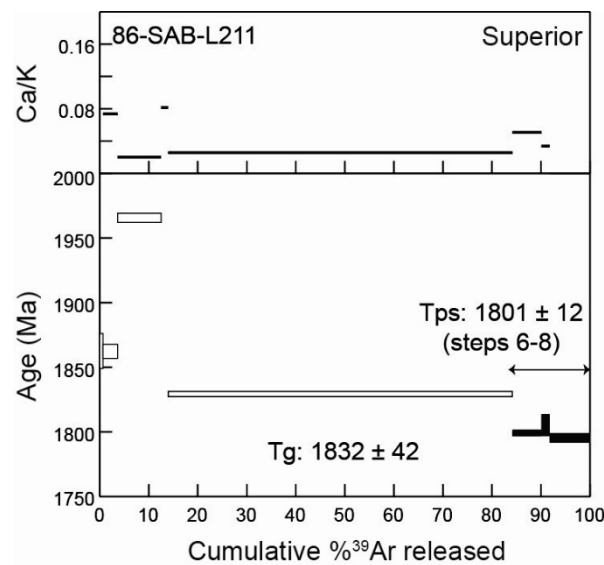


Figure 45: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating muscovite spectrum.

Superior Craton

Sample Number: 87-SAB-L355

Lithology: Tonalite

Mineral analyzed: Biotite

Age: 1816 ± 11 Ma

Interpretation: Maximum cooling age

Confidence: Medium

Location:

Lat: 61.832961

Long: -73.310006

Geologist: Stephen Lucas

Sample Description: Coarse-grained, strongly foliated, hornblende- and biotite-bearing tonalite. Foliation is defined by aligned biotite, and is parallel to that in the Paleoproterozoic cover rocks.

Results: Step heating of biotite yielded a plateau age of 1816 ± 11 Ma. As this apparent age is significantly older than that of hornblende in the same sample (ca. 1764, presented below), it is likely contaminated with excess Ar, and is inferred to represent the maximum cooling age of biotite.

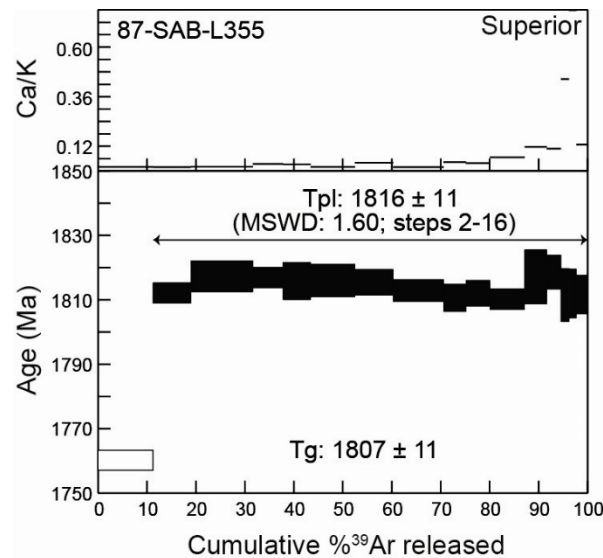


Figure 46: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating biotite spectrum.

Superior Craton

Sample Number: 87-SAB-L355

Lithology: Tonalite

Mineral analyzed: Hornblende

Age: 1764 ± 11 Ma

Interpretation: Cooling age

Confidence: High

Location:

Lat: 61.832961

Long: -73.310006

Geologist: Stephen Lucas

Sample Description: Coarse-grained, strongly foliated, hornblende- and biotite-bearing tonalite. Foliation is defined by aligned biotite, and is parallel to that in the Paleoproterozoic cover rocks.

Results: Step heating of hornblende yielded a homogeneous gas release spectrum with a plateau age of 1764 ± 11 Ma, which is interpreted as the cooling age of hornblende.

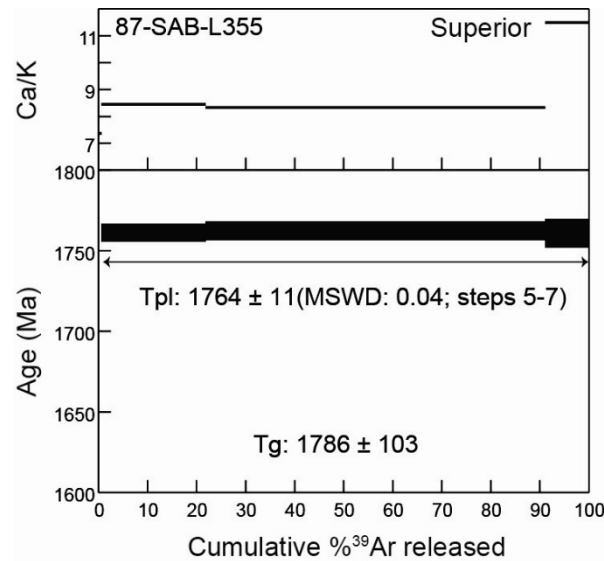


Figure 47: $^{40}\text{Ar}/^{39}\text{Ar}$ step-heating hornblende spectrum.

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