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**GEOLOGICAL SURVEY OF CANADA
OPEN FILE 7924**

A compilation of $^{40}\text{Ar}/^{39}\text{Ar}$ age determinations for igneous and metamorphic rocks, and mineral occurrences from central and southeast Yukon

N.L. Joyce, J.J. Ryan, M. Colpron, C.J.R. Hart and D.C. Murphy

2015

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2015

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doi:10.4095/297446

This publication is available for free download through GEOSCAN (<http://geoscan.nrcan.gc.ca/>).

Recommended citation

Joyce, N.L., Ryan, J.J., Colpron, M., Hart, C.J.R., and Murphy, D.C., 2015. A compilation of $^{40}\text{Ar}/^{39}\text{Ar}$ age determinations for igneous and metamorphic rocks, and mineral occurrences from central and southeast Yukon; Geological Survey of Canada, Open File 7924, 1 .zip file. doi:10.4095/297446

Publications in this series have not been edited; they are released as submitted by the author.

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A compilation of $^{40}\text{Ar}/^{39}\text{Ar}$ age determinations for igneous and metamorphic rocks, and mineral occurrences from central and southeast Yukon

Introduction

This report presents a dataset comprising almost 200 previously unpublished $^{40}\text{Ar}/^{39}\text{Ar}$ analyses and age determinations that were carried out in the Geological Survey of Canada (GSC) Argon Lab facility in Ottawa, Ontario, for samples collected across the southern half of Yukon between 1997 and 2004 (Fig. 1). These samples were collected as part of several collaborative projects between GSC and the Yukon Geological Survey (YGS; formerly Yukon Geology Program), under the National Mapping Program (NATMAP), Targeted Geoscience Initiatives (TGI), and as part of regular field activities of the YGS. This report constitutes the largest single, modern thermochronology dataset available for Yukon, and generally supersedes many of the older K/Ar determinations from the 1960s to 1980s compiled in the YukonAge database (Breitsprecher and Mortensen, 2004). Other available $^{40}\text{Ar}/^{39}\text{Ar}$ modern datasets across this region that supplement this dataset include Joyce (2002), Betsi et al. (2012), Knight et al. (2013), Allan et al. (2013), and Staples (2014).

The samples were collected across a wide-range of geographic and geologic regions, to answer a wide-range of questions. In this report they have been divided into groups of related samples, and for each grouping, a brief discussion of the rationale for $^{40}\text{Ar}/^{39}\text{Ar}$ analyses and first-order interpretations is presented. Following each discussion section, a one-page (in most cases) summary for each sample is provided, including sample information, age results, data plots, and detailed data interpretations. Tables providing location information, age results, and basic information about each sample is included in Appendix 1. Analytical results for each sample are provided in Appendix 2.

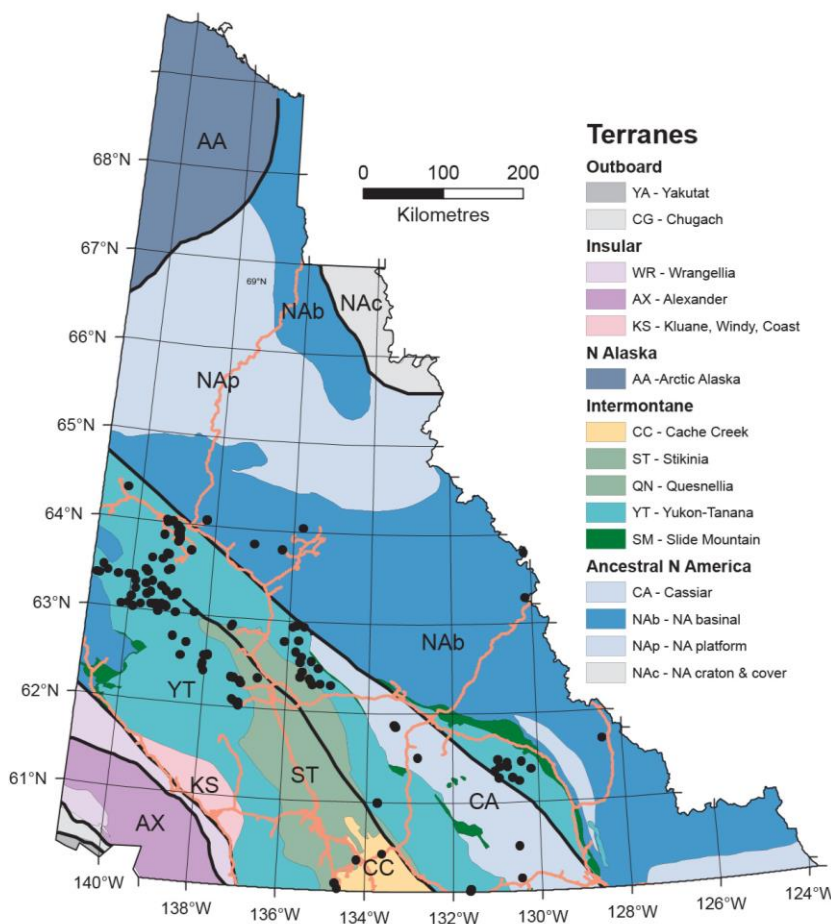


Figure 1. Terrane map of Yukon showing the distribution of samples discussed in this report (after Colpron and Nelson, 2011).

Sample Preparation

Samples were processed for $^{40}\text{Ar}/^{39}\text{Ar}$ analysis of mineral or whole rock fragments by standard preparation techniques, including hand-picking of unaltered grains in the size range 0.25 to 0.50 mm. Individual mineral or whole rock separates were loaded into aluminum foil packets along with grains of Fish Canyon Tuff Sanidine (FCT-SAN) to act as flux monitor (apparent age = 28.03 ± 0.18 Ma (2σ ; Renne et al., 1994)). In cases where multiple mineral phases were targeted for an individual sample, those phases were loaded together in the same packet with the FCT-SAN. The sample packets were loaded into vertical tubes and the tubes were arranged radially inside an aluminum can (see Kellett and Joyce (2014) for further details). Each aluminum can was assigned an irradiation batch number (e.g. GSC #35).

Sample Irradiation and Planchet Loading

The can and its contained samples were irradiated at the research reactor of McMaster University in Hamilton, Ontario in the high flux position 5c. Irradiation parameters for each sample batch are summarized in Table 1. Upon return from the reactor, samples were split into one or more aliquots and loaded with tweezers or pipettes into individual 1.5 mm-diameter holes in a copper planchet. The planchet was then placed in the source chamber of the CO_2 extraction line and the system evacuated.

Laser Step Heating

For GSC #23, 24, 25, heating of samples was carried out with a 45W, Weck® CO_2 surgical laser with a ~200 micron beam diameter optically attenuated by 20x. The small beam size relative to grain size necessitated panning of the beam to try to maintain even heating. For GSC #26-51, samples were heated using a Merchantek® MIR-10 10W CO_2 laser equipped with 2mm x 2 mm flat-field lens, obviating the need for beam panning.

Gas Clean-up and Data Collection

The released Ar gas was cleaned over getters for ten minutes, and then analyzed isotopically using the secondary electron multiplier system of a VG3600 gas source mass spectrometer; details of data collection protocols can be found in Villeneuve and MacIntyre (1997) and Villeneuve et al. (2000). Error analysis on individual steps follows numerical error analysis routines outlined in Scaillet (2000); error analysis on grouped data follows algebraic methods of Roddick (1988). Decay constants used in the data reduction were those recommended by Steiger and Jäger (1977). The data reduction routines were carried out using customized in-house software referred to herein as GSC GRID Argon module (GRID = Geochronology and Radiogenic Isotope Database).

Corrected argon isotopic data are listed in Appendix 2 and presented in the data summaries below as spectra of gas release if they did not contain evidence for excess ^{40}Ar (i.e. $^{40}\text{Ar}/^{36}\text{Ar} = 295.5$), and as inverse isochron plots (Roddick et al. 1980; error analysis follows Roddick, 1988) if they did. Each plotted gas-release spectrum contains step-heating data from up to five aliquots, alternately shaded and normalized to the total volume of ^{39}Ar released for each aliquot. The side-by-side plots provide a visual image of replicated

heating profiles, evidence for ^{40}Ar loss in the low-temperature steps, and the error and apparent age of each step. Upon ascertaining reproducibility of individual spectra and plateau regions between aliquots, data were combined by integrating plateau portions (marked by the line above steps in the gas release spectra) weighted by analytical error. Reported plateau ages are defined as three or more consecutive heating steps, the ages of which are within 2σ error of each other, and together comprise greater than 50% of the total ^{39}Ar released (Fleck et al., 1977). Alternatively, data may be displayed in inverse-isochron diagrams. In this case, relationships between temperature of heating and apparent age are lost, but the most radiogenic steps are considered to give the best estimate of the age. Steps that are not included in the inverse isochron age calculation appear as grey data points. Steps used in calculation of inverse-isochron regressions or step-heating plateaus are marked in Appendix 2. Uncertainties on decay constants and apparent age of the monitor are not included in the quoted errors.

Neutron flux gradients throughout the sample capsule were evaluated by analyzing the sanidine flux monitors that were loaded in the sample packets and interpolating a linear fit against calculated J factor and sample position. The error on individual J factor values is conservatively estimated between $\pm 0.6\%$ and $\pm 1.0\%$ (2σ). Because the error associated with the J factor is systematic and not related to individual analyses, correction for this uncertainty is not applied until calculation of dates from isotopic correlation diagrams are completed (Roddick, 1988). Since all aliquots of the sample were exposed to sensibly identical neutron flux, plateau steps from each aliquot were combined and regressed to provide a final age, and J factor uncertainty was quadratically applied to arrive at age uncertainty. Blank measurements were made between samples or aliquots, and values varied between the maximum and minimum levels reported in Appendix 2. Nucleogenic interference corrections were $(^{40}\text{Ar}/^{39}\text{Ar})_{\text{K}} = 0.025 \pm 0.005$, $(^{38}\text{Ar}/^{39}\text{Ar})_{\text{K}} = 0.011 \pm 0.010$, $(^{40}\text{Ar}/^{37}\text{Ar})_{\text{Ca}} = 0.002 \pm 0.002$, $(^{39}\text{Ar}/^{37}\text{Ar})_{\text{Ca}} = 0.00068 \pm 0.00005$, $(^{38}\text{Ar}/^{37}\text{Ar})_{\text{Ca}} = 0.00003 \pm 0.00003$, $(^{36}\text{Ar}/^{37}\text{Ar})_{\text{Ca}} = 0.00028 \pm 0.00016$. All errors associated with age determinations are herein quoted at the 2σ level of uncertainty.

$^{40}\text{Ar}/^{39}\text{Ar}$ Geochronology Results and Discussions

The $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology results in this report are presented in three different formats; one-page summaries for samples that are grouped together, tabulated listings of samples and their locations and ages (Appendix 1), and $^{40}\text{Ar}/^{39}\text{Ar}$ analytical data tables (Appendix 2).

To assist the reader in finding and understanding the information about a particular sample, please note the following regarding the organization and presentation of the data in the three formats:

Sample summaries

One-page summaries of sample information, data plots and result interpretations are presented within each section *in order of their Geochronology Lab Number*. This four-digit number is a unique identifier sequentially assigned to a sample when it is accepted to the GSC Geochronology Laboratory, and this number will be found on the sixth line of each one-page summary. The Geochronology Lab Number appears in the data plots, preceded by the letter Z. The Argon Number is the unique identifier assigned by the GSC noble gas laboratory to each *mineral* that is analyzed; therefore a sample for which both hornblende and biotite were analyzed, for example, will have one Geochronology Lab Number, and two Argon Numbers associated with it. Each mineral phase is presented in its own one-page summary, and in cases where the two phases were packaged in the same packet for irradiation, the age uncertainty without incorporating the J -error

is given in brackets to enable better resolution between the ages of the phases. The MSWD, or mean square of the weighted deviations, is presented for both plateau and inverse isochron age determinations.

The UTM coordinates provided in the one-page summaries are NAD83. For quick reference, Yukon Minfile numbers are given for samples that were collected from mineral occurrences or deposits. The ages reported on these one-page summaries are calculated using the **28.03 Ma ± 0.18 Ma** age for FCT-SAN (2σ; Renne et al., 1994).

Table of sample locations, information and age results (Appendix 1)

Within this Excel workbook, there are two spreadsheets that contain the same sample information but are listed differently. The first page lists the samples divided into the same groupings that are outlined in the one-page summaries, in order of increasing Geochronology Lab Number. The groupings are spaced apart with an empty row and heading row to make it easier for the reader to see the group separations. The second page lists all the samples in a continuous manner, with the grouping specified in its own column; this format is targeted toward geospatial data scientists for use in plotting the data in a GIS software platform.

Note that there are two age columns in the table. The ages and errors highlighted in yellow are those calculated using the Renne et al. (1994) FCT-SAN age of **28.03 Ma ± 0.18 Ma**, and the decay constants and isotopic abundances of Steiger and Jäger (1977; $^{40}\text{K } \lambda_{\text{total}} = 5.543 \times 10^{-10}/\text{a}$), which were “hard-wired” values within the GSC GRID Argon module for the purpose of data reduction. We recognize that many researchers in the Ar-Ar community have begun to favour the use of more recently determined values for the FCT-SAN age and ^{40}K total decay constant ($^{40}\text{K } \lambda_{\text{total}}$), particularly because the use of $^{40}\text{K } \lambda_{\text{total}}$ from Steiger and Jäger (1977) yields ages up to 1% younger than the ^{238}U - ^{206}Pb ages for zircon from the same rocks (Renne et al, 2010; Kuiper et al., 2008). $^{40}\text{Ar}/^{39}\text{Ar}$ ages calculated using the FCT-SAN age of **28.201 ± 0.046 Ma** (2σ) from Kuiper et al. (2008), and the $^{40}\text{K } \lambda_{\text{total}} = 5.463 \pm 0.214 \times 10^{-10}/\text{a}$ (2σ) from Min et al. (2000) are in much closer agreement with zircon U-Pb ages from the same rock, particularly for rapidly cooled igneous rocks (Kuiper et al., 2008). Therefore, in this appendix we present all the ages recalculated using these newer values in the age column further to the right, highlighted in blue. These recalculations were carried out using the Earthtime Ar tool built by Noah McLean at MIT. In general, the recalculated ages are approximately 0.65% older than previously calculated. Propagation of the uncertainty in $^{40}\text{K } \lambda_{\text{total}}$ results in an age error of approximately ± 4% at 2σ, but really only needs to be taken into consideration when comparing ages from the $^{40}\text{Ar}/^{39}\text{Ar}$ and U-Pb systems. *The reader is cautioned that most, if not all, of the currently published $^{40}\text{Ar}/^{39}\text{Ar}$ ages for Yukon are calculated using the decay constants and isotopic abundances of Steiger and Jäger (1977).*

First-order interpretations are provided in both the sample summary pages and tables in Appendix 1, for each $^{40}\text{Ar}/^{39}\text{Ar}$ age based on our current level of understanding of the geologic context of the samples. Definitions of the seven different age interpretations are as follows:

Igneous Crystallization: age of a phase, from an undeformed rock, that crystallized directly from a magma or lava, and cooled quickly

Metamorphic Cooling: age reflects the timing of cooling of a system below the closure temperature of the mineral, following a regional tectono-thermal event

Peak Metamorphic: an age for a mineral phase that grew as part of the peak metamorphic assemblage, and therefore constrains the timing of peak metamorphism

Igneous Cooling: age reflects the time at which a mineral cooled below its closure temperature during conductive cooling of a pluton

Reset: an age for a phase that was heated above its closure temperature in the absence of deformation processes, and in which none of the original argon is preserved (e.g. wall rock within a contact aureole of a pluton)

Hydrothermal: an age of a phase that grew as a result of the interaction of hydrothermal fluids with the wall rock. Hydrothermal is also used for minerals that grew entirely within a vein or late-stage pegmatite

No Age: disturbed and uninterpretable spectrum with no plateau, and non-collinear data distribution on the inverse isochron diagram. Disturbance may be due to thermal perturbations, or degassing of heterogeneities within the grain, which have variable argon retentivity (e.g. fluid or mineral inclusions, exsolution features, damaged portions of the crystal lattice)

⁴⁰Ar/³⁹Ar analytical data tables (Appendix 2)

Because samples were from several irradiation batches and analyzed over a period of several years, the ⁴⁰Ar/³⁹Ar analytical data tables are organized by irradiation batch. This digital appendix is an Excel workbook in which each irradiation batch is presented in a separate worksheet, labelled by batch number (e.g. GSC #35). These batch numbers can be found within the analytical details section at the bottom of each one-page summary for the sample, and in the tables of Appendix 1. Analytical parameters relevant to each irradiation batch are given in the footnotes of each worksheet table. The Geochronology Lab Numbers that appear in these tables are preceded by the letter Z as seen in the data plots.

One-page Summaries of Samples and $^{40}\text{Ar}/^{39}\text{Ar}$ Results

Jurassic Regional Metamorphic Cooling and Intrusions

Cooling of Yukon-Tanana terrane – Stewart River and Glenlyon areas

In the Stewart River and Glenlyon areas, Yukon-Tanana terrane rocks generally constitute greenschist to middle amphibolite facies, schistose metasedimentary and metavolcanic rocks and moderately foliated to gneissic metaplutonic rocks of pre-Devonian to middle Permian parentage (Figs. 2 and 3; Appendix 1). Metamorphic biotite and muscovite were separated from metasedimentary rocks and felsic to intermediate meta-igneous rocks in the hopes of determining the lower temperature limit of cooling of the $^{40}\text{Ar}/^{39}\text{Ar}$ system. Metamorphic hornblende was separated from intermediate to mafic meta-igneous rocks to bracket the higher temperature limit of cooling the $^{40}\text{Ar}/^{39}\text{Ar}$ system. It was anticipated that the $^{40}\text{Ar}/^{39}\text{Ar}$ age determinations would improve our understanding of the age of regional metamorphism and exhumation in the area, which was only broadly constrained through results of less reliable K/Ar dating carried out between the 1960's to 1990's. It was also anticipated that $^{40}\text{Ar}/^{39}\text{Ar}$ age determinations would illustrate domains of differing cooling history, and might delineate geological structures that dissect the geology and post-date the peak of regional metamorphism. More complete descriptions of the regional geology can be found in Ryan et al. (2001, 2002, 2003), Colpron et al. (2002, 2003, 2006), Colpron and Ryan (2010), and Ryan et al. (2014b).

Most of Yukon-Tanana terrane in west-central Yukon (from western Stewart River map sheet to eastern Glenlyon map sheet) cooled through argon closure temperatures in the Early Jurassic, with deviations to Middle Jurassic closure in the central Klondike region, and along Thistle Creek (in the vicinity of the White Gold deposit).

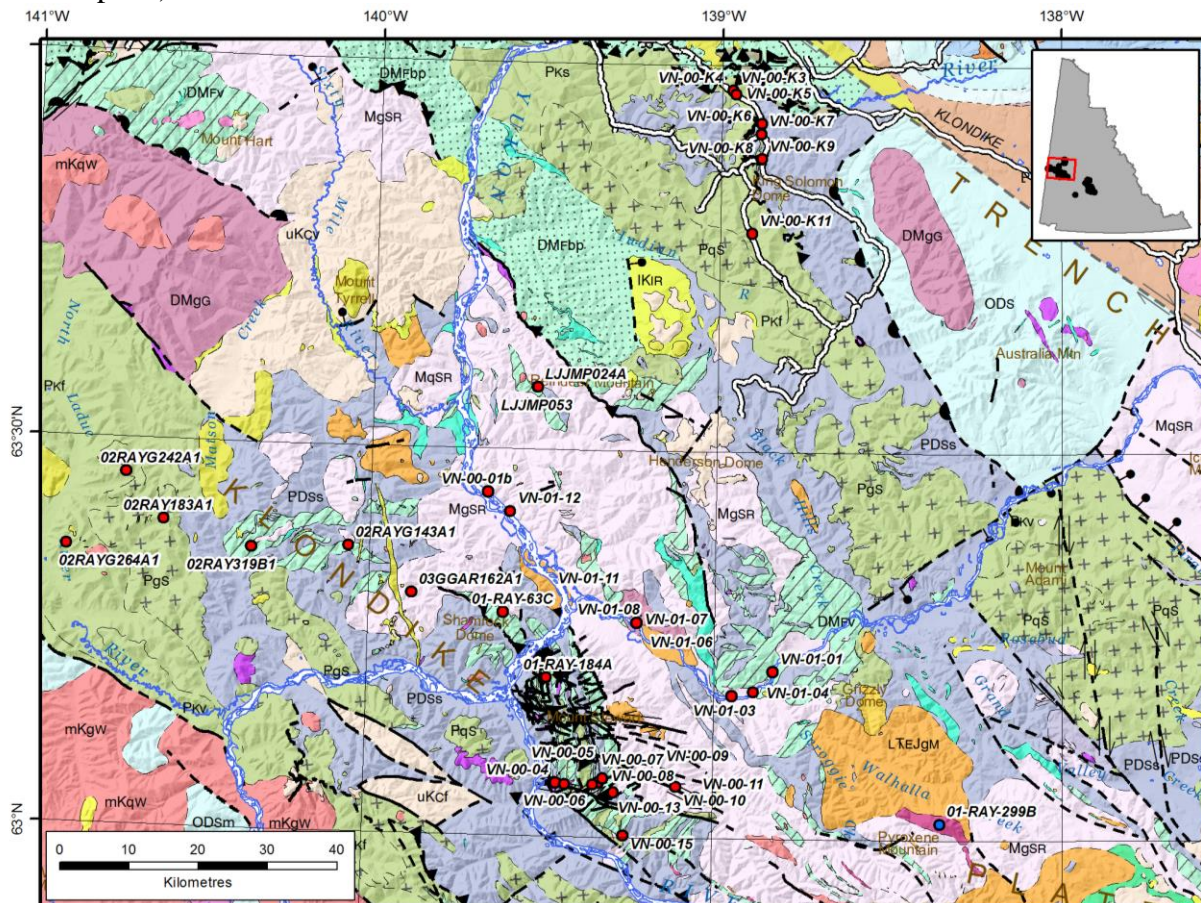


Figure 2. Geological map of the Stewart River area showing location of samples constraining Jurassic regional metamorphic cooling, including some Triassic (blue) and Jurassic plutons. Geology from Yukon Geological Survey, www.geology.gov.yk.ca.

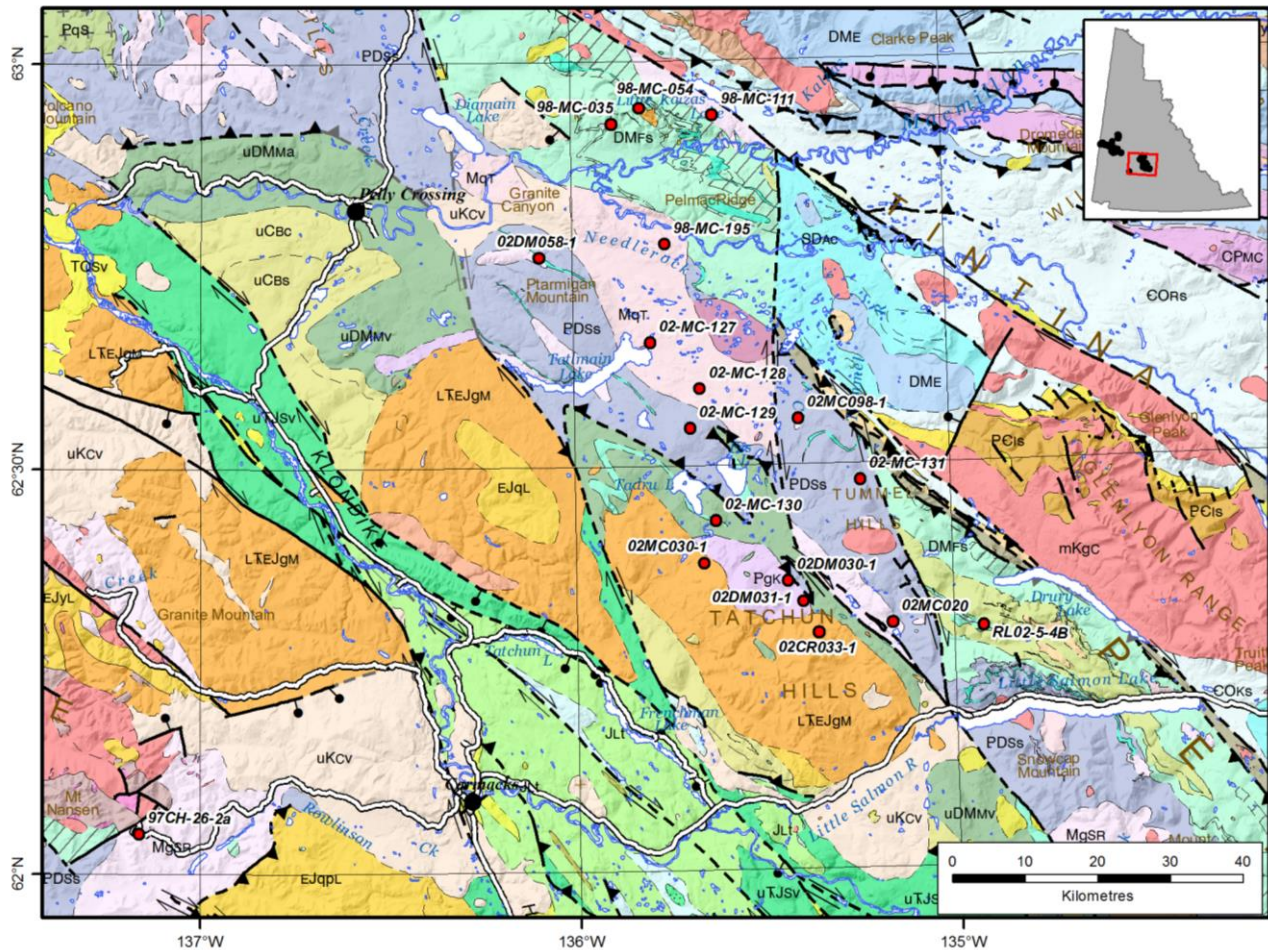


Figure 3. Geological map of the Glenlyon and Carmacks areas showing location of samples constraining Jurassic regional metamorphic cooling. Geology from Yukon Geological Survey, www.geology.gov.yk.ca.

Pyroxene Mountain and Aishihik plutonic suites

The Pyroxene Mountain suite comprises clinopyroxenite (and hornblendite after pyroxenite) sills that are found only in the hanging wall of the Yukon River thrust (Fig. 2; Ryan et al., 2014), and probably correlate with the Stikine plutonic suite regionally, south of the Yukon River thrust. A sample of coarse hornblende from a hornblendite phase (01-RAY-299B) yielded an age of ca. 218 Ma, which is consistent with a poor quality ca. 220 Ma U-Pb titanite age (Villeneuve, unpublished data, 2003) obtained from a nearby trondhjemite sampled from within the pyroxenite. Ryan et al. (2014) note that the Pyroxene Mountain suite is broadly cospatial with the Late Triassic Semenof formation volcanic rocks, and consider them to be co-magmatic.

Four samples from the Stewart River area, three from Glenlyon area, and one from the Granite Mountain batholith in the Williams Creek area were submitted from the Late Triassic to Early Jurassic Aishihik plutonic suite (Minto Suite), which are typical of the granite that hosts the Minto Copper-Gold mine. The ages from these samples range from 202 to 189 Ma. We interpret the ages between 202 and 196 Ma as magmatic crystallization ages, they are consistent with U-Pb determinations in the region (eg. Hood (2012) and references therein). The 194 to 189 Ma ages likely reflect minor resetting or slow cooling. The fact that these rocks record $^{40}\text{Ar}/^{39}\text{Ar}$ ages so close to U-Pb ages indicates that they cooled below Ar closure temperature soon after magmatic crystallization. One sample (VN-01-11) yielded an anomalous age of 116

Ma, and we interpret this as an estimated reset age of a Jurassic intrusion; however, the cause of this reset is uncertain.

Sample Number: 97CH-26-2a

Yukon Minfile 115I 064

Lithology: Muscovite gneiss

Mineral analyzed: Muscovite

Age: 179.2 ± 1.8 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 4712

Argon Number: 983

Location: Mount Nansen deposit

UTM Zone 8 - 386910 E 6881737 N; NTS sheet 115I/3

Unit Name (if available): Yukon-Tanana gneiss

Geologist: C. J. R. Hart

Sample Description:

Coarse-grained altered and oxidized muscovite gneiss, in graphitic section of drill core, DDH IP-1, at 91.0 meters.

Results:

Two aliquots were run; both gave concordant flat multistep plateaus. Age is derived from the combined plateau ages for both aliquots, 99.6% of released ^{39}Ar gas, MSWD=0.679.

Analytical details:

Irradiation Batch: GSC #26

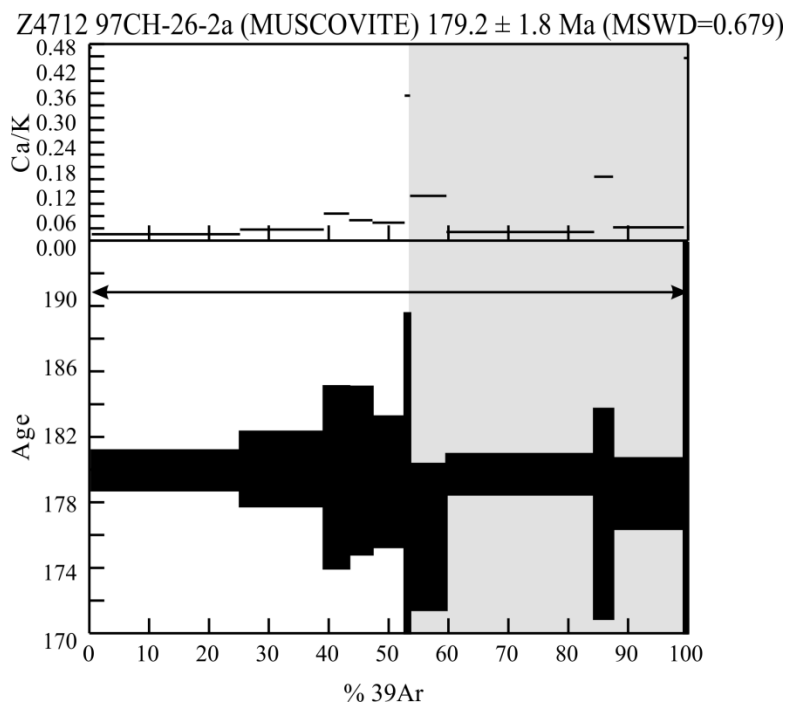
Date analyzed: June 22, 1998

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 98-MC-054

Lithology: Hornblende-biotite quartz monzonite

Mineral analyzed: Biotite

Age: 194.4 ± 1.3 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6204

Argon Number: 1582

Location: YTT; 5300' elevation, along alpine ridge, Macmillan Range, ~8 km W of Little Kalzas Lake

UTM Zone 8 - 458557 E 6979409 N; NTS sheet 105L/13

Unit Name (if available): Cornolio pluton

Geologist: M. Colpron

Sample Description:

Massive, medium-grained, hornblende-biotite quartz monzonite

Results:

Three aliquots were analyzed, all giving hump-shaped spectra. Age is based on plateau/pseudoplateau regions formed by highest-temperature steps for all three aliquots (35.2% of gas), MSWD=4.164.

Analytical details:

Irradiation Batch: GSC #35

Date analyzed: April 27 & May 15, 2000

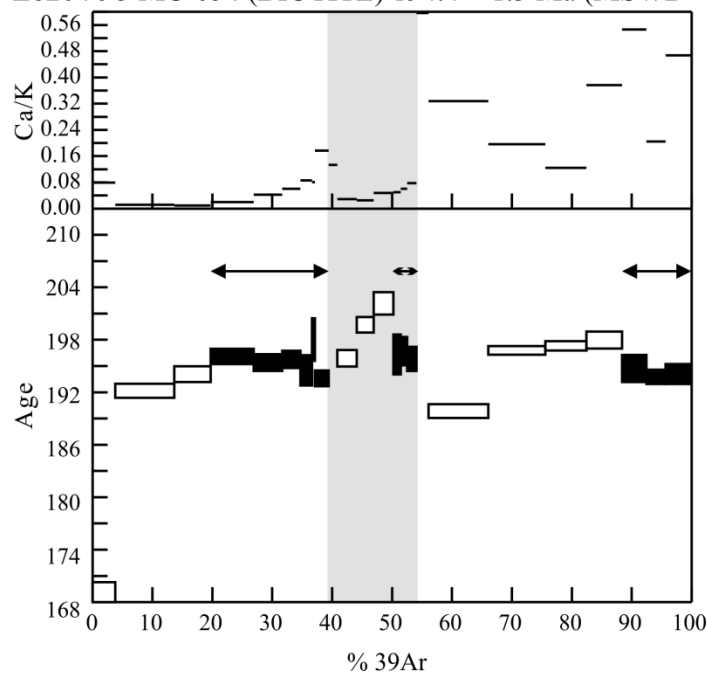
Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module

Z6204 98-MC-054 (BIOTITE) 194.4 ± 1.3 Ma (MSWD=4.164)



Sample Number: 98-MC-054

Lithology: Hornblende-biotite quartz monzonite

Mineral analyzed: Hornblende

Age: 191.5 ± 1.2 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6204

Argon Number: 1499

Location: YTT; 5300' elevation, along alpine ridge, Macmillan Range, ~8 km W of Little Kalzas Lake

UTM Zone 8 - 458557 E 6979409 N; NTS sheet 105L/13

Unit Name (if available): Cornolio pluton

Geologist: M. Colpron

Sample Description:

Massive, medium-grained, hornblende-biotite quartz monzonite

Results:

Three aliquots were run, all showing down-stepping spectra (Fig. A). The highest temperature steps drop out to ~188-190 Ma. The assigned age is based on the plateau regions for all three aliquots (70% of gas released, MSWD=0.783). Despite younging of ages with heating step, data generally fall along the atmospheric line in the inverse isochron plot (Fig. B), giving an inverse isochron age of 190.7 ± 1.5 Ma (MSWD=4.872).

Analytical details:

Irradiation Batch: GSC #35

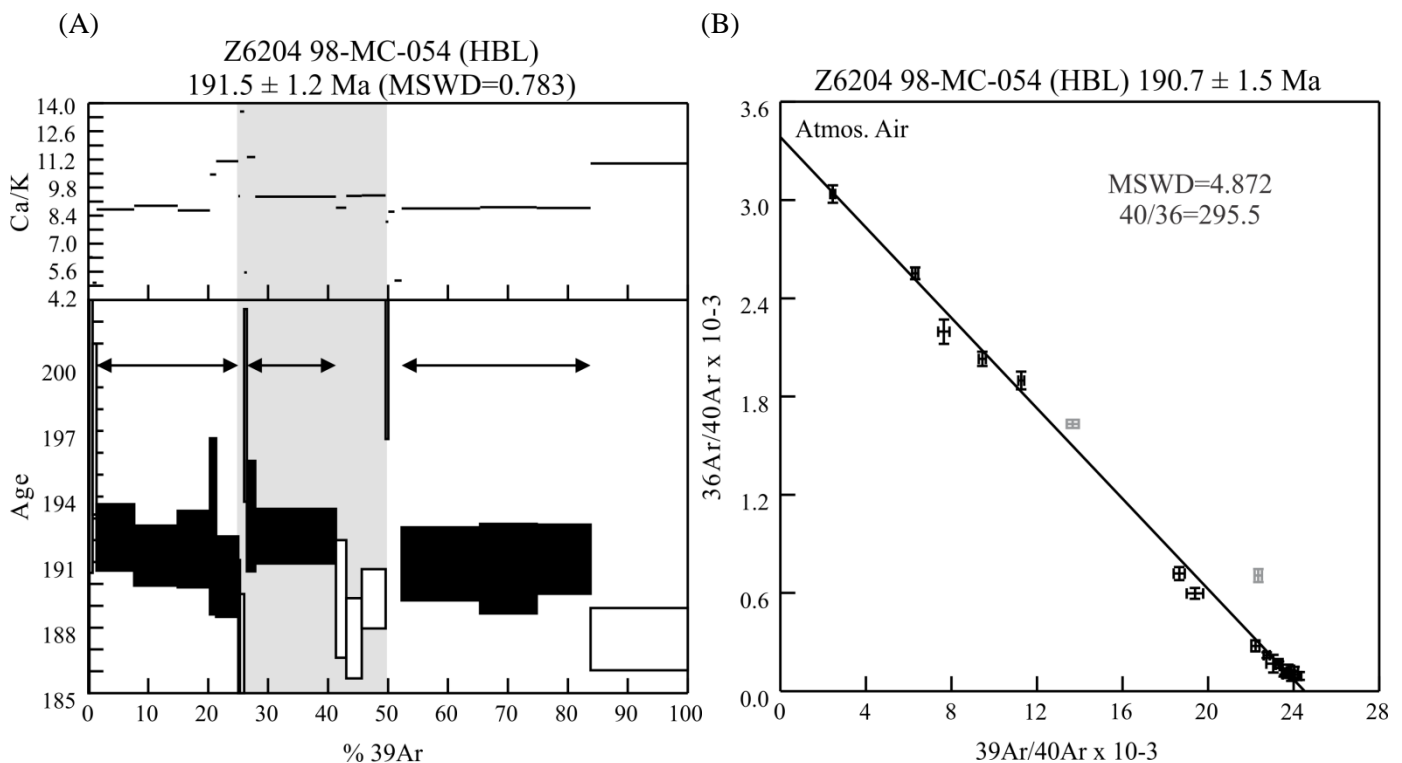
Date analyzed: April 27-28, & May 12, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 98-MC-035
Lithology: Quartz dioritic orthogneiss
Mineral analyzed: Muscovite
Age: 192.0 ± 1.2 Ma
Interpretation: Metamorphic Cooling

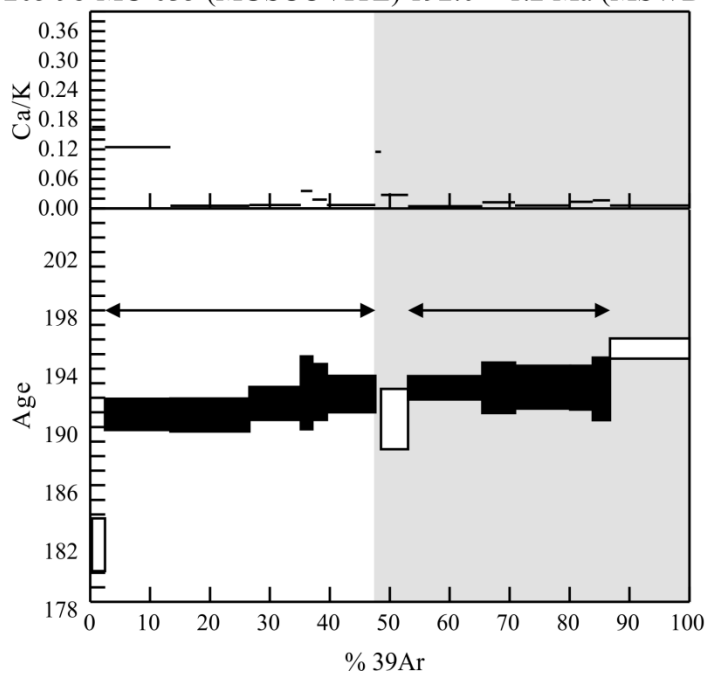
Geochronology Lab Number: 6205
Argon Number: 1500
Location: Yukon-Tanana terrane; 4700 ft., south end of "Dillweed Plateau"
UTM Zone 8 - 454685 E 6977334 N; NTS sheet 105L/13
Unit Name (if available): Dillweed orthogneiss
Geologist: M. Colpron

Sample Description:
Medium-grained strongly-foliated quartz dioritic orthogneiss

Results:
Two aliquots were run, both giving slightly upward-stepping spectra. Age is based on the combined plateau regions of both aliquots, comprising 78.8% of the total released ^{39}Ar , MSWD=1.554.

Analytical details:
Irradiation Batch: GSC #35
Date analyzed: May 2-3, 2000
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module

Z6205 98-MC-035 (MUSCOVITE) 192.0 ± 1.2 Ma (MSWD=1.554)



Sample Number: 98-MC-195

Lithology: Hornblende-biotite quartz diorite

Mineral analyzed: Biotite

Age: NO AGE

Interpretation: No Age

Geochronology Lab Number: 6206

Argon Number: 1581

Location: YTT; 2400 ft, 12.6 km SE of confluence of Macmillan and Pelly rivers

UTM Zone 8 - 461539 E 6960638 N; NTS sheet 105L/13

Unit Name (if available): Tatlain Batholith

Geologist: M. Colpron

Sample Description:

Medium-grained equigranular hornblende-biotite quartz diorite; massive intrusion, lower greenschist to lower amphibolite grade. Grains were greenish-brown books.

Results:

Three aliquots were analyzed, the results of which were not in agreement with each other. All three yielded hump-shaped spectra with most apparent ages in the 350-365 Ma range (Fig. A). The inverse isochron gives 354 ± 4 Ma, with data in a scattered cluster at x-axis (MSWD=67, Fig. B). This sample gave a U-Pb zircon age of 339.5 ± 1.3 Ma, and a hornblende $^{40}\text{Ar}/^{39}\text{Ar}$ age of 343.7 ± 3.2 Ma (Colpron et al., 2006).

Analytical details:

Irradiation Batch: GSC #35

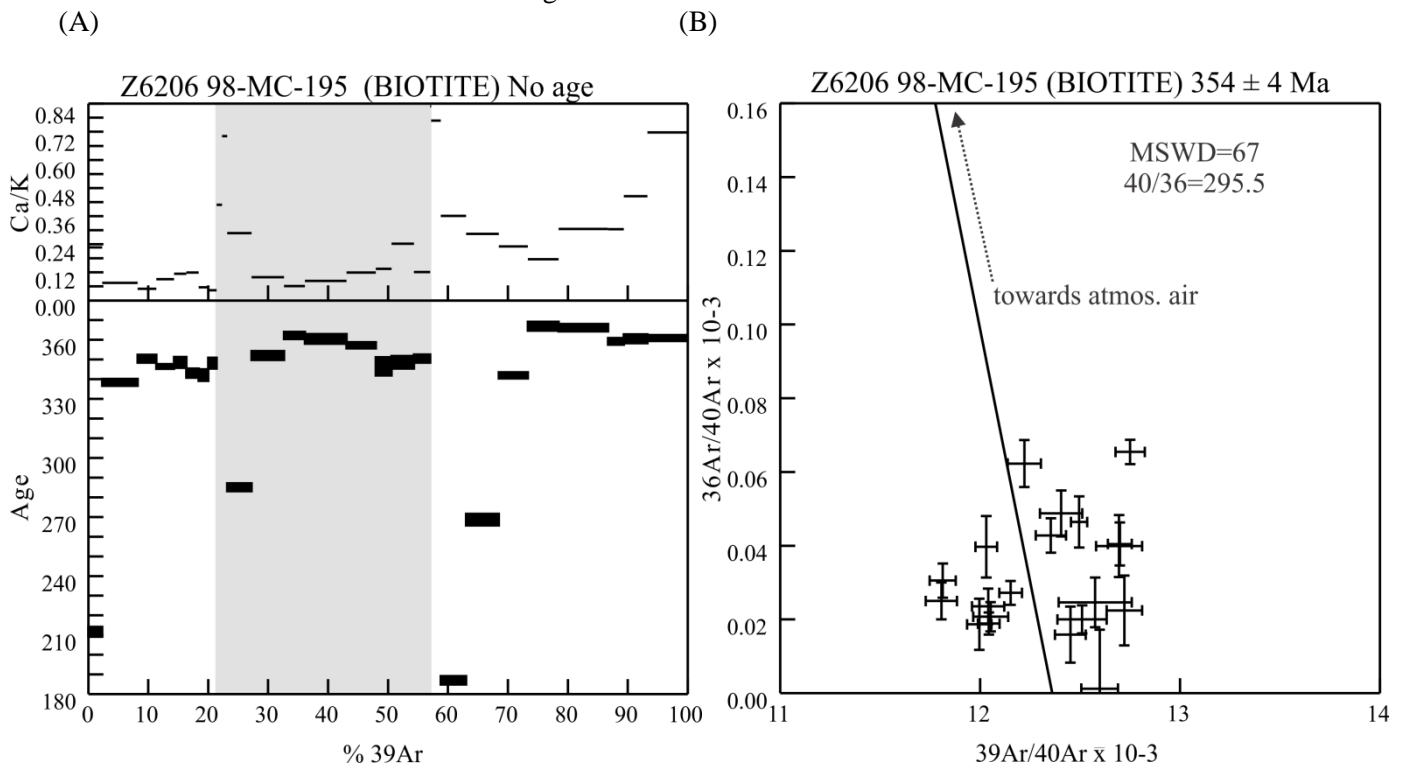
Date analyzed: April 28, May 1 & 15, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 98-MC-111
Lithology: Biotite granite to tonalite
Mineral analyzed: Biotite
Age: 216.7 ± 1.2 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6207
Argon Number: 1502
Location: Yukon-Tanana terrane; 2750 ft., east of Little Kalzas Lake
UTM Zone 8 - 468577 E 6978303 N; NTS sheet 105L/13
Unit Name (if available): Little Kalzas Orthogneiss
Geologist: M. Colpron

Sample Description:

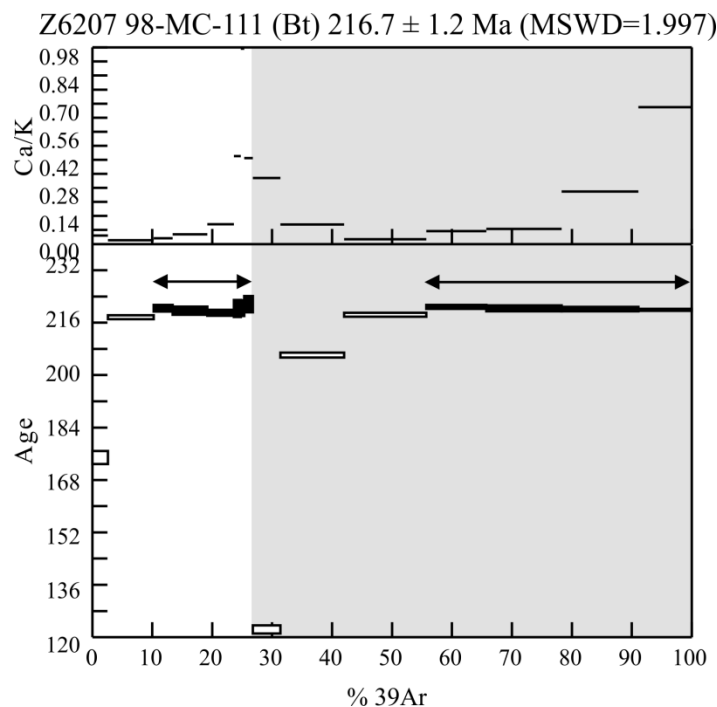
Strongly-foliated biotite granite to tonalite. The biotite submitted for analysis was slightly chloritized.

Results:

Two aliquots were analyzed, and both showed significant argon loss in low temperature steps. Mid- to high-temperature steps formed relatively flat multistep plateaus reproducible across two aliquots (61% of gas released, 10 of 15 steps, MSWD=1.997)

Analytical details:

Irradiation Batch: GSC #35
Date analyzed: May 3, 2000
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-11
Lithology: Quartz diorite
Mineral analyzed: Hornblende
Age: 170.9 ± 1.7 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6511
Argon Number: 1733
Location: On top of a large pingo at the upper end of Thistle Creek road
UTM Zone 7 - 598494 E 6993090 N; NTS sheet 1150/3
Unit Name (if available): Simpson Range suite; Pingo Quartz Diorite
Geologist: J. J. Ryan

Sample Description:

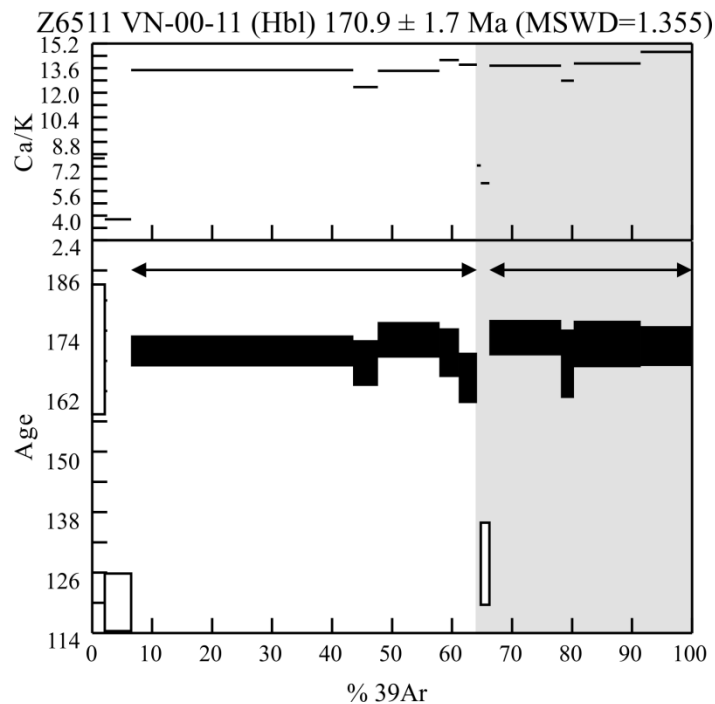
Hornblende-bearing quartz diorite from an intrusive complex that is strongly compositionally layered as different injected sheets (diorite intruded by tonalite and then granite), and all sheets are transposed together. Intrudes biotite-rich country rock. Analyzed hornblende grains were dark brown fragments.

Results:

Minor ^{40}Ar -loss in lowest temperature steps in each of two aliquots analyzed. Ca/K values of ~ 15 limit the precision on the results. The age is based on plateau regions for both aliquots, MSWD=1.355, 91% of released ^{39}Ar .

Analytical details:

Irradiation Batch: GSC #39
Date analyzed: June 12, 2001
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO_2 laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-07
Lithology: Muscovite-quartz schist
Mineral analyzed: Biotite
Age: 170.7 ± 1.0 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6512
Argon Number: 1732
Location: On Thistle Creek Road
UTM Zone 7 - 584351 E 6994585 N; NTS sheet 1150/3
Unit Name (if available): Klondike Schist
Geologist: J. J. Ryan

Sample Description:

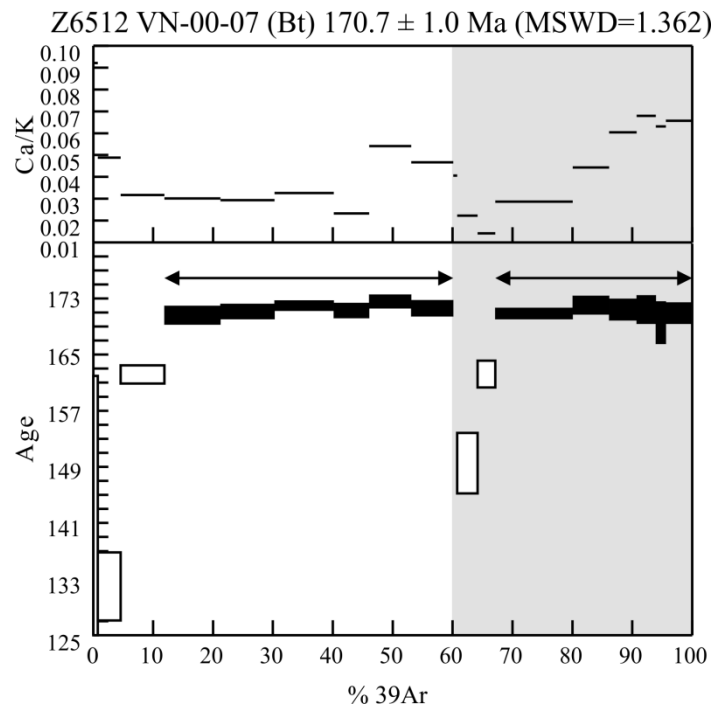
Light coloured, strongly attenuated muscovite-quartz schist from within a package of amphibolites. Likely a felsite dyke or rhyolite flow with strongly stretched silicates. Collected for dating in order to constrain age of volcanic/amphibolite pile. Analyzed grains were black to slightly steel-grey in colour.

Results:

Significant ^{40}Ar -loss profiles were obtained in lowest temperature steps in each of two aliquots analyzed. The assigned age is based on the combined plateau regions for both aliquots, MSWD=1.362, 81% of released ^{39}Ar .

Analytical details:

Irradiation Batch: GSC #39
Date analyzed: May 28-29, 2001
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO_2 laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-01b
Lithology: Tonalite/diorite orthogneiss
Mineral analyzed: Hornblende
Age: 185.9 ± 1.4 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6728
Argon Number: 1709
Location: Along Yukon River, on east shore, north of Stewart River
UTM Zone 7 - 566555 E 7035768 N; NTS sheet 1150/5
Unit Name (if available): Simpson Range suite
Geologist: J. J. Ryan

Sample Description:

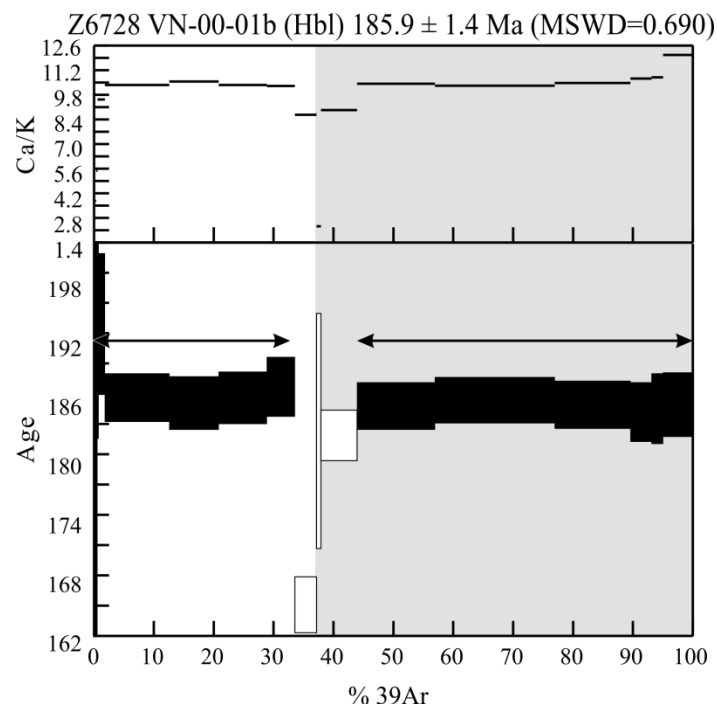
Relatively clean mafic-rich layers with minor 1/2 cm layers of felsic material, some cross-cutting. Most homogeneous mafic material was selected for dating. This is potentially part of the older sequence because it has seen the deformation. May be an intrusive body into the amphibolite complex. Grains selected for dating were dark brown and good quality.

Results:

Two aliquots were analyzed, and both gave flat-multistep plateaus. The fusion step of Aliquot A fell to 165 Ma, corresponding to a drop in Ca/K compared to the steps in the plateau region. Aliquot B showed minor ^{40}Ar loss in low-temperature steps. Age is based on reproducible plateau regions for both aliquots, containing 89% of the released ^{39}Ar gas, MSWD=0.690.

Analytical details:

Irradiation Batch: GSC #39
Date analyzed: July 17, 2001
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-K3

Lithology: Quartz-biotite-muscovite-garnet-K-feldspar schist

Mineral analyzed: Muscovite

Age: 165.4 ± 1.0 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6735

Argon Number: 1710

Location: Near Bee Creek/Not Much Gold Creek on Hunker Creek Road

UTM Zone 7 - 599366 E 7095088 N; NTS sheet 115O/15

Unit Name (if available): Klondike Schist

Geologist: C. J. R. Hart

Sample Description:

Highly deformed quartz-biotite-muscovite-garnet-K-feldspar schist. Syn-deformational formation of pegmatite melts. PSc unit of Mortensen (1996). Biotite from this sample was not selected for dating because it was very chloritized. Muscovite grains selected for analysis were clear, colourless, and anhedral flakes.

Results:

Two aliquots were analyzed, yielding flat multistep plateaus comprising 98.8% of the total released ^{39}Ar gas; MSWD = 0.307, POF = 98.47.

Analytical details:

Irradiation Batch: GSC #39

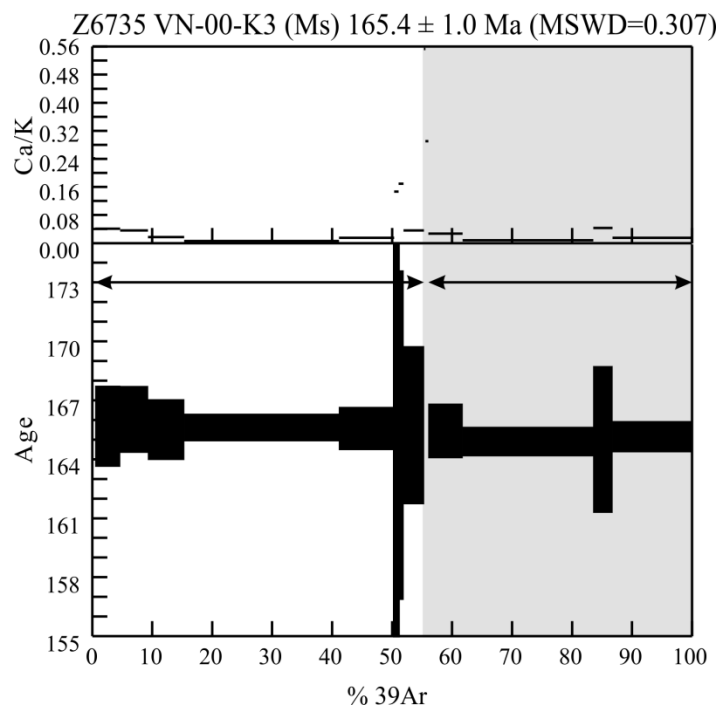
Date analyzed: May 28, 2001

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-K4
Lithology: Hornblende diorite
Mineral analyzed: Hornblende
Age: 151.9 ± 2.7 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6736
Argon Number: 1711
Location: Just south of gold panning attraction on Hunker Creek Road
UTM Zone 7 - 599780 E 7094553 N; NTS sheet 115O/15
Unit Name (if available):
Geologist: C. J. R. Hart

Sample Description:

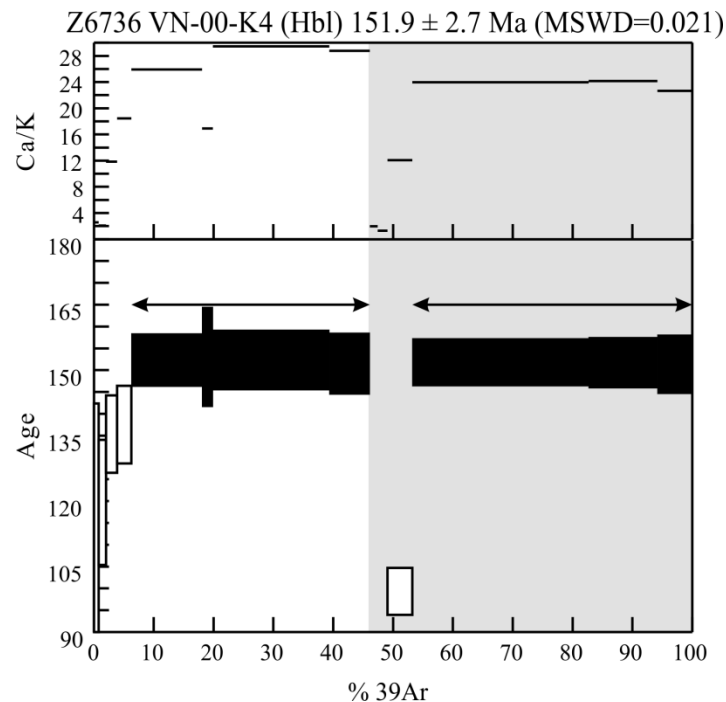
Hornblende diorite; massive, equigranular with only minor zones of felsic segregation and very rich in coarse hornblende. Pg unit of Mortensen (1996). An anomalously old hornblende K-Ar age of 221 ± 5 Ma was obtained for this unit previously (sample MLB-88-103; Hunt and Roddick, 1992). Hornblende grains analyzed were good quality black fragments.

Results:

Two aliquots were analyzed, both giving flat multistep plateaus comprising 86.6 % of gas, MSWD=0.021. Errors on the apparent ages are relatively large (typically 4-7%, 2σ) due to the high Ca and low K content of the hornblende.

Analytical details:

Irradiation Batch: GSC #39
Date analyzed: May 24-25, 2001
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-K5

Lithology: Hornblende diorite

Mineral analyzed: Biotite

Age: ca. 155 Ma

Interpretation: Estimated metamorphic cooling age

Geochronology Lab Number: 6737

Argon Number: 1714

Location: Just south of gold panning attraction on Hunker Creek Road

UTM Zone 7 - 599780 E 7094553 N; NTS sheet 1150/15

Unit Name (if available):

Geologist: C. J. R. Hart

Sample Description:

Melt segregation in small shear zone in outcrop of hornblende diorite. Contains syn-formational biotite growth. In Pg unit of Mortensen (1996). The biotite grains that were analyzed were black with ragged edges.

Results:

Two aliquots were analyzed, and both gave severely humped spectra with oldest ages at about 155-157 Ma in the mid-temperature heating steps. The Ca/K composition rose in the high-temperature steps, potentially symptomatic of the degassing of a foreign mineral or fluid phase. On the inverse isochron diagram, many of the points plot above the atmospheric line, but several of the more radiogenic analyses plot broadly along it, suggesting an age of ca. 155 Ma (MSWD=41). This is at best an estimate of the metamorphic cooling age.

Analytical details:

Irradiation Batch: GSC #39

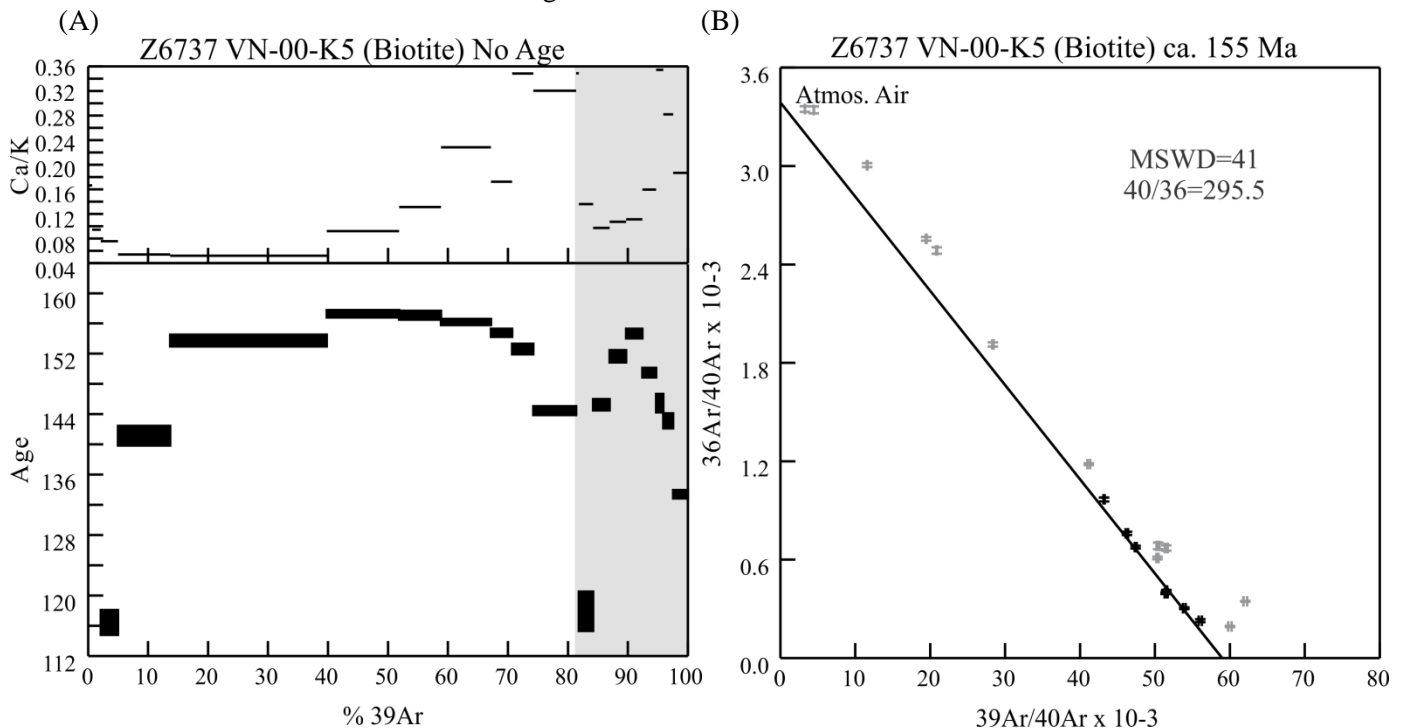
Date analyzed: June 5-6 & 27, 2001

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-K6

Lithology: Biotite-muscovite-K-feldspar orthogneiss

Mineral analyzed: Biotite

Age: 149.5 ± 0.9 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6738

Argon Number: 1715

Location: Hunker Creek Road, north side of Ontario Creek

UTM Zone 7 - 603771 E 7090459 N; NTS sheet 1150/15

Unit Name (if available):

Geologist: C. J. R. Hart

Sample Description:

Biotite-muscovite-K-feldspar orthogneiss with syn-deformational pegmatitic pods, collected from within the Psq unit of Mortensen (1996). Heterogeneous with distinct biotite-rich zones. Biotite could have formed during late retrogression or recrystallization. Grains were good quality dark brown books; they may be higher-grade equivalent of VN-00-K3 (this report).

Results:

Two aliquots were analyzed. Both had minor ^{40}Ar loss in early steps and reproducible plateaus comprising 83.6% of the total released ^{39}Ar . Age is calculated from combined plateau regions of both aliquots, MSWD=2.343, POF=0.52.

Analytical details:

Irradiation Batch: GSC #39

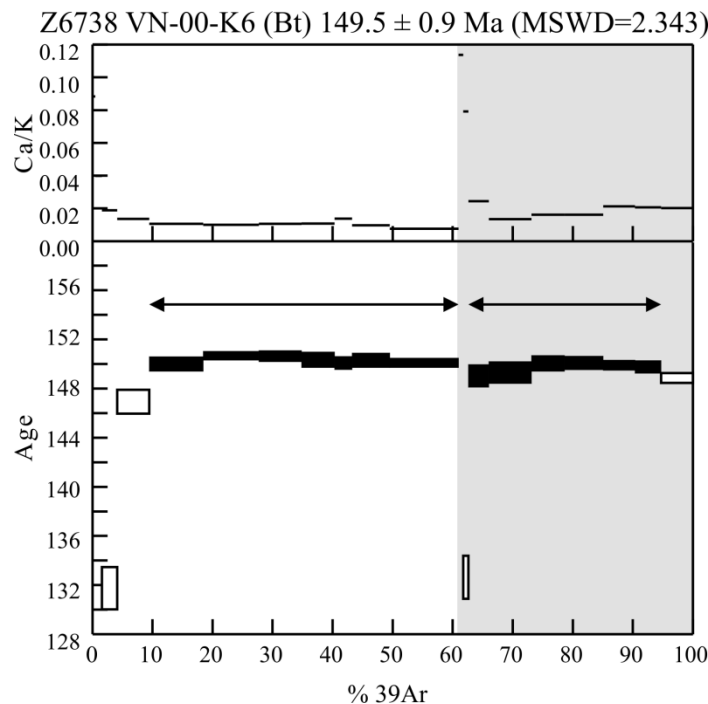
Date analyzed: June 5 & 28, 2001

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO_2 laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-K7

Lithology: Quartz-muscovite schist

Mineral analyzed: Muscovite

Age: 168.6 ± 1.0 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6739

Argon Number: 1716

Location: Hunker Creek Road, east of waste-pile

UTM Zone 7 - 603728 E 7089004 N; NTS sheet 1150/15

Unit Name (if available): Klondike Schist

Geologist: C. J. R. Hart

Sample Description:

Collected from an outcrop with a mix of chlorite schist and subordinate muscovite schist and quartz-muscovite schist, from the Psqm unit of Mortensen (1996). Locally rich in muscovite. Unpublished U-Pb of 254 ± 3 Ma, K-Ar Mu of 143 ± 1.4 Ma. Muscovite grains selected for analysis were excellent quality, clear and colourless, with minor small bubble-like inclusions.

Results:

Three aliquots were analyzed. Aliquots A and C gave down-stepping spectra with no plateaus. Age is based on Aliquot B, which showed minor ^{40}Ar loss in the two lowest-temperature heating steps and formed a four-step flat plateau comprising 96.6% of the ^{39}Ar gas, MSWD=0.394. Notably, Aliquots A and C had two-step pseudo-plateau regions within error of the Aliquot B plateau age.

Analytical details:

Irradiation Batch: GSC #39

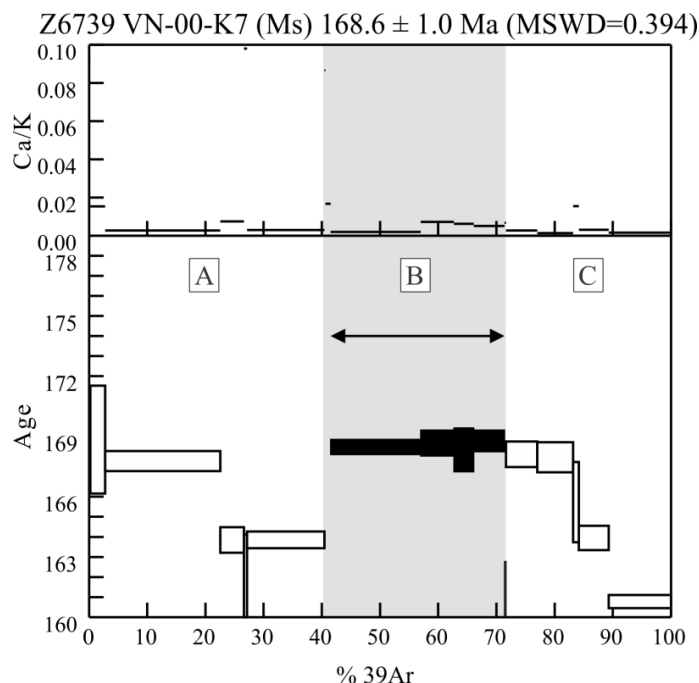
Date analyzed: June 26, 2001

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-K8
Lithology: Muscovite schist
Mineral analyzed: Muscovite
Age: 173.4 ± 1.0 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6740

Argon Number: 1717

Location: Hunker Creek Road, just south of the intersection with Dominion Creek Road

UTM Zone 7 - 603922 E 7085359 N; NTS sheet 1150/15

Unit Name (if available): Klondike Schist

Geologist: C. J. R. Hart

Sample Description:

Sample of muscovite schist collected from an outcrop that comprised strongly-foliated muscovite-biotite schist and orthogneiss of tonalite/diorite protolith. About 25m south from the trace of an interpreted thrust fault. In Psc unit of Mortensen (1996). The muscovite grains were coarse, colourless, and slightly cloudy.

Results:

Two aliquots gave hump-shaped spectra; Aliquot A gave a plateau covering 98% of its released ^{39}Ar at 174 Ma (MSWD=3.5). The last two steps of Aliquot B (20% of Aliquot B ^{39}Ar) were concordant with the Aliquot A plateau. The assigned age includes plateau portions of both aliquots (MSWD=2.798).

Analytical details:

Irradiation Batch: GSC #39

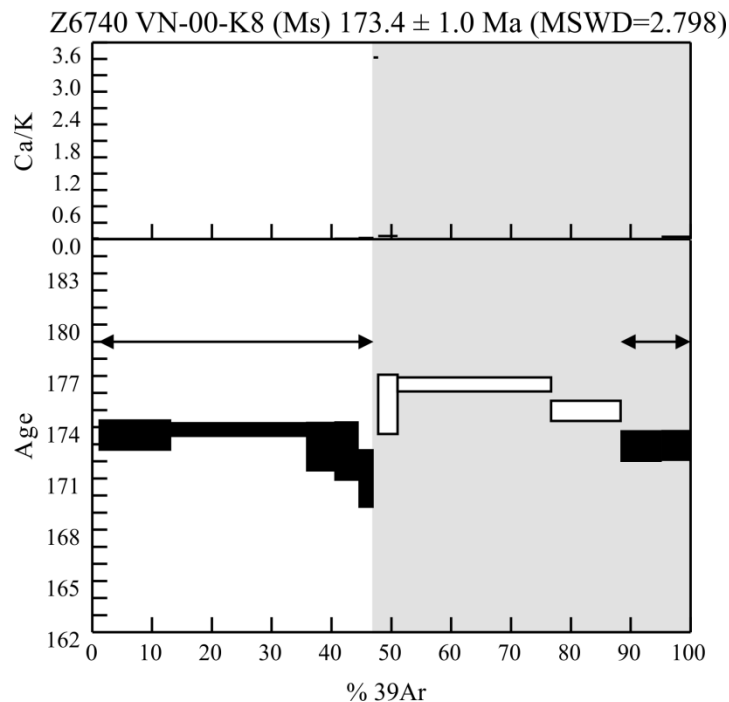
Date analyzed: June 22, 2001

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-K9
Lithology: Muscovite-quartz schist
Mineral analyzed: Muscovite
Age: 163.8 ± 1.0 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6741

Argon Number: 1718

Location: Hunker Creek Road, just north of the intersection with Dominion Creek Road

UTM Zone 7 - 603923 E 7085409 N; NTS sheet 1150/15

Unit Name (if available): Klondike Schist

Geologist: C. J. R. Hart

Sample Description:

Sampled from 20m north of a thrust fault within muscovite-quartz schist, in the Psc unit of Mortensen (1996). Highly oxidized. Within the thrust, the outcrop is extremely disaggregated, with many pulled apart clinopyroxene grains and disharmonic folds. Muscovite grains were clear, colourless, and thick.

Results:

Two aliquots were run and both gave flat multistep plateaus at different ages (Fig. A). Aliquot A was 164.0 ± 1.0 Ma (MSWD=0.929) and Aliquot B was 161.5 ± 1.0 Ma (MSWD=0.566). The assigned age is based on the inverse isochron for both aliquots, MSWD = 3.2, $^{40}\text{Ar}/^{36}\text{Ar} = 295.5$, using 10 of 14 heating steps (Fig. B).

Analytical details:

Irradiation Batch: GSC #39

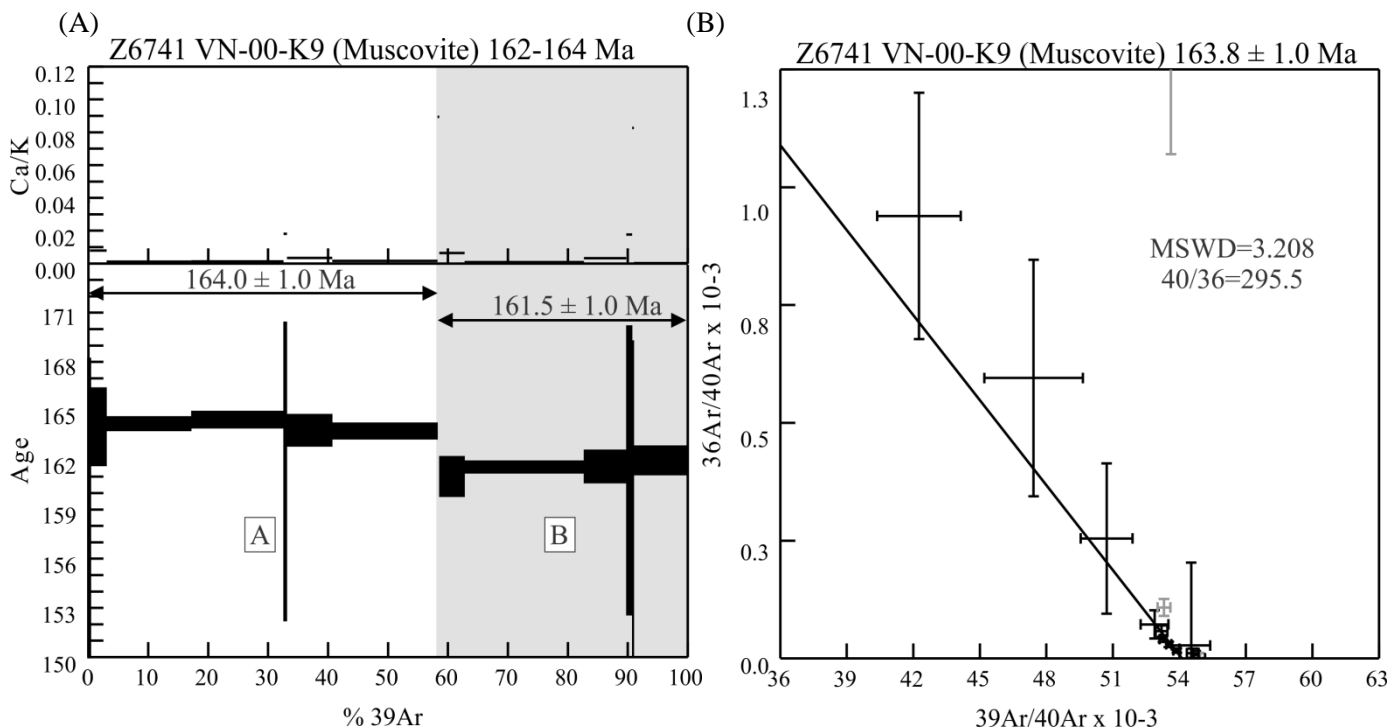
Date analyzed: July 16, 2001

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-K11
Lithology: Monzogranitic orthogneiss
Mineral analyzed: Muscovite
Age: 172.6 ± 1.0 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6743

Argon Number: 1720

Location: Hunker Creek Road, north side of Sulphur Creek orthogneiss, low outcrop by road

UTM Zone 7 - 603010 E 7074617 N; NTS sheet 1150/15

Unit Name (if available): Sulphur Creek Orthogneiss

Geologist: C. J. R. Hart

Sample Description:

Sampled from a less micaceous, muscovite-bearing foliated monzogranite with blue quartz eyes. The muscovite from this sample was heavily altered and of relatively poor quality. Grains were green to brown in colour, and riddled with long dark opaque inclusions.

Results:

Four aliquots run, each with ^{40}Ar loss in the first step, but flat reproducible multistep plateaus for the remainder of heating schedules. Age is based on plateau regions for all 4 aliquots, 98.5 % of ^{39}Ar gas, MSWD=0.866.

Analytical details:

Irradiation Batch: GSC #39

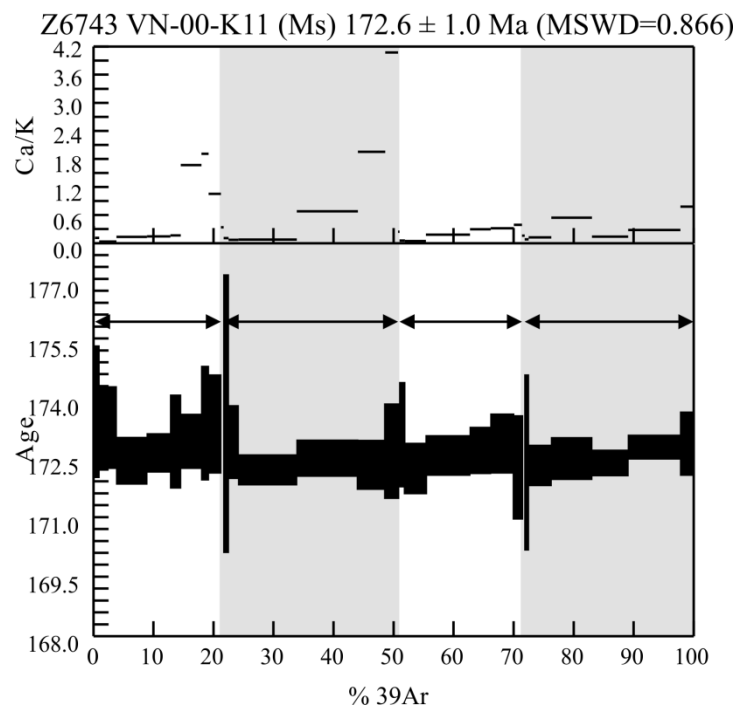
Date analyzed: June 4, July 19 & 24, 2001

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-04
Lithology: Quartz-mica schist
Mineral analyzed: Biotite
Age: NO AGE
Interpretation: No Age

Geochronology Lab Number: 6744
Argon Number: 1736
Location: Along Thistle Creek Road, just west of main placer camp
UTM Zone 7 - 578136 E 6994292 N; NTS sheet 115O/3
Unit Name (if available): Snowcap Assemblage
Geologist: J. J. Ryan

Sample Description:

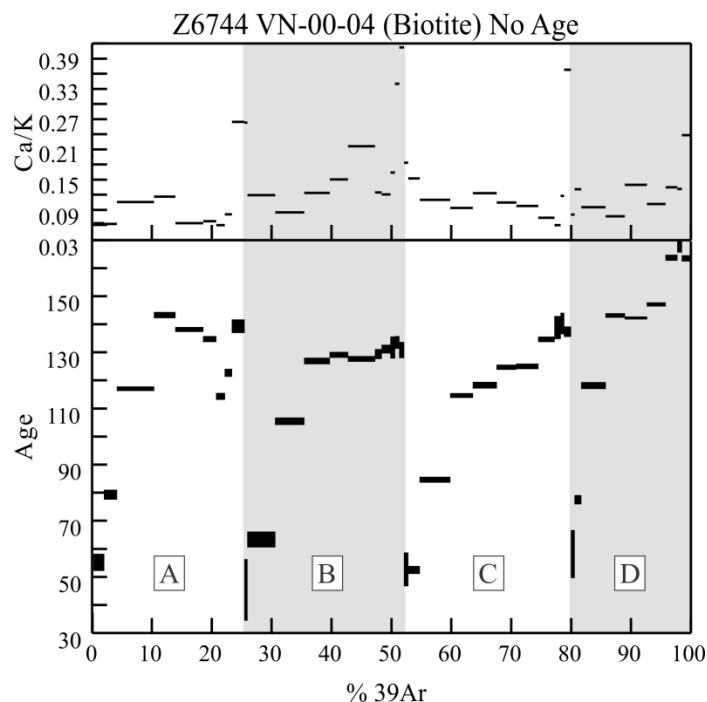
Quartz-mica schist, strongly layered and likely transposed. From part of sequence of schists that grade into semi-pelitic package. Although distinct, VN-00-04 is distinct from this package (more mica, less quartz). The contact zone is poorly defined and there is likely intimate interfolding. Unit 3/4 of Ryan and Gordey (2001). In hand sample, the rock has rusty brown weathering, but good, black 0.5-1.0 mm diameter biotite and muscovite along cleavages.

Results:

Four aliquots were analyzed, each with continually rising apparent ages and no defined plateau.

Analytical details:

Irradiation Batch: GSC #39
Date analyzed: May 23-24, July 18-19 & 24, 2001
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-04
Lithology: Quartz-mica schist
Mineral analyzed: Muscovite
Age: 171.0 ± 1.2 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6744
Argon Number: 1721
Location: Along Thistle Creek Road, just west of main placer camp
UTM Zone 7 - 578136 E 6994292 N; NTS sheet 115O/3
Unit Name (if available): Snowcap Assemblage
Geologist: J. J. Ryan

Sample Description:

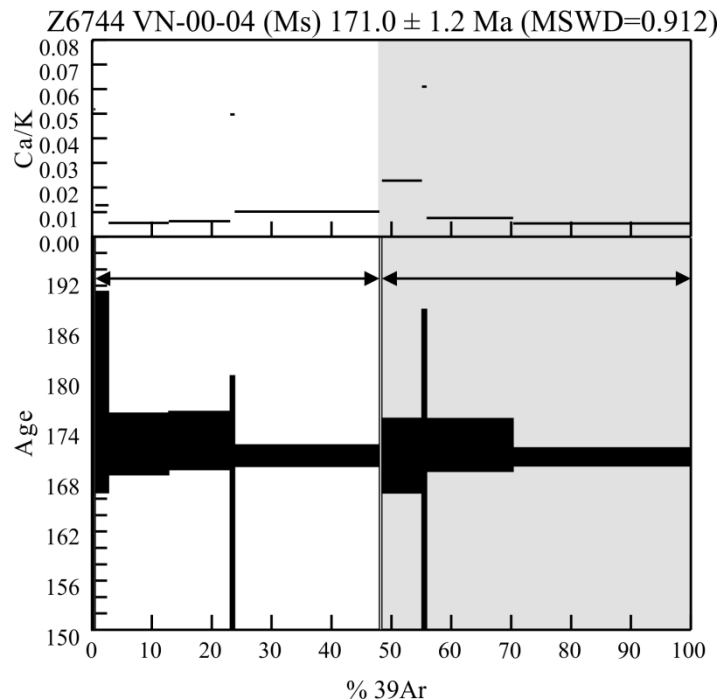
Quartz-mica schist, strongly layered and likely transposed. From part of sequence of schists that grade into semi-pelitic package. Although distinct, VN-00-04 is distinct from this package (more mica, less quartz). The contact zone is poorly defined and there is likely intimate interfolding. Unit 3/4 of Ryan and Gordey (2001). In hand sample, the rock has rusty brown weathering, but good, black 0.5-1.0 mm diameter biotite and muscovite along cleavages. After crushing, the muscovite separates were found to be slightly red-stained.

Results:

Abnormally low quantity of gas for muscovite, perhaps indicating post-cooling alteration. Two aliquots were run, both giving flat multistep plateaus comprising 99% of released ^{39}Ar , MSWD=0.912.

Analytical details:

Irradiation Batch: GSC #39
Date analyzed: May 22-23, 2001
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-05

Lithology: Amphibolite

Mineral analyzed: Biotite

Age: NO AGE

Interpretation: No Age

Geochronology Lab Number: 6745

Argon Number: 1723

Location: Along Thistle Creek Road, just east of main placer camp

UTM Zone 7 - 579567 E 6994098 N; NTS sheet 115O/3

Unit Name (if available): Finlayson Assemblage

Geologist: J. J. Ryan

Sample Description:

Amphibolite with coarse- to fine-grained good quality hornblende. Small biotite-rich zones contain fresher biotite (elsewhere the biotite is chloritized).

Results:

Reproducible, hump-shaped spectra in two aliquots with severe ^{40}Ar -loss in most of low temperature steps. Highest-temperature steps for both aliquots are late Cretaceous.

Analytical details:

Irradiation Batch: GSC #39

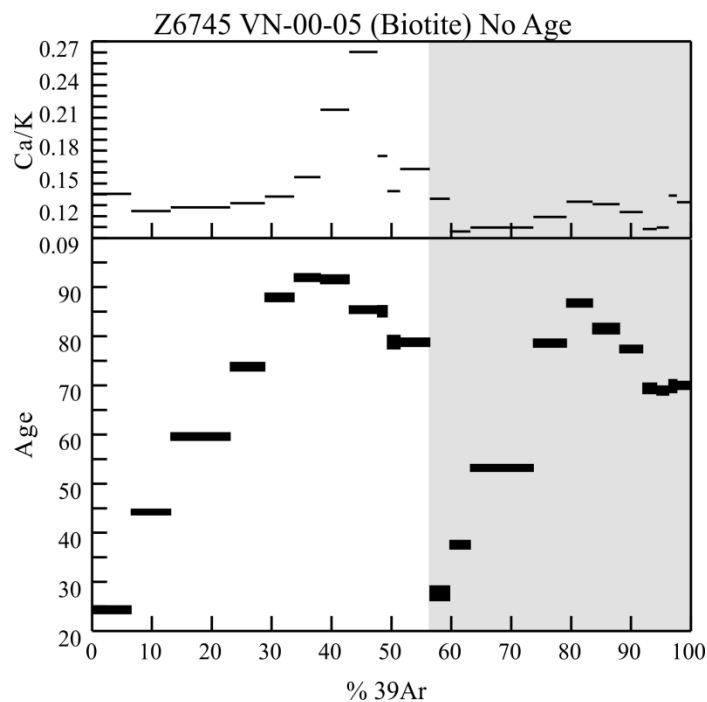
Date analyzed: May 16-17, 2001

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO_2 laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-05
Lithology: Amphibolite
Mineral analyzed: Hornblende
Age: 175.3 ± 3.9 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6745
Argon Number: 1722
Location: Along Thistle Creek Road, just east of main placer camp
UTM Zone 7 - 579567 E 6994098 N; NTS sheet 115O/3
Unit Name (if available): Finlayson Assemblage
Geologist: J. J. Ryan

Sample Description:

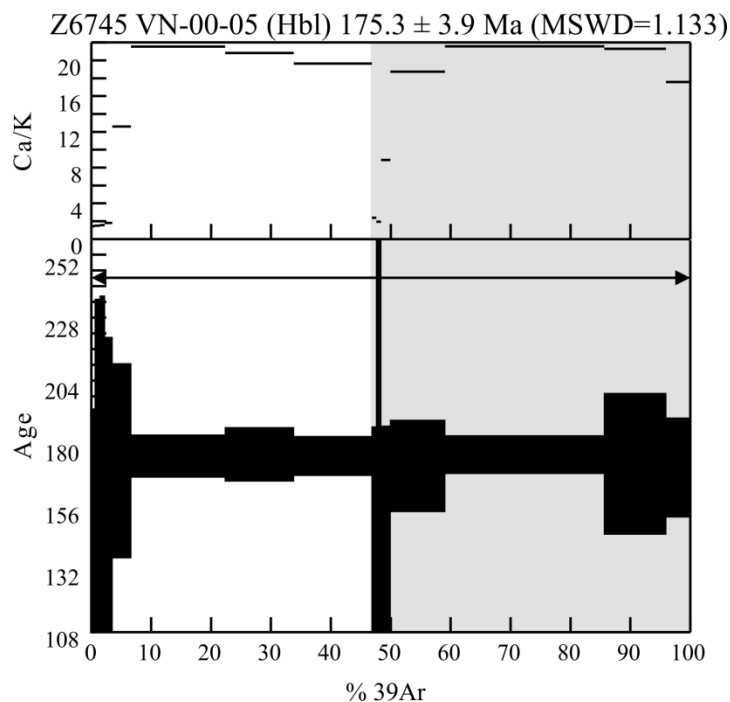
Amphibolite with coarse- to fine-grained good quality hornblende. Small biotite-rich zones contain fresher biotite (elsewhere the biotite is chloritized).

Results:

Very low gas amounts in this sample. 100% of gas used in plateau calculation for two aliquots (MSWD = 1.133). Low K and high Ca/K (ca. 22) result in degraded analytical precision.

Analytical details:

Irradiation Batch: GSC #39
Date analyzed: May 17-18, 2001
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-06
Lithology: Mica-hornblende schist
Mineral analyzed: Hornblende
Age: 172.7 ± 2.4 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6746
Argon Number: 1725
Location: Along Thistle Creek Road, east of main placer camp
UTM Zone 7 - 583645 E 6994215 N; NTS sheet 1150/3
Unit Name (if available): Finlayson Assemblage
Geologist: J. J. Ryan

Sample Description:

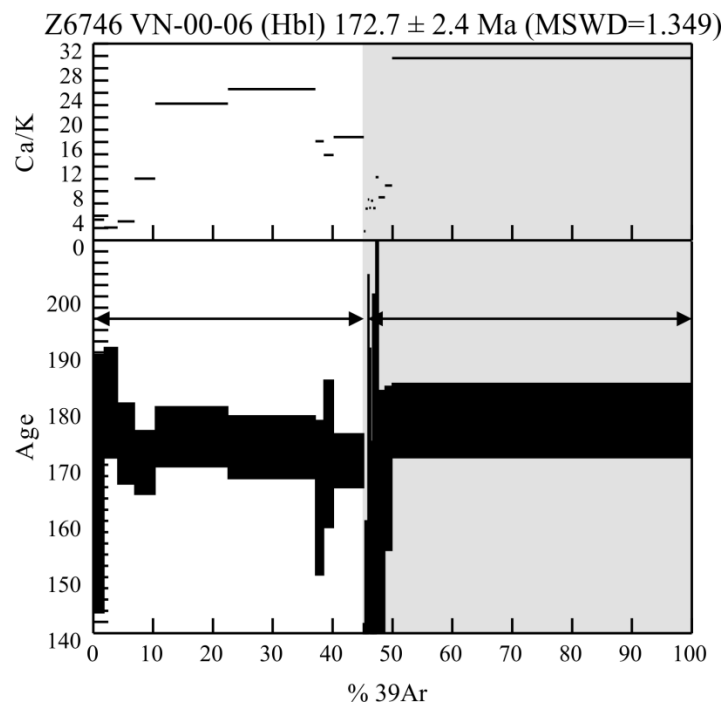
Layered amphibolite ranging from mica-hornblende schist to hornblende amphibolite. Can contain very large (3-4 cm) hornblende in bowtie structures. Sample contains coarse hornblende within muscovite-rich zone. From Unit 6 of Ryan and Gordey (2001). May be part of a pillow basalt/supracrustal volcanic arc assemblage.

Results:

High Ca/K (up to 25). Low gas volumes and uneven gas release. Marginal gas volumes in low-temperature steps, and only a few steps contained significant gas. However, all steps are in agreement, so the age is considered to be robust. Plateau age is derived from 99.5% of gas from both aliquots, MSWD=1.349

Analytical details:

Irradiation Batch: GSC #39
Date analyzed: May 18 & 28, June 28-29, 2001
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-06
Lithology: Mica-hornblende schist
Mineral analyzed: Muscovite
Age: 169.0 ± 1.4 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6746
Argon Number: 1724
Location: Along Thistle Creek Road, east of main placer camp.
UTM Zone 7 - 583645 E 6994215 N; NTS sheet 115O/3
Unit Name (if available): Finlayson Assemblage
Geologist: J. J. Ryan

Sample Description:

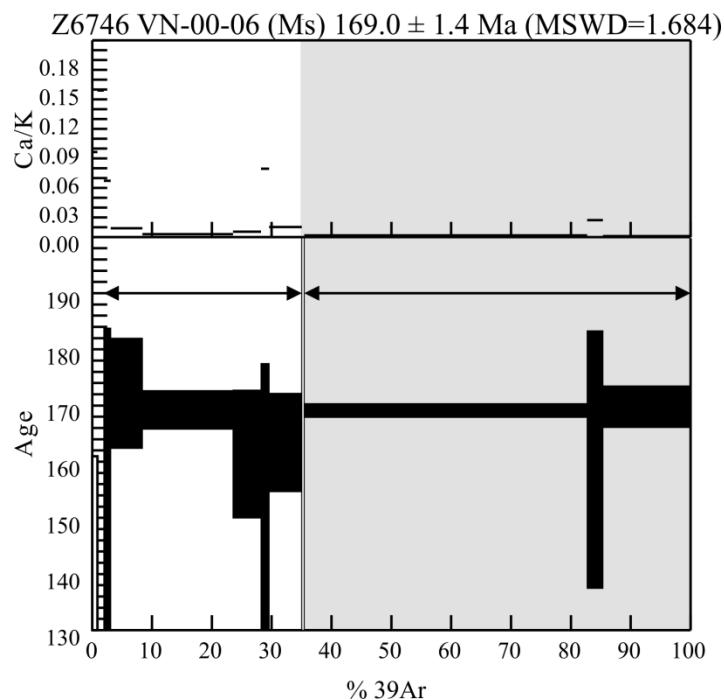
Layered amphibolite ranging from mica-hornblende schist to hornblende amphibolite. Can contain very large (3-4 cm) hornblende in bowtie structures. Sample contains coarse hornblende within muscovite-rich zone. From Unit 6 of Ryan and Gordey (2001). May be part of a pillow basalt/supracrustal volcanic arc assemblage.

Results:

Flat, reproducible plateaus containing 98% of gas on two aliquots, MSWD=1.684. Low gas volumes (from small size of sample loaded). Age is mostly pinned by 3 or 4 gas-rich steps.

Analytical details:

Irradiation Batch: GSC #39
Date analyzed: May 22, 2001
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-08
Lithology: Granitic orthogneiss
Mineral analyzed: Biotite
Age: 168.2 ± 1.0 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6747
Argon Number: 1726
Location: Along Thistle Creek Road, east of main placer camp
UTM Zone 7 - 584971 E 6995208 N; NTS sheet 1150/3
Unit Name (if available): Sulphur Creek suite; Klondike Assemblage
Geologist: J. J. Ryan

Sample Description:

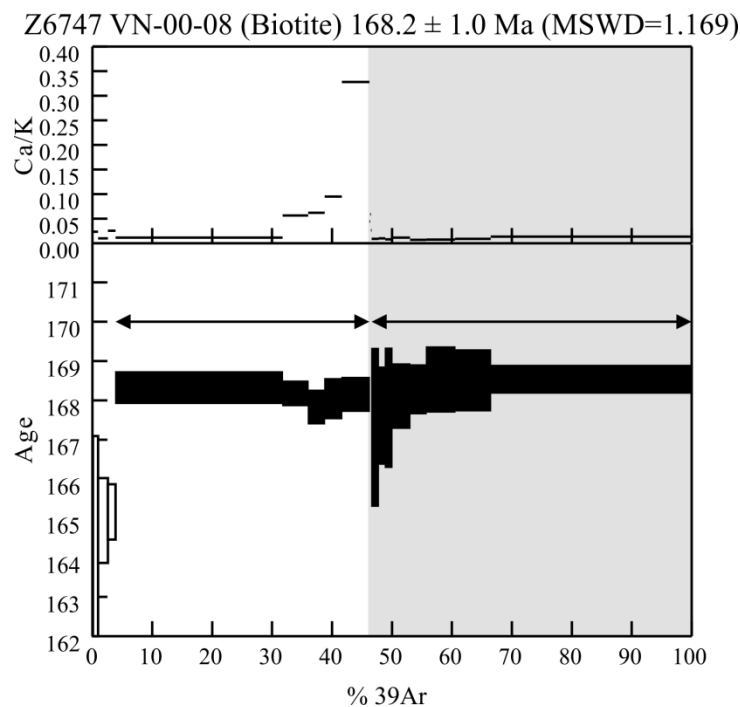
Orthogneiss/foliated granite with stretched quartz veins giving layered appearance. Some compositional layering (possibly primary magmatic) was observed. Sample taken for dating was from a biotite-muscovite rich zone with biotite in dark black books and muscovite on layering surfaces.

Results:

Minor ^{40}Ar loss in lowest temperature steps, but reproducible multistep plateaus were achieved containing 96% of ^{39}Ar gas across two aliquots (MSWD=1.169)

Analytical details:

Irradiation Batch: GSC #39
Date analyzed: June 19-20, 2001
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO_2 laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-08
Lithology: Granitic orthogneiss
Mineral analyzed: Muscovite
Age: 175.3 ± 1.0 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6747
Argon Number: 1735
Location: Along Thistle Creek Road, east of main placer camp
UTM Zone 7 - 584971 E 6995208 N; NTS sheet 115O/3
Unit Name (if available): Sulphur Creek suite; Klondike Assemblage
Geologist: J. J. Ryan

Sample Description:

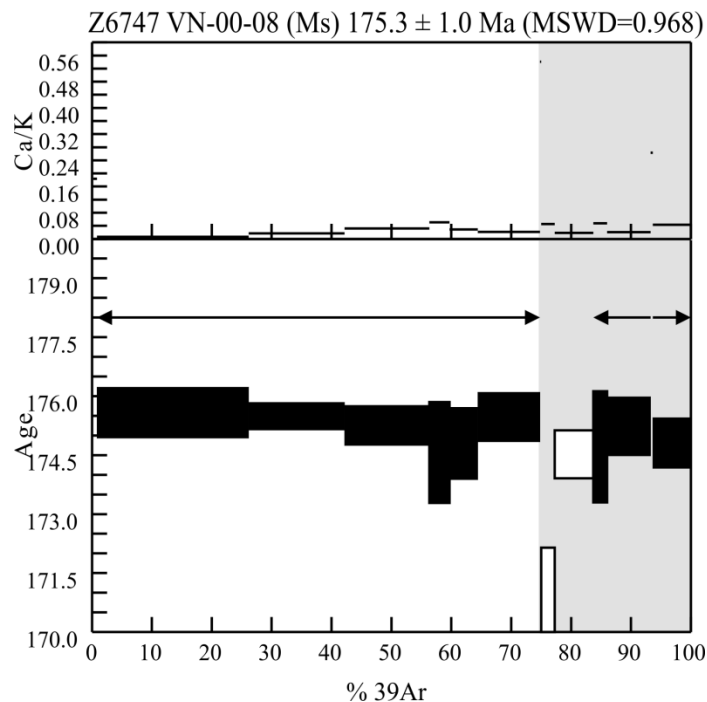
Orthogneiss/foliated granite with stretched quartz veins giving layered appearance. Some compositional layering (possibly primary magmatic). Sample taken for dating was from a biotite-muscovite rich zone with biotite in books and muscovite on layering surfaces. Muscovite grains were very clear with rare clear colourless inclusions.

Results:

A flat, multistep plateau was obtained in Aliquot A. Aliquot B contained less gas and showed distinct ^{40}Ar -loss profile, with a pseudo-plateau comprised of three non-consecutive heating steps. Age is based on the combined pseudo-plateau and plateau regions of both aliquots, 90% of released ^{39}Ar (MSWD=0.968).

Analytical details:

Irradiation Batch: GSC #39
Date analyzed: June 20-21, 2001
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO_2 laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-09
Lithology: Amphibolite
Mineral analyzed: Hornblende
Age: 163.8 ± 2.6 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6748

Argon Number: 1727

Location: Along Thistle Creek Road, east of main placer camp, west of Feller's placer operation
UTM Zone 7 - 590664 E 6995873 N; NTS sheet 115O/3

Unit Name (if available): Finlayson Assemblage

Geologist: J. J. Ryan

Sample Description:

Hornblende \pm biotite amphibolite, with small garnets(?), strongly layered. The hornblende that was analyzed was fresh and black.

Results:

High Ca/K (up to 25), and low K content limit analytical precision. The age is based on the combined reproducible plateaus on 97% of gas across two aliquots, MSWD=0.985.

Analytical details:

Irradiation Batch: GSC #39

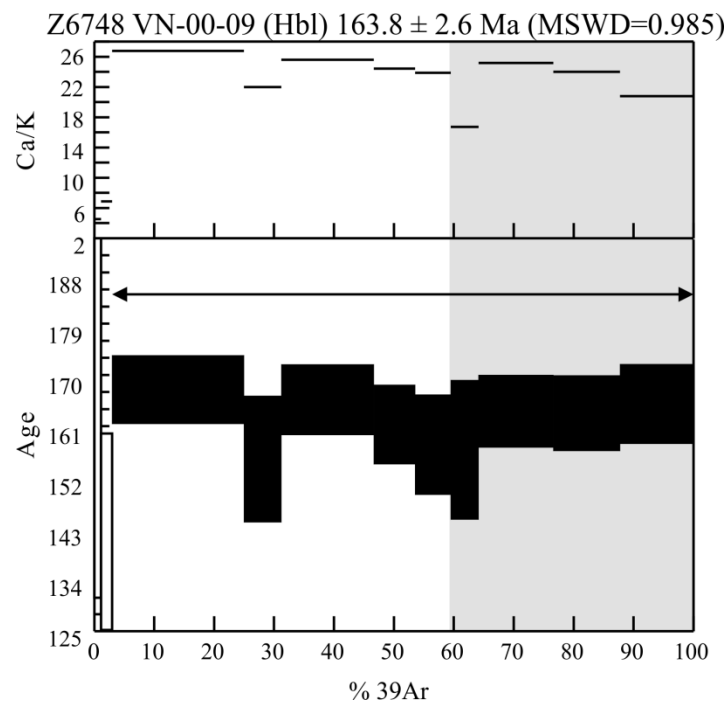
Date analyzed: May 31, June 1 & 4, 2001

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-10
Lithology: Amphibolite
Mineral analyzed: Hornblende
Age: 177.6 ± 1.3 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6749
Argon Number: 1728
Location: Along Thistle Creek Road, east of Feller's placer operation
UTM Zone 7 - 595586 E 6994442 N; NTS sheet 115O/3
Unit Name (if available): Finlayson Assemblage
Geologist: J. J. Ryan

Sample Description:

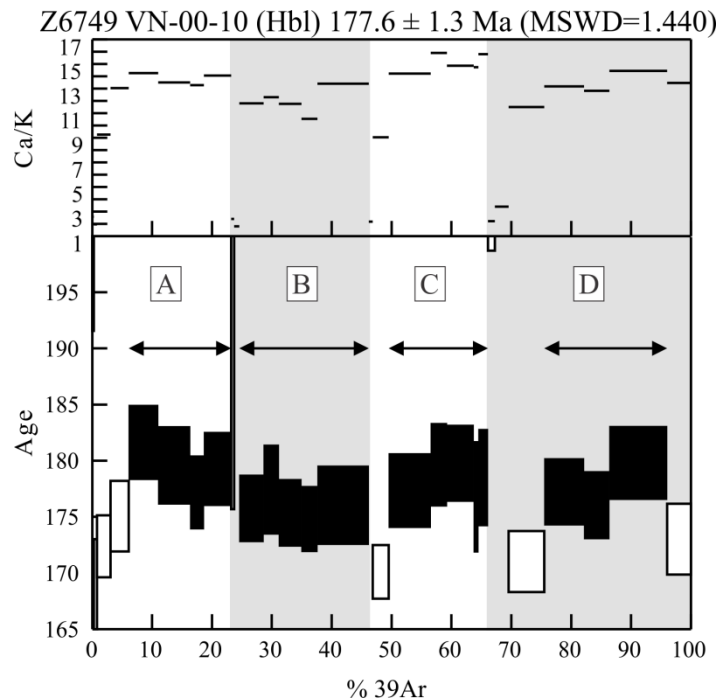
Intermixed intrusive and gneissic amphibolite. Amphibolite contains hornblende that ranges from coarse-grained (4cm long laths) to fine-grained, hornblende-dominated quartzofeldspathic gneiss. The analyzed grains were black fragments with minor clear inclusions.

Results:

Four aliquots were analyzed. Two contained apparent plateaus (aliquots B and C), and two were slightly hump-shaped (aliquots A and D). Analytical data was noisy with poor gas cleanup. Age is based on plateau regions of all four aliquots, 76% of total ^{39}Ar released, MSWD=1.440.

Analytical details:

Irradiation Batch: GSC #39
Date analyzed: May 30-31, July 18 & 20, 2001
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-13
Lithology: Mica quartz monzonite
Mineral analyzed: Biotite
Age: 164.7 ± 1.1 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6750
Argon Number: 1729
Location: On Kirkman connector road, near Thistle Creek intersection
UTM Zone 7 - 586653 E 6993264 N; NTS sheet 1150/3
Unit Name (if available): Simpson Range suite
Geologist: J. J. Ryan

Sample Description:

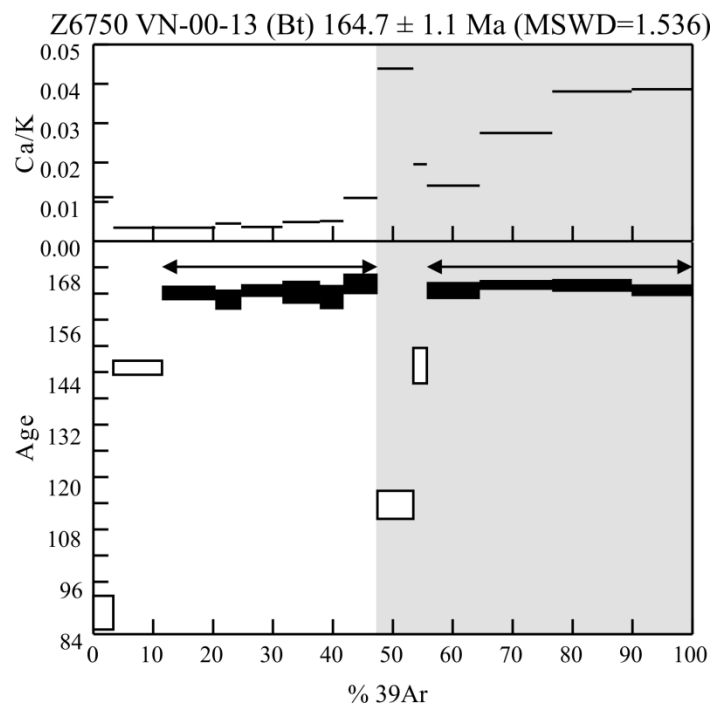
Two-mica quartz monzonite with abundant 1-3 mm muscovite flakes and subordinate 0.5-1 mm biotite. Foliated at this locality, but other portions of pluton are massive. The biotite analyzed from this sample was dark brown and fresh.

Results:

Age is based on the combined reproducible multistep plateaus for two aliquots, containing 80% of ^{39}Ar gas. Significant ^{40}Ar loss in first quarter of gas released in each spectrum. MSWD=1.536

Analytical details:

Irradiation Batch: GSC #39
Date analyzed: June 11-12, 2001
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-13
Lithology: Mica quartz monzonite
Mineral analyzed: Muscovite
Age: 171.7 ± 1.0 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6750
Argon Number: 1737
Location: On Kirkman connector road, near Thistle Creek intersection.
UTM Zone 7 - 586653 E 6993264 N; NTS sheet 1150/3
Unit Name (if available): Simpson Range suite
Geologist: J. J. Ryan

Sample Description:

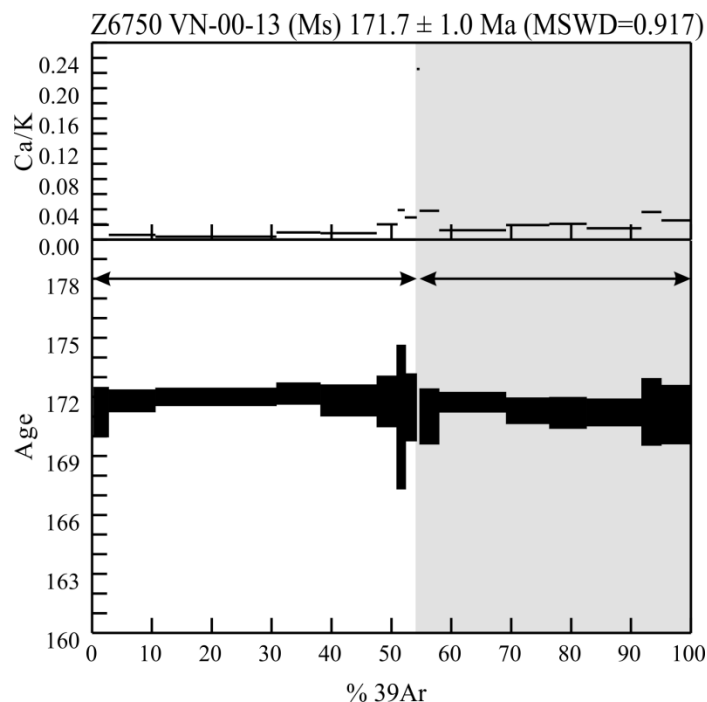
Two-mica quartz monzonite with abundant 1-3 mm muscovite flakes and subordinate 0.5-1 mm biotite. Foliated at this locality, but other portions of pluton are massive. The muscovite analyzed from this sample was clear and inclusion-free, slightly tan-coloured with minor red staining.

Results:

Age is derived from the combined flat, reproducible plateaus containing 99% of gas for two aliquots, MSWD=0.917.

Analytical details:

Irradiation Batch: GSC #39
Date analyzed: June 7-8, & 27, 2001
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-15
Lithology: Mylonitized granite
Mineral analyzed: Biotite
Age: 162.6 ± 1.1 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6751
Argon Number: 1712
Location: On Kirkman connector road
UTM Zone 7 - 588230 E 6987108 N; NTS sheet 1150/3
Unit Name (if available): Sulphur Creek suite; Klondike Assemblage
Geologist: J. J. Ryan

Sample Description:

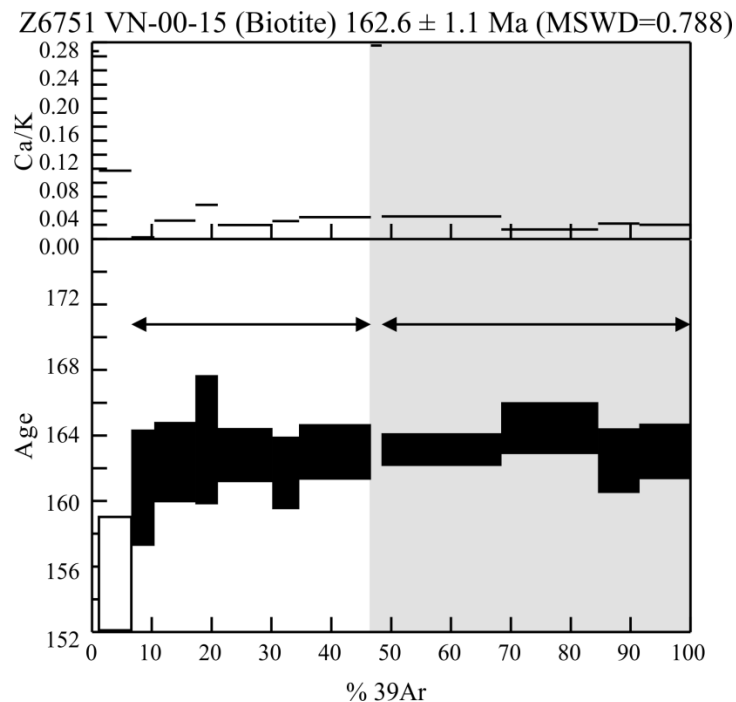
Mylonitized granite next to amphibolite. Compositional bands of pink and black about 1-4 cm thick. Relict K-feldspar megacrysts. Interpreted as augen granite. Located near where Teslin suture zone would pass. VN-00-15a has muscovite and biotite. VN-0015b contains biotite and hornblende. Should all mark age of deformation. Biotite selected for analysis were good quality black flakes.

Results:

Two aliquots were run, both showing minor ^{40}Ar loss in low-temperature steps, but 92% of the released ^{39}Ar formed reproducible, flat plateaus across both aliquots. Age was calculated using combined plateau regions, MSWD=0.788.

Analytical details:

Irradiation Batch: GSC #39
Date analyzed: June 6-7, 2001
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-15
Lithology: Mylonitized granite
Mineral analyzed: Hornblende
Age: 169.1 ± 2.7 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6751
Argon Number: 1731
Location: On Kirkman connector road
UTM Zone 7 - 588230 E 6987108 N; NTS sheet 1150/3
Unit Name (if available): Sulphur Creek suite; Klondike Assemblage
Geologist: J. J. Ryan

Sample Description:

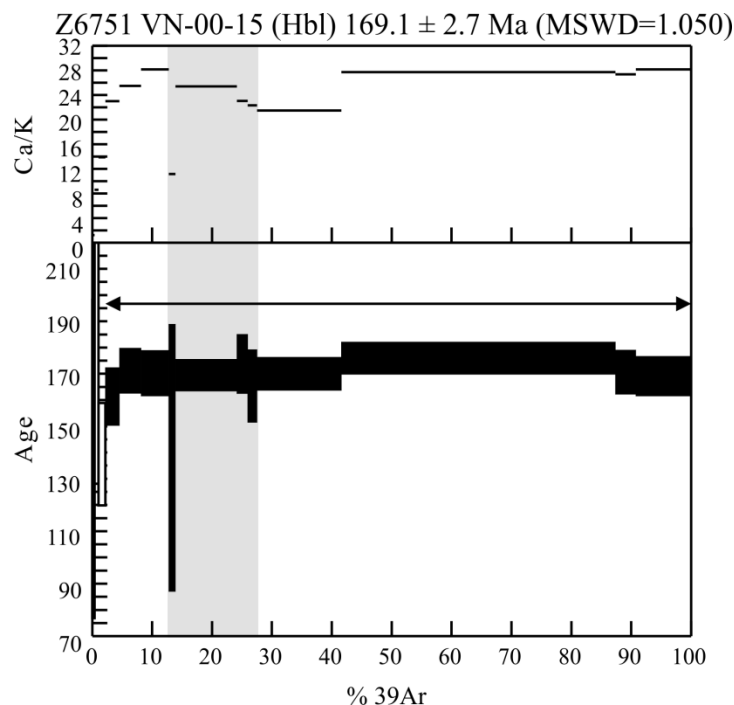
Mylonitized granite next to amphibolite. Compositional bands of pink and black about 1-4 cm thick. Relict K-feldspar megacrysts. Interpreted as augen granite. Located near where Teslin suture zone would pass. VN-00-15a has muscovite and biotite. VN-0015b contains biotite and hornblende. Should all mark age of deformation. Hornblende grains selected for analysis were good quality black fragments.

Results:

Three aliquots were run, all containing high atmospheric argon, high Ca and low K, which limits precision on the age results. Reproducible plateaus were obtained in all three aliquots each with minimum three steps containing 98% of gas. Age is calculated from plateau regions of all aliquots, MSWD=1.050.

Analytical details:

Irradiation Batch: GSC #39
Date analyzed: May 29, July 18, 2001
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-00-15
Lithology: Mylonitized granite
Mineral analyzed: Muscovite
Age: 170.1 ± 1.0 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6751
Argon Number: 1730
Location: On Kirkman connector road
UTM Zone 7 - 588230 E 6987108 N; NTS sheet 1150/3
Unit Name (if available): Sulphur Creek suite; Klondike Assemblage
Geologist: J. J. Ryan

Sample Description:

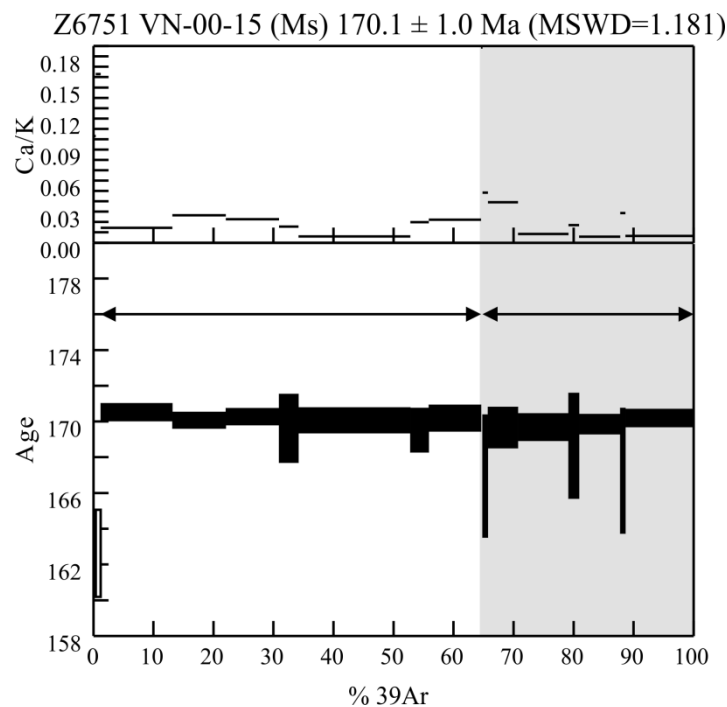
Mylonitized granite next to amphibolite. Compositional bands of pink and black about 1-4 cm thick. Relict K-feldspar megacrysts. Interpreted as augen granite. Located near where Teslin suture zone would pass. VN-00-15a has muscovite and biotite. VN-0015b contains biotite and hornblende. Should all mark age of deformation. Muscovite grains selected for analysis were clear, slightly green flakes.

Results:

Two aliquots were run, both giving flat, reproducible plateaus consisting of 99% of ^{39}Ar released, MSWD=1.181.

Analytical details:

Irradiation Batch: GSC #39
Date analyzed: May 30, 2001
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-01-01 (VN-01-01b)

Lithology: Muscovite-biotite schist

Mineral analyzed: Biotite

Age: 177.0 ± 1.1 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7039

Argon Number: 1830

Location: On Stewart River, ~ 1 km downstream from Maisy May Creek at an elevation of 374 m

UTM Zone 7 - 608812 E 7011653 N; NTS sheet 1150/2

Unit Name (if available): Finlayson Assemblage

Geologist: J. J. Ryan

Sample Description:

Sample taken from muscovite-biotite schist that is interlayered with amphibolite in the same outcrop (forms part of overall amphibolite package – see also Muscovite and Hornblende results for same locality, this report). This location has marble bands (which increase in number and thickness to the south across Stewart River) that form boudins within the amphibolite. Biotite selected for analysis was very fresh and dark brown.

Results:

Aliquot A in general showed rising apparent age with increasing temperature, with oldest step at ca. 174 Ma. Ca/K is much more variable in Aliquot A than in B, which could be indicative of lattice damage or inclusions that may contribute to the disturbed nature of the spectrum. Aliquot B formed a flat multistep plateau on 89% of the ^{39}Ar gas released, from which the assigned age of 177.0 ± 1.1 Ma is obtained (MSWD=0.517).

Analytical details:

Irradiation Batch: GSC #43

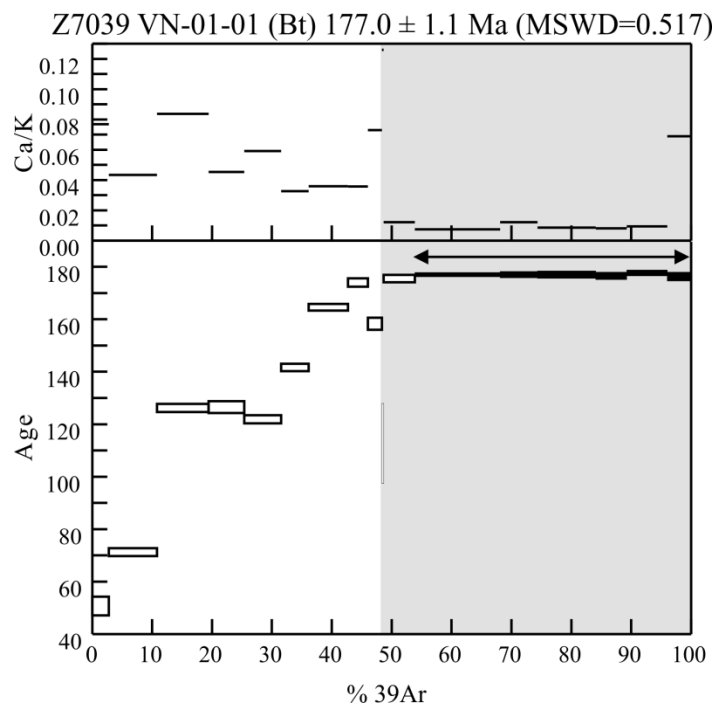
Date analyzed: December 2, 2002

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-01-01 (VN-01-01d)

Lithology: Amphibolite

Mineral analyzed: Hornblende

Age: 187.5 ± 1.8 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7039

Argon Number: 1832

Location: On Stewart River ~ 1 km downstream from Maisy May Creek at an elevation of 374 m

UTM Zone 7 - 608812 E 7011653 N; NTS sheet 1150/2

Unit Name (if available): Finlayson Assemblage

Geologist: J. J. Ryan

Sample Description:

Strained, straight amphibolite with boudins and fault cut-offs. Forms part of overall amphibolite package. Dark hornblende-plagioclase, medium- to fine- grained, with interlayers of muscovite and biotite schist. This location has marble bands (which increase in number and thickness to the south across Stewart River) that form boudins within the amphibolite. Hornblende selected for analysis was fresh and dark brown.

Results:

Reproducible plateaus were obtained for two aliquots comprising 98% of the ^{39}Ar released (MSWD=0.286). Low gas amounts and high Ca/K result in low precision on the age.

Analytical details:

Irradiation Batch: GSC #43

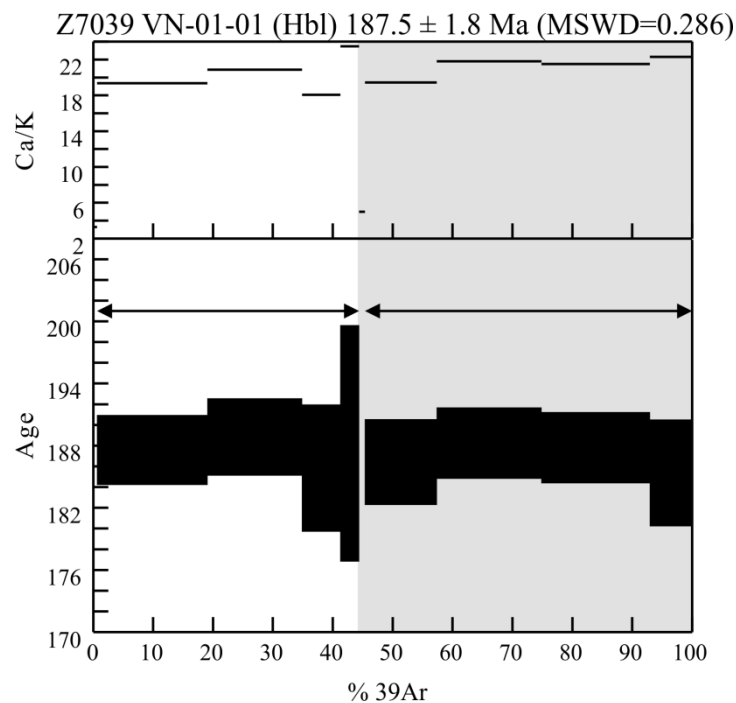
Date analyzed: November 29, 2002

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-01-01 (VN-01-01c)

Lithology: Garnet-biotite-muscovite schist

Mineral analyzed: Muscovite

Age: 180.4 ± 1.1 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7039

Argon Number: 1831

Location: On Stewart River, ~ 1 km downstream from Maisy May Creek at an elevation of 374 m

UTM Zone 7 - 608812 E 7011653 N; NTS sheet 115O/2

Unit Name (if available): Finlayson Assemblage

Geologist: J. J. Ryan

Sample Description:

Garnet-biotite-muscovite schist that is interlayered with amphibolite in the same outcrop (forms part of overall amphibolite package – see also Biotite and Hornblende results for same locality, this report). Forms part of overall amphibolite package. This location has marble bands (which increase in number and thickness to the south across Stewart River) that form boudins within the amphibolite. Muscovite grains were excellent quality; clear, thick, and inclusion-free.

Results:

Two aliquots were analyzed, both yielding flat, reproducible plateaus, both of which were used to calculate the age. Steps with <1% of gas were not included in the age calculation; the remaining steps comprised 98.5% of the ^{39}Ar gas (MSWD=0.809). Low gas quantities for muscovite.

Analytical details:

Irradiation Batch: GSC #43

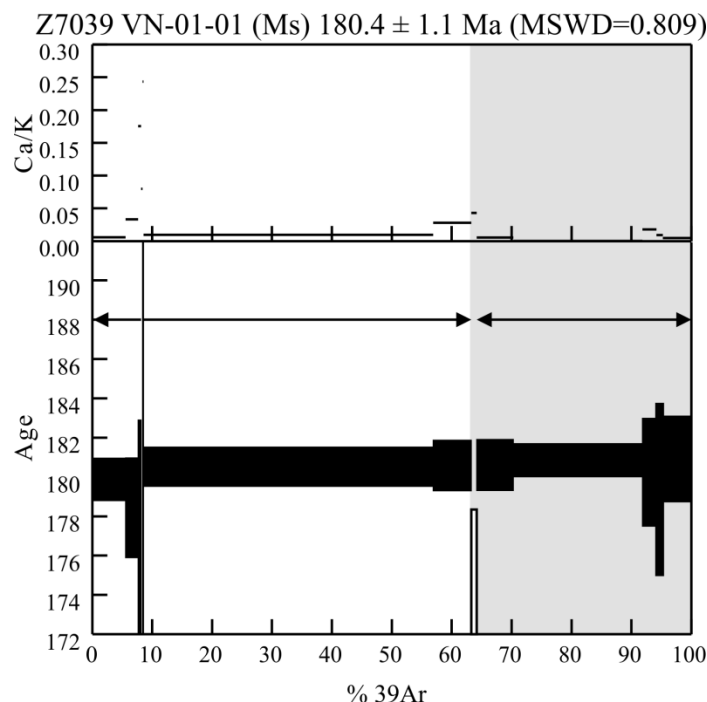
Date analyzed: December 3, 2002

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-01-03

Lithology: Biotite-muscovite-quartz schist

Mineral analyzed: Biotite

Age: NO AGE

Interpretation: No Age

Geochronology Lab Number: 7041

Argon Number: 1833

Location: On the north shore of the Stewart River, approximately 0.5 km downstream from VN-01-02 at an elevation of 379 m

UTM Zone 7 - 606167 E 7008577 N; NTS sheet 1150/2

Unit Name (if available):

Geologist: J. J. Ryan

Sample Description:

Mixed biotite-muscovite-quartz schists. Coarse muscovite and good quality, dark biotite, strongly foliated and layered. Some minor amphibolite bands, but the hornblende is poikilitic with the biotite.

Results:

Four aliquots of biotite were analyzed, and all have extremely low K indicating post-crystallization alteration. No consistency of apparent ages between aliquots or steps, nor any plateau.

Analytical details:

Irradiation Batch: GSC #43

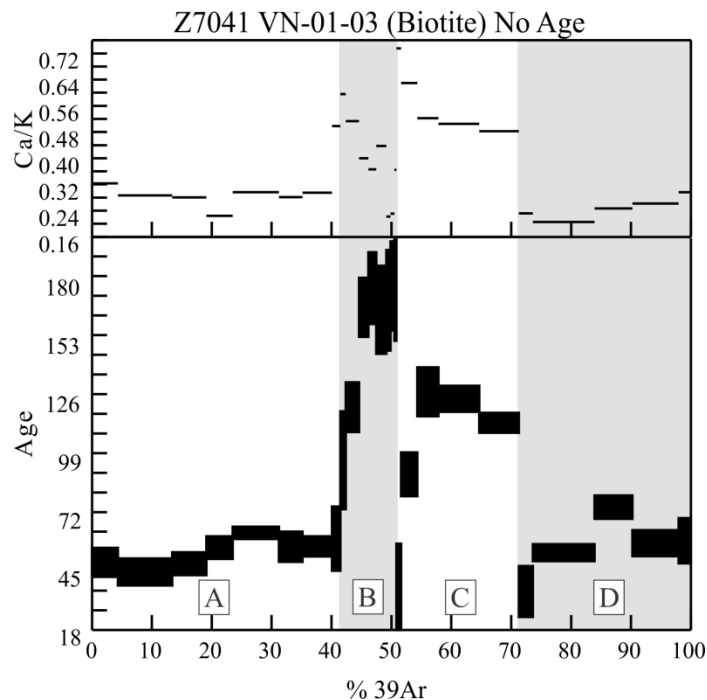
Date analyzed: December 4 & 20, 2002

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-01-03
Lithology: Biotite-muscovite-quartz schist
Mineral analyzed: Muscovite
Age: 181.7 ± 1.1 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7041

Argon Number: 1834

Location: On the north shore of the Stewart River, approximately 0.5 km downstream from VN-01-02 at an elevation of 379 m

UTM Zone 7 - 606167 E 7008577 N; NTS sheet 1150/2

Unit Name (if available):

Geologist: J. J. Ryan

Sample Description:

Mixed biotite-muscovite-quartz schists. Coarse muscovite and good quality, dark biotite, strongly foliated and layered. Some minor amphibolite bands, but the hornblende is poikilitic with the biotite. Muscovite grains selected for analysis were clear, good quality thin books with minor dark discolouration along grain edges.

Results:

Age is based on the combined flat, reproducible plateaus for two aliquots, including 100% of ^{39}Ar released (MSWD=0.252).

Analytical details:

Irradiation Batch: GSC #43

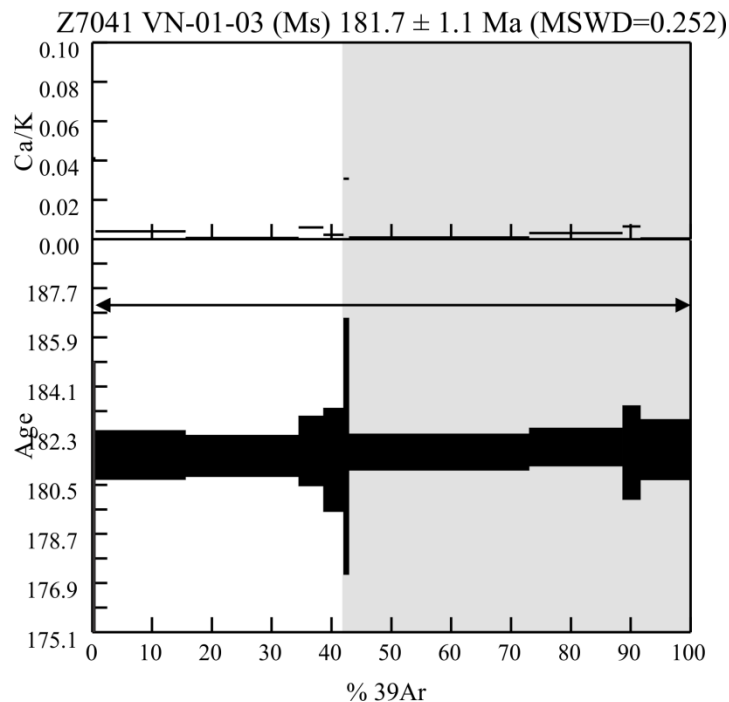
Date analyzed: December 4-5, 2002

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-01-04
Lithology: Garnet-hornblende amphibolite
Mineral analyzed: Hornblende
Age: 184.9 ± 2.1 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7042
Argon Number: 1835
Location: On Stewart River; elevation 374 m
 UTM Zone 7 - 603108 E 7007943 N; NTS sheet 1150/2
Unit Name (if available): Finlayson Assemblage
Geologist: J. J. Ryan

Sample Description:

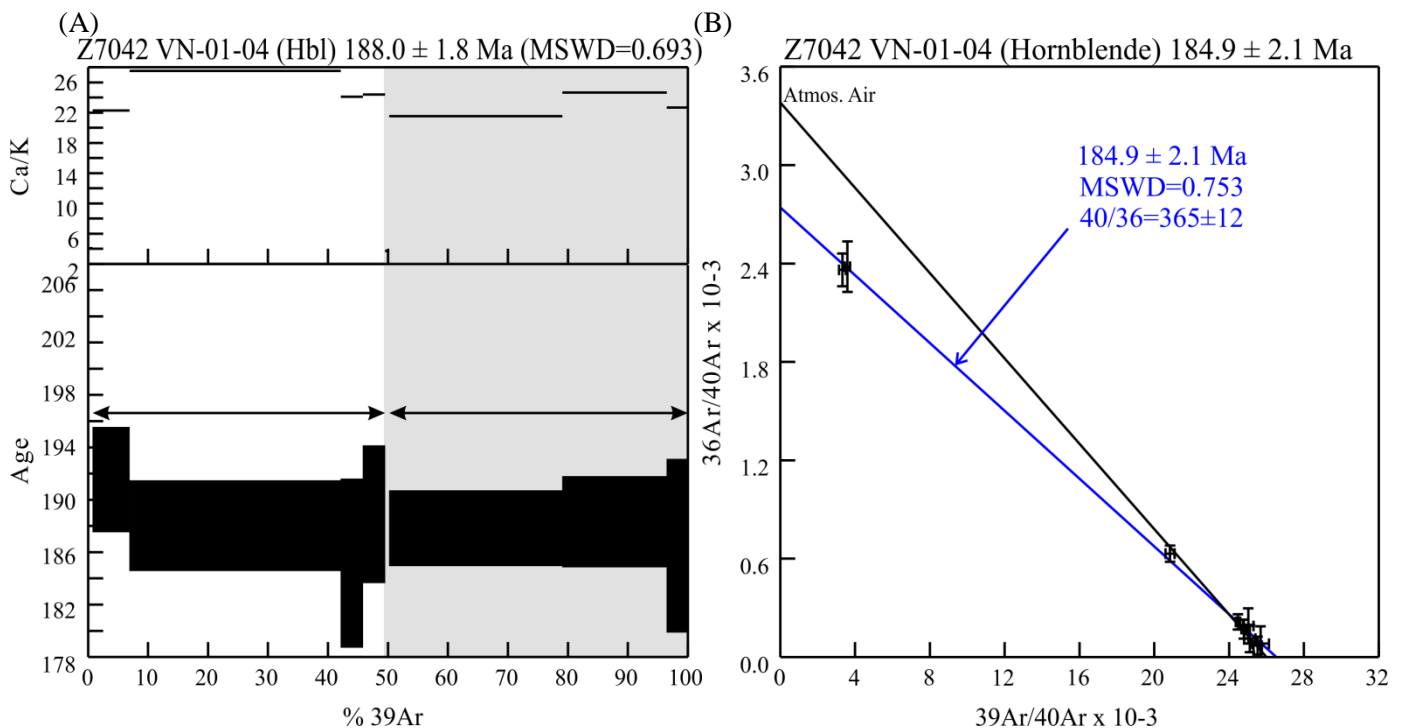
Garnet-hornblende amphibolite. Medium- to coarse-grained, equigranular plagioclase, hornblende and minor small red garnets. The analyzed hornblende was fresh, dark brown, and of excellent quality.

Results:

Two aliquots were analyzed, both forming plateaus at 188 ± 1.8 Ma (Fig. A). However, distribution of data on the inverse isochron plot suggests both aliquots contained excess ^{40}Ar (Fig. B). All data points fell along an excess composition line intersecting at $^{40}\text{Ar}/^{36}\text{Ar} = 365 \pm 12$, giving an age of 184.9 ± 2.1 Ma (MSWD=0.753). Although slightly less precise, the inverse isochron age is considered more accurate than the plateau age.

Analytical details:

Irradiation Batch: GSC #43
 Date analyzed: December 5, 2002
 Monitor used: FCT-San
 Laser used: Merchantek® MIR-10 CO₂ laser
 Instrument used for analysis: GSC VG3600
 Data reduction software used: GSC GRID Argon module



Sample Number: VN-01-08
Lithology: Layered amphibolite
Mineral analyzed: Hornblende
Age: 192.0 ± 2.2 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7046
Argon Number: 1839
Location: On Stewart River
UTM Zone 7 - 588872 E 7017876 N; NTS sheet 1150/6
Unit Name (if available): Finlayson Assemblage
Geologist: J. J. Ryan

Sample Description:

Upstream of the outcrop from which this sample was collected is a major high strain mylonite zone in tonalite, with rare low-strain lozenges. This outcrop is mostly marble to the east, grading into more mafic zones interlayered with marble, and is interpreted to be part of the high strain zone. Some amphibolite contains large amphiboles that are overprinted by the fabric. Some pockets of biotite-rich material were also observed. Portions of the outcrop have meta-plutons that are interpreted to intrude into marble, possibly related to augen granite located downstream. The hornblende selected for dating was excellent quality, fresh, and dark brown to black in colour.

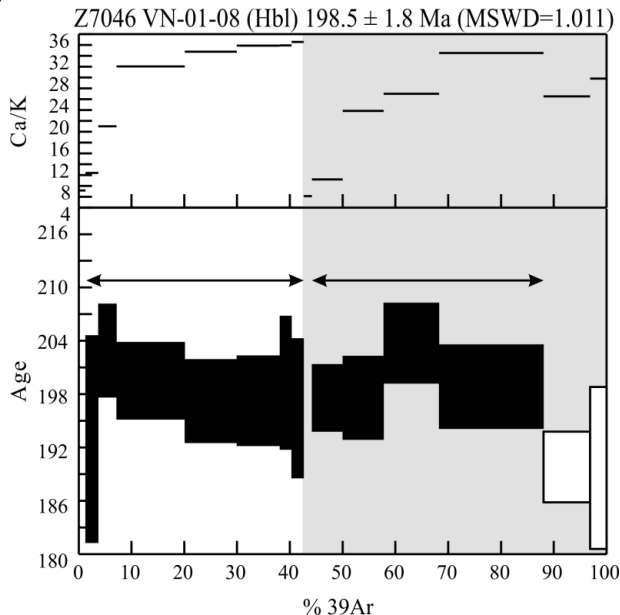
Results:

High Ca/K limited analytical precision on this sample. Multi-step plateaus in mid-temp steps for two aliquots contained 85% of gas at ca. 199 Ma (Fig. A). The spectra were weakly hump-shaped with ^{40}Ar loss at low temperatures, and Aliquot B showed a decrease in age at the two highest-temperature steps, perhaps due to degassing of a mineral inclusion. Because excess ^{40}Ar was evident from the inverse isochron diagram, particularly in the lowest temperature heating steps (Fig. B), the assigned age is the inverse isochron age: 192.0 ± 2.2 Ma, MSWD=1.647, $^{40}\text{Ar}/^{36}\text{Ar}=405 \pm 12$.

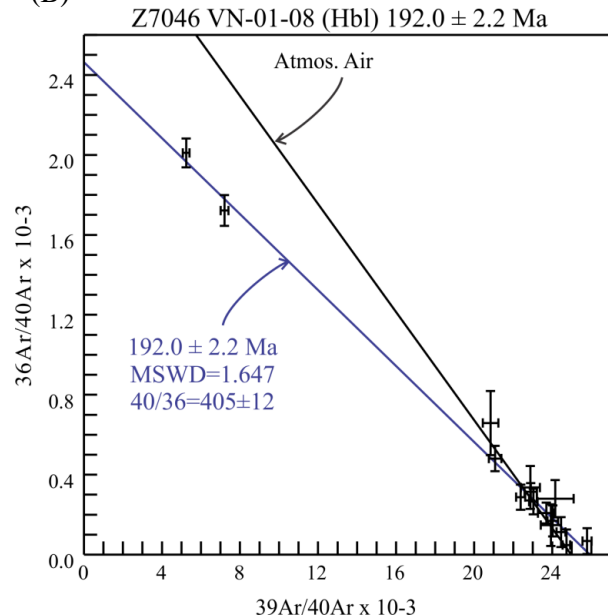
Analytical details:

Irradiation Batch: GSC #43
Date analyzed: January 20, 2003
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module

(A)



(B)



Sample Number: VN-01-12
Lithology: Hornblende amphibolite
Mineral analyzed: Hornblende
Age: NO AGE
Interpretation: No Age

Geochronology Lab Number: 7050
Argon Number: 1842
Location: Yukon River
UTM Zone 7 - 569951 E 7033087 N; NTS sheet 1150/5
Unit Name (if available): Simpson Range suite - mafic
Geologist: S. Gordey

Sample Description:

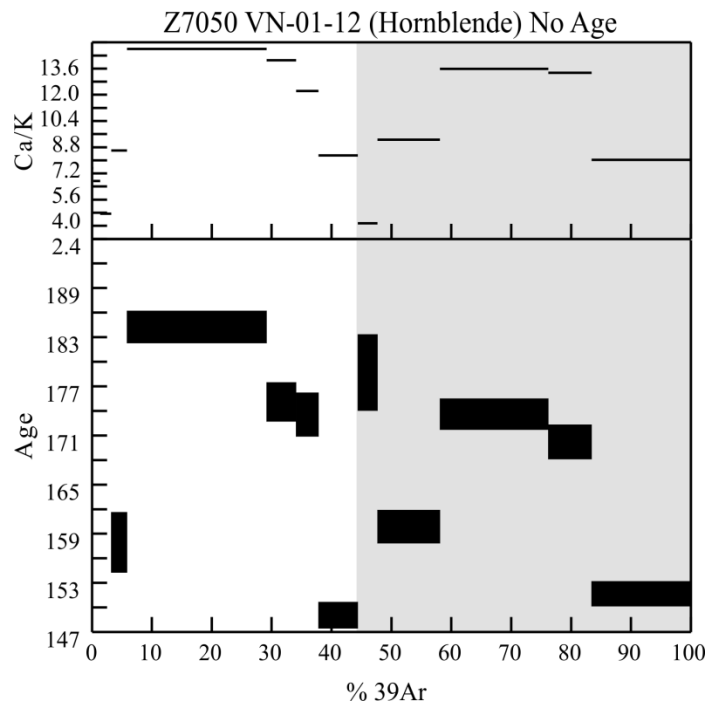
Dark black, hornblende amphibolite with large biotite flakes in one layer. Hornblende selected for dating was fresh and clean. Collected at the same site from which Gordey sampled a "tweaked" dyke in 1998, and for which a preliminary Jurassic age was obtained (177 Ma, unpublished University of Alberta data). Biotite flakes appear to have overgrown fabric. The amphibolite is cut by a 20 cm dyke which crosscuts foliation. Jurassic dyke is tweaked at one end.

Results:

Two aliquots yielded uninterpretable hump-shaped spectra with near-random variation of apparent ages. Data are similarly scattered and inconclusive on the inverse isochron diagram (not shown).

Analytical details:

Irradiation Batch: GSC #43
Date analyzed: January 22-23, 2003
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: 01-RAY-63C

Lithology: Amphibolite

Mineral analyzed: Hornblende

Age: 169.8 ± 1.0 Ma (± 0.3 Ma without J-error)

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7369

Argon Number: 2014

Location: Excelsior Creek, north of Shamrock Dome

UTM Zone 7 - 569466 E 7018555 N; NTS sheet 1150/5

Unit Name (if available): Finlayson Assemblage

Geologist: J.J. Ryan

Sample Description:

Coarse decussate hornblende amphibolite. Grains selected for analysis were brown to brownish-green soft breakable grains, with some slight greening at rims.

Results:

One aliquot was analyzed, for which a flat, multistep plateau was obtained, consisting of 96% of the ^{39}Ar gas released (MSWD=0.684).

Analytical details:

Irradiation Batch: GSC #45

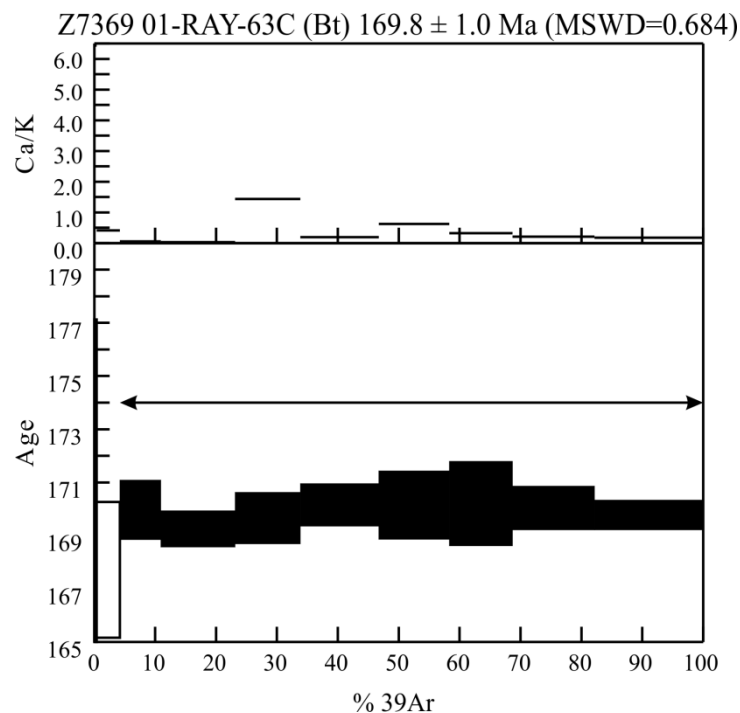
Date analyzed: February 16, 2004

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 01-RAY-63C

Lithology: Amphibolite

Mineral analyzed: Hornblende

Age: 164.4 ± 9.3 Ma (± 9.3 Ma without J-error)

Interpretation: Metamorphic Cooling (estimate)

Geochronology Lab Number: 7369

Argon Number: 2013

Location: Excelsior Creek, north of Shamrock Dome

UTM Zone 7 - 569466 E 7018555 N; NTS sheet 1150/5

Unit Name (if available): Finlayson Assemblage

Geologist: J.J. Ryan

Sample Description:

Coarse decussate hornblende amphibolite. Grains selected for analysis were good quality and dark green in colour.

Results:

Two aliquots were analyzed, showing evidence of excess ^{40}Ar and disturbed spectra (Fig. A). Poor collinearity of points on the inverse isochron diagram, (Fig. B) potentially due to mixing with atmospheric Ar. Age is estimated from regression through mid- to high-temperature steps, but gives a poor MSWD of 17, $^{40}\text{Ar}/^{36}\text{Ar} = 461 \pm 15$.

Analytical details:

Irradiation Batch: GSC #45

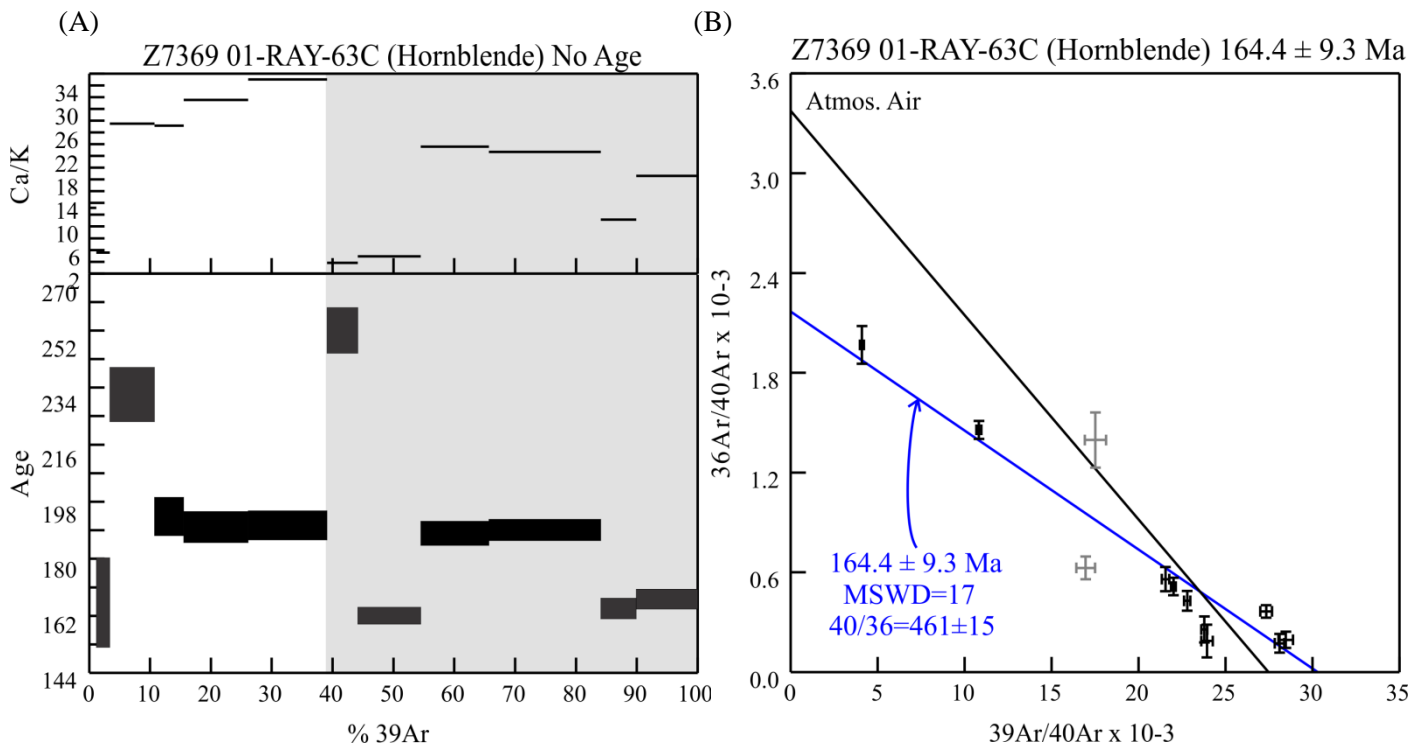
Date analyzed: February 9 & 23, 2004

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 01-RAY-184A
Lithology: Amphibolite
Mineral analyzed: Hornblende
Age: 174.4 ± 1.9 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7371
Argon Number: 1904
Location: Excelsior Creek
UTM Zone 7 - 576228 E 7009370 N; NTS sheet 1150/3
Unit Name (if available): Finlayson Assemblage
Geologist: J. J. Ryan

Sample Description:

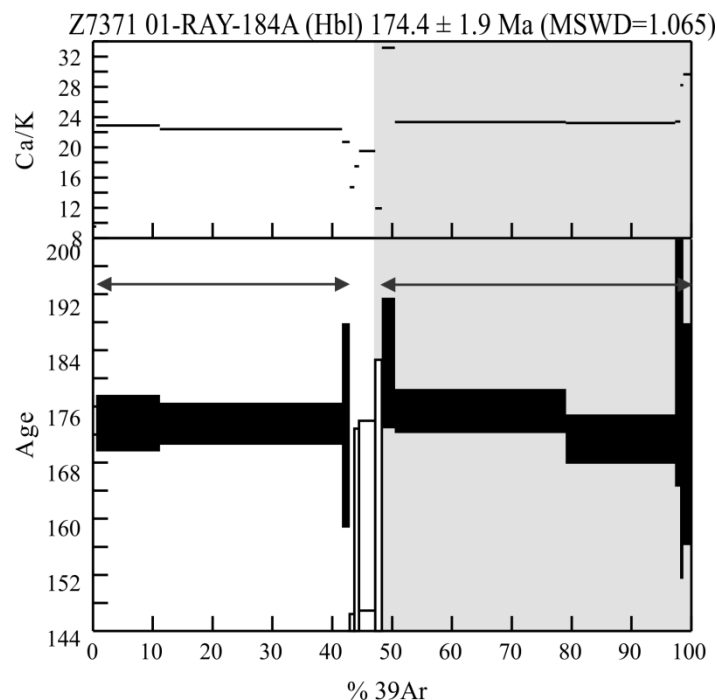
Sample is fine-grained and almost black in hand-sample. Good quality fresh black hornblende grains were selected for analysis.

Results:

There was a low amount of gas and elevated Ca/K in all the analyses, but two aliquots gave reproducible plateaus. Age is derived from 94% of ^{39}Ar gas released for both aliquots, MSWD=1.065.

Analytical details:

Irradiation Batch: GSC #45
Date analyzed: July 14-15, 2003
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: 02-MC-127
Lithology: Hornblende-biotite granite
Mineral analyzed: Biotite
Age: 194.4 ± 1.2 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7604
Argon Number: 1987
Location: Yukon-Tanana terrane; near eastern end of Tatlain Lake
UTM Zone 8 - 459234 E 6947182 N; NTS sheet 105L/12
Unit Name (if available): Tatlain batholith
Geologist: M. Colpron

Sample Description:

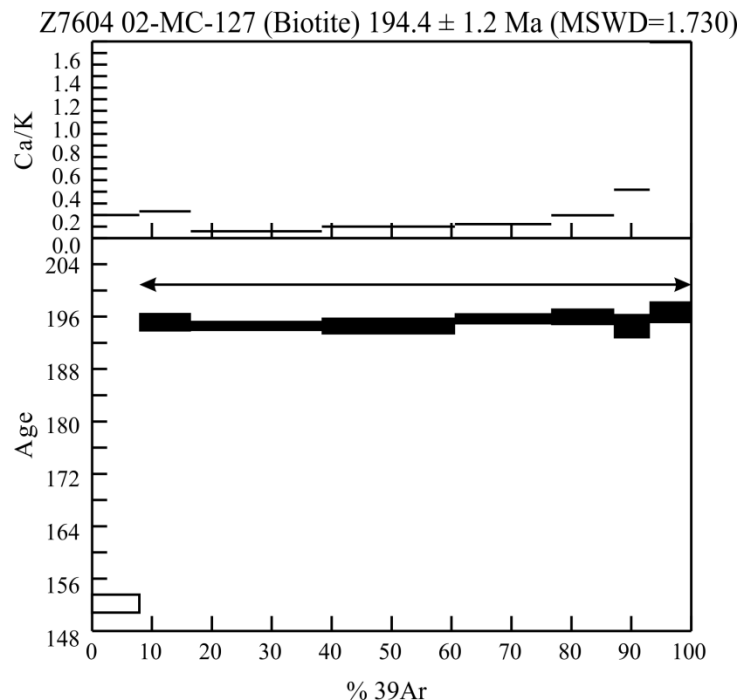
Coarse-grained, equigranular, hornblende-biotite granite. Sample had a massive, thick weathering rind, but was relatively fresh beneath the weathered surface. The biotite grains selected for analysis were thick, dark brown fresh books.

Results:

One aliquot was analyzed. A relatively flat, multistep plateau was obtained, comprising 92% of the released ^{39}Ar gas, with evidence for minor Ar-loss in the lowest temperature steps (MSWD=1.730).

Analytical details:

Irradiation Batch: GSC #45
Date analyzed: December 9, 2003
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: 02-MC-128
Lithology: Biotite-hornblende granite
Mineral analyzed: Biotite
Age: 195.4 ± 1.2 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7605
Argon Number: 1988
Location: Yukon-Tanana terrane; N-NE of Ess Hill
UTM Zone 8 - 465832 E 6940639 N; NTS sheet 105L/12
Unit Name (if available): Tatlain batholith
Geologist: M. Colpron

Sample Description:

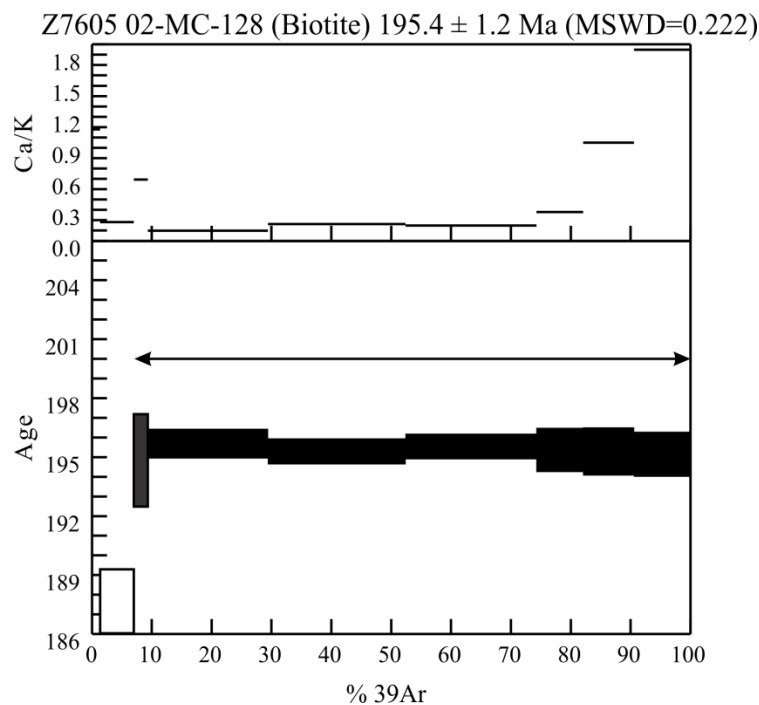
Medium-grained, equigranular biotite-hornblende granite. Small biotite and hornblende crystals disseminated throughout the rock. Biotite grains selected for analysis were large, thick, fresh dark brown books.

Results:

A multi-step flat plateau was obtained for one analyzed aliquot, with evidence for minor Ar-loss in the lowest temperature steps. Plateau comprised 93% of the released ^{39}Ar gas, MSWD=0.222.

Analytical details:

Irradiation Batch: GSC #45
Date analyzed: December 9, 2003
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: 02-MC-129

Lithology: Amphibolite

Mineral analyzed: Biotite

Age: 180.7 ± 1.3 Ma (± 0.8 Ma without J error)

Interpretation: Metamorphic Cooling (Minimum estimate)

Geochronology Lab Number: 7606

Argon Number: 1990

Location: Yukon-Tanana terrane; on ridge on top of Ess Hill

UTM Zone 8 - 464385 E 6935250 N; NTS sheet 105L/12

Unit Name (if available): Snowcap assemblage

Geologist: M. Colpron

Sample Description:

Mixed amphibolites, layered at cm-scale. Coarse to medium grained amphiboles, some forming 0.5 cm long blades. Possible volcanic protolith with interlayered chert. Biotite was collected from a biotite-rich layer in the amphibolite package.

Results:

Two aliquots analyzed, both spectra showing partial ^{40}Ar loss patterns, classically attributed to thermal overprinting. A hint of a plateau (or near plateau) is achieved in final four steps of Aliquot A, but they contain only 49% of gas, which suggests that this may be viewed as a minimum age. Highest temperature steps of the more disturbed Aliquot B were 183 and 186 Ma. Aliquot B showed higher Ca/K than Aliquot A, which could indicate the biotite was slightly altered or contained fluid or mineral inclusions.

Analytical details:

Irradiation Batch: GSC #45

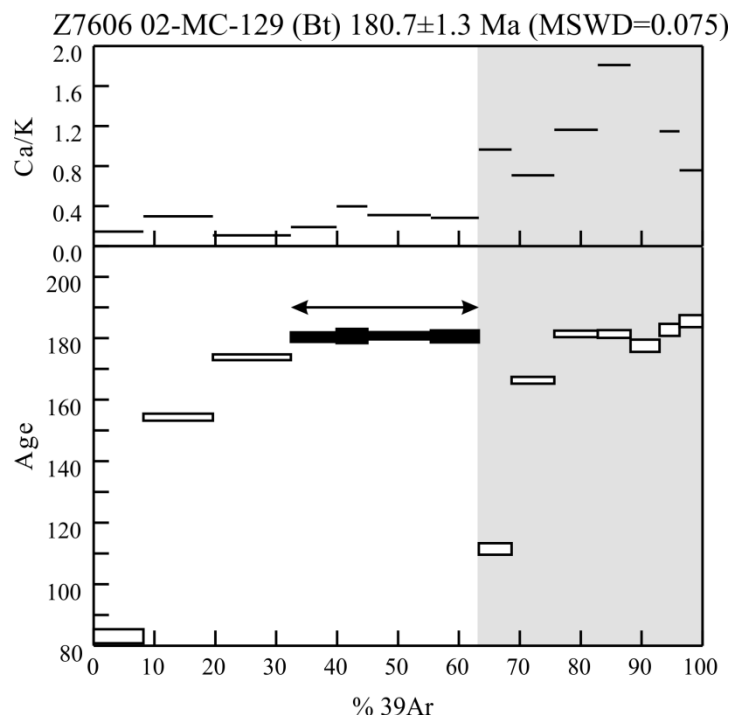
Date analyzed: December 15, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02-MC-129

Lithology: Amphibolite

Mineral analyzed: Hornblende

Age: 192.5 ± 2.4 Ma (± 2.1 Ma without J-error)

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7606

Argon Number: 1989

Location: Yukon-Tanana terrane; on ridge on top of Ess Hill

UTM Zone 8 - 464385 E 6935250 N; NTS sheet 105L/12

Unit Name (if available): Snowcap assemblage

Geologist: M. Colpron

Sample Description:

Mixed amphibolites, layered at cm-scale. Coarse to medium grained amphiboles, some forming 0.5 cm long blades. Possible volcanic protolith with interlayered chert.

Results:

A well-defined plateau was obtained for one aliquot, but sub-optimal split on gas results in 70% gas release in a medium-low temperature step. Five additional steps with smaller amounts of gas confirm plateau. Steps used in plateau age calculation comprised 98% of released ^{39}Ar . High Ca/K of ca. 25 limits precision.

Analytical details:

Irradiation Batch: GSC #45

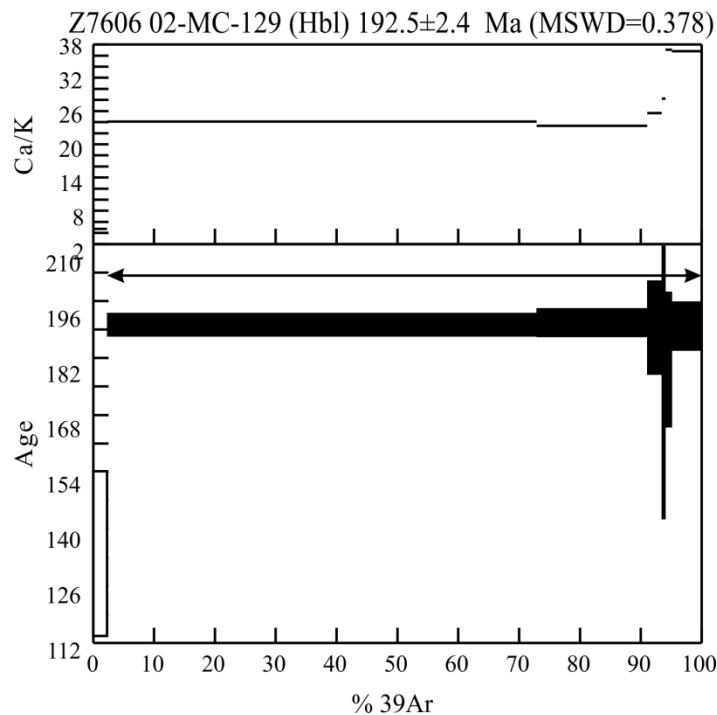
Date analyzed: June 26, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02-MC-129

Lithology: Amphibolite

Mineral analyzed: Muscovite

Age: 192.0 ± 1.4 Ma (± 0.8 Ma without J-error)

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7606

Argon Number: 1991

Location: Yukon-Tanana terrane; on ridge on top of Ess Hill

UTM Zone 8 - 464385 E 6935250 N; NTS sheet 105L/12

Unit Name (if available): Snowcap assemblage

Geologist: M. Colpron

Sample Description:

Mixed amphibolites, layered at cm-scale. Coarse to medium grained amphiboles, some forming 0.5 cm long blades. Possible volcanic protolith with interlayered chert. Muscovite was collected from a biotite-rich layer in the amphibolite package.

Results:

One aliquot was analyzed, and gave a flat, multistep plateau comprising 98% of the released ^{39}Ar , with no evidence of ^{40}Ar loss. A similar age was obtained for hornblende from same sample. MSWD = 0.195.

Analytical details:

Irradiation Batch: GSC #45

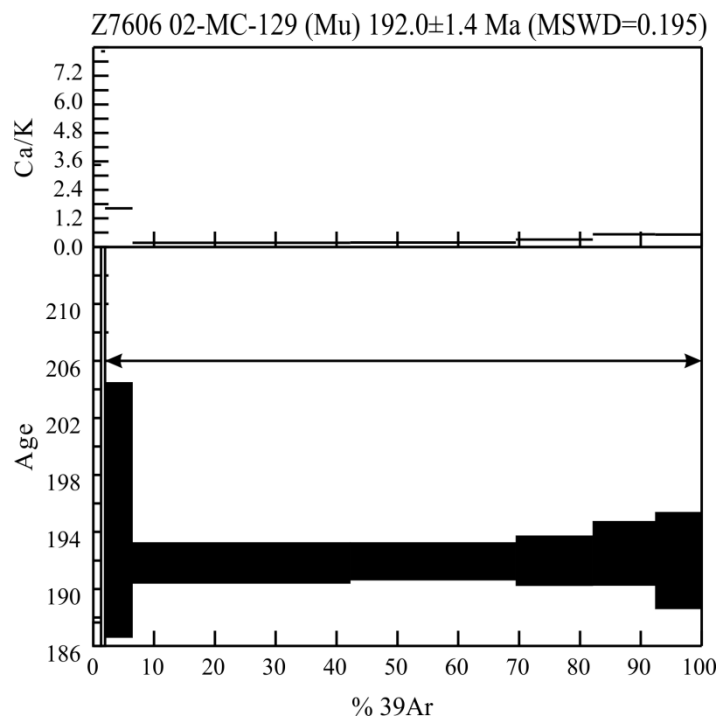
Date analyzed: December 15, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02-MC-130

Lithology: Amphibolite interlayered with marble

Mineral analyzed: Biotite

Age: 181.6 ± 1.1 Ma (± 0.3 Ma without J-error)

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7607

Argon Number: 1993

Location: Quesnellia; South of Tadru Lake

UTM Zone 8 - 467559 E 6922487 N; NTS sheet 105L/5

Unit Name (if available): Boswell assemblage

Geologist: M. Colpron

Sample Description:

Amphibolite interlayered with marble. Coarse crystalline marble beds also mix on cm-scale with amphibolite. Possibly visible titanite in these zones. Marble horizon forms regional marker unit.

Results:

Flat, multi-step plateau gives robust age from 99% of released ^{39}Ar gas in 1 aliquot, MSWD=0.347.

Analytical details:

Irradiation Batch: GSC #45

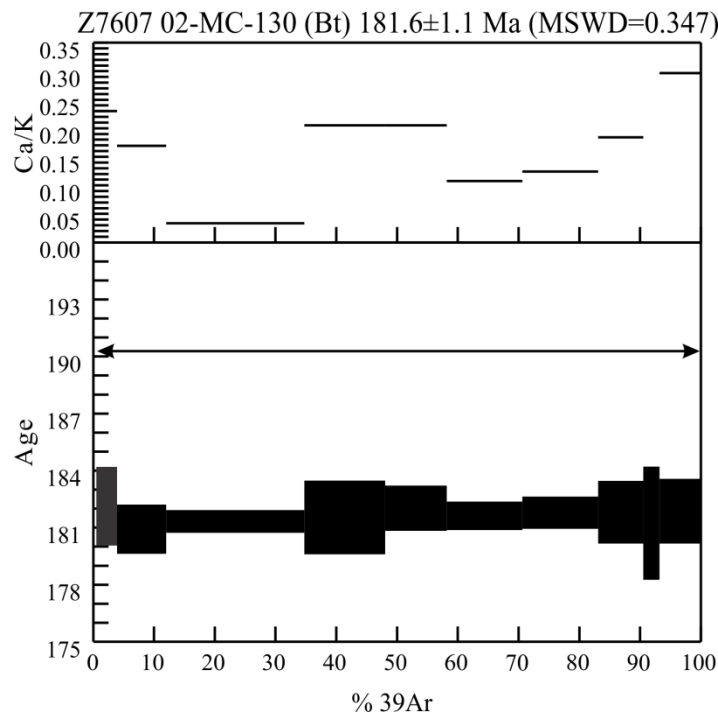
Date analyzed: January 2, 2004

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02-MC-130

Lithology: Amphibolite interlayered with marble

Mineral analyzed: Hornblende

Age: 185.8 ± 2.1 Ma (± 1.7 Ma without J-error)

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7607

Argon Number: 1992

Location: Quesnellia; South of Tadru Lake

UTM Zone 8 - 467559 E 6922487 N; NTS sheet 105L/5

Unit Name (if available): Boswell assemblage

Geologist: M. Colpron

Sample Description:

Amphibolite interlayered with marble. Coarse crystalline marble beds also mix on cm-scale with amphibolite. Possibly visible titanite in these zones. Marble horizon forms regional marker unit.

Results:

One aliquot was analyzed, giving a somewhat noisy (although steps overlap within error) 4 step plateau containing 95% of gas. Low K content and concomitant low gas volumes increases susceptibility to blank variations, and high Ca/K of ca. 22 limits attainable precision. MSWD = 2.716.

Analytical details:

Irradiation Batch: GSC #45

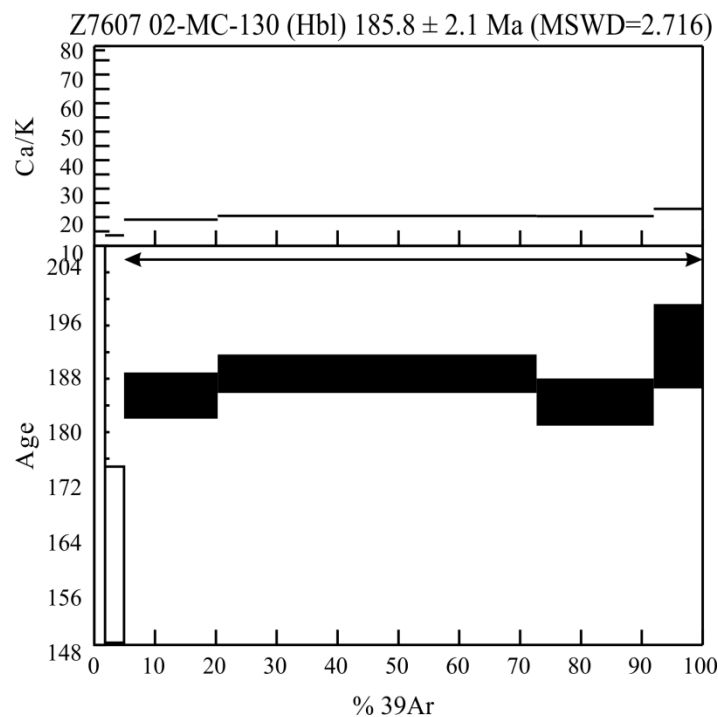
Date analyzed: June 27, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02-MC-131

Lithology: Quartzofeldspathic schist

Mineral analyzed: Biotite

Age: 129.8 ± 0.8 Ma (± 0.3 Ma without J-error)

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7608

Argon Number: 1995

Location: Yukon-Tanana terrane; 15km due east of Ess Lake

UTM Zone 8 - 487518 E 6927624 N; NTS sheet 105L/6

Unit Name (if available): Snowcap assemblage

Geologist: M. Colpron

Sample Description:

Biotite-muscovite quartzofeldspathic schist with good early crenulation cleavage, relatively equigranular and monotonous.

Results:

Flat, multistep plateau containing 92% of released gas in one aliquot, MSWD=0.665.

Analytical details:

Irradiation Batch: GSC #45

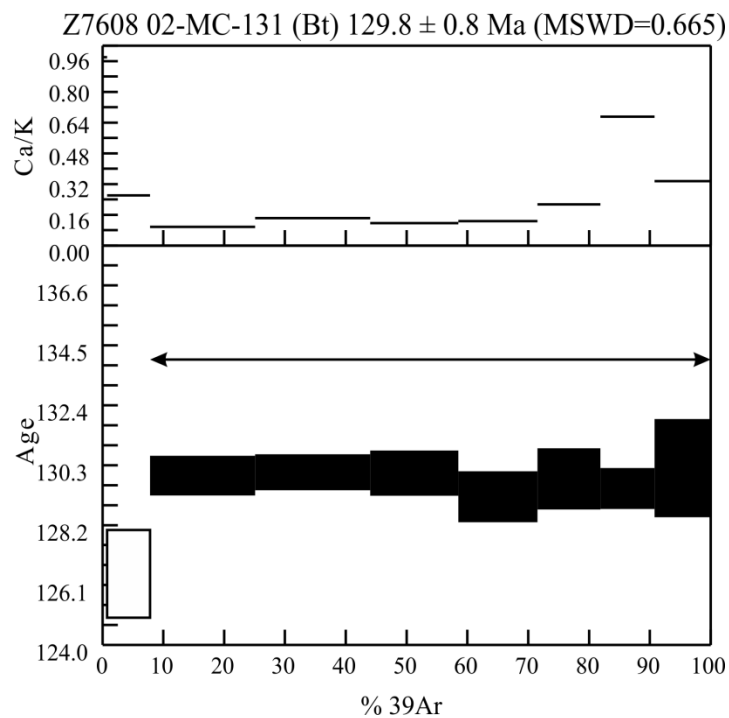
Date analyzed: January 5, 2004

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02-MC-131

Lithology: Quartzofeldspathic schist

Mineral analyzed: Muscovite

Age: 182.2 ± 1.2 Ma (± 0.5 Ma without J-error)

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7608

Argon Number: 1994

Location: Yukon-Tanana terrane; 15km due east of Ess Lake

UTM Zone 8 - 487518 E 6927624 N; NTS sheet 105L/6

Unit Name (if available): Snowcap assemblage

Geologist: M. Colpron

Sample Description:

Biotite-muscovite quartzofeldspathic schist with good early crenulation cleavage, relatively equigranular and monotonous.

Results:

One aliquot was analyzed. A three-step plateau containing 82% of released gas (MSWD=0.391) was obtained, but anomalously younger ages of high temperature steps indicate degassing of second phase or grain or possibly reheating of previously unheated portion of analyzed grain. Because these young ages are interpreted as analytical effect, the age is derived from the plateau which comprises the bulk of the ^{39}Ar released.

Analytical details:

Irradiation Batch: GSC #45

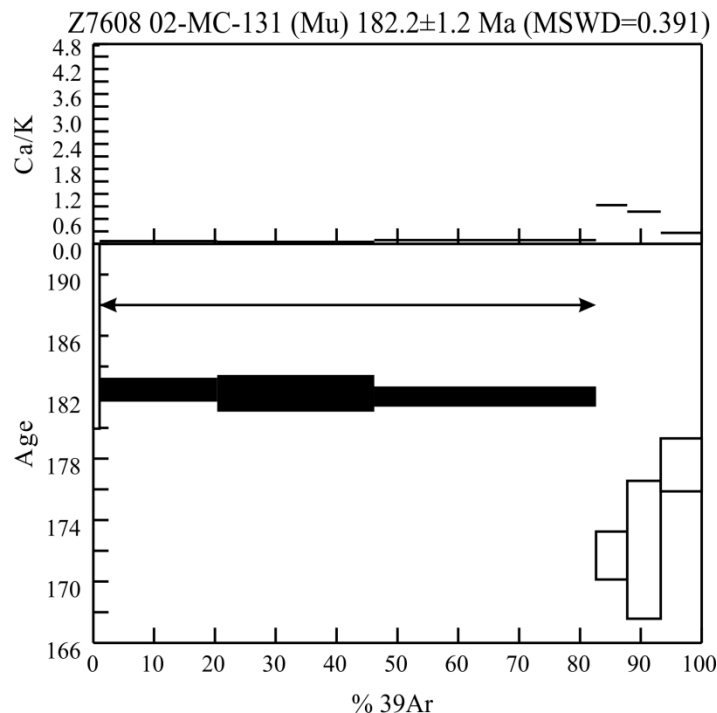
Date analyzed: January 5, 2004

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02MC030-1

Lithology: Hornblende granodiorite

Mineral analyzed: Biotite

Age: 188.7 ± 1.1 Ma (± 0.3 Ma without J-error)

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7609

Argon Number: 1997

Location: Aishihik plutonic suite; 6.8 km south of Tadru Lake

UTM Zone 8 - 465710 E 6916597 N; NTS sheet 105L/5

Unit Name (if available): Tatchun batholith

Geologist: M. Colpron

Sample Description:

Very coarse-grained hornblende \pm biotite granodiorite to quartz monzonite; hornblende grain size is up to 1 cm in quartz + plagioclase matrix

Results:

One aliquot was analyzed. Minor ^{40}Ar -loss is evident in the lowest-temperature step, but otherwise analyses give flat, multi-step plateau consisting of 94% of released ^{39}Ar gas (MSWD = 0.920).

Analytical details:

Irradiation Batch: GSC #45

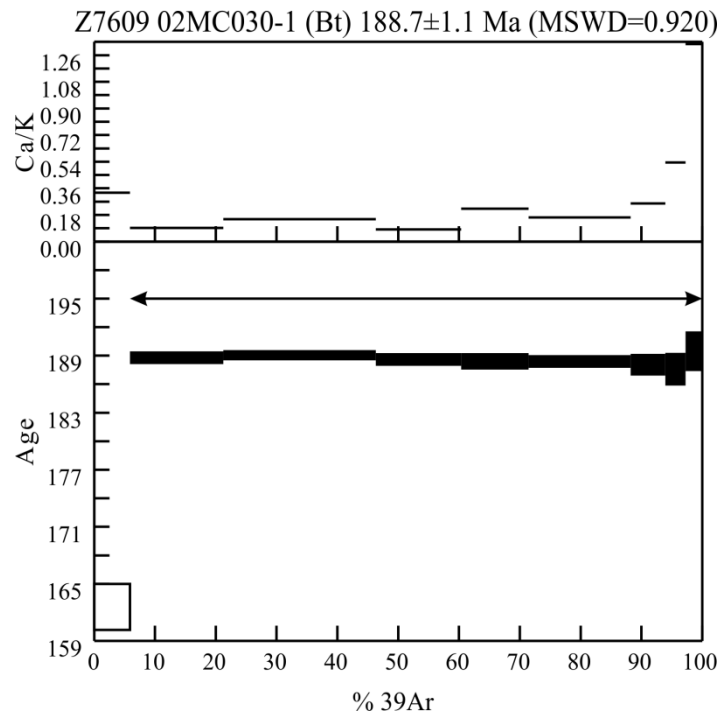
Date analyzed: January 6, 2004

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO_2 laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02MC030-1
Lithology: Hornblende granodiorite
Mineral analyzed: Hornblende
Age: 193.6 ± 1.4 Ma (± 0.8 Ma without J-error)
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7609
Argon Number: 1996
Location: Aishihik plutonic suite; 6.8 km south of Tadru Lake
 UTM Zone 8 - 465710 E 6916597 N; NTS sheet 105L/5
Unit Name (if available): Tatchun batholith
Geologist: M. Colpron

Sample Description:

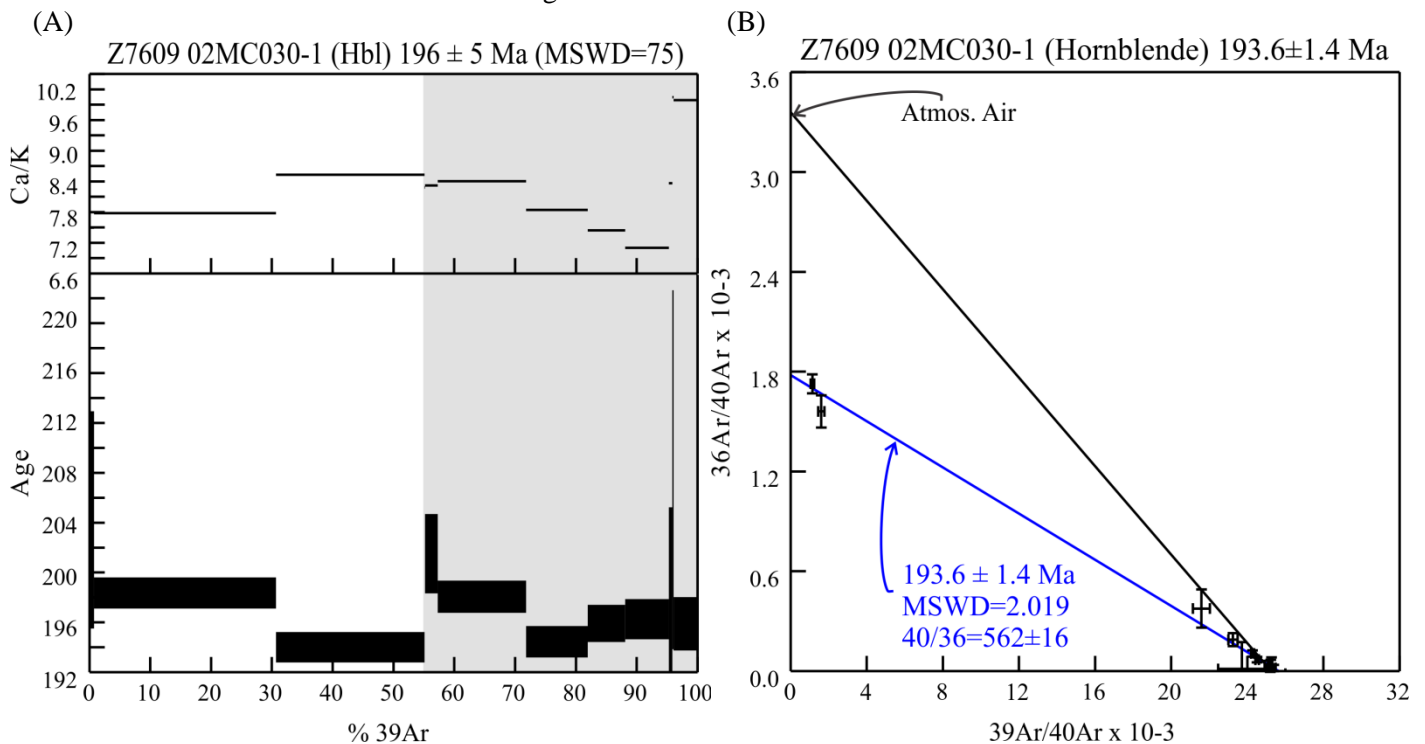
Very coarse-grained hornblende \pm biotite granodiorite to quartz monzonite; hornblende grain size is up to 1 cm in quartz + plagioclase matrix

Results:

Two aliquots were run. The release spectra were disturbed, and no plateau was obtained in either aliquot (Fig. A). Excess ^{40}Ar was observed in both aliquots and was mostly concentrated in the low temperature steps. The total gas age for Aliquots A and B together was 196 ± 5 Ma (MSWD=75). The assigned age of 193.6 ± 1.4 Ma is derived from the inverse isochron regression through all heating steps for both aliquots (Fig. B; MSWD=2.019, $^{40}\text{Ar}/^{36}\text{Ar}=562 \pm 16$).

Analytical details:

Irradiation Batch: GSC #45
 Date analyzed: June 27, & August 8, 2003
 Monitor used: FCT-San
 Laser used: Merchantek® MIR-10 CO₂ laser
 Instrument used for analysis: GSC VG3600
 Data reduction software used: GSC GRID Argon module



Sample Number: 02CR033-1

Lithology: K-feldspar megacrystic granodiorite

Mineral analyzed: Hornblende

Age: 196.1 ± 1.8 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 7664

Argon Number: 1976

Location: 23.2 km SE of Tadru Lake

UTM Zone 8 - 481205 E 6906693 N; NTS sheet 105L/6

Unit Name (if available): Tatchun batholith

Geologist: C. Roots

Sample Description:

K-feldspar megacrystic granodiorite; analyzed grains were excellent quality, fresh, and dark green to black in colour.

Results:

Release spectra for two analyzed aliquots were reproducible, with both showing some evidence for excess ^{40}Ar , especially in lowest temperature steps (Fig. A). Higher temperature steps gave good, multi-step plateaus of 197.4 Ma. However, because of the presence of excess ^{40}Ar , the inverse isochron age of 196.1 ± 1.8 Ma is the preferred age, and is considered an igneous crystallization age (Fig. B; MSWD = 0.991, $^{40}\text{Ar}/^{36}\text{Ar} = 991 \pm 113$).

Analytical details:

Irradiation Batch: GSC #45

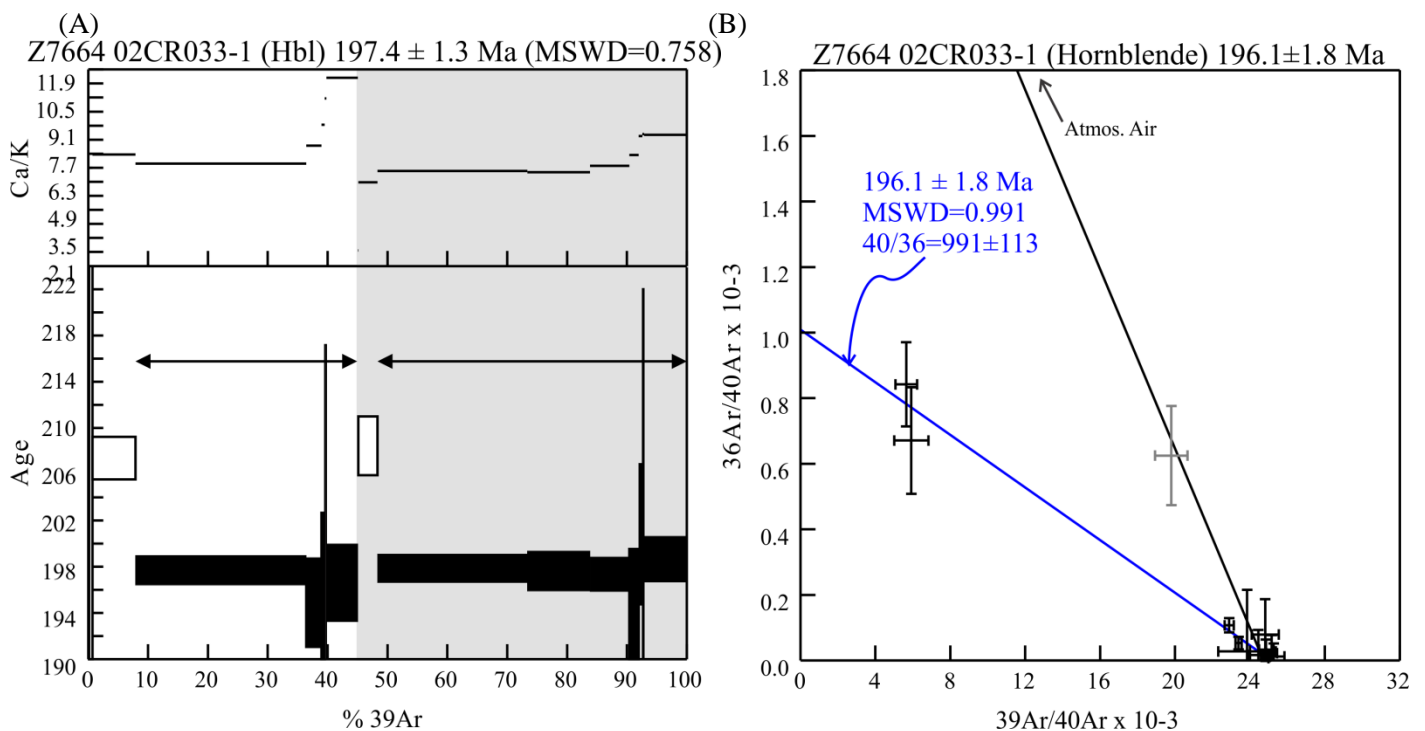
Date analyzed: June 20, & August 8, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO_2 laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02DM030-1

Lithology: Diorite to granodiorite

Mineral analyzed: Biotite

Age: 177.8 ± 1.1 Ma (± 0.5 Ma without J-error)

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7665

Argon Number: 1977

Location: Quesnellia; 15.8 km SE of Tadru Lake

UTM Zone 8 - 477201 E 6913931 N; NTS sheet 105L/6

Unit Name (if available): Kelly pluton

Geologist: M. Colpron

Sample Description:

Foliated, medium-grained diorite to granodiorite. Biotite was dark brown and very fresh.

Results:

Flat, multi-step plateau containing 100% of gas in one aliquot, MSWD=0.260.

Analytical details:

Irradiation Batch: GSC #45

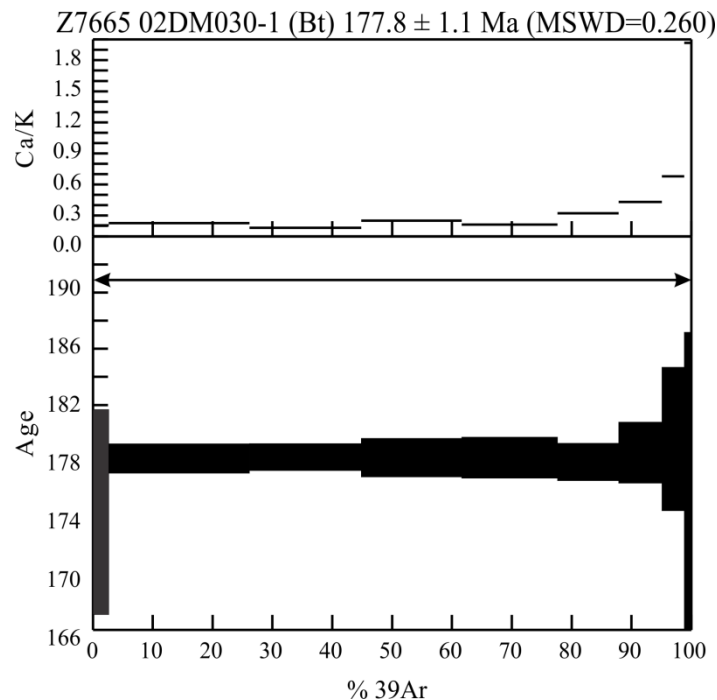
Date analyzed: November 24 & 28, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02DM030-1

Lithology: Diorite to granodiorite

Mineral analyzed: Hornblende

Age: 194.8 ± 1.7 Ma (± 1.2 Ma without J-error)

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7665

Argon Number: 1978

Location: Quesnellia; 15.8 km SE of Tadru Lake

UTM Zone 8 - 477201 E 6913931 N; NTS sheet 105L/6

Unit Name (if available): Kelly pluton

Geologist: M. Colpron

Sample Description:

Foliated, medium-grained diorite to granodiorite. Hornblende grains selected for analysis were excellent quality black fragments.

Results:

A flat, multi-step plateau was obtained for one aliquot, with precision limited slightly by Ca/K ratio of ca. 10-15, which propagates into errors on individual steps. Age includes 99% of the released ^{39}Ar gas, MSWD=1.538.

Analytical details:

Irradiation Batch: GSC #45

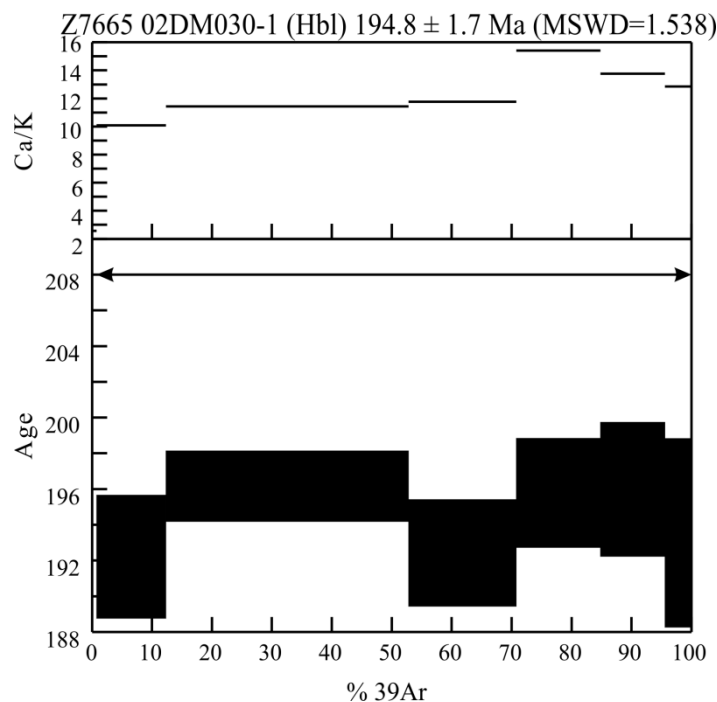
Date analyzed: June 25, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02DM031-1

Lithology: Granite

Mineral analyzed: Biotite

Age: 184.7 ± 1.2 Ma (± 0.5 Ma without J-error)

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7666

Argon Number: 1980

Location: Quesnellia; 18.6 km SE of Tadru Lake

UTM Zone 8 - 479202 E 6910990 N; NTS sheet 105L/6

Unit Name (if available): Kelly pluton

Geologist: M. Colpron

Sample Description:

Foliated granite, cut by folded aplite dike. Biotite grains selected for analysis were thick, fresh dark brown books.

Results:

Minor ^{40}Ar loss evidenced in first step only, otherwise an excellent multi-step plateau age containing 97% of the ^{39}Ar gas in a single aliquot, with MSWD=0.281.

Analytical details:

Irradiation Batch: GSC #45

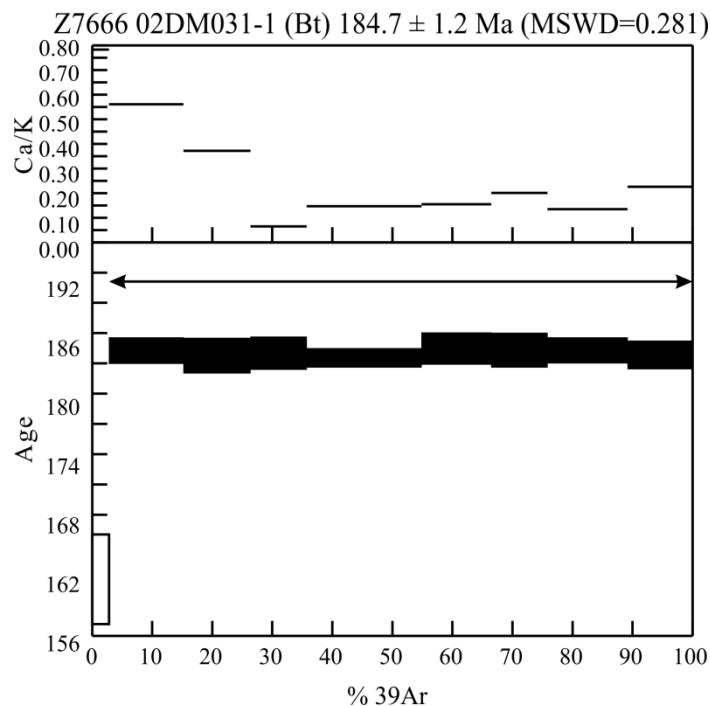
Date analyzed: November 25, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO_2 laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02DM031-1

Lithology: Granite

Mineral analyzed: Muscovite

Age: 186.4 ± 1.1 Ma (± 0.3 Ma without J-error)

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7666

Argon Number: 1979

Location: Quesnellia; 18.6 km SE of Tadru Lake

UTM Zone 8 - 479202 E 6910990 N; NTS sheet 105L/6

Unit Name (if available): Kelly pluton

Geologist: M. Colpron

Sample Description:

Foliated granite, cut by folded aplite dike. Muscovite grains selected for analysis were large, thick, clear yellow books.

Results:

One aliquot was analyzed, and formed a flat multi-step plateau containing 99.5% of the released ^{39}Ar gas, MSWD=0.593.

Analytical details:

Irradiation Batch: GSC #45

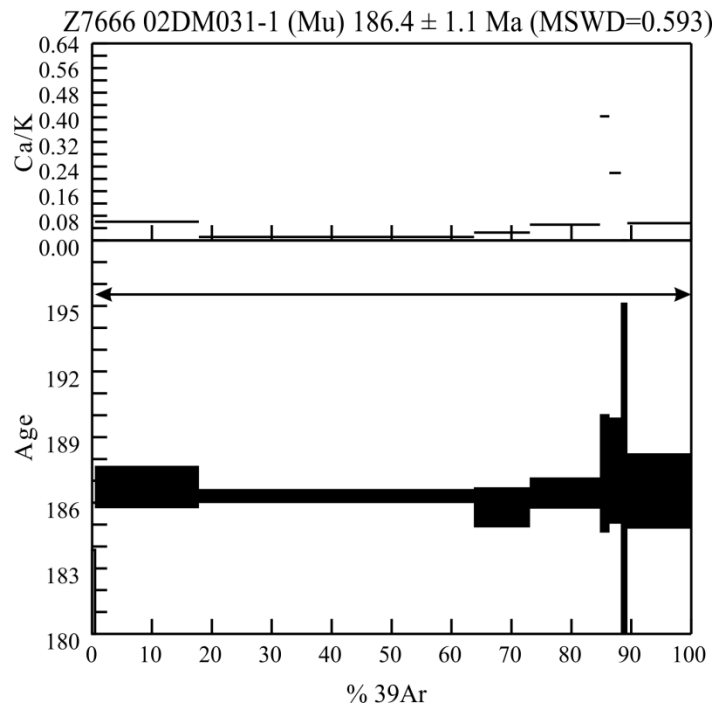
Date analyzed: November 24 & 28, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02DM058-1

Lithology: Two-mica granite

Mineral analyzed: Biotite

Age: 187.0 ± 1.3 Ma (± 0.7 Ma without J-error)

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7668

Argon Number: 1981

Location: Yukon-Tanana terrane; 16.7 km south of Diamain Lake

UTM Zone 8 - 444198 E 6959219 N; NTS sheet 115I/16

Unit Name (if available): Simpson Range suite

Geologist: M. Colpron

Sample Description:

Coarse-grained, foliated two-mica granite. Biotite grains selected for analysis were large, dark brown, thick fresh books.

Results:

Minor ^{40}Ar -loss in first step, but otherwise, good, well-defined plateau consisting of 90% of gas released from a single aliquot, MWSD=0.131.

Analytical details:

Irradiation Batch: GSC #45

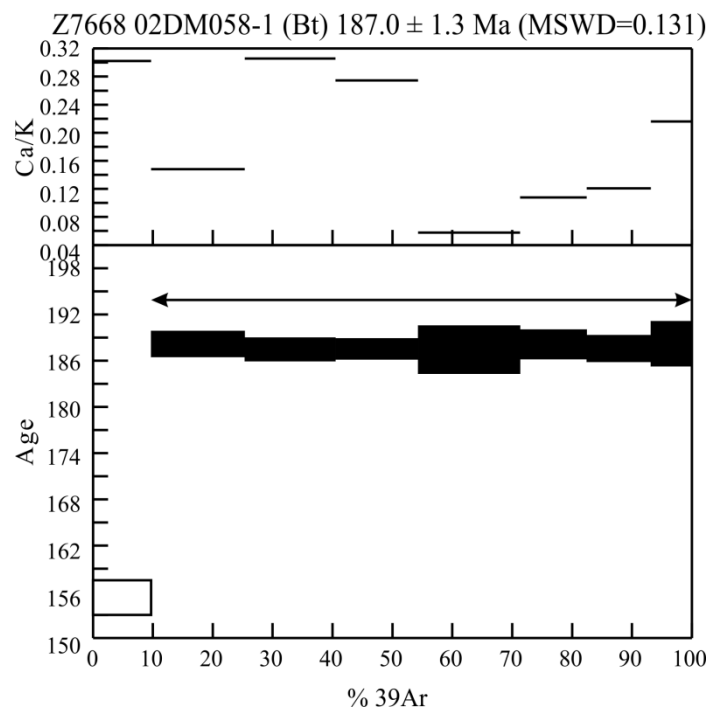
Date analyzed: December 1, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO_2 laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02DM058-1

Lithology: Two-mica granite

Mineral analyzed: Muscovite

Age: 190.9 ± 1.2 Ma (± 0.4 Ma without J-error)

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7668

Argon Number: 1982

Location: Yukon-Tanana terrane; 16.7 km south of Diamain Lake

UTM Zone 8 - 444198 E 6959219 N; NTS sheet 115I/16

Unit Name (if available): Simpson Range suite

Geologist: M. Colpron

Sample Description:

Coarse-grained, foliated two-mica granite. Muscovite grains selected for analysis were fresh, thick, clear yellow books.

Results:

Good multi-step plateau containing 100% of gas in a single aliquot, MSWD=0.682.

Analytical details:

Irradiation Batch: GSC #45

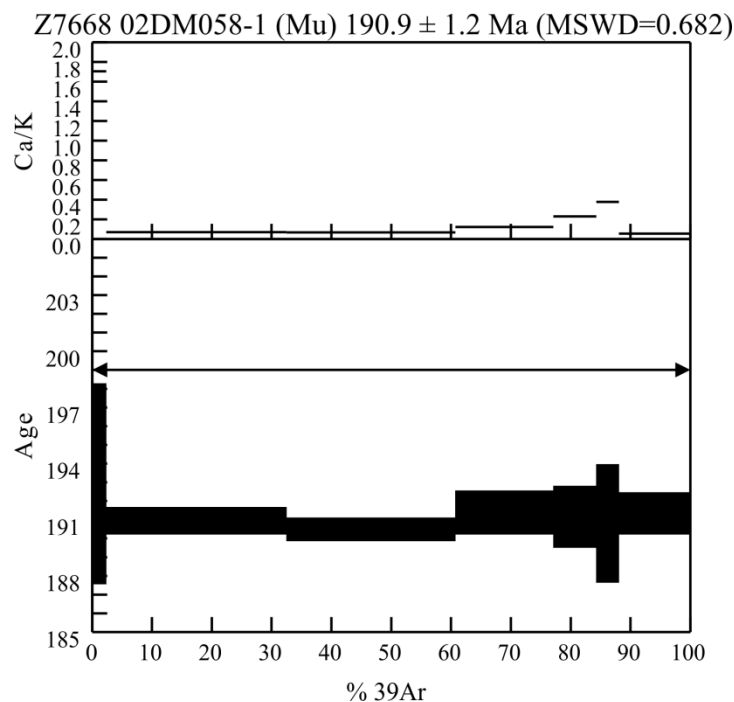
Date analyzed: December 1, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02MC098-1

Lithology: Two-mica granite

Mineral analyzed: Biotite

Age: 191.3 ± 1.1 Ma (± 0.4 Ma without J-error)

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7670

Argon Number: 1983

Location: Yukon-Tanana terrane; 9.4 km south of Ragged Lake

UTM Zone 8 - 479258 E 6936274 N; NTS sheet 105L/11

Unit Name (if available): Simpson Range suite

Geologist: M. Colpron

Sample Description:

Strongly-lineated muscovite + biotite granite; intrudes upper part of Snowcap assemblage. Biotite grains selected for analysis were large, thick, dark brown books.

Results:

Flat, multi-step plateau containing 100.0 % of released ^{39}Ar gas in one aliquot, MSWD=0.384.

Analytical details:

Irradiation Batch: GSC #45

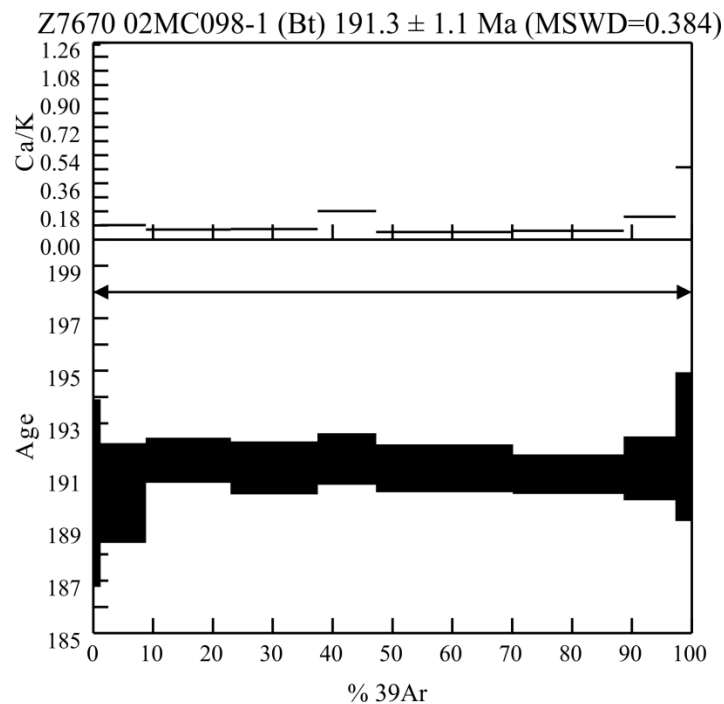
Date analyzed: December 4, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02MC098-1

Lithology: Two-mica granite

Mineral analyzed: Muscovite

Age: 196.8 ± 1.2 Ma (± 0.4 Ma without J-error)

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7670

Argon Number: 1984

Location: Yukon-Tanana terrane; 9.4 km south of Ragged Lake

UTM Zone 8 - 479258 E 6936274 N; NTS sheet 105L/11

Unit Name (if available): Simpson Range suite

Geologist: M. Colpron

Sample Description:

Strongly-lineated muscovite + biotite granite; intrudes upper part of Snowcap assemblage. Muscovite grains selected for analysis were large, thick, clear yellow books.

Results:

Flat, multi-step plateau including 98% of the released ^{39}Ar gas on one aliquot, MSWD=1.519.

Analytical details:

Irradiation Batch: GSC #45

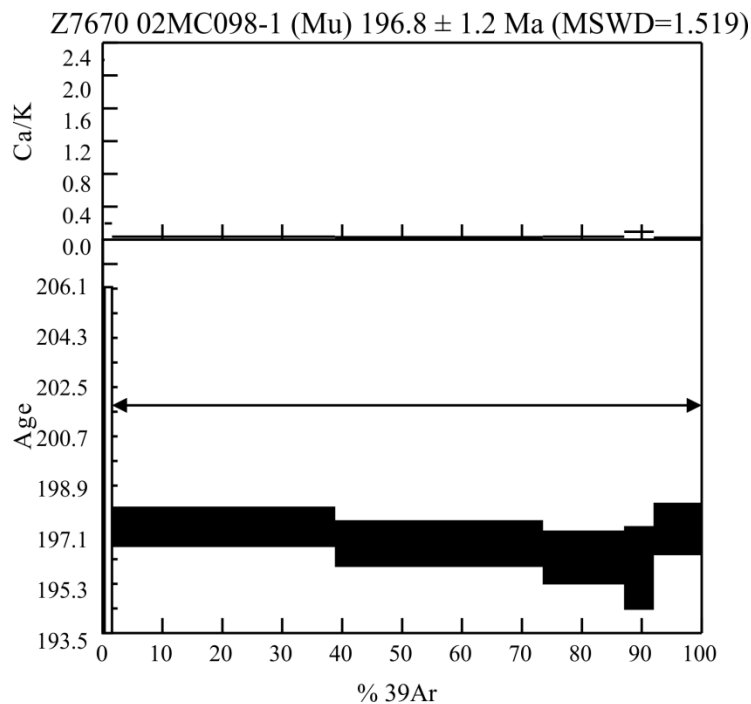
Date analyzed: December 4, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02MC020

Lithology: Hornblende tonalite

Mineral analyzed: Biotite

Age: 193.1 ± 1.2 Ma (± 0.6 Ma without J-error)

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7671

Argon Number: 1985

Location: Yukon-Tanana terrane; 15.5 km NW of west end of Little Salmon Lake

UTM Zone 8 - 491391 E 6907883 N; NTS sheet 105L/6

Unit Name (if available): Simpson Range suite

Geologist: M. Colpron

Sample Description:

Strongly foliated hornblende tonalite. Biotite grains selected for analysis were brownish green thick books.

Results:

Multi-step plateau of 193.1 ± 1.2 Ma, with evidence for some later thermal overprinting from the lowest temperature steps. 69% of gas falls within the plateau region for a single aliquot, MSWD=0.114.

Analytical details:

Irradiation Batch: GSC #45

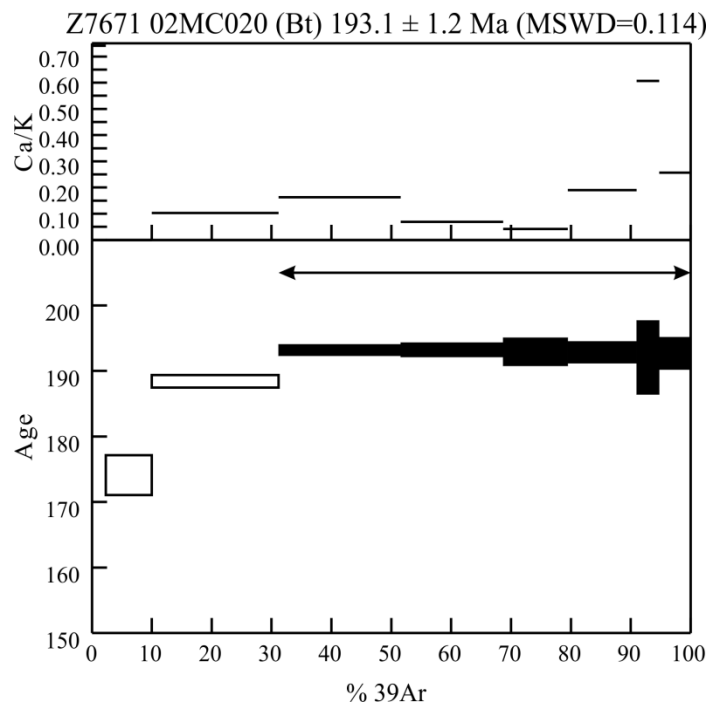
Date analyzed: December 5, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02MC020
Lithology: Hornblende tonalite
Mineral analyzed: Hornblende
Age: 198.9 ± 7.2 Ma (± 7.1 Ma without J-error)
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7671

Argon Number: 1986

Location: Yukon-Tanana terrane; 15.5 km NW of west end of Little Salmon Lake

UTM Zone 8 - 491391 E 6907883 N; NTS sheet 105L/6

Unit Name (if available): Simpson Range suite

Geologist: M. Colpron

Sample Description:

Strongly foliated hornblende tonalite. Hornblende was pale olive-green in colour, with a needle-like habit.

Results:

Two aliquots gave plateaus at slightly different ages (Fig. A). An age of 215.3 ± 3.6 Ma is based on plateau regions of both aliquots (87% of ^{39}Ar , MSWD=0.959). Low precision on the age is due to elevated Ca/K in the sample (most steps had Ca/K >45). The first heating step of Aliquot A contained excess ^{40}Ar ; on an inverse isochron plot, data for both aliquots fell along a regression line yielding an age of 198.9 ± 7.2 Ma (Fig. B; MSWD=1.632, $^{40}\text{Ar}/^{36}\text{Ar}=523 \pm 44$). Albeit less precise than the plateau age, the inverse isochron age is considered to be more accurate.

Analytical details:

Irradiation Batch: GSC #45

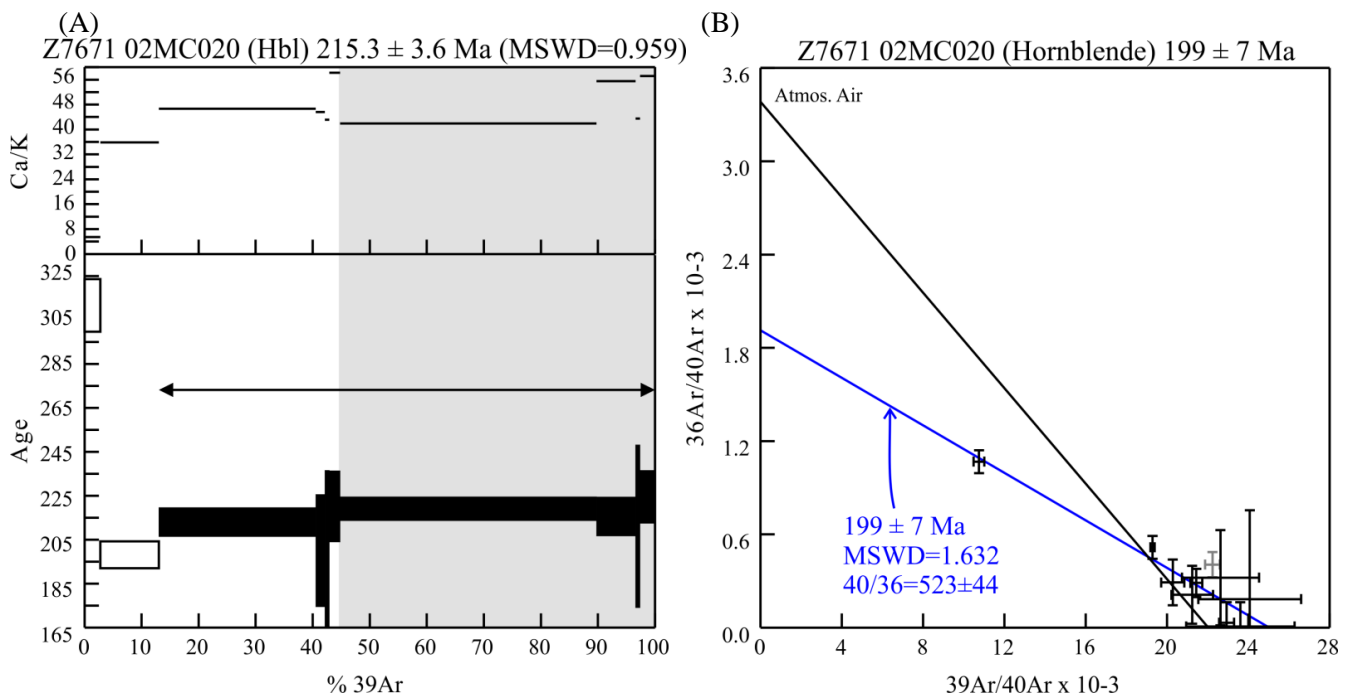
Date analyzed: June 25, & August 25, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: RL02-5-4B
Lithology: Leucogabbro
Mineral analyzed: Amphibole
Age: 207 ± 7 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7672

Argon Number: 2012

Location: Yukon-Tanana terrane; 3 km south of the west end of Drury Lake

UTM Zone 8 - 503953 E 6907172 N; NTS sheet 105L/7

Unit Name (if available): Little Salmon

Geologist: M. Colpron

Sample Description:

Foliated leucogabbro, intruding marble of the Little Salmon formation. Ragged-looking green grains with possible alteration.

Results:

Despite the seemingly poor quality of the grains, the analyses from two multigrain aliquots give a relatively well-defined ($\text{MSWD}=2.231$) regression on the inverse isochron diagram, indicating presence of excess ^{40}Ar ($^{40}\text{Ar}/^{36}\text{Ar}=726\pm43$). Low K content causes large analytical errors and imprecise age on the two aliquots.

Analytical details:

Irradiation Batch: GSC #45

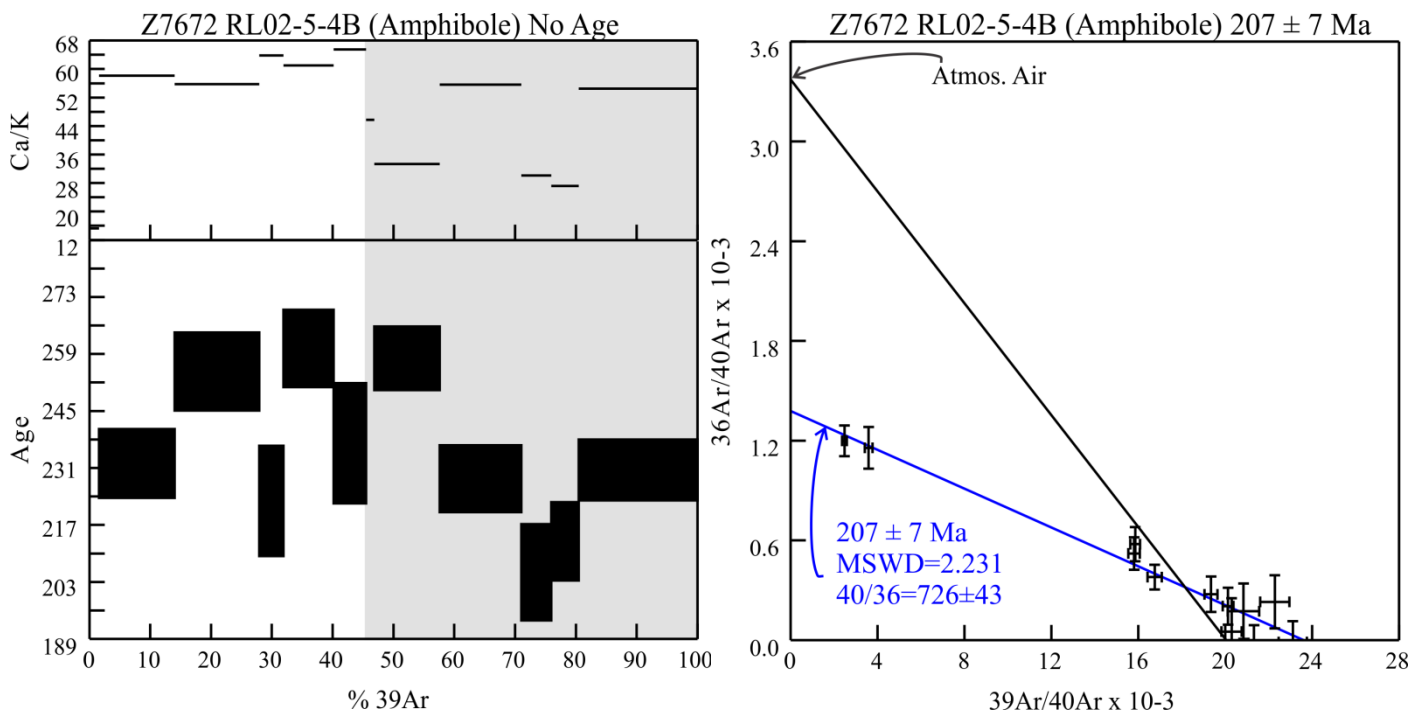
Date analyzed: February 9, & March 1, 2004

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO_2 laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: LJJMP024A

Yukon Minfile 1150 051

Lithology: Gneiss

Mineral analyzed: Phlogopite

Age: 187.7 ± 1.3 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 8351

Argon Number: 2351

Location: Drill Hole 76-5 at 643.25 feet depth on Lucky Joe Cu-Au prospect

UTM Zone 7 - 573029 E 7051146 N; NTS sheet 1150/12

Unit Name (if available):

Geologist: J. Peter

Sample Description:

Mineralized zone; feldspar (40%)-quartz-biotite gneiss with 1-2% chalcopyrite blebs. Analyzed aliquot consisted of two large dark brown thick clean grains (700-1000 μ m each).

Results:

One aliquot analyzed, giving a flat, multistep plateau containing 95.0% of gas released (MSWD=0.141).

Analytical details:

Irradiation Batch: GSC #51

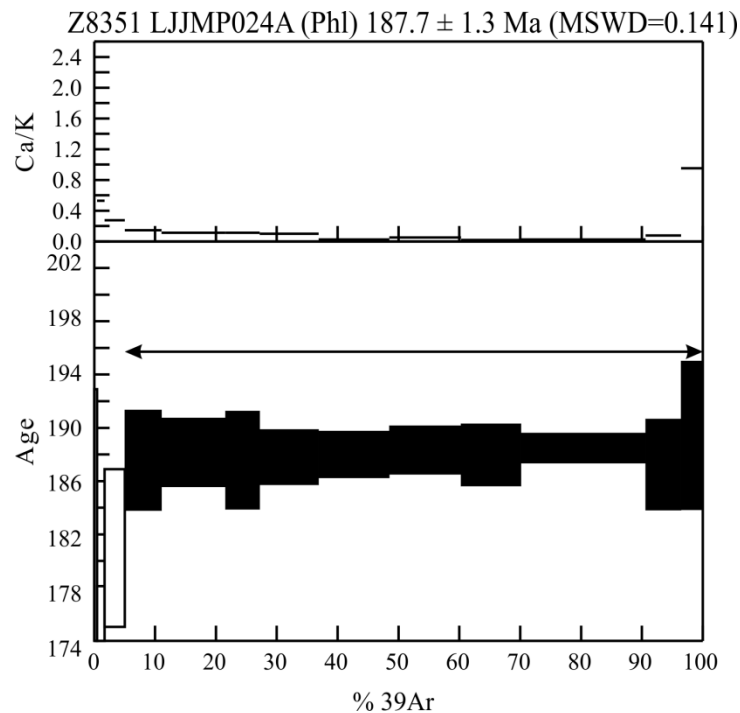
Date analyzed: July 19, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: LJJMP053

Yukon Minfile 1150 051

Lithology: Amphibolite

Mineral analyzed: Biotite

Age: 187.5 ± 1.3 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 8352

Argon Number: 2352

Location: Drill Hole 76-2 at 359 feet depth on Lucky Joe Cu-Au prospect.

UTM Zone 7 - 573127 E 7051123 N; NTS sheet 1150/12

Unit Name (if available): Finlayson Assemblage

Geologist: J. Peter

Sample Description:

Amphibolite schist that is immediately up-hole (structural hanging wall) to mineralized horizon; chlorite>feldspar>hornblende>muscovite>garnet; feldspars are 1-2mm granules distributed throughout; non-magnetic (in this particular part); no pyrite or other sulphides. Analyzed aliquot consisted of two large dark brown thick clean grains (700-1000µm each).

Results:

One aliquot analyzed, giving a flat, multistep plateau consisting of 95% of gas released, MSWD=0.395.

Analytical details:

Irradiation Batch: GSC #51

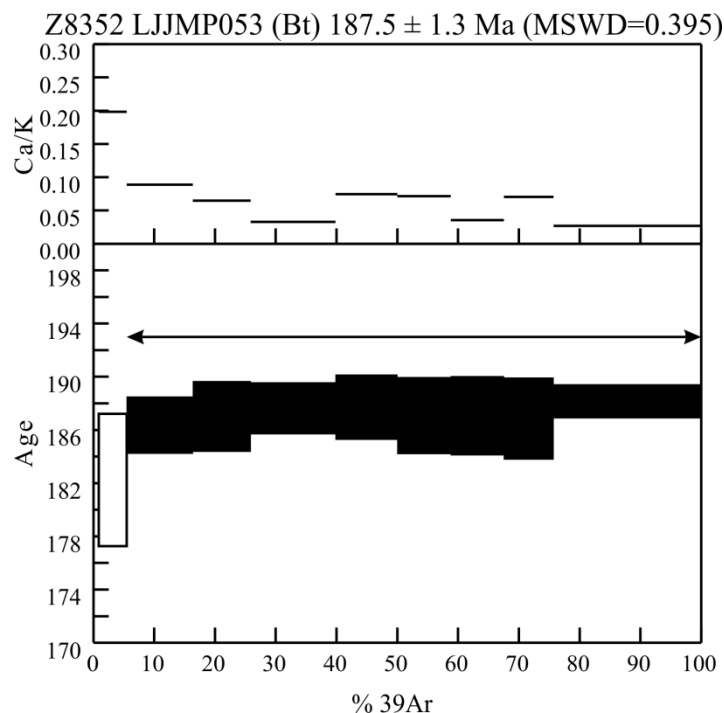
Date analyzed: July 19-20, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02RAY183A1

Lithology: Orthogneiss

Mineral analyzed: Muscovite

Age: 176.9 ± 1.9 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 8552

Argon Number: 2414

Location: 15.699 km bearing $123^\circ 7'$ from mouth of Deep Creek

UTM Zone 7 - 519902 E 7029796 N; NTS sheet 115N/7

Unit Name (if available): Sulphur Creek suite; Klondike Assemblage

Geologist: J.J. Ryan

Sample Description:

Medium-grained monzogranite orthogneiss. The analyzed aliquot consisted of two large thin clear grains (700-900 μ m each).

Results:

One aliquot was analyzed, and gave a flat plateau comprising 99.6% of gas, but with uneven gas release. However, ages of all steps were within error of each other (MSWD=0.953).

Analytical details:

Irradiation Batch: GSC #51

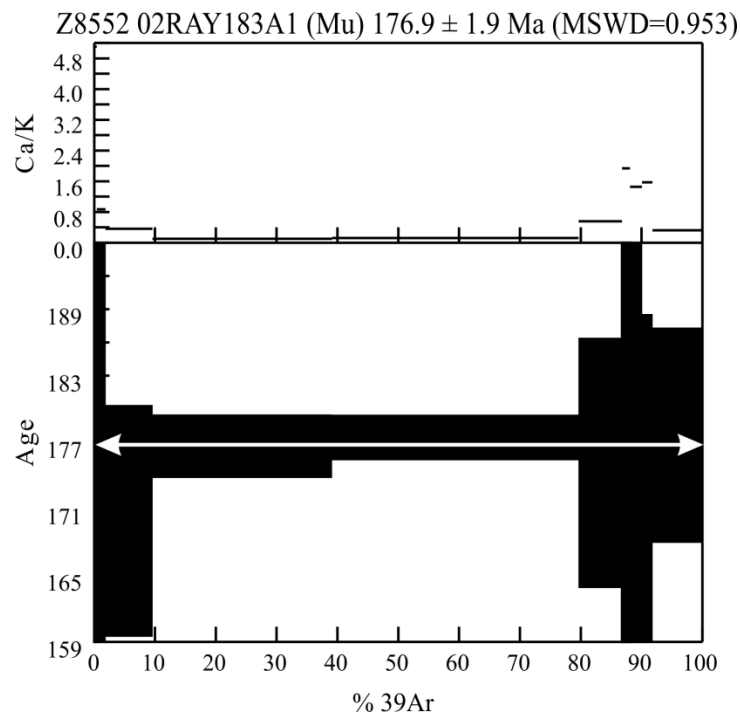
Date analyzed: August 22, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02RAY319B1
Lithology: Amphibolite
Mineral analyzed: Hornblende
Age: 183.8 ± 1.8 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 8553
Argon Number: 2415
Location: 28.644 km bearing $114^{\circ} 58'$ from mouth of Deep Creek
UTM Zone 7 - 532724 E 7026315 N; NTS sheet 115N/8
Unit Name (if available): Finlayson Assemblage
Geologist: S. Gordey

Sample Description:

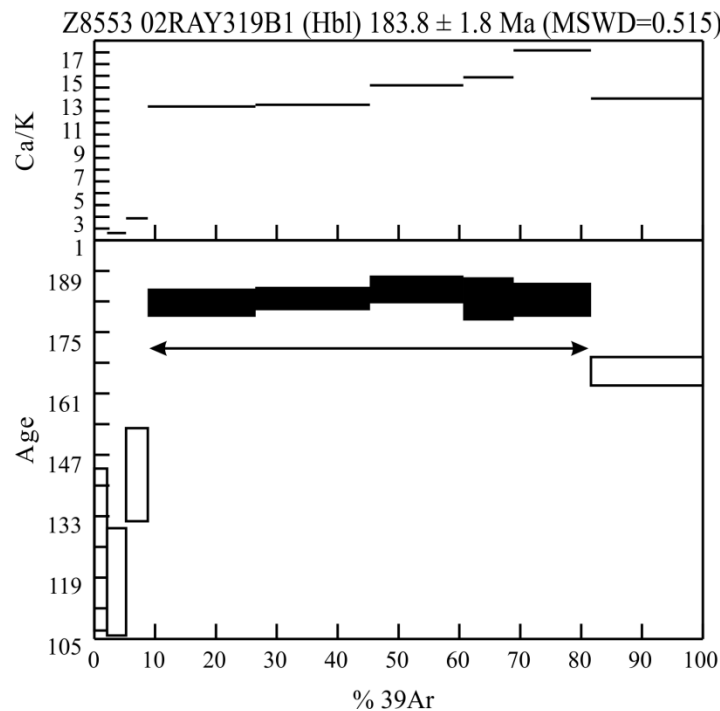
Amphibolite; fresh, fine to medium grained, interlayered with marble. The analyzed aliquot consisted of five black fresh grains (600-1000 μ m each).

Results:

One aliquot was analyzed, and gave a hump-shaped spectrum. A flat plateau was obtained from 5 consecutive mid- to high-temperature steps, consisting of 73% of gas (MSWD=0.515). Highest temperature step shows significant drop in apparent age (possibly analytical or contamination?). Low temperature steps show ^{40}Ar -loss.

Analytical details:

Irradiation Batch: GSC #51
Date analyzed: October 31, & November 1, 2005
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: 02RAYG143A1

Lithology: Amphibolite

Mineral analyzed: Hornblende

Age: 185.1 ± 5.6 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 8554

Argon Number: 2425

Location: 24.713 km bearing 269° 20' from mouth of Chris Creek

UTM Zone 7 - 546778 E 7027111 N; NTS sheet 115N/8

Unit Name (if available): Finlayson Assemblage

Geologist: S. Gordey

Sample Description:

Amphibolite, medium-grained, with slight chlorite alteration. The analyzed aliquot consisted of six large greenish-brown grains (500-700µm in size).

Results:

One aliquot was analyzed. A flat, multistep plateau was obtained comprising all the heating steps (100% of gas, MSWD=0.396), although low K-content resulted in overall low gas volumes and resultant large imprecision on the age.

Analytical details:

Irradiation Batch: GSC #51

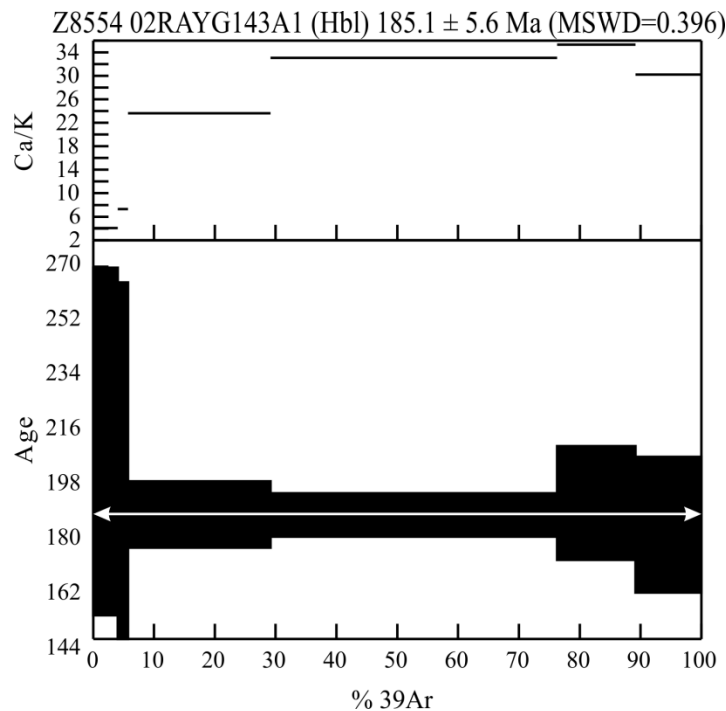
Date analyzed: October 26, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02RAYG242A1

Lithology: Granite

Mineral analyzed: Muscovite

Age: 176.5 ± 1.1 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 8555

Argon Number: 2416

Location: 7.722 km bearing $104^\circ 57'$ from mouth of Deep Creek

UTM Zone 7 - 514202 E 7036367 N; NTS sheet 115N/7

Unit Name (if available): Sulphur Creek suite; Klondike Assemblage

Geologist: S. Gordey

Sample Description:

Augen granite, medium grained, with slight chlorite alteration, possible sericite. The muscovite grains were thick apple-green books ($\sim 800\mu\text{m}$ each).

Results:

One aliquot was analyzed. A flat, multistep plateau was obtained, containing 99.6% of the released ^{39}Ar gas, MSWD=0.573.

Analytical details:

Irradiation Batch: GSC #51

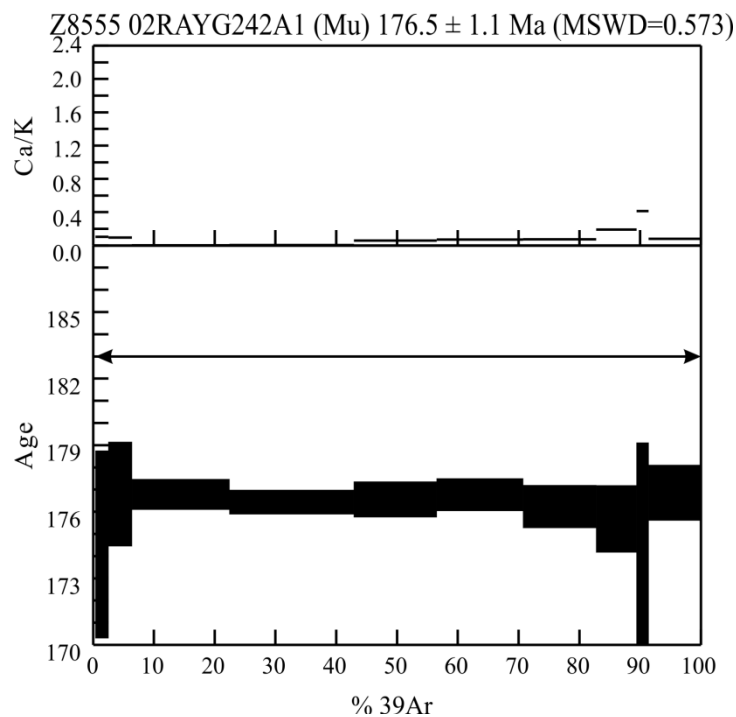
Date analyzed: October 11, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO_2 laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02RAYG264A1

Lithology: Schist

Mineral analyzed: Muscovite

Age: No Age

Interpretation: No Age

Geochronology Lab Number: 8557

Argon Number: 2418

Location: 12.651 km bearing 182° 53' from mouth of Deep Creek

UTM Zone 7 - 506131 E 7025711 N; NTS sheet 115N/7

Unit Name (if available): Sulphur Creek suite; Klondike Assemblage

Geologist: S. Gordey

Sample Description:

Schist, probably derived from a monzogranite; reminiscent of the Sulphur Creek orthogneiss/Klondike Schist, medium-grained with slight chlorite alteration. Muscovite grains were clean, clear, yellow, and coarse (900-1000µm)

Results:

One aliquot was analyzed (2 grains). The step-heating pattern is typical of a sample with excess ^{40}Ar (i.e. decreasing apparent age with increasing temperature; down-stepping from ~160 Ma to ~140 Ma), but there was no co-linearity of data on the inverse isochron (not shown) and no age could be resolved. Gas volume was low for a muscovite and may be indicative of alteration (despite the fresh appearance of the grains).

Analytical details:

Irradiation Batch: GSC #51

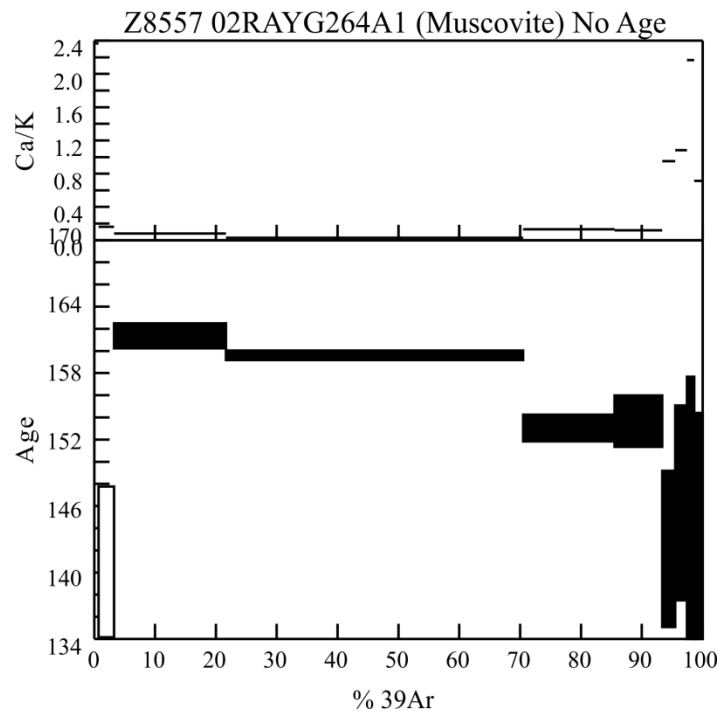
Date analyzed: October 11 & 14, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 03GGAR162A1

Lithology: Amphibolite

Mineral analyzed: Hornblende

Age: 190.4 ± 1.6 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 8558

Argon Number: 2426

Location: 16.894 km bearing $246^\circ 19'$ from mouth of Chris Creek

UTM Zone 7 - 556158 E 7020820 N; NTS sheet 1150/5

Unit Name (if available): Simpson Range suite

Geologist: S. Gordey

Sample Description:

Amphibolite, fine- to medium-grained, looks fresh. The analyzed aliquot consisted of six large flat tabular black grains (600-800 μ m in size).

Results:

One aliquot was analyzed, giving a flat, multistep plateau, but the bulk of gas (72%) released in one medium-temperature step. Other steps agree well within error (MSWD=0.215). 99.7% of ^{39}Ar gas was used for the plateau calculation.

Analytical details:

Irradiation Batch: GSC #51

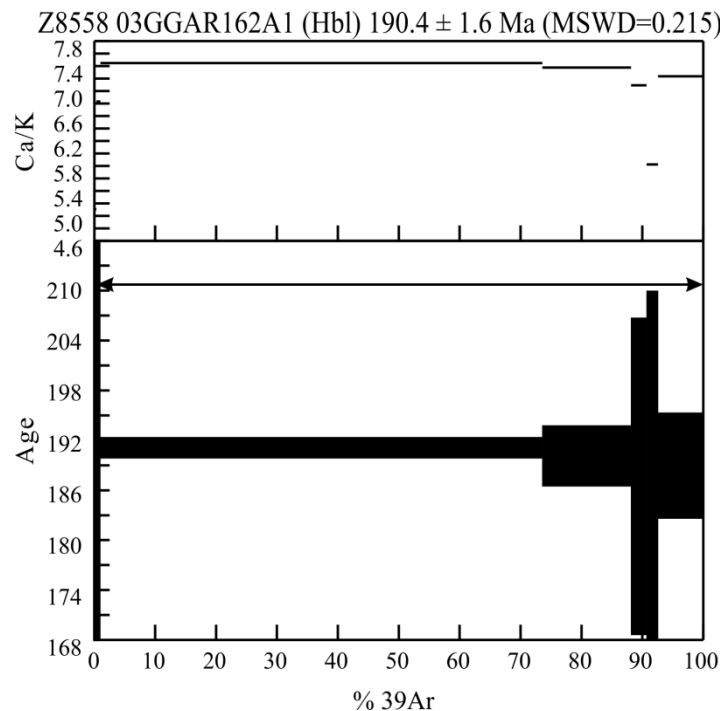
Date analyzed: October 26-27, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 01-RAY-299B

Lithology: Hornblendite

Mineral analyzed: Hornblende

Age: 218.1 ± 1.6 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 7372

Argon Number: 1902

Location: Pyroxene Mountain

UTM Zone 7 - 634021 E 6990760 N; NTS sheet 115O/1

Unit Name (if available): Pyroxene Mountain Suite

Geologist: J. J. Ryan

Sample Description:

Coarse hornblendite collected to determine age of the cooling or the hornblende-facies alteration of the pyroxenite. Good quality fresh black hornblende was selected for analysis.

Results:

A relatively flat plateau was obtained containing all steps from two analyzed aliquots. The bulk of gas in each aliquot was restricted to the final three to four heating steps. Aliquot B showed evidence for minor excess ^{40}Ar , but the age using the inverse isochron is indistinguishable from the plateau age reported here. Hornblende age is consistent with a poor quality ~ 220 Ma U-Pb titanite age (Villeneuve, unpublished data, 2003) obtained from a nearby trondhjemite sampled from within the pyroxenite.

Analytical details:

Irradiation Batch: GSC #45

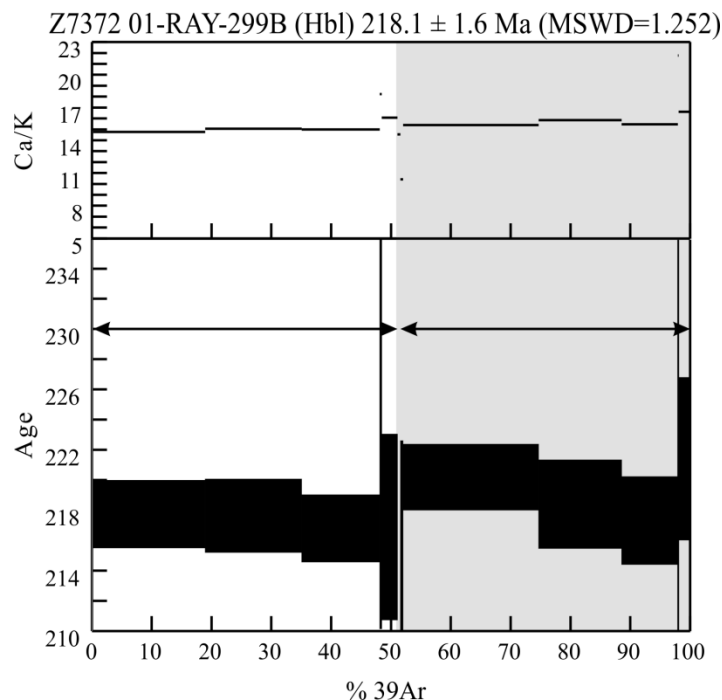
Date analyzed: June 30, & July 31, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO_2 laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-01-06B

Lithology: Biotite lamprophyre

Mineral analyzed: Biotite

Age: 202.2 ± 1.2 Ma

Interpretation: Estimate of maximum igneous crystallization age

Geochronology Lab Number: 7044

Argon Number: 1837

Location: On Stewart River

UTM Zone 7 - 595937 E 7012475 N; NTS sheet 1150/3

Unit Name (if available): Minto Suite

Geologist: J. J. Ryan

Sample Description:

Likely co-magmatic with hornblende granodiorite from sample VN-01-06A from same outcrop (this report). Gradational contact over 30-50 cm with granodiorite. The lamprophyre also grades into hornblende in same exposure. All rocks at this locality are massive and unfoliated, except along gradational contact zone (enhanced by weathering). Fine-grained veins of aplitic granodiorite cut mafic section. Biotite was excellent quality, dark brown thick books.

Results:

Two aliquots of biotite were analyzed. Significant ^{40}Ar loss was seen in low temperature parts of spectra (Fig. A). A humped-shaped spectrum was obtained for Aliquot A, the peak of which formed a 3-step pseudo-plateau at 202.2 ± 1.2 Ma. Aliquot B gave negatively sloping higher temperature steps, forming a 4-step pseudo-plateau at 202.3 ± 1.3 Ma. The 202.2 ± 1.2 Ma age is derived from the pseudo-plateau portions of both aliquots, comprising only 42% of the total released ^{39}Ar , MSWD=0.701. The inverse isochron diagram shows slight excess ^{40}Ar for the same heating steps used to calculate the pseudo-plateau age, but the inverse isochron age is indistinguishable at 201.9 ± 1.3 Ma (Fig. B; $^{40}\text{Ar}/^{36}\text{Ar}=372 \pm 110$, MSWD=0.360). This biotite is older than hornblende from the granodiorite with which the lamprophyre is interpreted to be co-magmatic, and the biotite age is, therefore, likely a maximum estimate only.

Analytical details:

Irradiation Batch: GSC #43

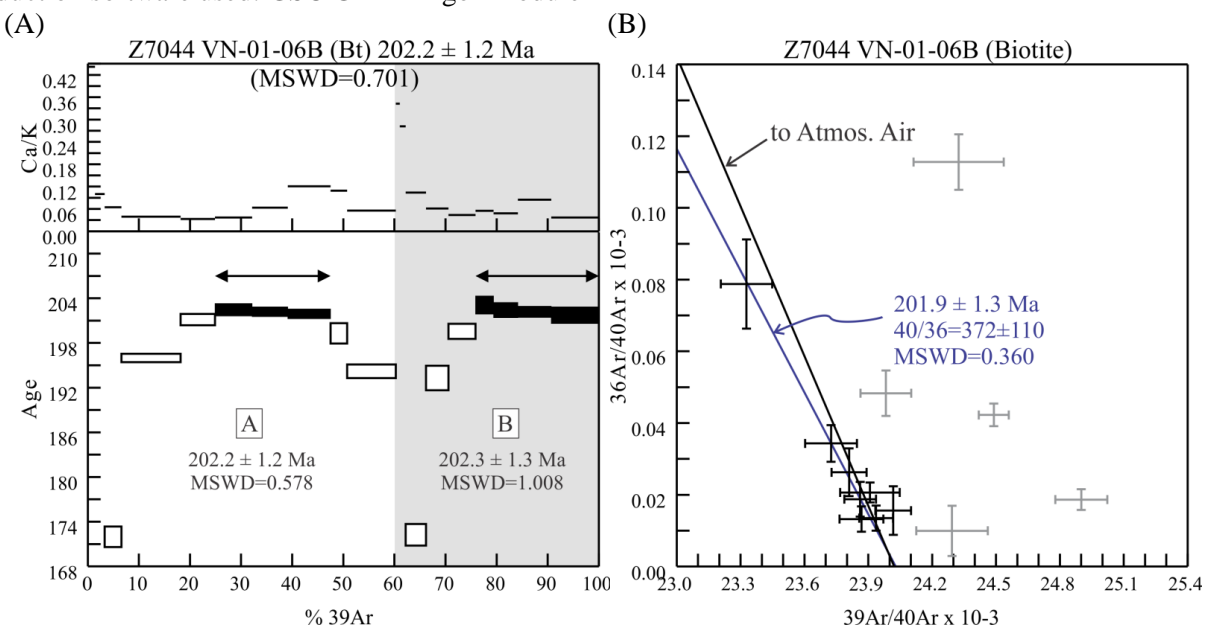
Date analyzed: January 13 & 15, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-01-06A
Lithology: Hornblende granodiorite
Mineral analyzed: Hornblende
Age: 196.5 ± 1.3 Ma
Interpretation: Igneous Crystallization

Geochronology Lab Number: 7044
Argon Number: 1836
Location: On Stewart River
UTM Zone 7 - 595937 E 7012475 N; NTS sheet 1150/3
Unit Name (if available): Minto Suite
Geologist: J. J. Ryan

Sample Description:

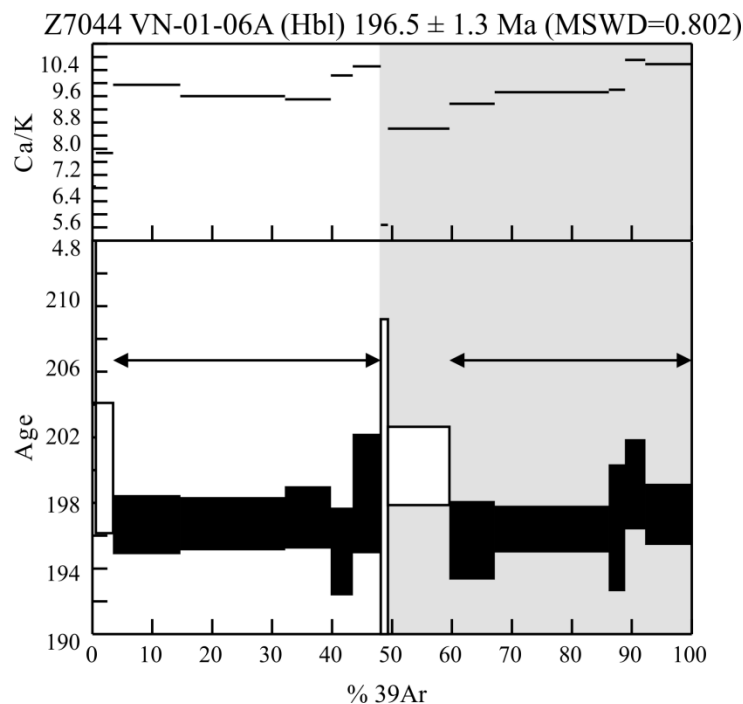
Likely co-magmatic with mafic hornblendite/lamprophyre on west side of outcrop (sampled for biotite VN-01-06B, this report). Hornblende phenocrysts are up to 5-7 mm in diameter. Mafic content varies but overall the granodiorite composition is the same throughout the exposure. Gradational contact over 30-50 cm with the lamprophyre. All rocks at this locality are massive and unfoliated, except along gradational contact zone (enhanced by weathering). Amphibolite xenolith approximately 50 cm long was observed in granodiorite.

Results:

Minor amount of excess ^{40}Ar in lowest-temperature heating steps of two aliquots, but most of the steps and released gas volume formed flat multistep reproducible plateaus from which the age was calculated (85% of the ^{39}Ar , MSWD=0.802).

Analytical details:

Irradiation Batch: GSC #43
Date analyzed: January 10, 2003
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-01-07

Lithology: Biotite granodiorite

Mineral analyzed: Biotite

Age: 191.5 ± 1.2 Ma

Interpretation: Reset or slow igneous cooling

Geochronology Lab Number: 7045

Argon Number: 1838

Location: On Stewart River, elevation 384 m

UTM Zone 7 - 589691 E 7017170 N; NTS sheet 1150/6

Unit Name (if available): Minto Suite

Geologist: J. J. Ryan

Sample Description:

Sampled from a large body of granodiorite (approximately 8 km extent). Faint foliation in the granodiorite is defined by biotite, which is potentially recrystallized. Minor chlorite with epidote was observed in the rock. The biotite separated for dating was excellent quality, thick dark brown books.

Results:

Two aliquots were analyzed. Both spectra showed ^{40}Ar loss in early heating steps, and mid-temperature steps were slightly hump-shaped. The age is derived from the three highest-temperature steps from both aliquots which formed two pseudo-plateaus comprising 46% of the total released ^{39}Ar (MSWD=3.234); those in Aliquot A decreased in age from 192 to 190 Ma, and those in Aliquot B were more reproducible at 192 Ma. Age likely reflects metamorphic resetting or slow cooling of the pluton emplaced at ca. 197 Ma (Minto Suite).

Analytical details:

Irradiation Batch: GSC #43

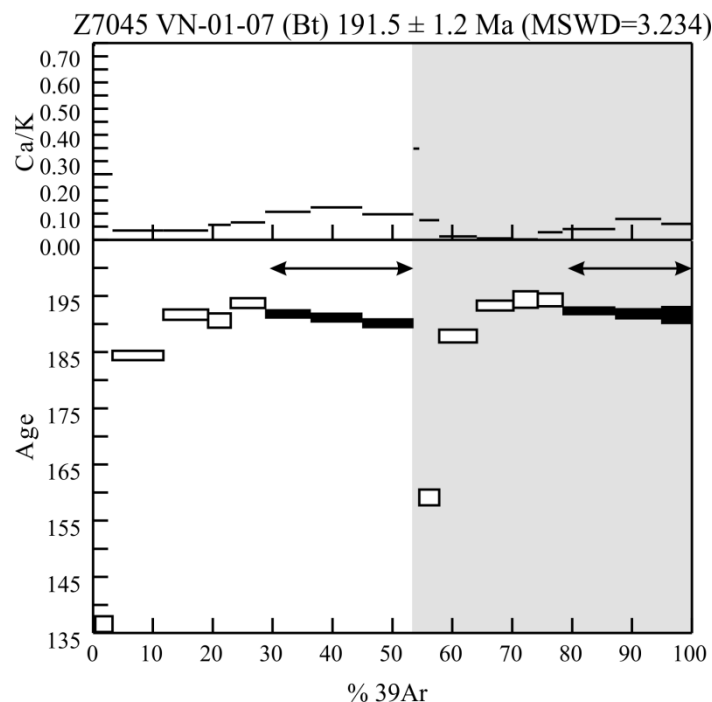
Date analyzed: January 16-17, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-01-11

Lithology: Hornblende granite to granodiorite

Mineral analyzed: Hornblende

Age: 116.4 ± 2.6 Ma

Interpretation: Estimated age of resetting

Geochronology Lab Number: 7049

Argon Number: 1841

Location: North of mouth of Stewart River on Yukon River

UTM Zone 7 - 576971 E 7022571 N; NTS sheet 1150/6

Unit Name (if available): Minto Suite

Geologist: J. J. Ryan

Sample Description:

Massive, large body, assumed to be of Jurassic age. Medium- to coarse-grained equigranular hornblende is altered to chlorite but relict fragments of fresh dark-brown hornblende were selected for dating.

Results:

Reproducible plateaus were obtained on two aliquots. Although the final plateau age appears robust, it has low K content with high Ca/K (> 30), which limits precision. Furthermore, the sample degassed at temperatures lower than normal for hornblende, and there were some impurities in the sample that caused interferences with the ^{40}Ar signal in the first few minutes of some analyses. Noisy measurements of ^{40}Ar in the earliest portions of some runs were discarded, resulting in fewer data points from which to determine time-zero values of ^{40}Ar , and thus reduced precision. The reader is advised to use this age with caution.

Analytical details:

Irradiation Batch: GSC #43

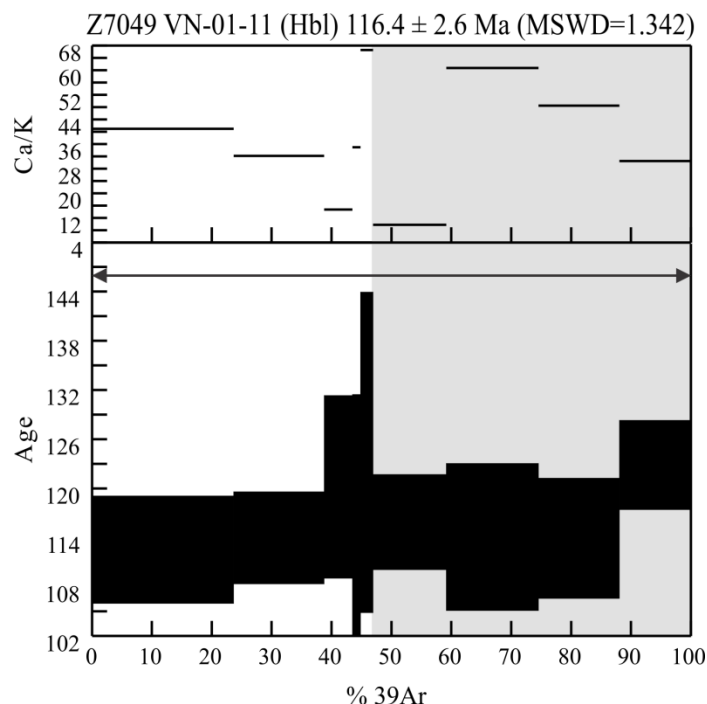
Date analyzed: January 21-22, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO_2 laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Cretaceous Regional Metamorphic Cooling

Yukon-Tanana terrane and the North River fault – Finlayson Lake area

In the Finlayson Lake area, samples were collected in order to constrain the age(s) of deformation and metamorphism in this part of Yukon-Tanana terrane (Fig. 4; see Murphy et al. (2006) for description of the regional geology). Most of the samples were collected from the strongly foliated and variably metamorphosed rocks of the structurally deepest Big Campbell thrust sheet; these samples are also in the footwall of the North River extension fault. The one exception is 97DM-107, a roof pendant of gabbro within Late Devonian–Early Mississippian granodiorite of the structurally highest thrust sheet of Yukon-Tanana terrane, the Cleaver Lake thrust sheet; these rocks are in the hanging wall of the North River fault.

Most of the samples from the footwall of the North River fault are broadly mid-Cretaceous in age, coeval with or slightly younger than late to post-kinematic granite plutons occurring extensively in the area. Two exceptions are hornblendes with Early Cretaceous ages (97DM-182 at 123.3 ± 1.6 Ma and 97DM-330 at ca. 140 Ma), indicating an earlier period of deformation and metamorphism; these two ages alone are insufficient to constrain the timing. The one sample of hornblende from gabbro (97DM-107) in the hanging wall of the North River fault gave a Late Devonian age (365 ± 9 Ma). The gabbro is inferred to be coeval with basalt in a basalt- and rhyolite-bearing volcanic unit in the Cleaver Lake thrust sheet; a subvolcanic porphyry feeder to the rhyolite is ca. 360 Ma (Mortensen, 1992), hence the Late Devonian $^{40}\text{Ar}/^{39}\text{Ar}$ age is consistent with the gabbro being co-magmatic with the basalt. The preservation of igneous $^{40}\text{Ar}/^{39}\text{Ar}$ ages and the lack of mid-Cretaceous $^{40}\text{Ar}/^{39}\text{Ar}$ ages and plutons in the hanging wall of the North River fault affirm the interpretation that the North River fault is a mid-Cretaceous extensional fault (Murphy, 2004).

Upper Hyland River area

Samples were taken to constrain the age of peak metamorphism or cooling in this region, which has a higher metamorphic grade than most surrounding areas, and an uncharacteristically high magnetic response from one stratigraphic unit. The ages for all three samples (from the western portion of the map area in Fig. 4) indicate that peak metamorphism and melt development that formed andalusite-bearing pegmatites occurred at ca. 105 Ma. This is also the timing of emplacement of large batholiths and could represent regional thermal resetting, but the results yield flat plateaus, possibly indicative of rapid cooling.

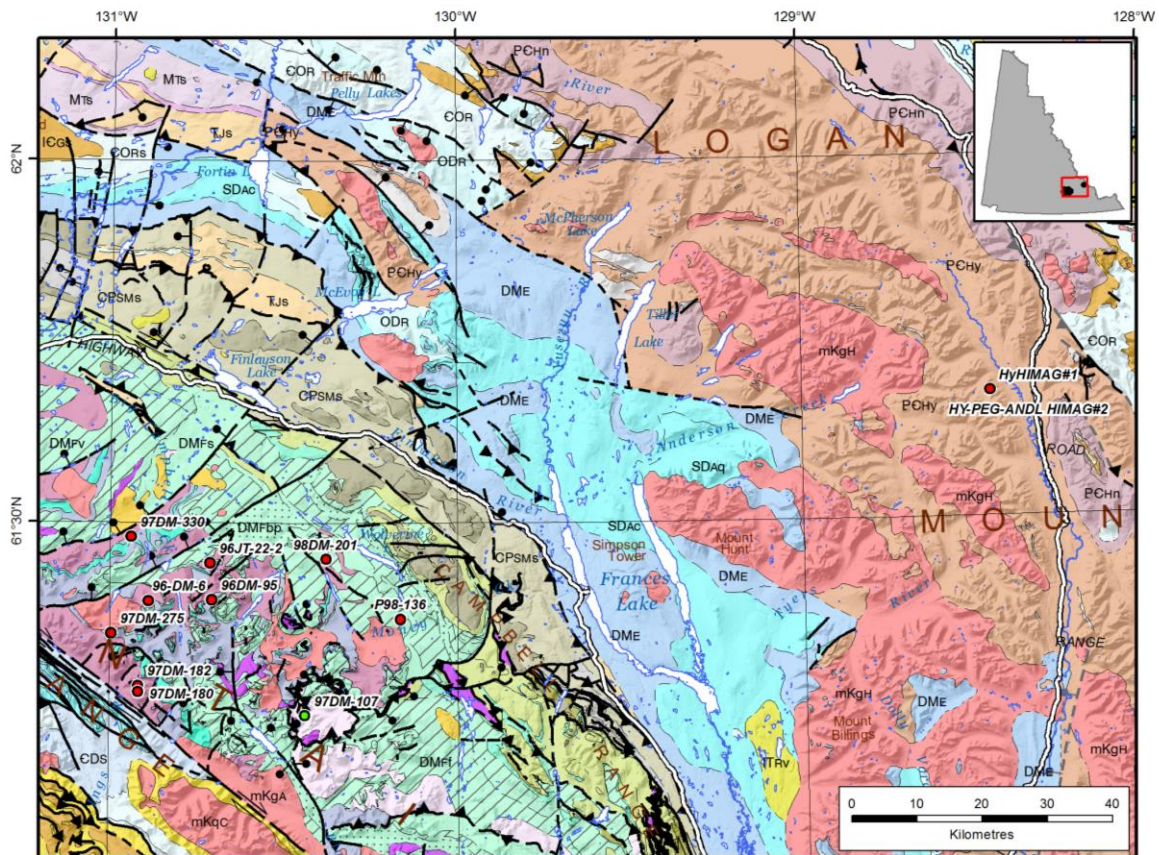


Figure 4. Geological map of the Finlayson Lake and Frances Lake areas showing location of samples constraining Cretaceous regional metamorphic cooling, also including the one sample from the Finlayson Lake area that gave a Devonian-Mississippian crystallization age (97DM-107; green). Geology from Yukon Geological Survey, www.geology.gov.yk.ca.

Sample Number: 97DM-107

Lithology: Gabbro

Mineral analyzed: Hornblende

Age: 365 ± 9 Ma

Interpretation: Estimate of igneous cooling age

Geochronology Lab Number: 5758

Argon Number: 1576

Location: Yukon-Tanana terrane, Cleaver Lake thrust sheet

UTM Zone 9 – 422642 E 6789736 N; NTS sheet 105G/1

Unit Name (if available):

Geologist: D. Murphy

Sample Description:

Hornblende from Early Mississippian gabbro in roof pendant of unstrained version of Mississippian mylonite

Results:

Two aliquots were run, and both contained elevated amounts of calcium and atmospheric argon and very low potassium. Errors on ages from individual heating steps were large ($>3\%$, 2σ), and the release spectra were disturbed and inconclusive (Fig. A). On the inverse isochron plot (Fig. B), most of the data points were collinear along the atmospheric $^{40}\text{Ar}/^{36}\text{Ar}$ line, giving an age of 365 ± 9 Ma, $\text{MSWD} = 1.127$. This is a very imprecise result, but provides a best estimate of age.

Analytical details:

Irradiation Batch: GSC #35

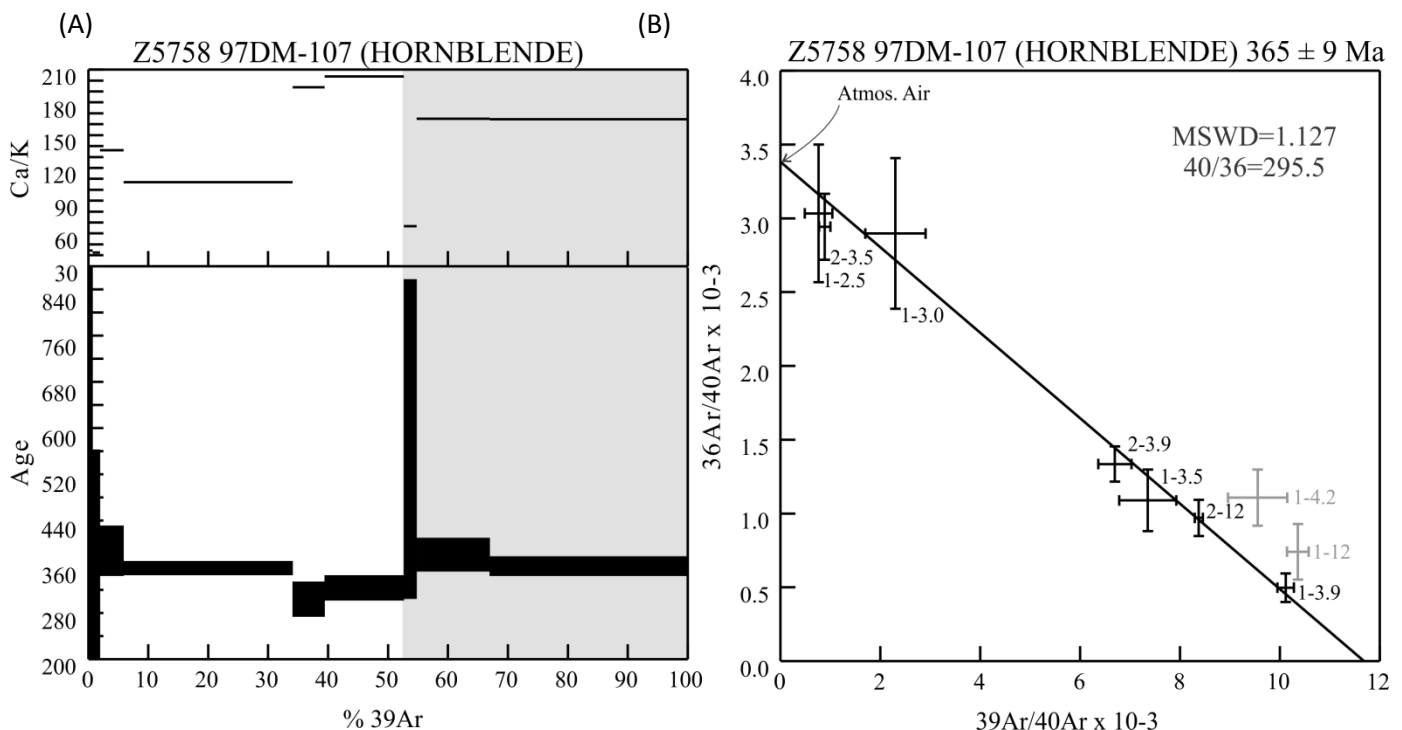
Date analyzed: April 14 & 17, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO_2 laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 97DM-182
Lithology: Amphibolite
Mineral analyzed: Hornblende
Age: 123.3 ± 1.6 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 5096
Argon Number: 1092
Location: Yukon-Tanana terrane, Big Campbell thrust sheet
UTM Zone 9 - 397095 E 6794938 N; NTS sheet 105G/7
Unit Name (if available): North River formation
Geologist: D. Murphy

Sample Description:

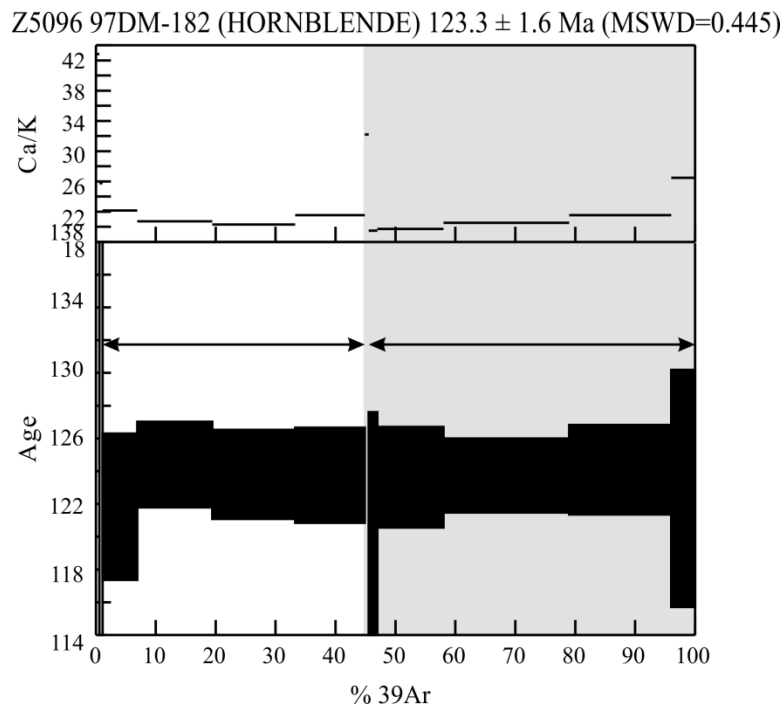
Hornblende-garnet amphibolite spatially associated with calcareous phyllite in upper part of North River formation of Murphy et al. (2006). Collected to test the extent of Cretaceous thermal overprinting. Grains selected for analysis were black ragged anhedral fragments with minor clear inclusions.

Results:

Two aliquots were analyzed, both giving flat, reproducible, multi-step plateaus with no evidence of argon loss. Age is based on plateau regions of both aliquots, 98% of released ^{39}Ar , MSWD=0.445.

Analytical details:

Irradiation Batch: GSC #26
Date analyzed: July 17 & 20, 1998
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: 97DM-330

Lithology: Garnet-biotite-bearing muscovite-quartz schist

Mineral analyzed: Biotite

Age: 110.3 ± 1.1 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 5097

Argon Number: 1093

Location: Yukon-Tanana terrane, Big Campbell thrust sheet

UTM Zone 9 - 396509 E 6817870 N; NTS sheet 105G/7

Unit Name (if available): North River formation

Geologist: D. Murphy

Sample Description:

This schist is from the upper part of the North River formation (Murphy et al., 2006). Protolith and fabric ages are unknown. This sample may provide an indication of the age of any pre-Cretaceous deformation/metamorphism. Sample is at lower grade at the northern edge of map area and is farthest from outcropping Cretaceous intrusions. Biotite grains were anhedral, thick, black to golden brown books.

Results:

Age based on inverse isochron comprising data from two aliquots of biotite (Fig. A). MSWD = 1.875, $^{40}\text{Ar}/^{36}\text{Ar} = 295.5$. Step-heating spectra for both aliquots were hump-shaped, but the integrated age for both aliquots was also 110.1 ± 1.1 Ma (93% of gas), MSWD=2.931 (Fig. B).

Analytical details:

Irradiation Batch: GSC #26

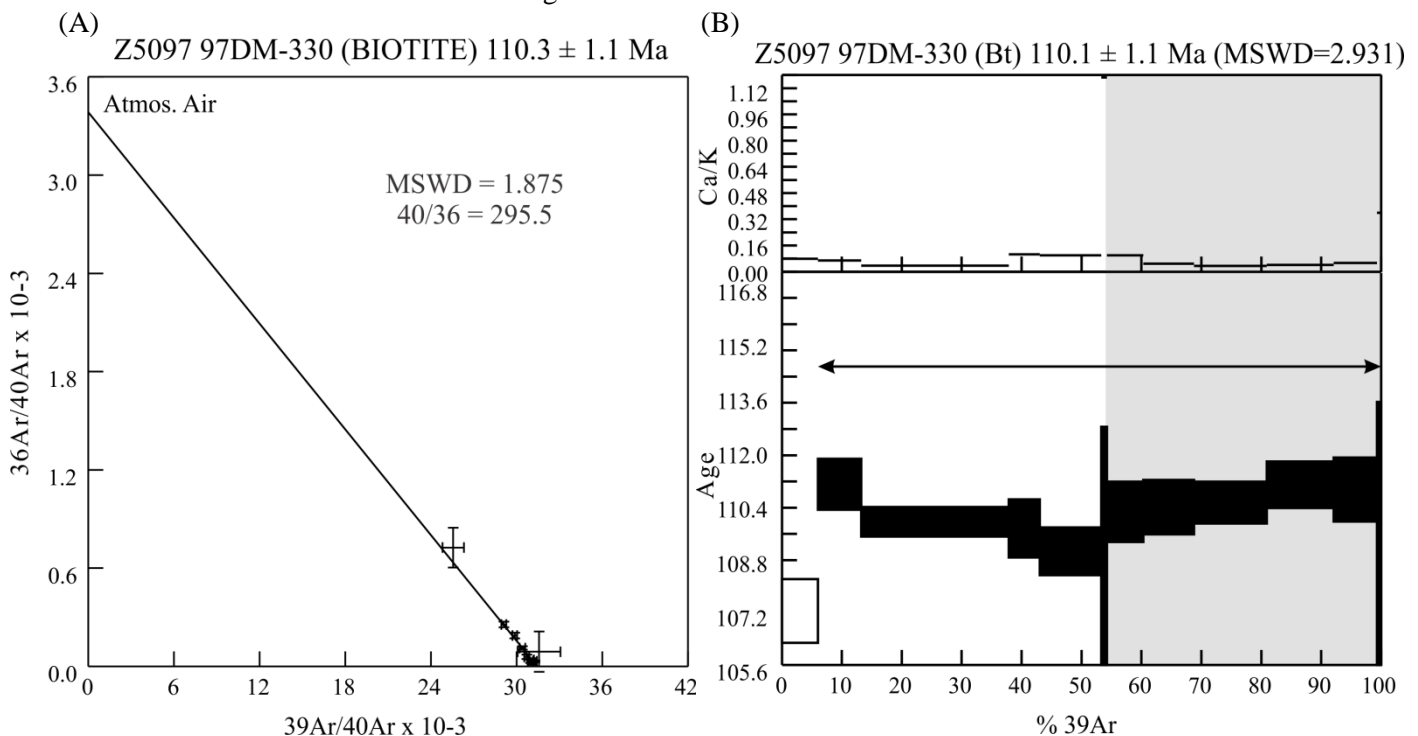
Date analyzed: July 7-8, 1998

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 97DM-330

Lithology: Garnet-biotite-bearing muscovite-quartz schist

Mineral analyzed: Hornblende

Age: ca. 135-140 Ma

Interpretation: Metamorphic Cooling estimate

Geochronology Lab Number: 5097

Argon Number: 1094

Location: Yukon-Tanana terrane, Big Campbell thrust sheet

UTM Zone 9 - 396509 E 6817870 N; NTS sheet 105G/7

Unit Name (if available): North River formation

Geologist: D. Murphy

Sample Description:

This schist is from the upper part of the North River formation (Murphy et al., 2006). Protolith and fabric ages are unknown. This sample may provide an indication of the age of any pre-Cretaceous deformation/metamorphism. Sample is at lower grade at the northern edge of map area and is farthest from outcropping Cretaceous intrusions. Hornblende grains were black striated subhedral fragments.

Results:

Spectra for two aliquots (Fig. A) were disturbed, generally down-stepping towards higher-temperature steps, suggesting presence of excess ^{40}Ar . The inverse isochron diagram (Fig. B) shows multiple excess compositions; regressions give ages of 135 ± 2 Ma ($^{40}\text{Ar}/^{36}\text{Ar} = 385 \pm 14$), 138 ± 2 Ma ($^{40}\text{Ar}/^{36}\text{Ar} = 346 \pm 12$), and 140 ± 2 Ma ($^{40}\text{Ar}/^{36}\text{Ar} = 295.5$). A robust age cannot be drawn from the data, hence the ~135-140 Ma estimate.

Analytical details:

Irradiation Batch: GSC #26

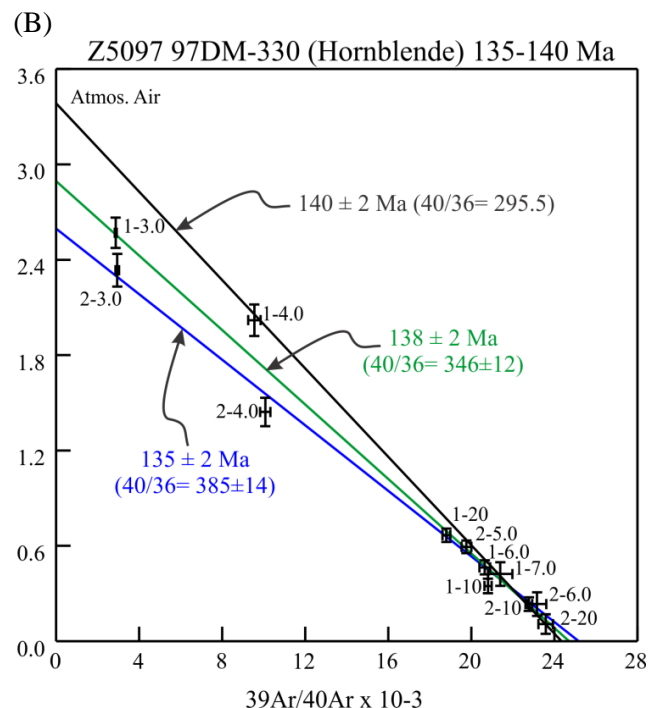
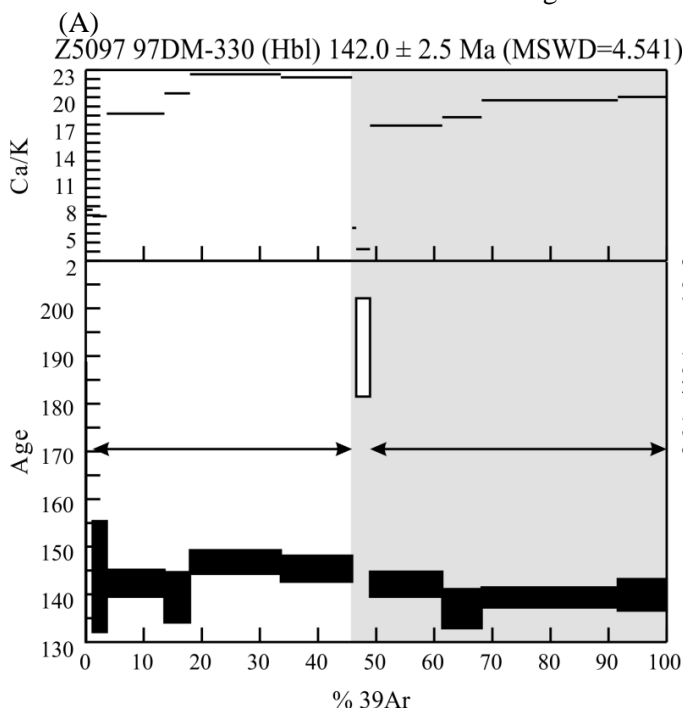
Date analyzed: July 9 & 14, 1998

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 96JT-22-2

Lithology: Biotite schist

Mineral analyzed: Biotite

Age: 109.7 ± 1.3 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 5098

Argon Number: 1095

Location: Yukon-Tanana terrane, Big Campbell thrust sheet

UTM Zone 9 - 408534 E 6813529 N; NTS sheet 105G/7

Unit Name (if available): North River formation

Geologist: D. Murphy

Sample Description:

Xenolith of North River formation biotite schist within the Grass Lakes metaplutonic suite of Murphy et al. (2006). The biotite grains from this sample were fine, ragged irregular flakes with a slight silvery lustre.

Results:

Two aliquots were run, showing significant ^{40}Ar loss in early heating steps. Age is based on pseudo-plateau regions of both aliquots 48.1% of the gas, MSWD = 0.538 (Fig. A). Inverse isochron gives regression at 109.2 ± 1.9 Ma, MSWD=4.673, $^{40}\text{Ar}/^{36}\text{Ar}=295.5$ (Fig. B).

Analytical details:

Irradiation Batch: GSC #26

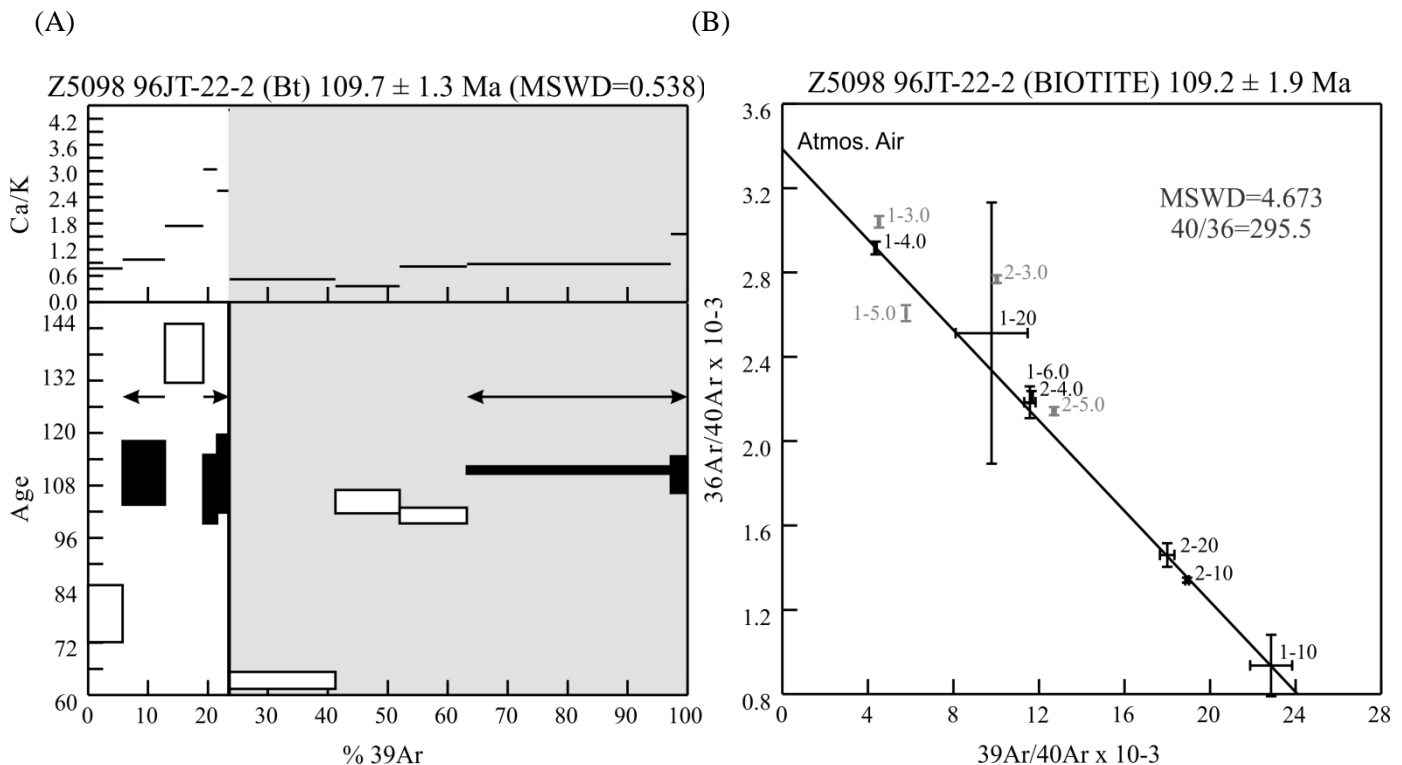
Date analyzed: July 9 & 14, 1998

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO_2 laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 97DM-180
Lithology: Quartz-muscovite schist
Mineral analyzed: Biotite
Age: 111.0 ± 1.1 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 5099
Argon Number: 1096
Location: Yukon-Tanana terrane, Big Campbell thrust sheet
UTM Zone 9 - 397091 E 6794010 N; NTS sheet 105G/7
Unit Name (if available): North River formation
Geologist: D. Murphy

Sample Description:

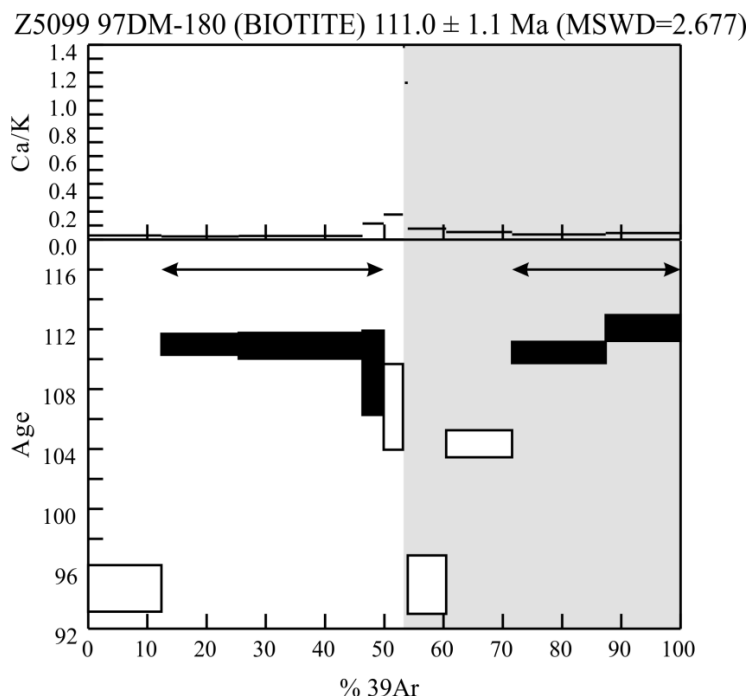
Xenolith of coarse-grained North River formation (biotite-garnet-) quartz-muscovite schist within the Grass Lakes metaplutonic suite of Murphy et al. (2006). This sample is from a small pendant of unit 1 rocks within an Early Mississippian augen granitic orthogneiss in the southwestern part of the Grass Lakes map area. Sample was collected to constrain pervasiveness of Cretaceous overprint to south. Protolith age is only constrained to be pre-Early Mississippian. Grains were variably altered, subhedral, black, green and golden flakes.

Results:

Two aliquots were run, both showing significant ^{40}Ar loss in low- to mid-temperature heating steps. Age is based on plateau and pseudo-plateau regions of both aliquots (66.0% of released ^{39}Ar gas, MSWD = 2.677).

Analytical details:

Irradiation Batch: GSC #26
Date analyzed: July 14-15, 1998
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO_2 laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: 97DM-275

Lithology: Biotite schist

Mineral analyzed: Biotite

Age: 111.1 ± 1.1 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 5100

Argon Number: 1097

Location: Yukon-Tanana terrane, Big Campbell thrust sheet

UTM Zone 9 - 393096 E 6803112 N; NTS sheet 105G/7

Unit Name (if available): Fire Lake formation

Geologist: D. Murphy

Sample Description:

This sample comes from near the contact with a mid-Cretaceous granitic stock. The rock unit is probably of Devonian-Mississippian age, may have been metamorphosed in the Paleozoic, and has probably been affected by the Cretaceous thermal overprint. This sample was collected to provide insight into the extent of the Cretaceous metamorphism. Biotite grains selected for analysis were black, shiny, subhedral fragile books.

Results:

Two aliquots were run. The first aliquot gave a hump-shaped spectrum with no plateau. The age is based on the second aliquot, which gave a flat multistep plateau (78% of gas, ignoring the two lowest temperature steps that showed ^{40}Ar loss, MSWD=2.315).

Analytical details:

Irradiation Batch: GSC #26

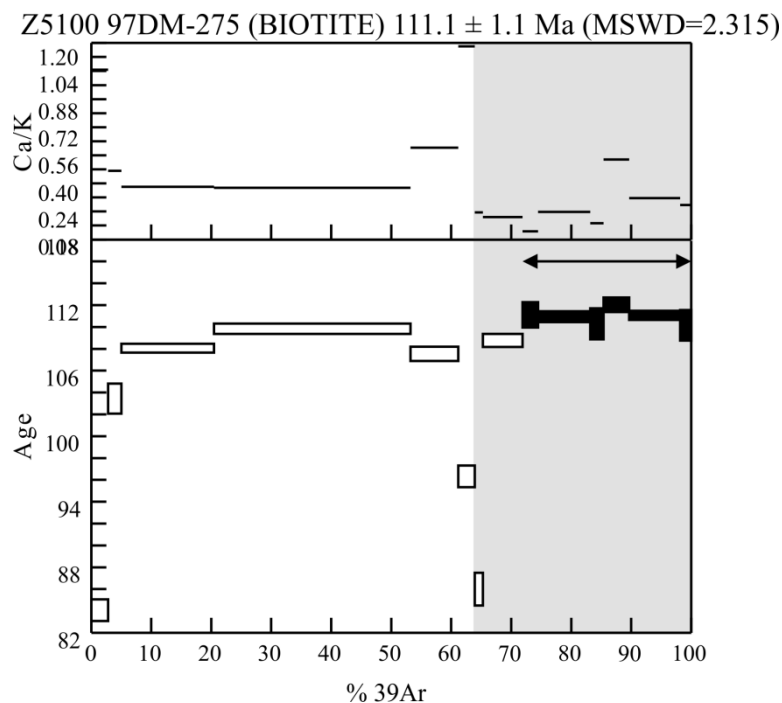
Date analyzed: July 6-7, 1998

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 96-DM-6

Lithology: Biotite schist

Mineral analyzed: Biotite

Age: No Age

Interpretation: No Age

Geochronology Lab Number: 5754

Argon Number: 1543

Location: Yukon-Tanana terrane, Big Campbell thrust sheet

UTM Zone 9 - 398908 E 6807933 N; NTS sheet 105G/7

Unit Name (if available): Fire Lake formation

Geologist: D. Murphy

Sample Description:

Biotite schist; roof pendant of Fire Lake formation of Murphy et al. (2006) in Grass Lakes metaplutonic suite. Grains selected for analysis were large, good quality, brown thick books.

Results:

Two aliquots were run, and both gas release spectra were hump-shaped (Fig. A). Apparent ages for the highest-temperature steps fell between 105 and 118 Ma. The gas steps contained variable excess argon compositions and elevated atmospheric ^{36}Ar . Inverse isochron regressions suggest the biotite age is between 109 to 116 Ma (Fig. B), but is poorly constrained due to scatter of data (MSWD ~55 for both regressions).

Analytical details:

Irradiation Batch: GSC #36

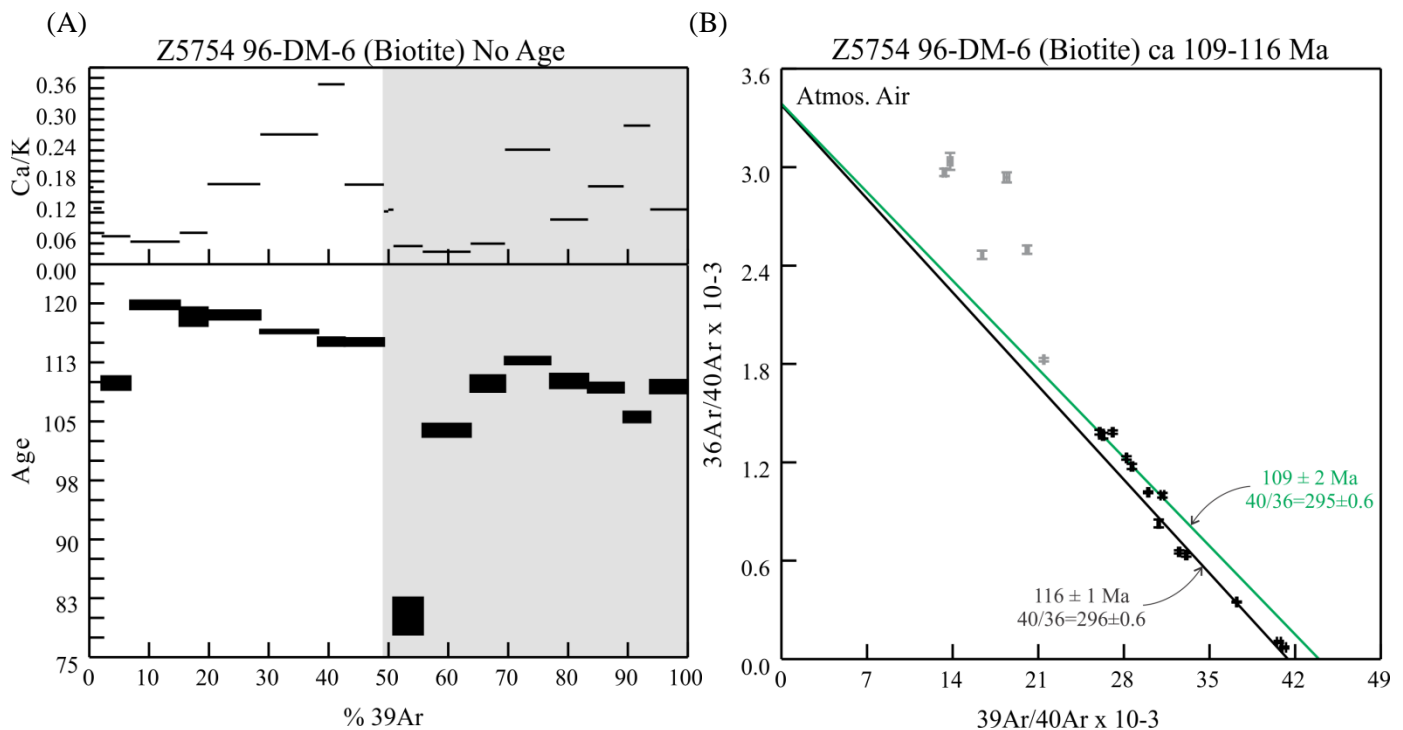
Date analyzed: October 11-13, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 96DM-95

Lithology: Biotite-chlorite-feldspar schist

Mineral analyzed: Biotite

Age: 113.9 ± 0.7 Ma

Interpretation: Metamorphic Cooling estimate

Geochronology Lab Number: 5755

Argon Number: 1536

Location: Yukon-Tanana terrane, Big Campbell thrust sheet

UTM Zone 9 - 408657 E 6807858 N; NTS sheet 105G/7

Unit Name (if available): Wind Lake formation

Geologist: D. Murphy

Sample Description:

Unit is a mafic meta-dyke associated with the Wind Lake formation of Murphy et al. (2006) cutting felsic schist of the Kudzu Ze Kayah formation of Murphy et al. (2006). Grains selected for analysis were large, dark brown, good quality flakes.

Results:

Two aliquots were analyzed, and the results were not the same. Aliquot A gave a relatively flat multi-step plateau (113.9 ± 0.7 Ma, MSWD=1.843, 80% of released ^{39}Ar), whereas Aliquot B produced a disturbed hump-shaped spectrum. All heating steps in Aliquot B were younger than any step in Aliquot A. The integrated age for both aliquots was ~ 113 Ma (99% of gas, MSWD=46).

Analytical details:

Irradiation Batch: GSC #35

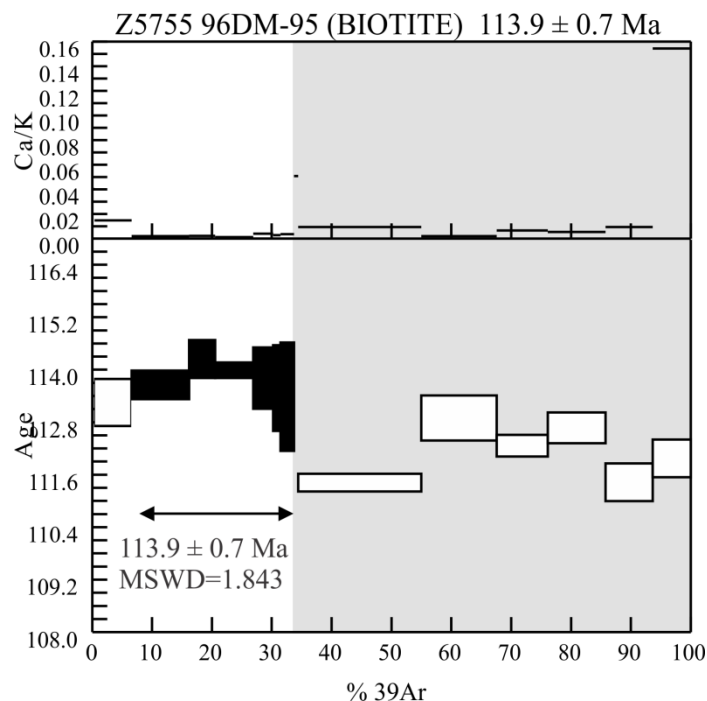
Date analyzed: May 19, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 98DM-201
Lithology: Biotite schist
Mineral analyzed: Biotite
Age: 107.6 ± 0.6 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 5761
Argon Number: 1548
Location: Yukon-Tanana terrane, Big Campbell thrust sheet
UTM Zone 9 - 426418 E 6813713 N; NTS sheet 105G/8
Unit Name (if available): Wind Lake formation
Geologist: D. Murphy

Sample Description:

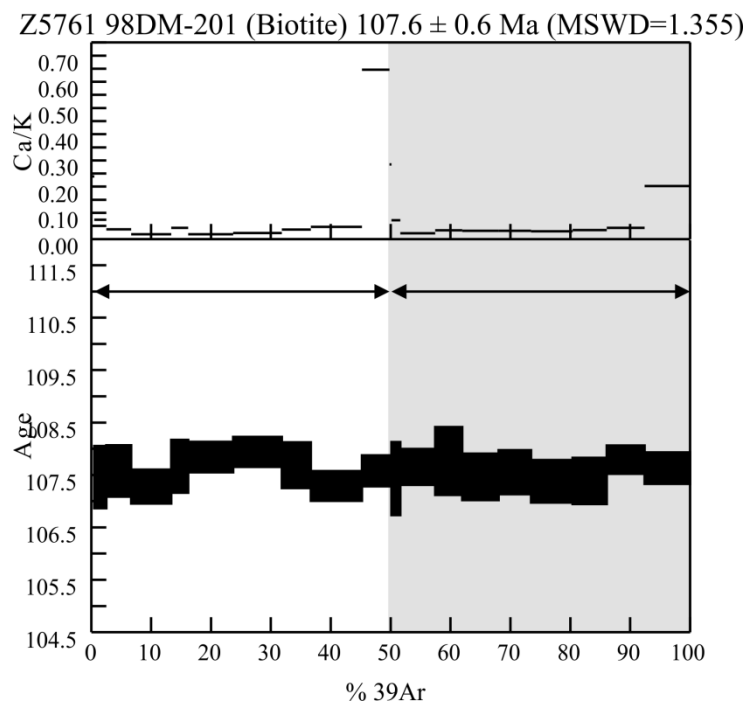
Mafic meta-dyke associated with the Wind Lake formation of Murphy et al. (2006) cutting felsic schist of the Kudzu Ze Kayah formation of Murphy et al. (2006). Biotite grains selected for analysis were large, dark brown, good quality flakes.

Results:

Two aliquots were analyzed, giving two flat multistep plateaus comprising 99.2 % of combined ^{39}Ar , MSWD = 1.355.

Analytical details:

Irradiation Batch: GSC #36
Date analyzed: December 7-8, 2000
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: P98-136

Lithology: Biotite schist

Mineral analyzed: Biotite

Age: 106.6 ± 0.6 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 5763

Argon Number: 1537

Location: Yukon-Tanana terrane, Big Campbell thrust sheet

UTM Zone 9 - 437625 E 6804286 N; NTS sheet 105G/8

Unit Name (if available): Wind Lake formation

Geologist: D. Murphy

Sample Description:

Unit is a mafic meta-dyke associated with the Wind Lake formation of Murphy et al. (2006) cutting felsic schist of the Kudzu Kayah formation of Murphy et al. (2006). Biotite grains that were analyzed were large fragile flakes.

Results:

Two aliquots were run, both giving flat multistep plateaus comprising 86.3 % of gas, MSWD=0.549.

Analytical details:

Irradiation Batch: GSC #35

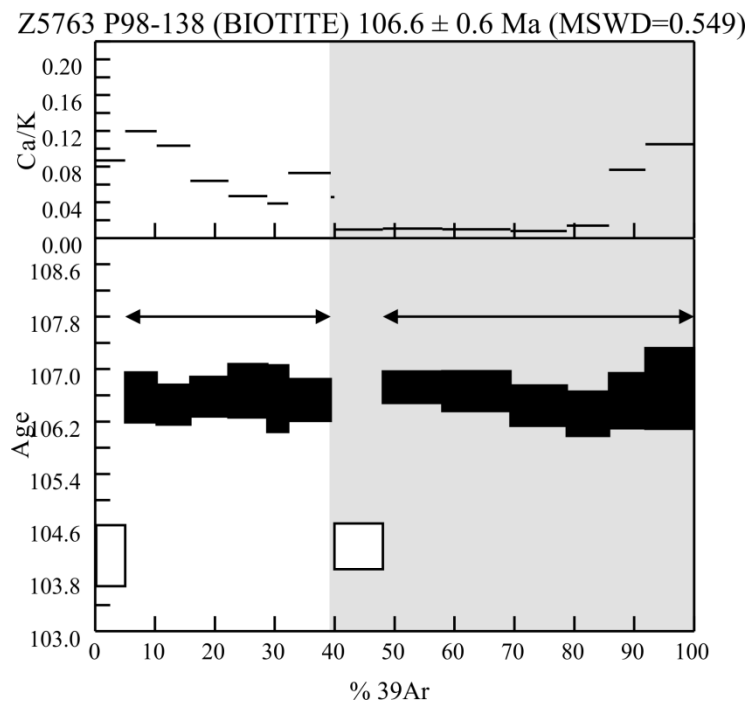
Date analyzed: May 23, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: HyHIMAG#1

Lithology: Phyllite/schist

Mineral analyzed: Biotite

Age: 104.4 ± 0.7 Ma (± 0.3 Ma without J-error)

Interpretation: Peak Metamorphic

Geochronology Lab Number: 8071

Argon Number: 2193

Location: Upper Hyland River, Himag #1 site

UTM Zone 9 - 528806 E 6837911 N; NTS sheet 105H/9

Unit Name (if available): Hyland Group

Geologist: C.J.R. Hart

Sample Description:

Siliceous phyllite/schist with good muscovite development on cleavage. Analyzed aliquot consisted of two large dark brown clean grains (600-700 μ m each).

Results:

One aliquot of biotite was analyzed, giving a flat multistep plateau comprising 100.0% of gas, MSWD=0.109.

Analytical details:

Irradiation Batch: GSC #51

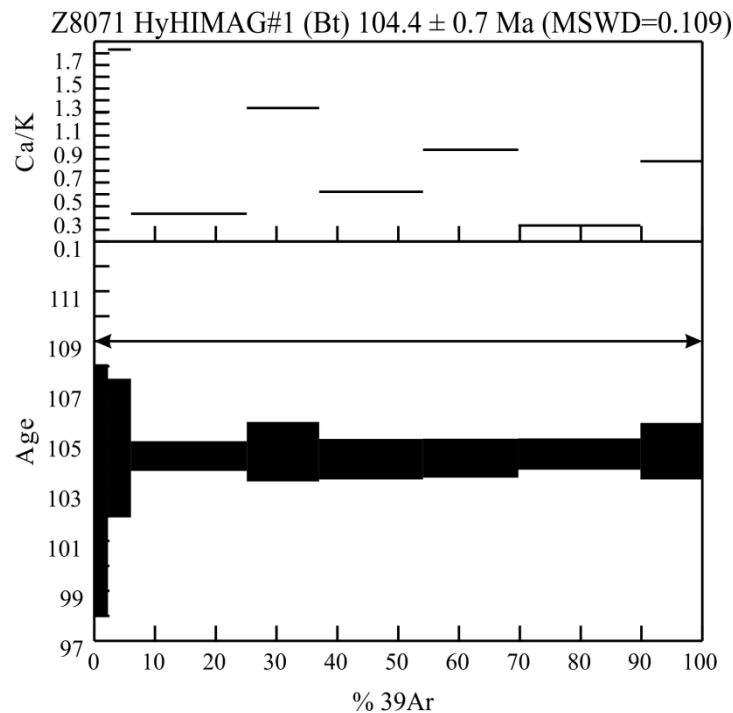
Date analyzed: January 11-12, 2006

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: HyHIMAG#1

Lithology: Phyllite/schist

Mineral analyzed: Muscovite

Age: 104.7 ± 0.7 Ma (± 0.4 Ma without J-error)

Interpretation: Peak Metamorphic

Geochronology Lab Number: 8071

Argon Number: 2192

Location: Upper Hyland River, Himag #1 site

UTM Zone 9 - 528806 E 6837911 N; NTS sheet 105H/9

Unit Name (if available): Hyland Group

Geologist: C.J.R. Hart

Sample Description:

Siliceous phyllite/schist with good muscovite development on cleavage. Analyzed aliquot consisted of two large grains (500-600 μ m each), that were clear to pale yellow in colour, with minor rusty or grey discolourations along grain edges.

Results:

One aliquot analyzed, giving flat multistep plateau comprising 99.5 % of gas, MSWD=0.877.

Analytical details:

Irradiation Batch: GSC #51

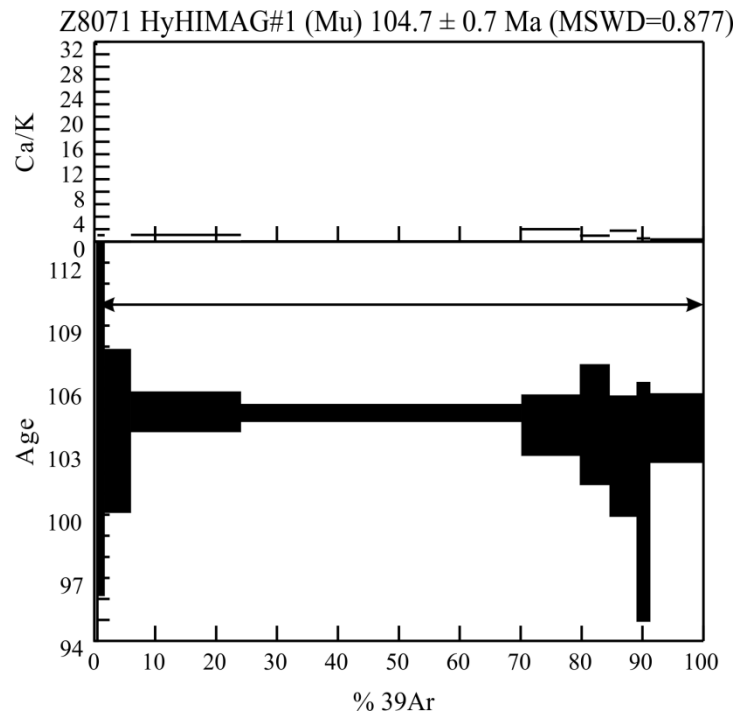
Date analyzed: January 11, 2006

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: HY-PEG-ANDL HIMAG#2

Lithology: Pegmatite

Mineral analyzed: Muscovite

Age: 104.5 ± 0.6 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 8072

Argon Number: 2194

Location: Upper Hyland River, Himag #2 site

UTM Zone 9 - 528806 E 6837911 N; NTS sheet 105H/9

Unit Name (if available): Hyland Group

Geologist: C.J.R. Hart

Sample Description:

Coarse-grained andalusite-K-feldspar-muscovite pegmatite dyke/vein that cuts Hyland Group. Analyzed aliquot consisted of two large clear colourless grains (700-900 μ m each).

Results:

One aliquot was analyzed, giving a flat multistep plateau comprising 100% of gas, MSWD = 0.767.

Analytical details:

Irradiation Batch: GSC #51

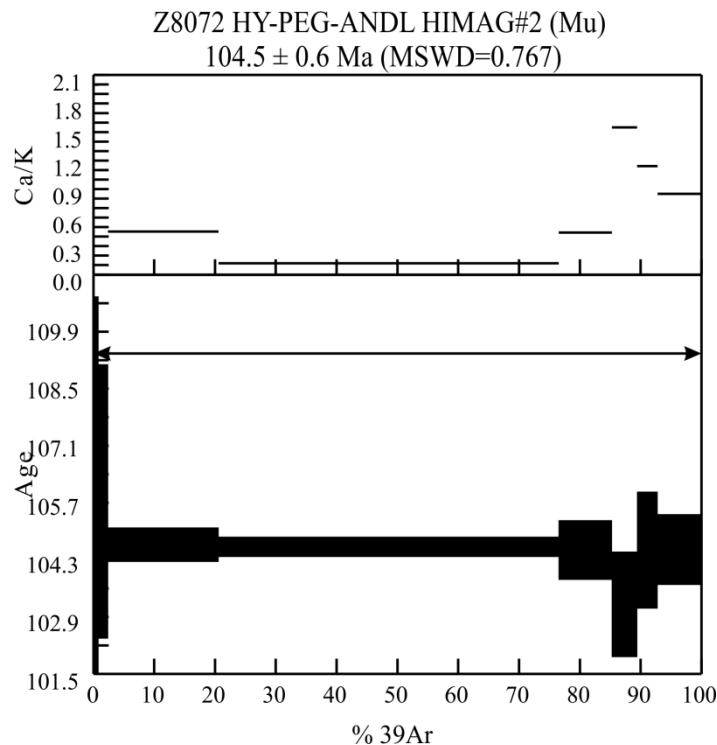
Date analyzed: January 12, 2006

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Cretaceous Plutonic and Volcanic rocks

Whitehorse plutonic suite

The Whitehorse plutonic suite is dominated by the Dawson Range batholith with smaller plutons of the co-magmatic Coffee phase (Fig. 5; Ryan et al., 2013a, 2013b). The suite has yielded various U-Pb crystallization ages regionally between ca. 107 and 99 Ma (e.g. Joyce, 2002; Betsi et al., 2012; Allan et al., 2013). Ten samples in this study were collected across the Dawson Range, and their $^{40}\text{Ar}/^{39}\text{Ar}$ ages correspond well to U-Pb ages in the suite locally. However, some results demonstrate later closure, or even resetting events in the suite. For example, sample 02GGA059B2 is a sample of typical blocky hornblende granodiorite of the Dawson Range batholith, but yielded a hornblende inverse isochron age of 84.5 Ma, and a biotite plateau age of ca. 69 Ma. We interpret these results to indicate that the sample is from a 100 Ma granodiorite, which suffered some resetting of hornblende at ca. 85 Ma due to an orogenic event (e.g., noted at Longline in the Moosehorn Range by Joyce (2002)), which then suffered resetting of biotite at ca. 69 Ma due to thermal effects of Carmacks Group magmatism prevalent in the vicinity.

Other samples from within the Whitehorse plutonic suite also show younger alteration events, and these are interesting to consider if there is any relationship with hydrothermal activity of known mineralizing episodes (see section on Mineralization Events).

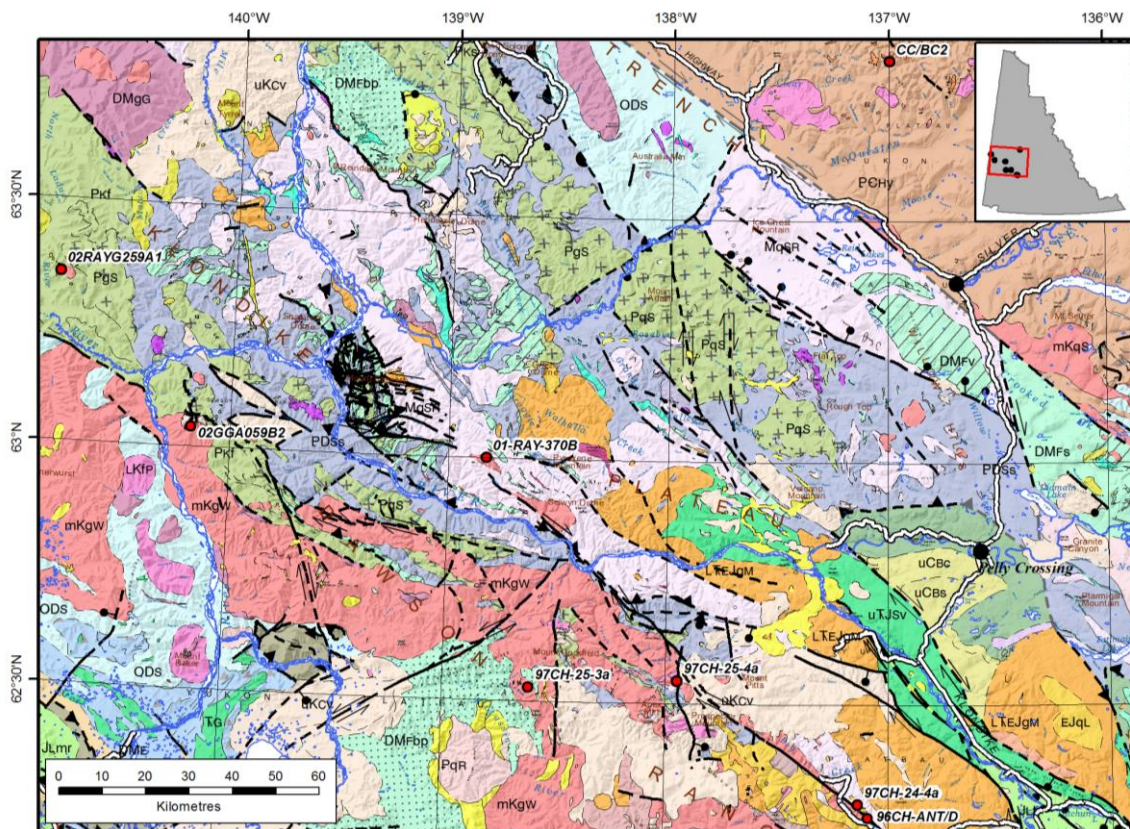


Figure 5. Geological map of west-central Yukon showing location of samples that yielded Cretaceous crystallization ages. Geology from Yukon Geological Survey, www.geology.gov.yk.ca.

Results from samples collected from mineralized occurrences associated with plutons of the Cassiar suite, which is broadly coeval with the Whitehorse suite, are also presented in this section (Fig. 6)

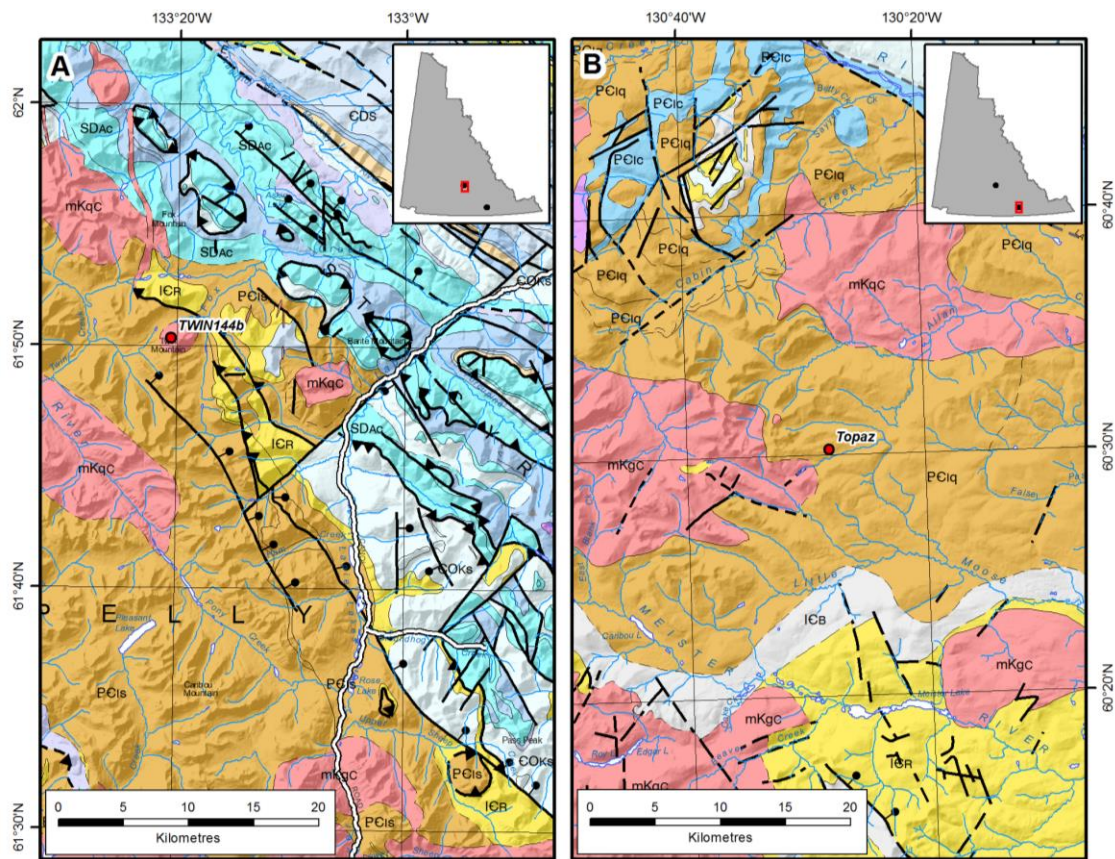


Figure 6. Geological map of two regions in the Pelly Mountains of southern Yukon showing location of samples associated with plutons of the Cretaceous Cassiar suite. Geology from Yukon Geological Survey, www.geology.gov.yk.ca.

Sample Number: Topaz
Lithology: Pegmatite
Mineral analyzed: Muscovite
Age: 102.5 ± 0.6 Ma
Interpretation: Hydrothermal

Yukon Minfile 105B 116

Geochronology Lab Number: 6149
Argon Number: 1525
Location: Topaz
UTM Zone 9 - 419400 E 6708500 N; NTS sheet 105B/9
Unit Name (if available): Marker Lake batholith
Geologist: sample and location provided to C. J. R. Hart

Sample Description:

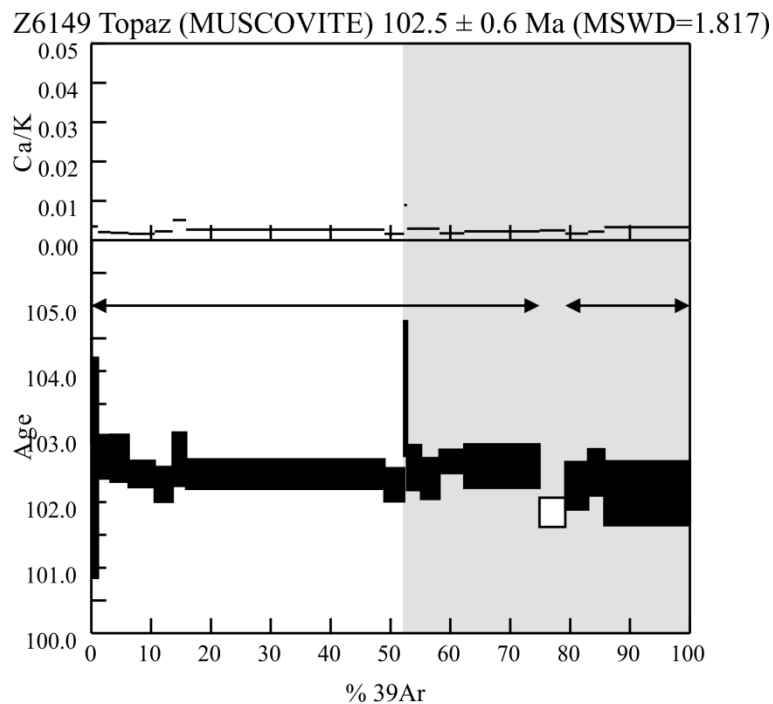
Coarse-grained, slightly brown muscovite from K-feldspar-muscovite-smoky quartz-topaz pegmatite

Results:

Two aliquots were run, both giving flat multi-step plateaus, both of which were used to calculate the age, comprising 95.7% of the total ^{39}Ar gas, MSWD=1.817.

Analytical details:

Irradiation Batch: GSC #35
Date analyzed: May 26, 2000
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: TWIN144b

Lithology: Hornblende-biotite granodiorite

Mineral analyzed: Amphibole

Age: 108.3 ± 1.1 Ma (± 0.9 Ma without J-error)

Interpretation: Igneous Crystallization

Geochronology Lab Number: 8074

Argon Number: 2197

Location: Twin Mountain pluton south of Risby tungsten deposit

UTM Zone 8 - 587152 E 6857363 N; NTS sheet 105F/14

Unit Name (if available): Twin Mountain Pluton

Geologist: C. J. R. Hart

Sample Description:

Massive, medium to coarse-grained hornblende-biotite granodiorite, I-type metaluminous magnetite series. Cuts all deformation. Analyzed aliquot consisted of six clean black grains (300-500 μ m each).

Results:

One aliquot of amphibole analyzed, giving a flat multistep plateau comprising 91.1% of gas, MSWD= 0.188.

Analytical details:

Irradiation Batch: GSC #51

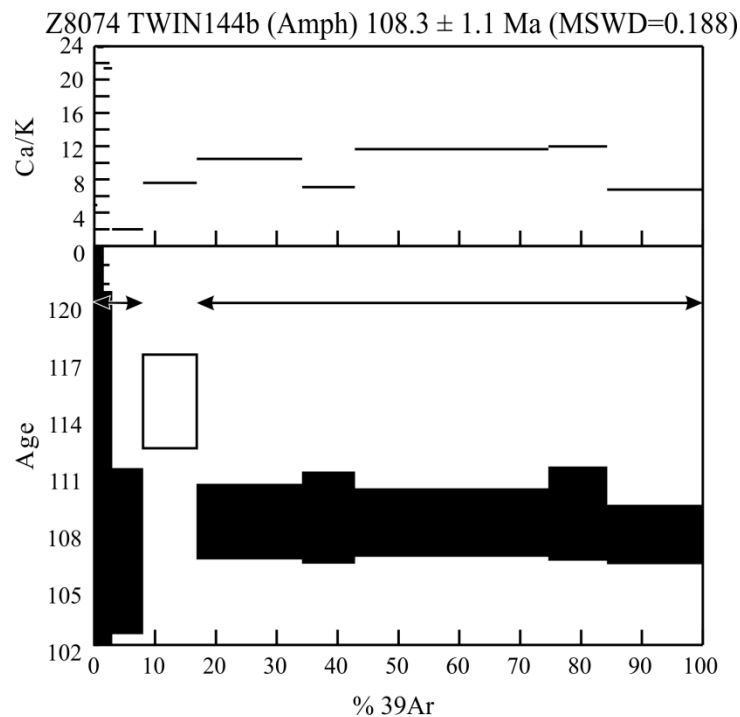
Date analyzed: January 13, 2006

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: TWIN144b

Lithology: Hornblende-biotite granodiorite

Mineral analyzed: Biotite

Age: 107.8 ± 0.8 Ma (± 0.5 Ma without J-error)

Interpretation: Igneous Crystallization

Geochronology Lab Number: 8074

Argon Number: 2196

Location: Twin Mountain pluton south of Risby tungsten deposit

UTM Zone 8 - 587152 E 6857363 N; NTS sheet 105F/14

Unit Name (if available): Twin Mountain Pluton

Geologist: C. J. R. Hart

Sample Description:

Massive, medium to coarse-grained hornblende-biotite granodiorite, I-type metaluminous magnetite series. Cuts all deformation. Analyzed aliquot consisted of two large grains.

Results:

One aliquot of biotite analyzed, giving flat multistep plateau comprising 97.6% of gas, MSWD=0.189.

Analytical details:

Irradiation Batch: GSC #51

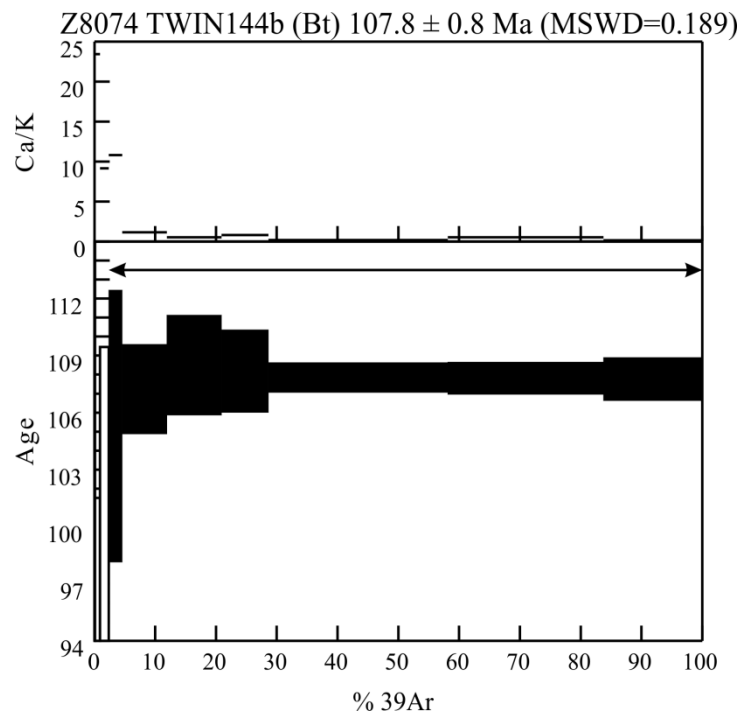
Date analyzed: January 12-13, 2006

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 96CH-ANT/D

Yukon Minfile 115I 111

Lithology: Rhyolite dyke

Mineral analyzed: Whole Rock

Age: 91.9 ± 1.0 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 4615

Argon Number: 953

Location: Mt. Freegold-Antoniuk Deposit

UTM Zone 8 - 391358 E 6905648 N; NTS sheet 115I/6

Unit Name (if available): Antoniuk Dyke

Geologist: C. J. R. Hart

Sample Description:

Quartz-phyric rhyolite dyke that cuts Antoniuk deposit. Constrains timing of mineralization.

Results:

Two aliquots were analyzed, both showing upward-stepping spectra indicative of significant ^{40}Ar loss in early heating steps. Age is based on the mid- to high-temperature steps of both aliquots that were in agreement with each other (43% of ^{39}Ar released, MSWD=0.889).

Analytical details:

Irradiation Batch: GSC #23

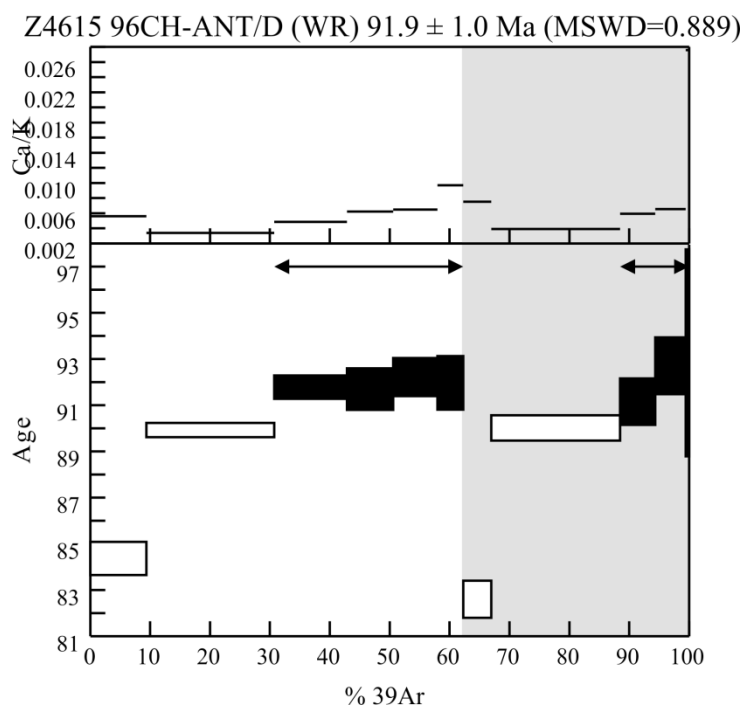
Date analyzed: August 12-13, 1997

Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 97CH-25-3a

Yukon Minfile 115J 089

Lithology: Granodiorite

Mineral analyzed: Biotite

Age: 107.4 ± 1.3 Ma

Interpretation: Igneous Cooling

Geochronology Lab Number: 4713

Argon Number: 984

Location: Pattison mineral occurrence; from drill hole DDH PATT 76 at a depth of 412'

UTM Zone 7 - 622721 E 6935369 N; NTS sheet 115J/10

Unit Name (if available): Patt Porphyry

Geologist: C. J. R. Hart

Sample Description:

Fine- to medium-grained, slightly porphyritic hornblende-biotite granodiorite with disseminated molybdenite. Looks exactly like sample 97CH-25-1A (from Mount Cockfield). The biotite grains selected for analysis were shiny, black anhedral thick books with a silvery lustre.

Results:

Two aliquots were run, both showing classic argon loss profiles for low- to mid-temperature heating steps. In the gas release spectra, both aliquots settle out into plateau regions upon which the age is based, comprising 54.2% of ^{39}Ar gas, MSWD=1.449.

Analytical details:

Irradiation Batch: GSC #24

Date analyzed: January 15, 1998

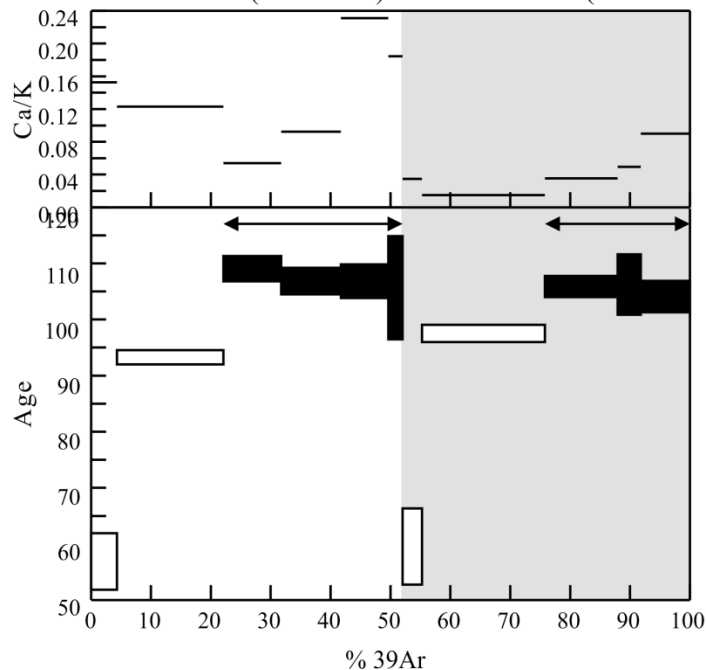
Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module

Z4713 97CH-25-3a (BIOTITE) 107.4 ± 1.3 Ma (MSWD=1.449)



Sample Number: 97CH-25-4a

Yukon Minfile 115I 031

Lithology: Quartz monzonite

Mineral analyzed: Muscovite

Age: 101.3 ± 1.3 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 4715

Argon Number: 988

Location: Western Dawson Range-Hayes Creek/TAD deposit

UTM Zone 8 – 348382 E 6938681 N; NTS sheet 115I/12

Unit Name (if available): Coffee Creek pluton

Geologist: C. J. R. Hart

Sample Description:

Coarse-grained pink quartz monzonite cut by quartz veins. Muscovite may have resulted from fluids associated with the quartz vein as there is a higher density adjacent to the vein. Rock is cut by fractures with green sericite/illite coatings.

Results:

Age is based on combined flat multistep plateaus from two aliquots, 100.0% of gas, MSWD=1.776

Analytical details:

Irradiation Batch: GSC #25

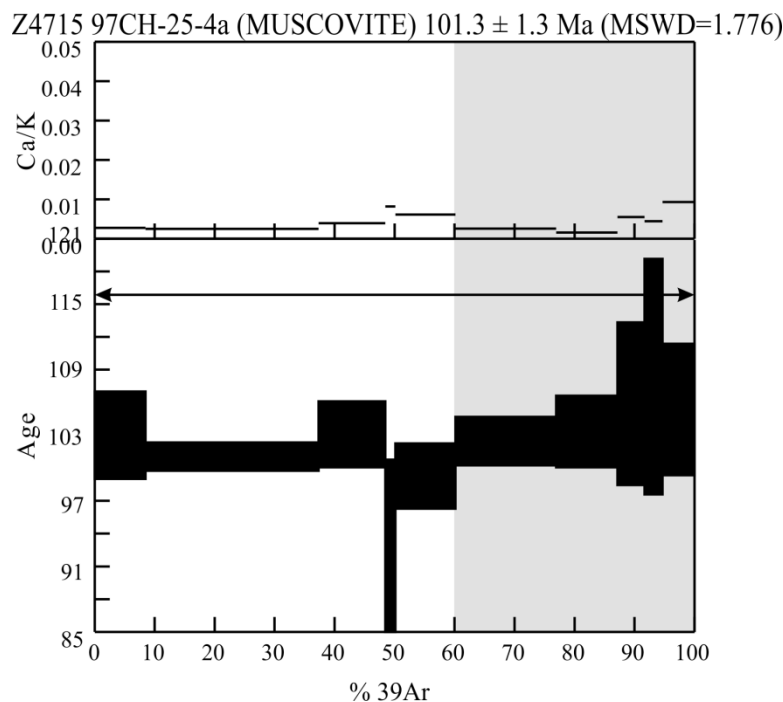
Date analyzed: February 10, 1998

Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 97CH-24-4a

Yukon Minfile 115I 053

Lithology: Granite porphyry

Mineral analyzed: Biotite

Age: 97.2 ± 1.5 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 4720

Argon Number: 992

Location: Mt. Freegold-Augusta skarn deposit

UTM Zone 8 - 389132 E 6908880 N; NTS sheet 115I/6

Unit Name (if available): Augusta Skarn

Geologist: C. J. R. Hart

Sample Description:

Coarse-grained crowded granite porphyry, grey dipyrarnidal quartz, megacrystic K-feldspar, clots of fine-grained hornblende, 20% plagioclase, with a fine-grained pink grey matrix.

Results:

Two aliquots done, and the plateau ages do not agree (Fig. A; 100.4 ± 1.5 Ma and 96.6 ± 1.4 Ma). 97.2 ± 1.5 Ma is the inverse isochron age for both aliquots, using 11 of 12 heating steps in the regression (Fig. B), MSWD = 1.278, $^{40}\text{Ar}/^{36}\text{Ar} = 342 \pm 27$.

Analytical details:

Irradiation Batch: GSC #25

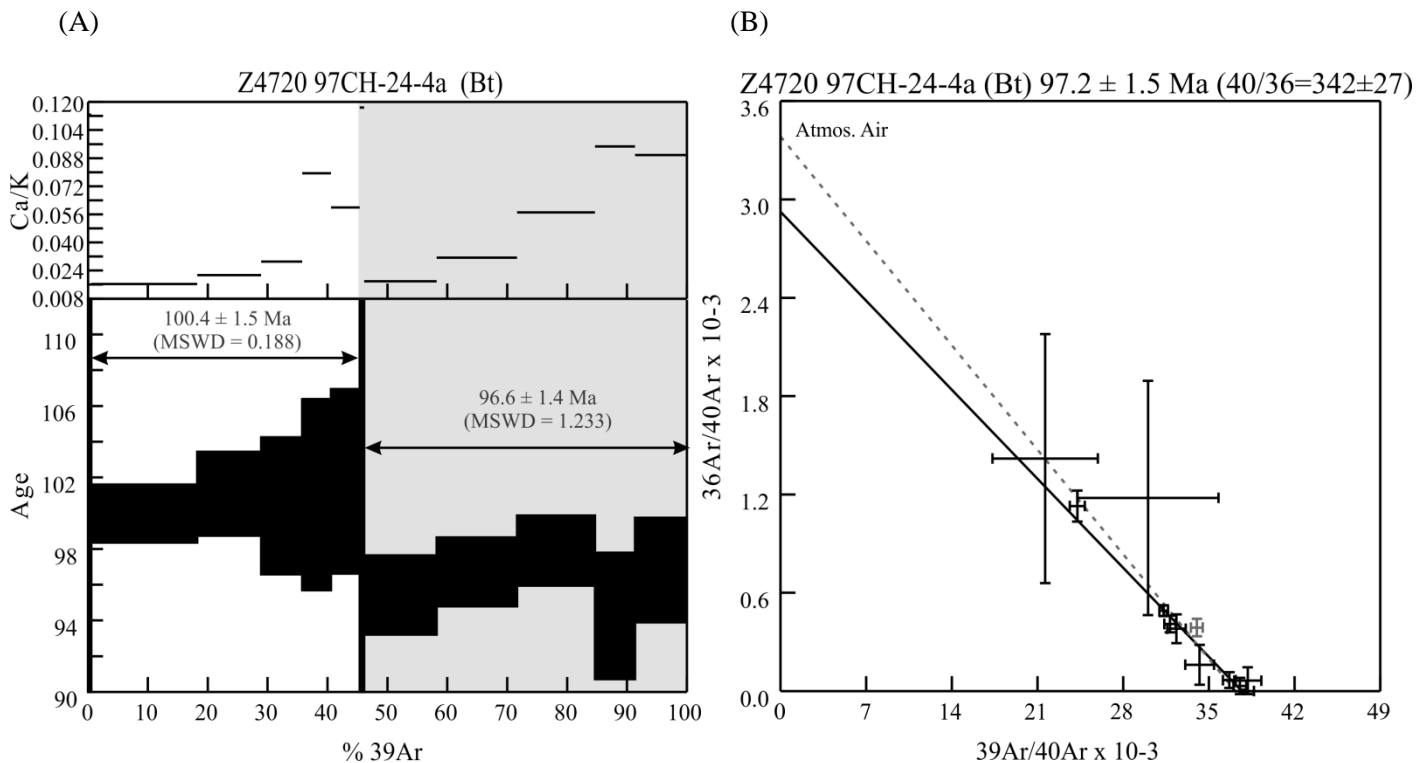
Date analyzed: February 25, 1998

Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 97CH-24-4b

Yukon Minfile 115I 053

Lithology: Granite porphyry

Mineral analyzed: Biotite

Age: 96.5 ± 1.0 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 4721

Argon Number: 993

Location: Mt. Freegold-Augusta skarn deposit

UTM Zone 8 - 389132 E 6908880 N; NTS sheet 115I/6

Unit Name (if available): Augusta Skarn

Geologist: C. J. R. Hart

Sample Description:

Hornblende – same lithology as 97CH-24-4a, but with large hornblende phenocrysts in outcrop

Results:

Two aliquots were run; large errors were obtained on the first, and a hump-shaped spectrum on second (see spectra in Fig. A). Age is the combined plateau age for both aliquots, comprising 89.0% of gas, MSWD=2.722. The 3.0W step from Aliquot A was excluded due to suspected ^{40}Ar loss, and the 4.0W step of Aliquot B was excluded because it showed slight excess ^{40}Ar component. The inverse isochron (Fig. B) gives same age, excluding those same two heating steps, with slightly better MSWD of 1.969.

Analytical details:

Irradiation Batch: GSC #25

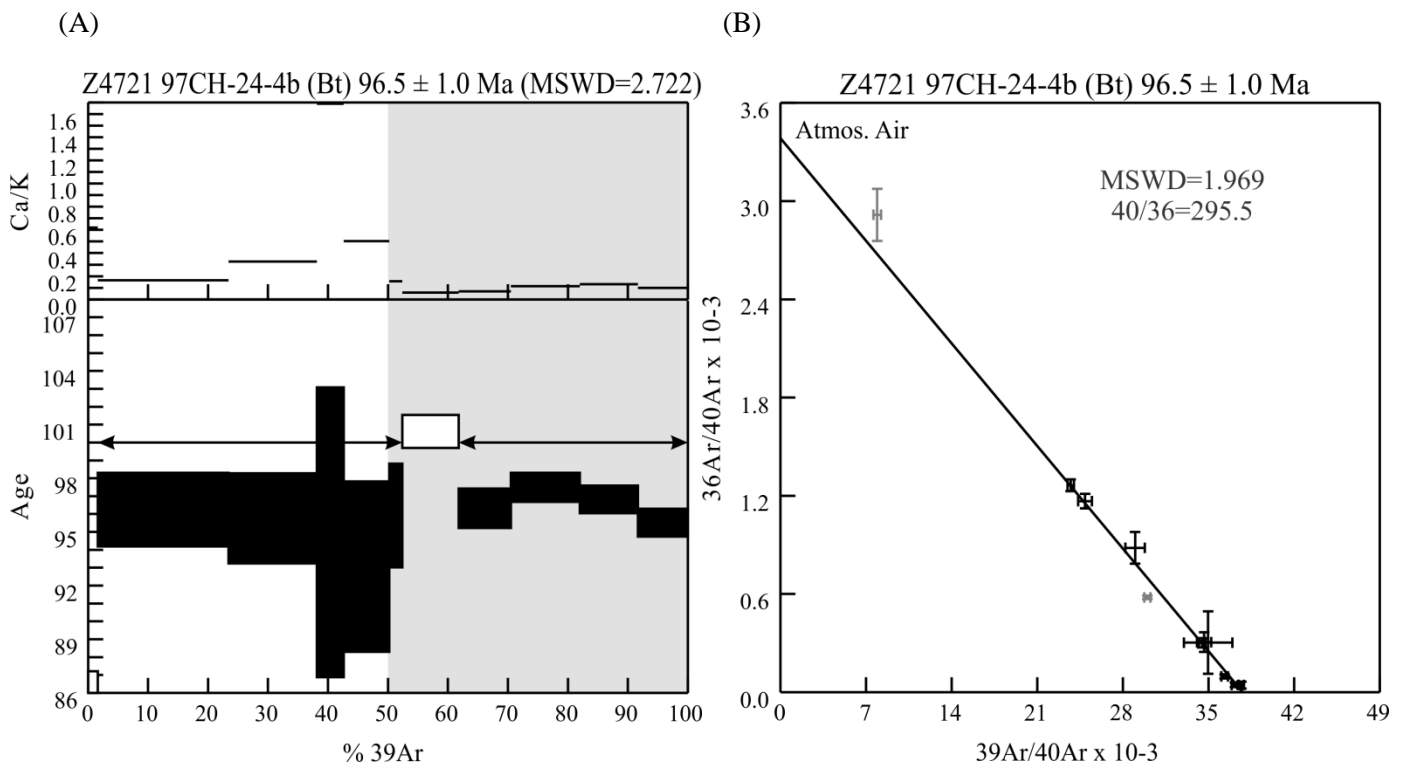
Date analyzed: February 26-27, 1998

Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 01-RAY-370B
Lithology: Rhyolite
Mineral analyzed: Whole Rock
Age: 88.4 ± 0.6 Ma
Interpretation: Igneous Crystallization

Geochronology Lab Number: 7373
Argon Number: 2435
Location: Stewart River area
UTM Zone 7 - 609818 E 6987492 N; NTS sheet 1150/2
Unit Name (if available): Coffee Creek phase; Whitehorse Suite
Geologist: J. J. Ryan

Sample Description:

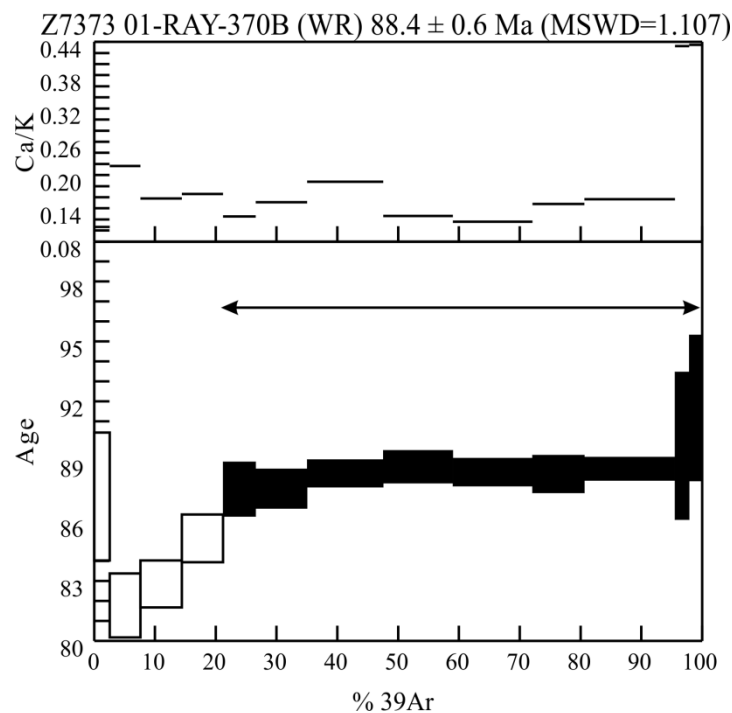
Quartz-eye porphyritic rhyolite, highly aphanitic, beige to pink in colour. The aliquot that was analyzed consisted of nine grains, 500-600 μ m each. The grains were colourless with a sugary texture, and speckled with pink staining and tiny opaques.

Results:

One aliquot analyzed, giving a multistep plateau containing 79% of ^{39}Ar gas, with classic ^{40}Ar -loss profile in lowest temperature steps, MSWD=1.107.

Analytical details:

Irradiation Batch: GSC #51
Date analyzed: October 27, 2005
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: CC/BC2

Lithology: Biotite-hornblende granodiorite

Mineral analyzed: Biotite

Age: 91.1 ± 0.6 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 8075

Argon Number: 2198

Location: Clear Creek Complex

UTM Zone 8 - 401666 E 7079672 N; NTS sheet 115P/15

Unit Name (if available): Big Creek Pluton

Geologist: C. J. R. Hart

Sample Description:

Medium-grained biotite>>hornblende granodiorite. Analyzed aliquot consisted of two good quality, large, dark brown clean grains (700-800 μ m each).

Results:

One aliquot of biotite analyzed, giving a flat multistep plateau comprising 97.9% of gas, MSWD=0.280.

Analytical details:

Irradiation Batch: GSC #51

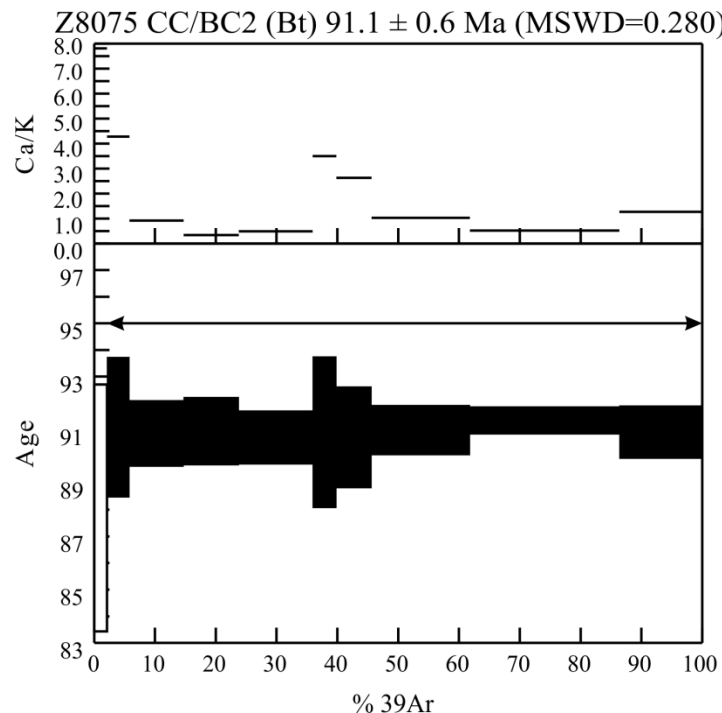
Date analyzed: January 16, 2006

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02GGA059B2

Lithology: Monzonite

Mineral analyzed: Biotite

Age: 68.7 ± 0.5 Ma

Interpretation: Reset?

Geochronology Lab Number: 8541

Argon Number: 2421

Location: along ridge, 11.160 km bearing $113^\circ 31'$ from mouth of Seven Mile Creek

UTM Zone 7 - 541399 E 6990351 N; NTS sheet 115N/1

Unit Name (if available): Dawson Range phase; Whitehorse Suite

Geologist: S. Gordey

Sample Description:

Hornblende quartz monzonite. Aliquot of biotite comprised three large excellent quality bottle-brown grains (700-1100 μ m).

Results:

One aliquot analyzed, giving a flat, multistep plateau comprising 99% of ^{39}Ar gas released, MSWD=0.204. Age may be reset from initial older age.

Analytical details:

Irradiation Batch: GSC #51

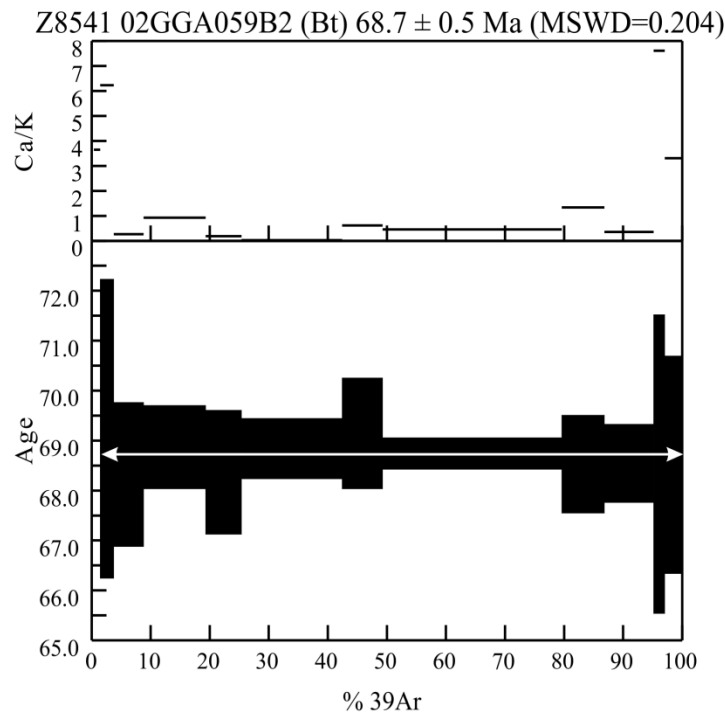
Date analyzed: February 17, 2006

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02GGA059B2

Lithology: Monzonite

Mineral analyzed: Hornblende

Age: 83.3 ± 4.2 Ma

Interpretation: Reset?

Geochronology Lab Number: 8541

Argon Number: 2420

Location: along ridge, 11.160 km bearing $113^\circ 31'$ from mouth of Seven Mile Creek

UTM Zone 7 - 541399 E 6990351 N; NTS sheet 115N/1

Unit Name (if available): Dawson Range phase; Whitehorse Suite

Geologist: S. Gordey

Sample Description:

Hornblende quartz monzonite, with some very fine biotite after hornblende. The aliquot analyzed consisted of two large black fresh grains (700-800 μ m each).

Results:

The release spectrum was stair-stepping downwards, with no interpretable age (Fig. A). The inverse isochron age is used due to excess ^{40}Ar in the sample (Fig. B, MSWD = 0.570, $^{40}\text{Ar}/^{36}\text{Ar} = 628 \pm 290$). Low gas quantities limit precision. Age may be reset from initial older age.

Analytical details:

Irradiation Batch: GSC #51

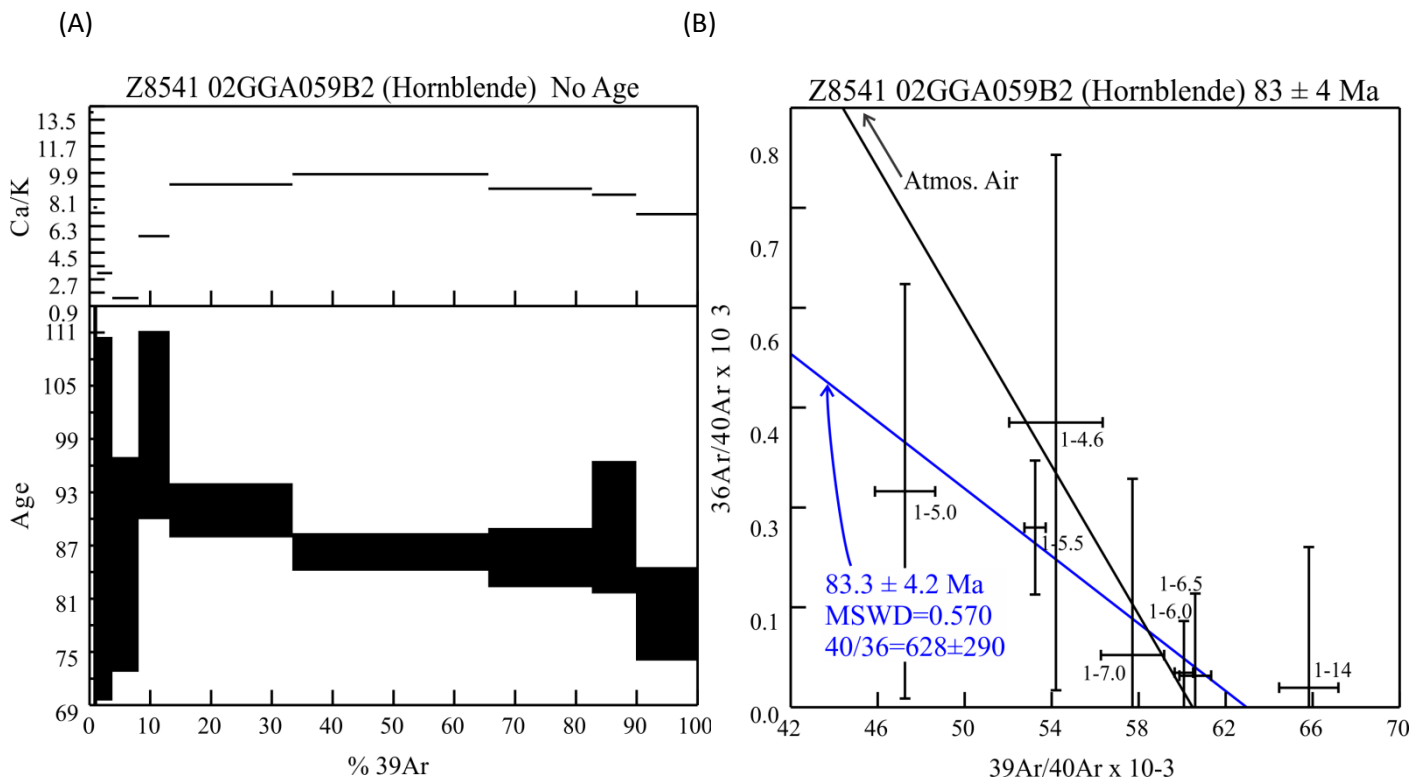
Date analyzed: November 7, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 02RAYG259A1

Lithology: Monzogranite

Mineral analyzed: Biotite

Age: 118.0 ± 1.1 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 8556

Argon Number: 2417

Location: 14.021 km bearing $170^\circ 0'$ from mouth of Deep Creek

UTM Zone 7 - 509203 E 7024545 N; NTS sheet 115N/7

Unit Name (if available): Whitehorse Suite

Geologist: S. Gordey

Sample Description:

Monzogranite, medium-grained, looks fresh. Aliquot analyzed consisted of two thick brown books $\sim 700\mu\text{m}$ each.

Results:

One aliquot was analyzed, yielding a traditional ^{40}Ar gas loss profile with plateau formed from 69% of total ^{39}Ar released (MSWD=1.053).

Analytical details:

Irradiation Batch: GSC #51

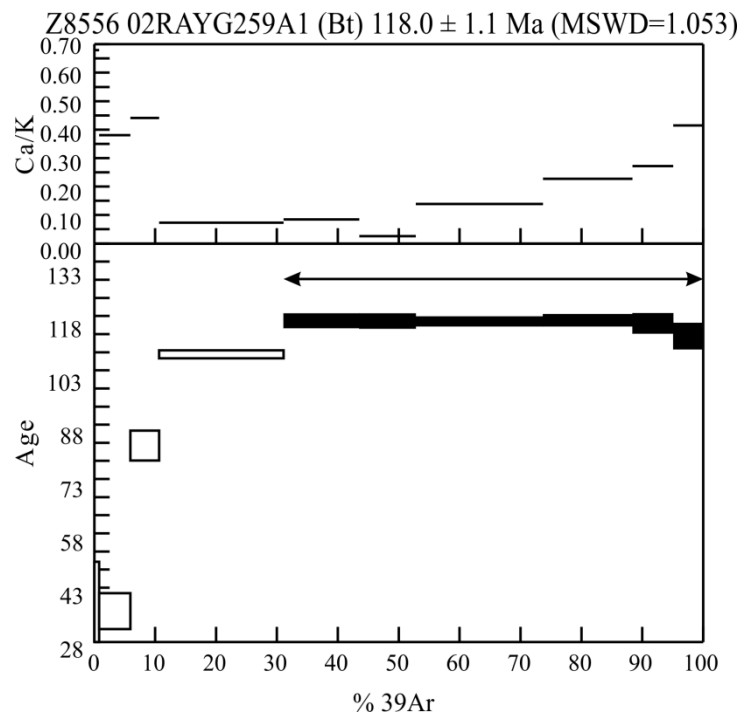
Date analyzed: September 7, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO_2 laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Late Cretaceous intrusions and Carmacks Group

A number of samples from late Mesozoic to Paleocene igneous rocks across the Stewart River, eastern Stevenson Ridge and western Carmacks maps areas we collected to try to constrain the youngest igneous suites that record little to no deformation or metamorphism. $^{40}\text{Ar}/^{39}\text{Ar}$ analysis was completed on fresh or relict igneous crystals of biotite and hornblende, and also by whole rock analysis of intermediate to mafic volcanic and/or hypabyssal intrusions of the late Cretaceous Casino and Prospector Mountain suites (Figs. 7 and 8), and Carmacks Group volcanic rocks.

Eight samples collected from the Casino suite porphyries from three different areas (Casino, Sonora Gulch, Revenue) generally yielded remarkably consistent ages between 76 to 74 Ma, in line with other recent dates from this suite (e.g. Bennett et al., 2010; Morris et al., 2014), and helps establish this as a regionally aerially extensive suite.

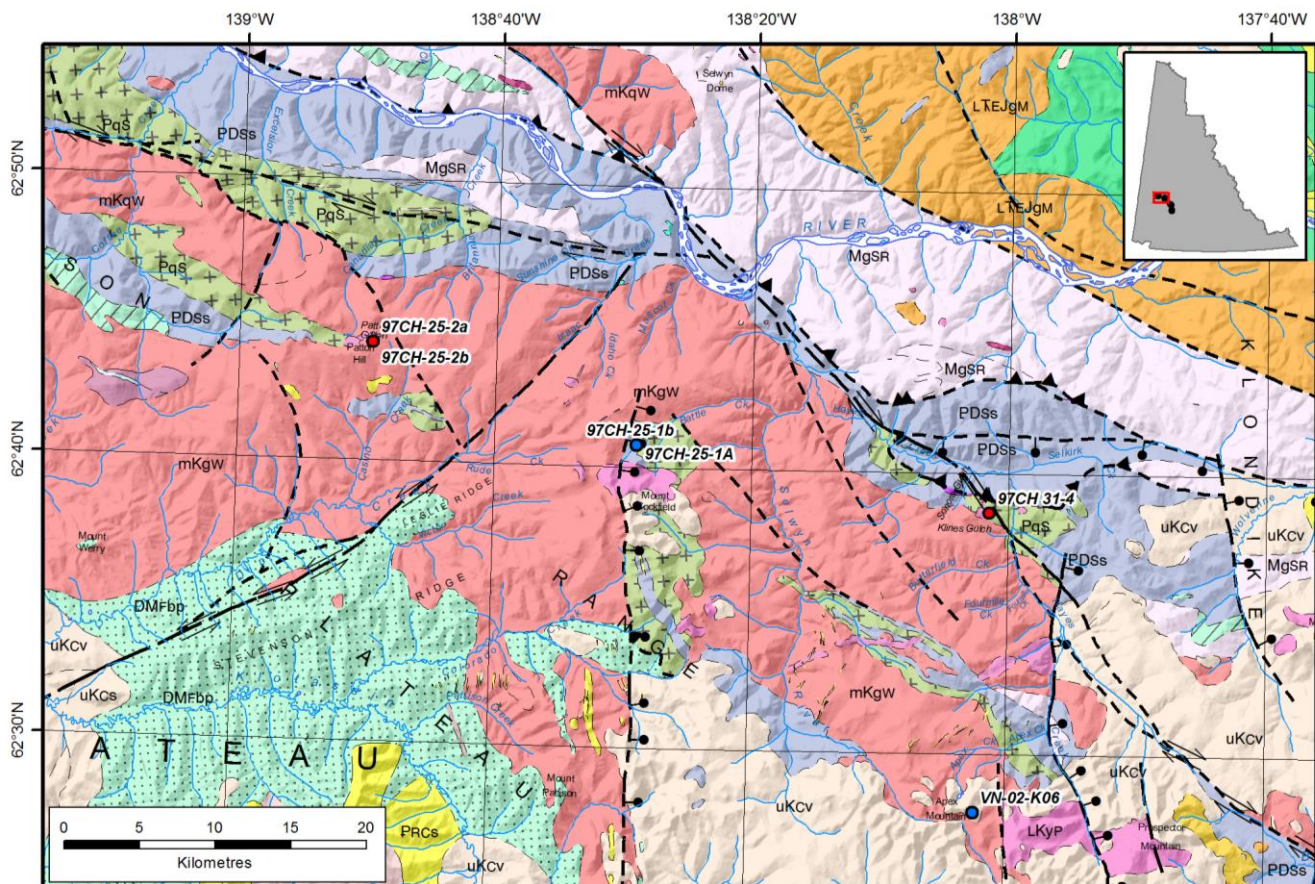


Figure 7. Geological map of the Dawson Range in northern Stevenson Ridge area showing location of samples from the Casino (red) and Prospector Mountain (blue) plutonic suites. Geology from Yukon Geological Survey, www.geology.gov.yk.ca.

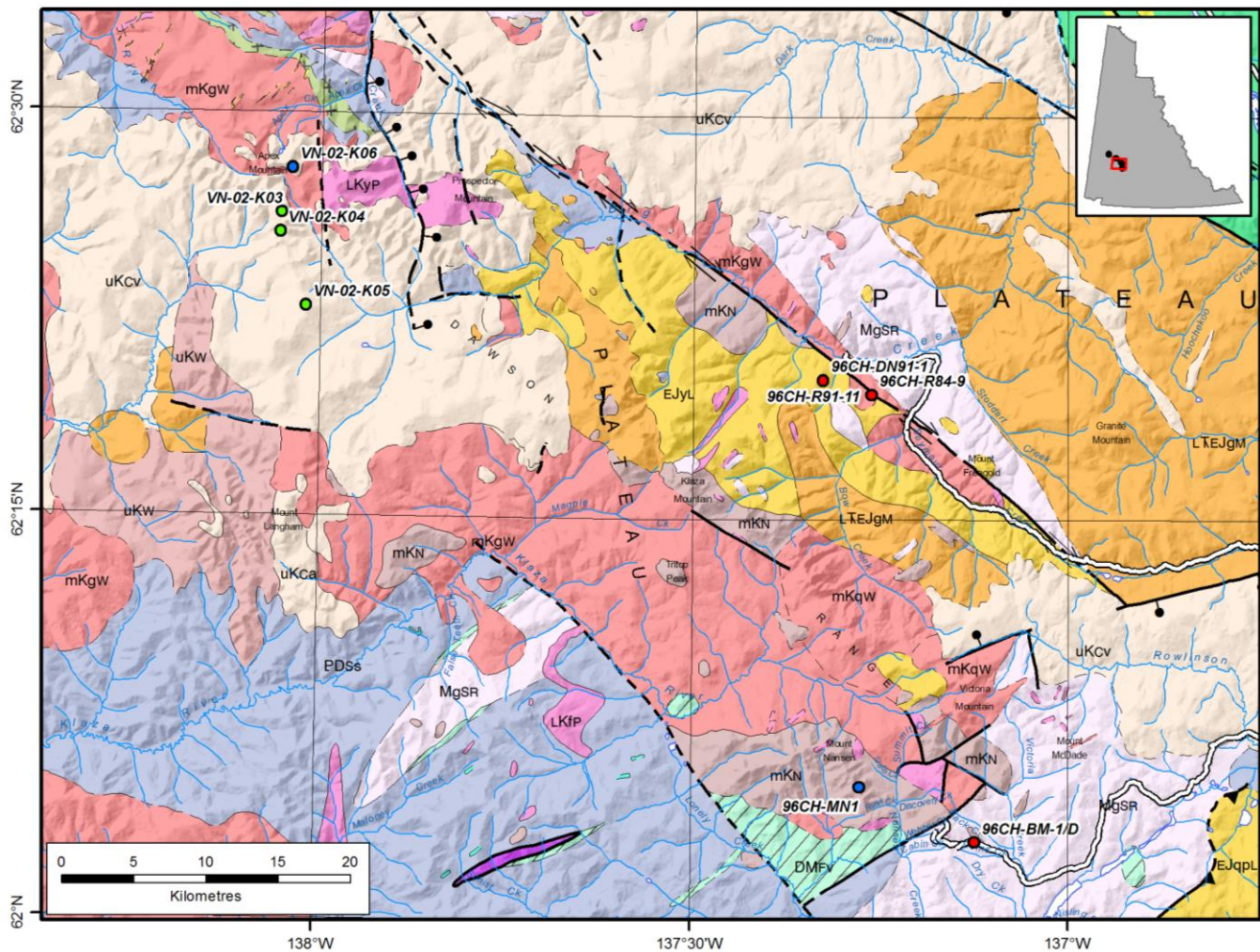


Figure 8. Geological map of the southern Dawson Range showing location of samples from the Casino (red) and Prospector Mountain (blue) plutonic suites, and samples of the Carmacks Group (green) near Apex Mountain. Geology from Yukon Geological Survey, www.geology.gov.yk.ca.

Thirteen samples were collected from various volcanic rocks of the Carmacks Group across the western Klondike plateau and Dawson Range (Figs. 8 and 9; Appendix 1) to provide a constraint on the age range of the Carmacks Group. Some of the samples (VN-02-K03, VN-02-K04, VN-02-K05) from the Apex Mountain area (Fig. 8) were specifically meant to follow up on sites that were sampled for paleomagnetic evaluations by Enkin et al. (2006). All samples yielded ages between 70 and 68 Ma, consistent with other age determinations of the Carmacks Group volcanics (eg. Grond et al., 1984; Lowey et al., 1986; Smuk et al., 1997). Further consideration is required in order to assess if the age range between the samples from Apex Mountain is truly indicative of timing differences between volcanic flows.

A small number of samples, collected from the Prospector Mountain suite intrusions, are broadly co-spatial with and locally intrude the Carmacks Group (Figs. 7 and 8). Age determinations reported here range between ca. 70 and 68 Ma, demonstrating that the suite is broadly consanguineous with the Carmacks Group. An age of 69.1 ± 0.5 Ma for biotite (sample VN-02-K06) from a newly-recognized small biotite syenite plug that intrudes Carmacks Group flows on Apex Mountain, indicates that the syenite is essentially coeval with the flows.

The association between this suite and numerous mineral prospects substantiates that this Late Cretaceous magmatic cycle is an economically prospective event (see also Allan et al., 2013).

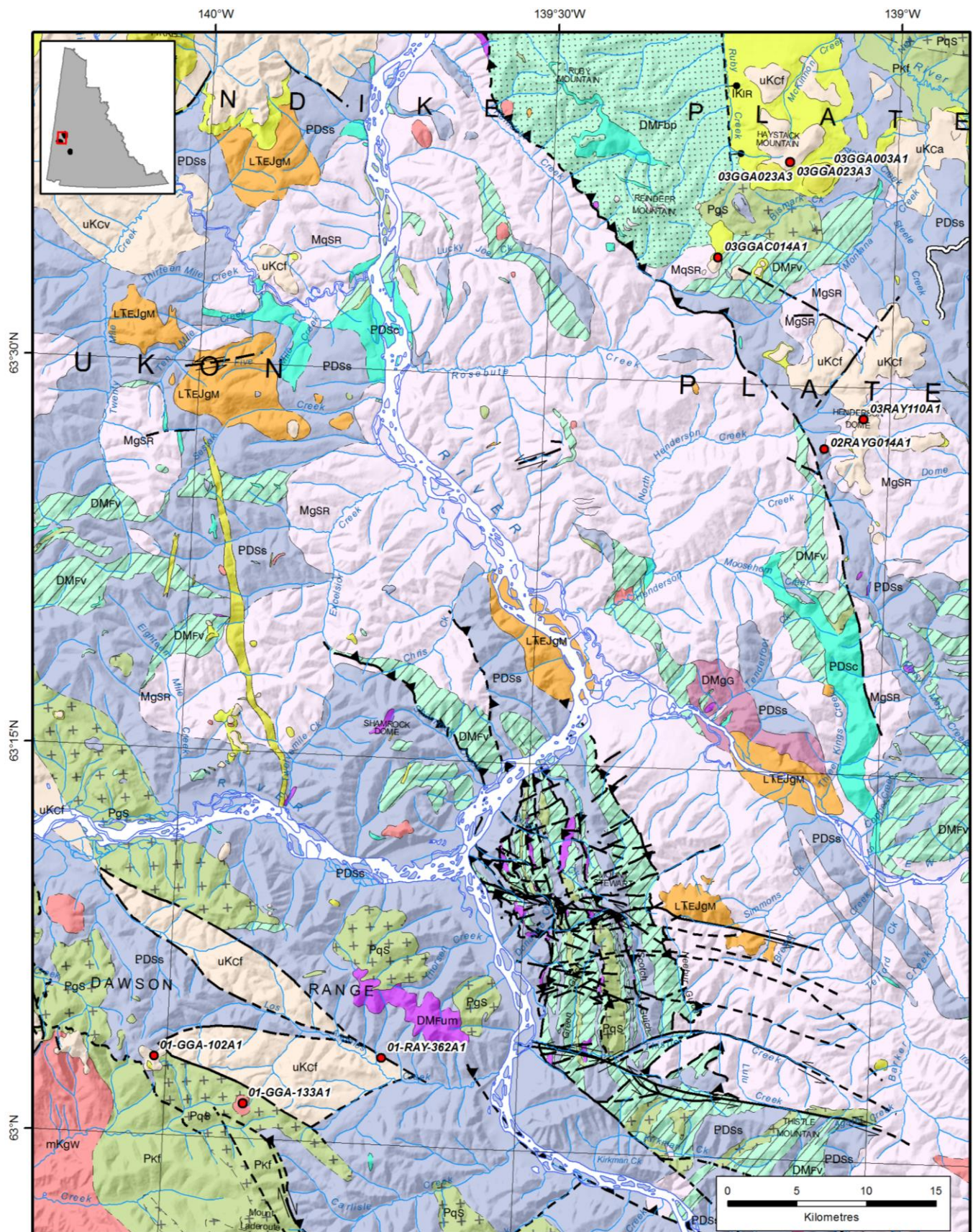


Figure 9. Geological map of the Stewart River area showing location of samples of the Carmacks Group. Geology from Yukon Geological Survey, www.geology.gov.yk.ca.

Sample Number: 96CH-BM-1/D

Yukon Minfile 115I 064

Lithology: Feldspar porphyry dyke

Mineral analyzed: Whole rock

Age: 80.1 ± 1.0 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 4606

Argon Number: 905

Location: Mt. Nansen in the Brown-McDade pit

UTM Zone 8 - 388832 E 6881630 N; NTS sheet 115I/3

Unit Name (if available): Mt. Nansen dykes

Geologist: C. J. R. Hart

Sample Description:

Orange weathering, pale green, strongly altered, zoned feldspar porphyry dyke with sparse mafic minerals. Dyke is cut and altered by mineralization.

Results:

Two aliquots were run, both giving flat multistep plateaus comprising 100% of the gas, MSWD=1.038.

Analytical details:

Irradiation Batch: GSC #23

Date analyzed: July 22-23, 1997

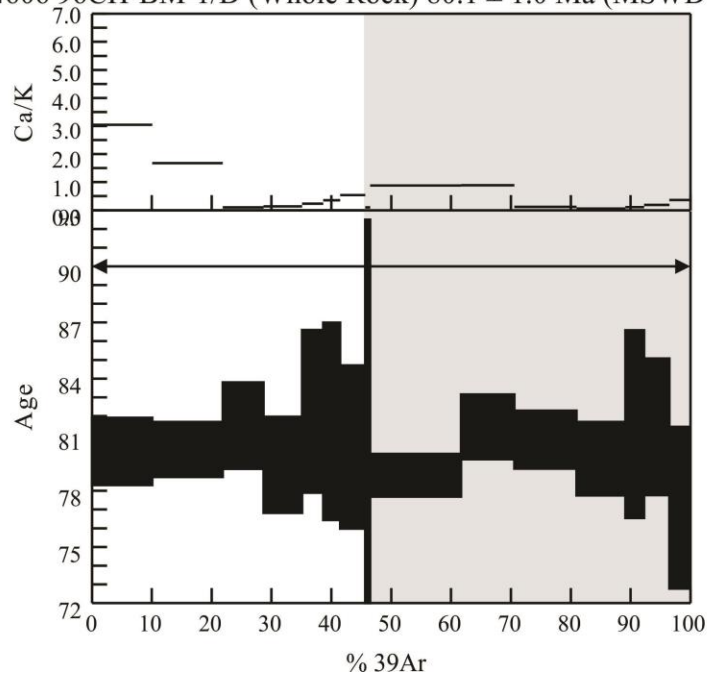
Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module

Z4606 96CH-BM-1/D (Whole Rock) 80.1 ± 1.0 Ma (MSWD=1.038)



Sample Number: 96CH-DN91-1

Yukon Minfile 115I 107

Lithology: Leucocratic granite

Mineral analyzed: Whole Rock

Age: 75.8 ± 1.7 Ma

Interpretation: Igneous Crystallization or possibly Reset

Geochronology Lab Number: 4607

Argon Number: 906

Location: Nucleus deposit

UTM Zone 8 - 379350 E 6913900 N; NTS sheet 115I/6

Unit Name (if available): Nucleus Granite

Geologist: C. J. R. Hart

Sample Description:

Medium grained, leucocratic granite, slight phyllic alteration, but feldspars retain crystallinity. Sulphide-bearing hairline fractures and small blebs. Age was expected to be approximately 100 Ma; possibly two generations of K-feldspar present, second injection is plagioclase associated with sericite.

Results:

Two aliquots were analyzed, both giving flat, reproducible multistep plateaus comprising 97.4% of released ^{39}Ar , MSWD=0.464. Age is younger than what was expected.

Analytical details:

Irradiation Batch: GSC #23

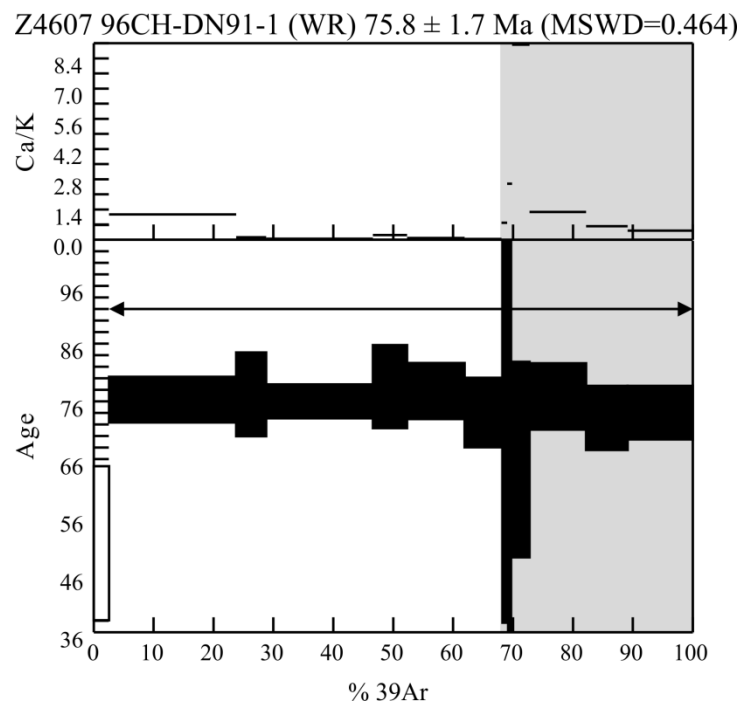
Date analyzed: July 23-24, 1997

Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 96CH-DN91-4

Yukon Minfile 115I 107

Lithology: Leucocratic granite

Mineral analyzed: Whole Rock

Age: 74.4 ± 0.8 Ma

Interpretation: Igneous Crystallization or possibly Reset

Geochronology Lab Number: 4608

Argon Number: 907

Location: Nucleus deposit

UTM Zone 8 - 379350 E 6913900 N; NTS sheet 115I/6

Unit Name (if available): Nucleus Foliated Granite

Geologist C. J. R. Hart

Sample Description:

Fine grained, leucocratic, slightly foliated granite, cut by quartz veins. Age expected to be about 100 Ma.

Results:

Two aliquots were analyzed. Aliquot A was saddle-shaped with slightly older first and last heating steps. Aliquot B was a flat multistep plateau across 99% of the gas released. Age is based on plateau regions for both aliquots, 92.1% of released ^{39}Ar , MSWD=0.748. Slightly younger age than expected.

Analytical details:

Irradiation Batch: GSC #23

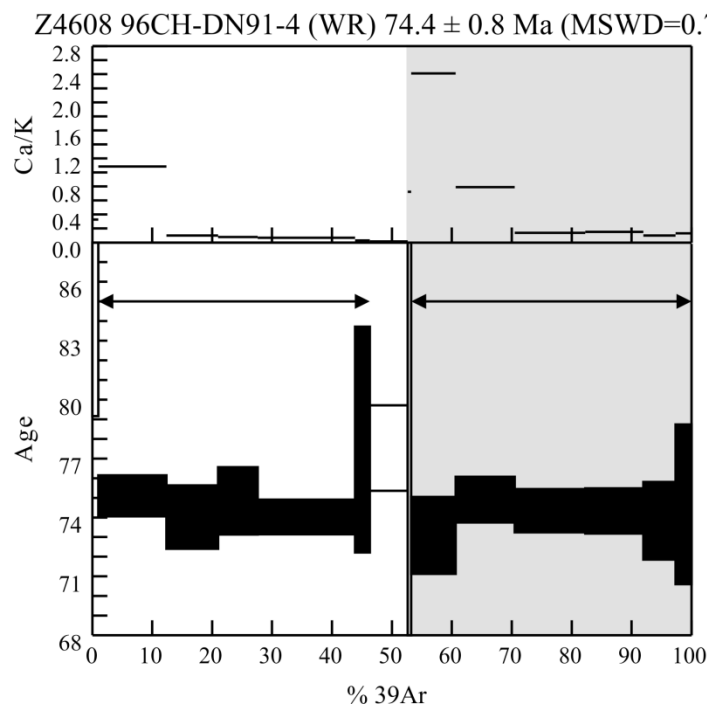
Date analyzed: July 24, 1997

Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 96CH-R84-9

Yukon Minfile 115I 042

Lithology: Feldspar porphyry rhyolite dyke

Mineral analyzed: Whole Rock

Age: 74 ± 4 Ma

Interpretation: Igneous Crystallization estimate

Geochronology Lab Number: 4610

Argon Number: 909

Location: Revenue deposit

UTM Zone 8 - 382682 E 6912781 N; NTS sheet 115I/6

Unit Name (if available): Revenue Rhyolite Dyke

Geologist: C. J. R. Hart

Sample Description:

Pale pink-mauve-yellow recessive weathering feldspar porphyry rhyolite dyke with slight flow-banded margins and weak argillic alteration. Collected to try and constrain timing of brecciation and mineralization.

Results:

Two aliquots were run. Both spectra (Fig. A, below) showed excess argon profiles down-stepping in age from ~90 Ma in early steps to the final two steps in each aliquot at ~74 Ma, which is the best estimate of age for the dyke. No plateau. Inverse isochron was scattered for both aliquots and inconclusive (Fig. B).

Analytical details:

Irradiation Batch: GSC #23

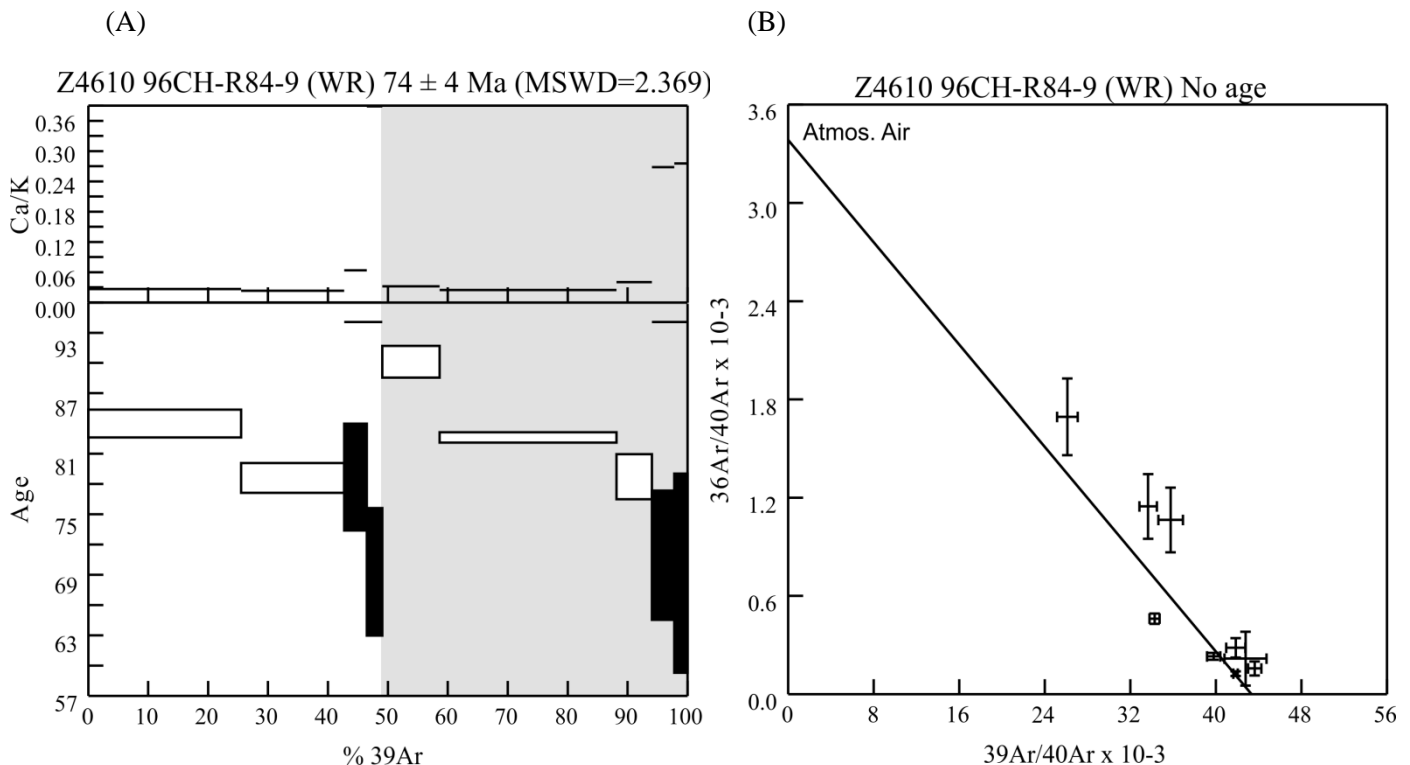
Date analyzed: July 31 & August 11, 1997

Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 96CH-R91-11

Yukon Minfile 115I 042

Lithology: Felsic breccia

Mineral analyzed: Whole Rock

Age: 73.8 ± 0.8 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 4611

Argon Number: 910

Location: Revenue deposit

UTM Zone 8 - 382682 E 6912781 N; NTS sheet 115I/6

Unit Name (if available): Revenue Breccia

Geologist: C. J. R. Hart

Sample Description:

Pale buff-tan recessive weathering felsic breccia with abundant white argillically-altered feldspar and clear quartz phenocrysts. Sample intended to constrain timing of brecciation and mineralization.

Results:

Two aliquots were analyzed. Aliquot A showed excess in two lowest-temperature heating steps, and settled into a plateau that was reproduced with over 90% of the gas in Aliquot B. Age is based on the combined plateau regions for both aliquots, comprising 90.7% of the total released ^{39}Ar gas, MSWD = 1.622.

Analytical details:

Irradiation Batch: GSC #23

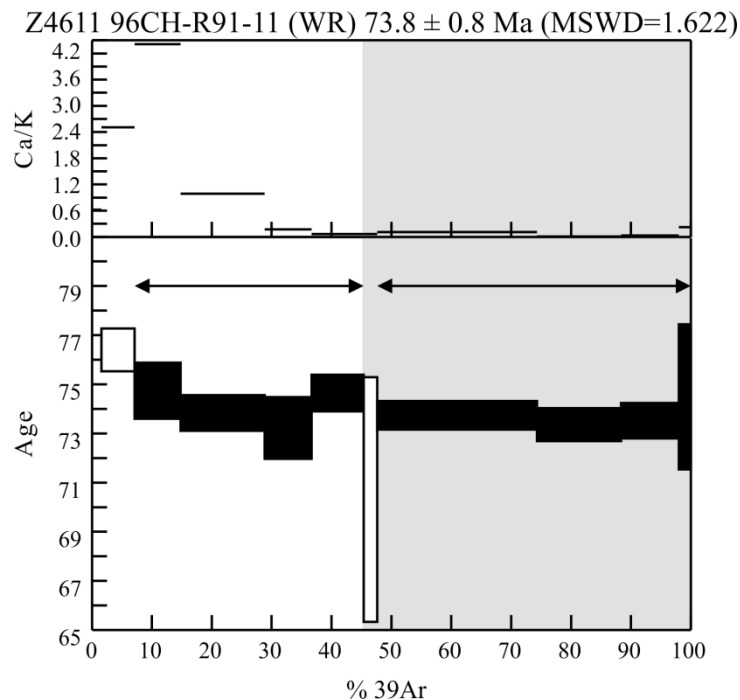
Date analyzed: August 11, 1997

Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 97CH-25-2a

Yukon Minfile 115J 028

Lithology: Granodiorite

Mineral analyzed: Biotite

Age: 74.3 ± 0.8 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 4718

Argon Number: 986

Location: Casino Deposit, Yukon

UTM Zone 7 - 610872 E 6958169 N; NTS sheet 115J/10

Unit Name (if available): Casino Porphyry

Geologist: C. J. R. Hart

Sample Description:

Secondary biotite in granodioritic rock, completely overprinted by biotite (potassic alteration). Rock is cross-cut by two phases of quartz veining, one of which contains chalcopyrite. Chalcopyrite also occurs disseminated within the rock and as fracture coatings. Potential molybdenite on fracture surfaces.

Results:

Age is from combined multistep flat plateaus from two aliquots comprising 99.0% of released ^{39}Ar , MSWD=1.191

Analytical details:

Irradiation Batch: GSC #25

Date analyzed: February 23, 1998

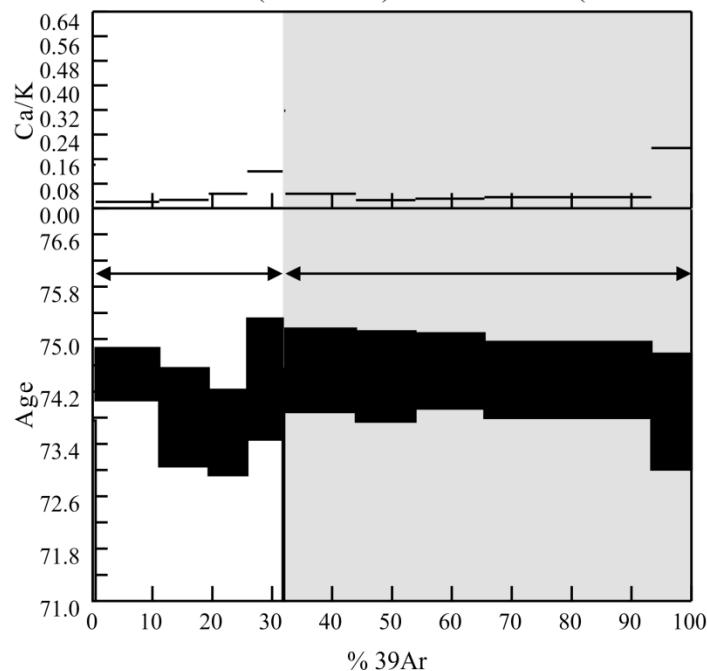
Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module

Z4718 97CH-25-2a (BIOTITE) 74.3 ± 0.8 Ma (MSWD=1.191)



Sample Number: 97CH-25-2b

Yukon Minfile 115J 028

Lithology: Dacite porphyry

Mineral analyzed: Biotite

Age: 74.4 ± 0.8 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 4719

Argon Number: 987

Location: Casino Deposit, Yukon

UTM Zone 7 - 610872 E 6958169 N; NTS sheet 115J/10

Unit Name (if available): Patton Porphyry

Geologist: C. J. R. Hart

Sample Description:

Patton Porphyry dyke; plagioclase-biotite porphyry in grey matrix, probably a dacite; DDH 93-184@9.25m

Results:

Age based on 100.0% of released ^{39}Ar from two aliquots of biotite, flat multistep plateaus, MSWD=0.658

Analytical details:

Irradiation Batch: GSC #25

Date analyzed: February 24, 1998

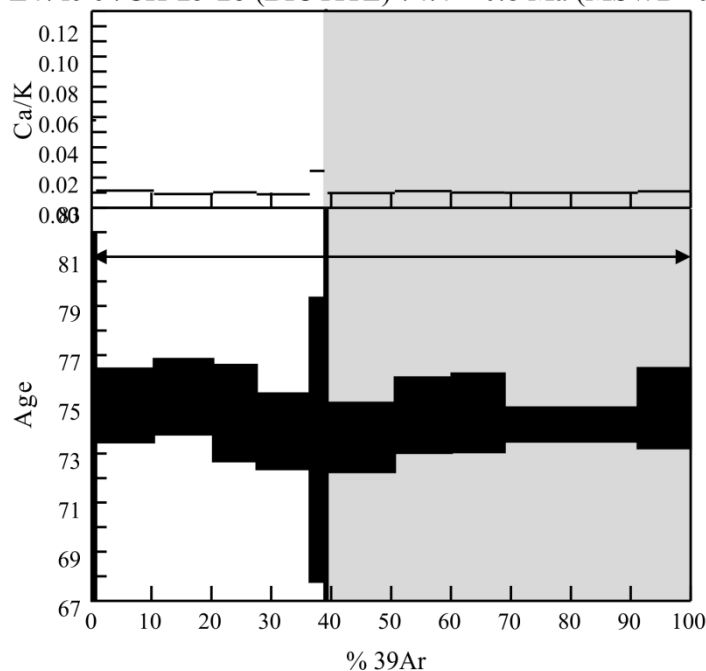
Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module

Z4719 97CH-25-2b (BIOTITE) 74.4 ± 0.8 Ma (MSWD=0.658)



Sample Number: 97CH 31-4

Yukon Minfile 115J 008

Lithology: Porphyry dyke

Mineral analyzed: Biotite

Age: 76.2 ± 0.8 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 5017

Argon Number: 1084

Location: Sonora Gulch gold occurrence

UTM Zone 7 - 652362 E 6949412 N; NTS sheet 115J/9

Unit Name (if available): Sonora Gulch porphyry

Geologist: C. J. R. Hart

Sample Description:

Plagioclase-biotite porphyry dyke associated with skarn mineralization. Sampled from drill core.

Results:

Two aliquots run, both showing slightly hump-shaped spectra. The majority of the heating steps formed plateaus and the age is derived from the combined plateau regions for both aliquots, comprising 94.2% of released ^{39}Ar , MSWD=2.030.

Analytical details:

Irradiation Batch: GSC #26

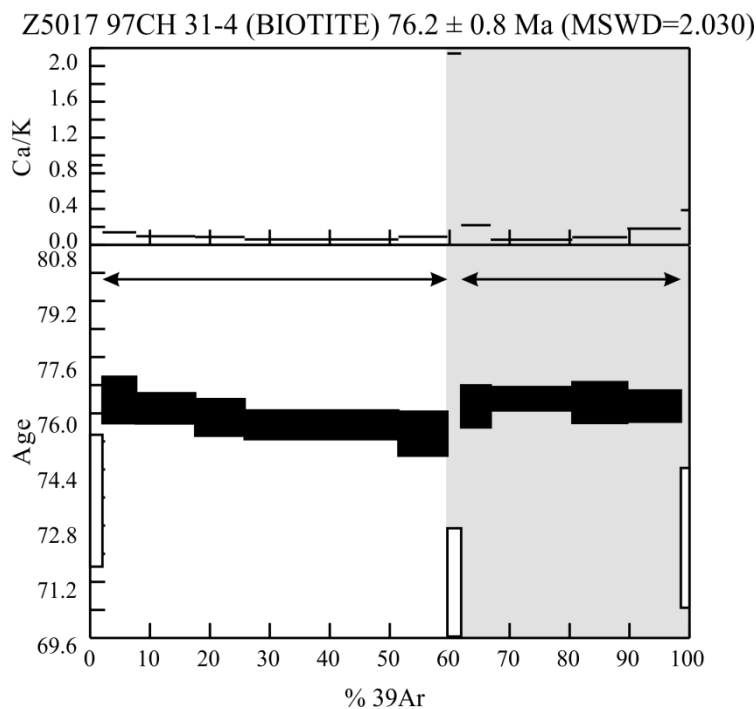
Date analyzed: August 25, 1998

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 01-RAY-362A1

Lithology: Rhyodacite

Mineral analyzed: Biotite

Age: 68.7 ± 0.8 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 7376

Argon Number: 2409

Location: Los Angeles Creek

UTM Zone 7 - 565888 E 7992531 N; NTS sheet 1150/4

Unit Name (if available): Carmacks Group

Geologist: J. J. Ryan

Sample Description:

Rhyodacite with biotite phenocrysts; unclear if flow or dyke. Unit has a high magnetic signature. Three thick brown grains (each 400-500 μ m) were loaded for a single aliquot.

Results:

Slight trend of decreasing age with increasing analysis temperature, but steps fall within error of each other. Age derived from a plateau containing 98% of the released ^{39}Ar gas, MSWD=0.571.

Analytical details:

Irradiation Batch: GSC #51

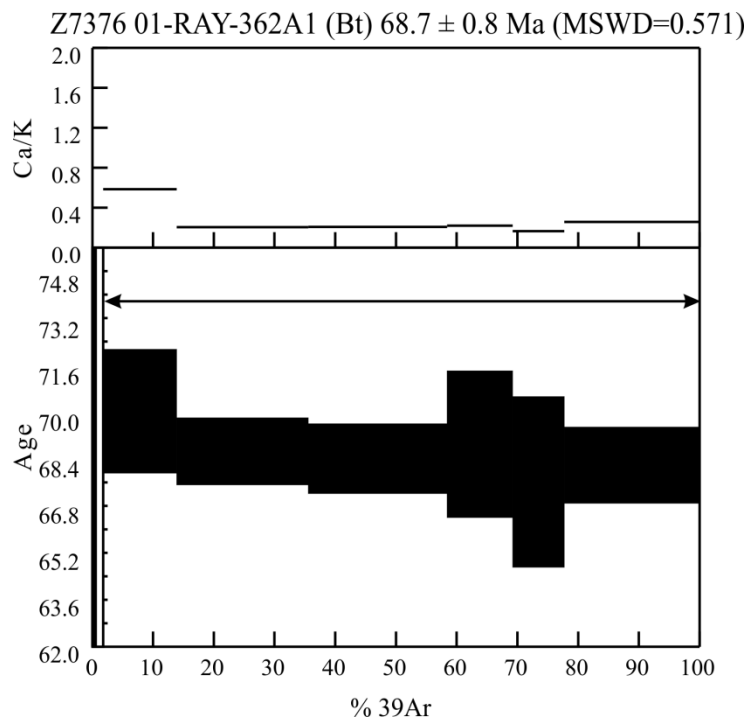
Date analyzed: September 6-7, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 01-GGA-102A1

Lithology: Andesite

Mineral analyzed: Biotite

Age: 68.5 ± 0.4 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 7377

Argon Number: 2016

Location: Ladue Creek

UTM Zone 7 - 549553 E 6991637 N; NTS sheet 115N/1

Unit Name (if available): Carmacks Group

Geologist: S. Gordey

Sample Description:

Porphyritic volcanic, with large, fresh, euhedral dark reddish-brown biotite crystals.

Results:

Two aliquots were analyzed, giving flat, reproducible plateaus comprising 99.7 % of gas released (MSWD=0.385).

Analytical details:

Irradiation Batch: GSC #45

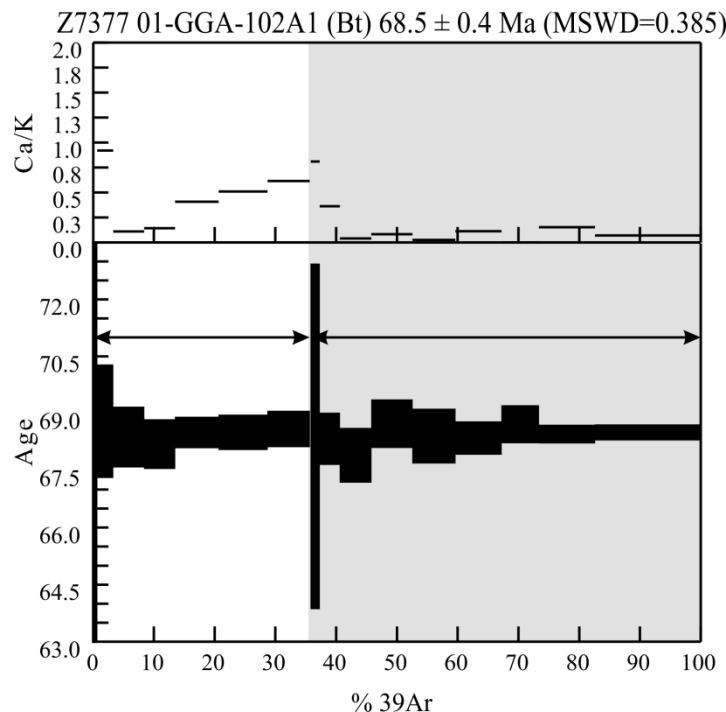
Date analyzed: February 17 & 23, 2004

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 01-GGA-133A1

Lithology: Biotite-K-feldspar porphyritic dacite

Mineral analyzed: Biotite

Age: 68.1 ± 0.4 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 7378

Argon Number: 1900

Location: Los Angeles Creek

UTM Zone 7 - 556135 E 6988644 N; NTS sheet 115O/4

Unit Name (if available): Carmacks Group

Geologist: S. Gordey

Sample Description:

Good quality coarse dark brown biotite.

Results:

One aliquot was analyzed and gave a flat plateau over 15 heating steps and 100% of the released ^{39}Ar (MSWD=0.692).

Analytical details:

Irradiation Batch: GSC #45

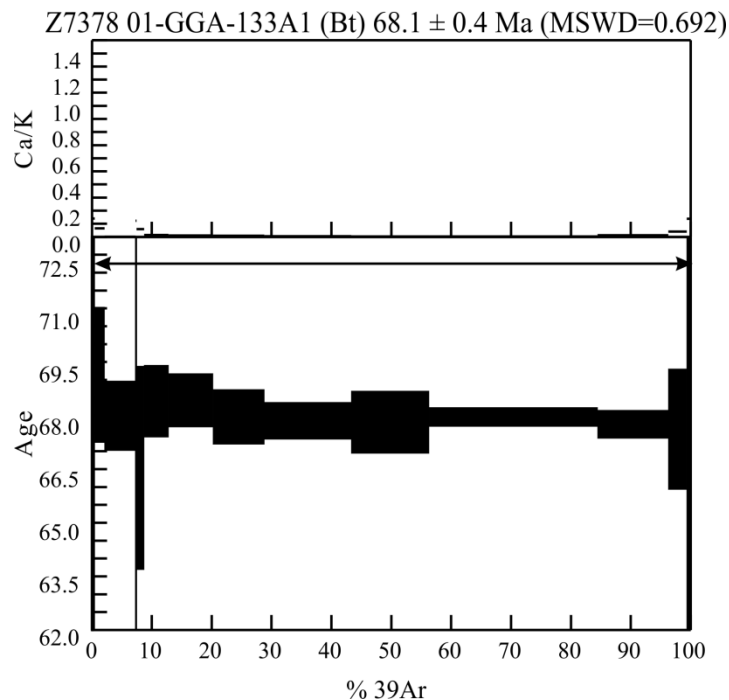
Date analyzed: November 21, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-02-K03
Lithology: Andesite/Basalt
Mineral analyzed: Whole Rock
Age: 67.6 ± 0.7 Ma
Interpretation: Igneous Crystallization

Geochronology Lab Number: 7568
Argon Number: 2005
Location: Just south of peak of Apex Mountain
UTM Zone 7 - 651911 E 6926437 N; NTS sheet 115J/8
Unit Name (if available): Carmacks Group
Geologist: C. J. R. Hart

Sample Description:

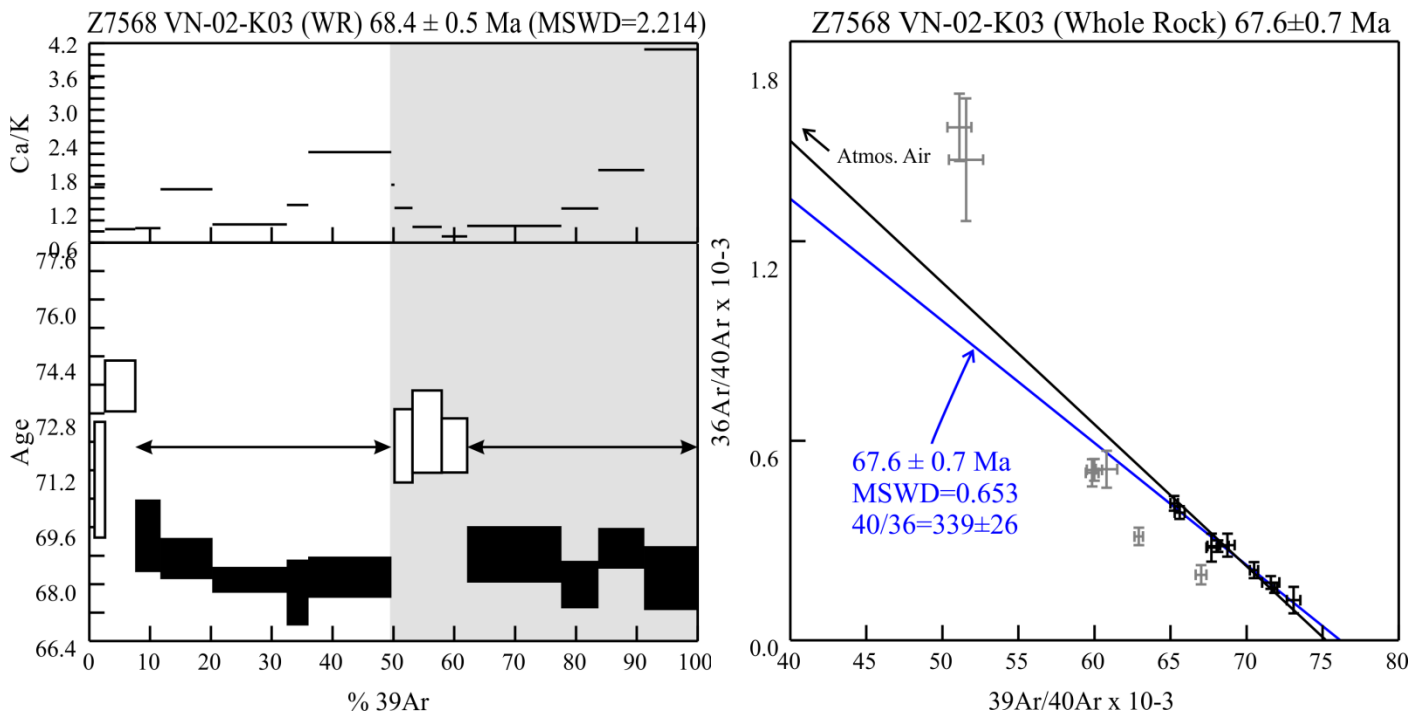
Augite- and plagioclase-phyric in fine-grained dark matrix. Outcrop is massive and blocky, interpreted as flow underlying basalt. Flow feature noted further down ridge. Grains selected for analysis were homogeneous fine-grained dark grey fragments peppered with abundant fine opaques.

Results:

Only highest temperature steps were used to construct isochron because of inhomogeneous distribution of excess ^{40}Ar . Instrument baselines were somewhat noisy during analyses, but data was reproducible over two aliquots with $\text{MSWD}=0.653$, $^{40}\text{Ar}/^{36}\text{Ar}=339\pm26$.

Analytical details:

Irradiation Batch: GSC #45
Date analyzed: December 22, 2003 & January 12, 2004
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO_2 laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-02-K04
Lithology: Basalt
Mineral analyzed: Whole Rock
Age: 69.9 ± 0.7 Ma
Interpretation: Igneous Crystallization

Geochronology Lab Number: 7569

Argon Number: 2006

Location: Just south of peak of Apex Mountain, west of main N-S ridge axis

UTM Zone 7 - 651908 E 6925113 N; NTS sheet 115J/8

Unit Name (if available): Carmacks Group

Geologist: C. J. R. Hart

Sample Description:

Massive, fine grained basaltic flow, immediately overlying augite andesites. Locally exhibits defined layering. Grains selected for analysis were dark grey, fine-grained, homogeneous fragments, peppered with abundant opaques. The basalt was locally feldspar-phyric but phenocrysts were avoided in grain selection.

Results:

Reproducible inverse isochron with evidence for excess ^{40}Ar in two aliquots ($^{40}\text{Ar}/^{36}\text{Ar}=364\pm19$) and good cluster of radiogenic points. Only the lowest temperature step from each aliquot was excluded from regression (each representing less than 1% of total ^{39}Ar released). Minor scatter about the line (MSWD=3.276).

Analytical details:

Irradiation Batch: GSC #45

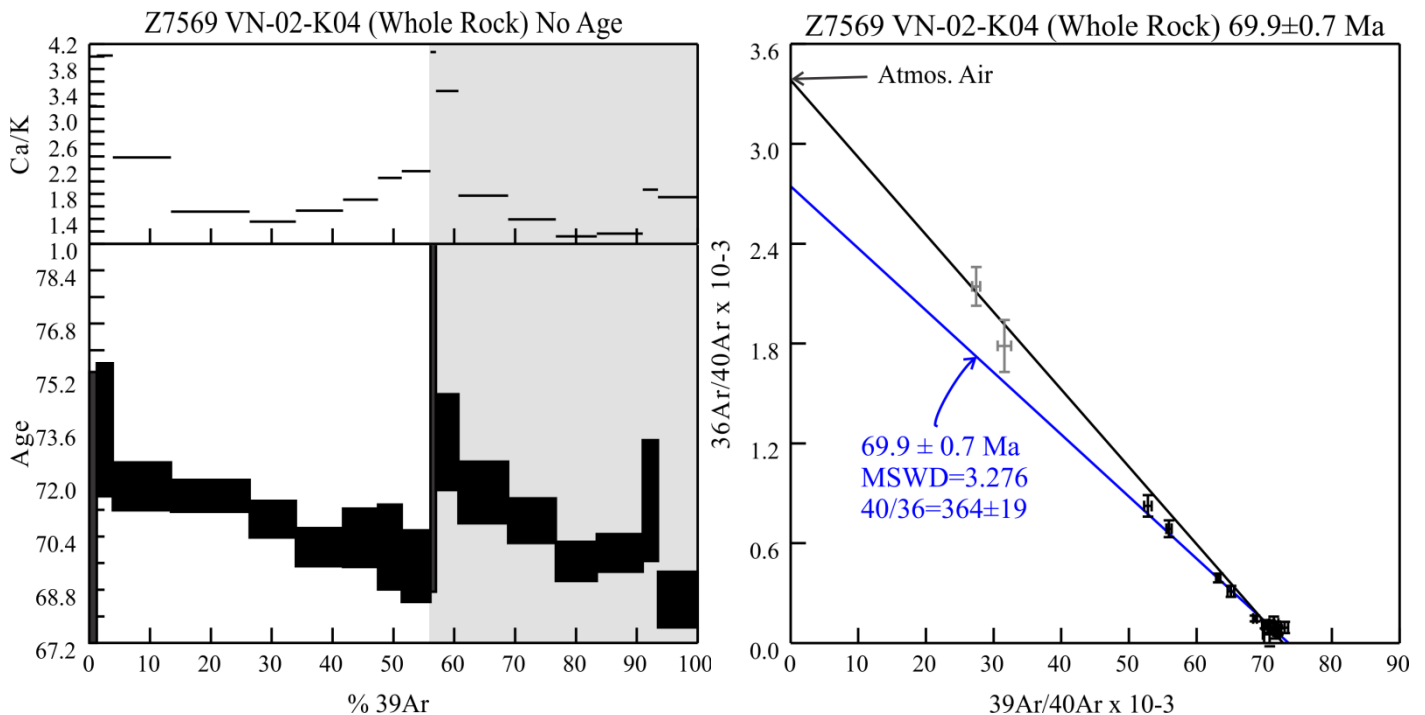
Date analyzed: December 22, 2003 & January 12-13, 2004

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-02-K05
Lithology: Basalt
Mineral analyzed: Whole Rock
Age: 70.0 ± 0.5 Ma
Interpretation: Igneous Crystallization

Geochronology Lab Number: 7570
Argon Number: 2007
Location: South of Apex Mountain, near sample site W10 of Wynne et al. (1998)
UTM Zone 7 - 653978 E 6920107 N; NTS sheet 115J/8
Unit Name (if available): Carmacks Group
Geologist: C. J. R. Hart

Sample Description:

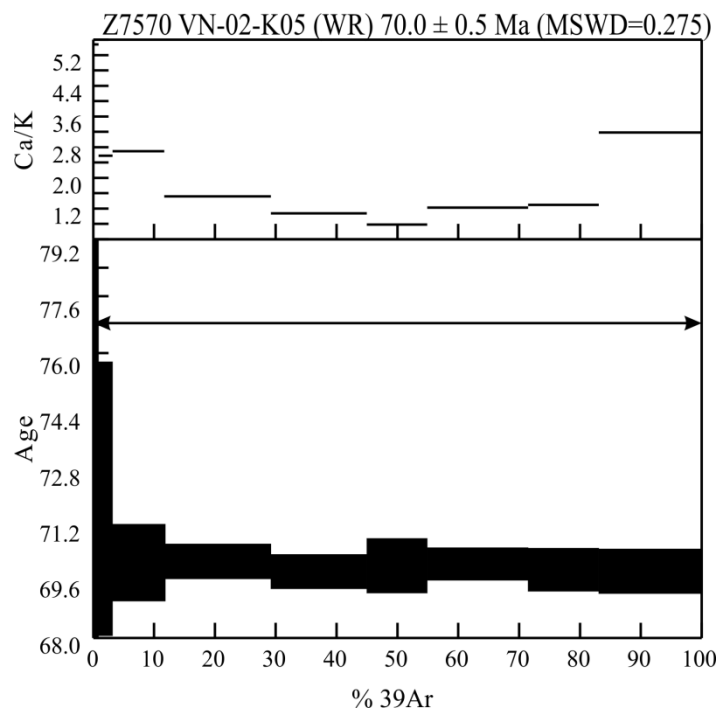
Massive olivine basalt, over 10m thick, lying at top of weakly south-dipping volcanic pile. Unaltered green olivine phenocrysts approximately 2-3 mm diameter. Grains selected for analysis were homogeneous translucent grey-green fragments peppered with abundant fine opaques.

Results:

One aliquot was analyzed and gave a flat, well-developed plateau at an age of 70.1 ± 0.5 Ma, with no evidence for excess ^{40}Ar or post-crystallization ^{40}Ar -loss. Plateau comprises 100.0 % of the released ^{39}Ar gas, MSWD=0.275.

Analytical details:

Irradiation Batch: GSC #45
Date analyzed: December 23, 2003
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: 02RAYG014A1

Lithology: Dacite

Mineral analyzed: Hornblende

Age: 67.9 ± 1.9 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 8543

Argon Number: 2410

Location: 3.593 km bearing 232° 23' from Henderson Dome

UTM Zone 7 - 594925 E 7038270 N; NTS sheet 115O/6

Unit Name (if available): Carmacks Group

Geologist: S. Gordey

Sample Description:

Hornblende- and plagioclase-phyric dacite. The analyzed aliquot consisted of four large brown grains (750-1000 μ m each).

Results:

One aliquot was analyzed, giving a flat, multistep plateau, comprising 98% of released ^{39}Ar gas, MSWD=0.143.

Analytical details:

Irradiation Batch: GSC #51

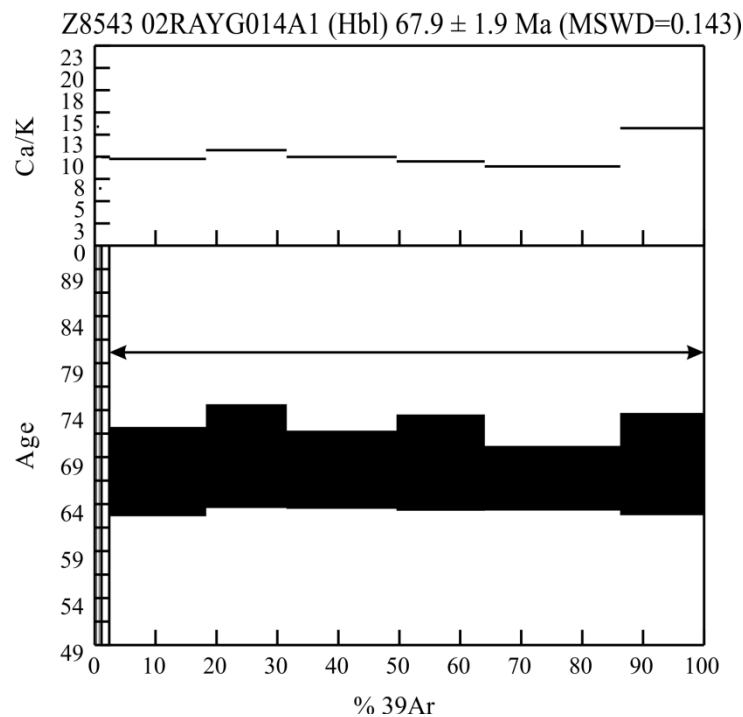
Date analyzed: October 7, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 03GGA003A1

Lithology: Rhyolite

Mineral analyzed: Biotite

Age: 68.1 ± 0.5 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 8546

Argon Number: 2422

Location: On smoothly rounded knoll, 3.916 km bearing $118^\circ 4'$ from Haystack Mountain
UTM Zone 7 - 593881 E 7058365 N; NTS sheet 1150/11

Unit Name (if available): Carmacks Group

Geologist: S. Gordey

Sample Description:

Biotite-, quartz-, and feldspar-phyric rhyolite. The aliquot analyzed consisted of two large bottle-brown grains of excellent quality (800-1000 μ m each).

Results:

One aliquot was analyzed, giving a flat, multistep plateau comprising 98% of the released ^{39}Ar , MSWD=0.508.

Analytical details:

Irradiation Batch: GSC #51

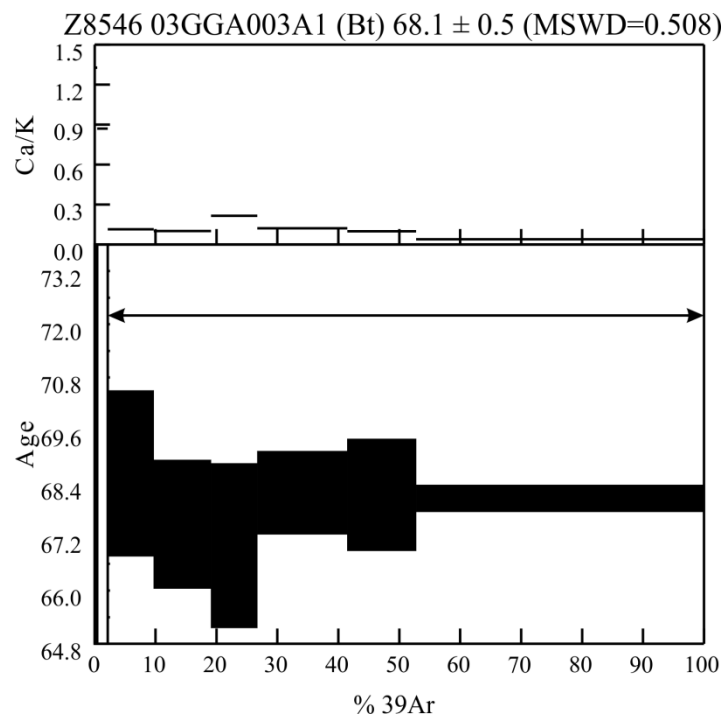
Date analyzed: October 18, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 03GGA023A3

Lithology: Dacite

Mineral analyzed: Biotite

Age: 69.6 ± 0.6 Ma (± 0.4 Ma without J-error)

Interpretation: Igneous Crystallization

Geochronology Lab Number: 8547

Argon Number: 2411

Location: 1.550 km bearing $153^\circ 7'$ from Haystack Mountain

UTM Zone 7 - 591155 E 7058747 N; NTS sheet 115O/11

Unit Name (if available): Carmacks Group

Geologist: S. Gordey

Sample Description:

Hornblende- and feldspar-phyric dacite. The analyzed aliquot consisted of two large, thick, brown grains.

Results:

One aliquot was analyzed, giving a flat, multistep plateau, comprising 98% of released ^{39}Ar gas, MSWD=0.221.

Analytical details:

Irradiation Batch: GSC #51

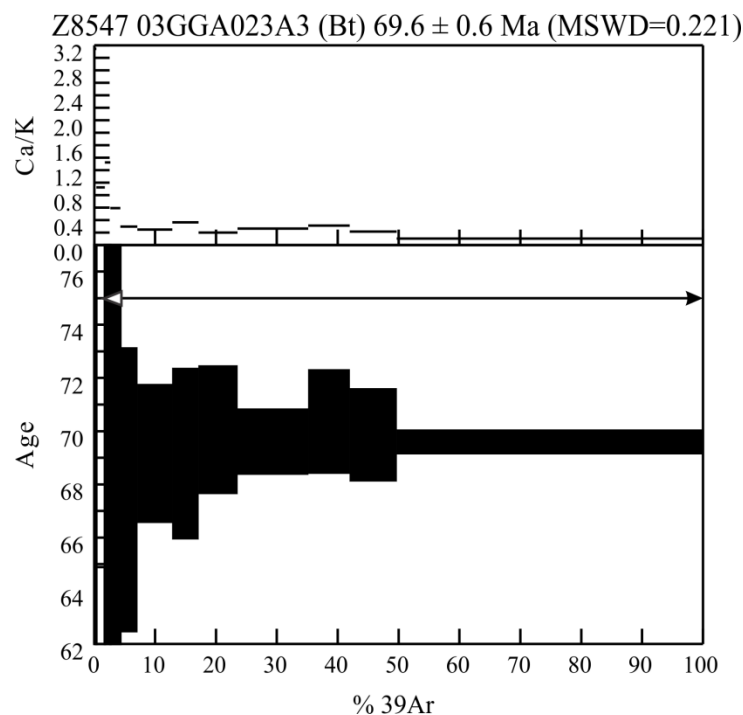
Date analyzed: August 22, & September 6, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 03GGA023A3

Lithology: Dacite

Mineral analyzed: Hornblende

Age: 68.6 ± 0.9 Ma (± 0.8 Ma without J-error)

Interpretation: Igneous Crystallization

Geochronology Lab Number: 8547

Argon Number: 2412

Location: 1.550 km bearing $153^\circ 7'$ from Haystack Mountain

UTM Zone 7 - 591155 E 7058747 N; NTS sheet 115O/11

Unit Name (if available): Carmacks Group

Geologist: S. Gordey

Sample Description:

Hornblende- and feldspar-phyric dacite. The analyzed aliquot consisted of five black fresh grains (500-700 μ m each).

Results:

One aliquot was analyzed, giving a flat, multistep plateau, comprising 99.7% of released ^{39}Ar gas, MSWD=0.282.

Analytical details:

Irradiation Batch: GSC #51

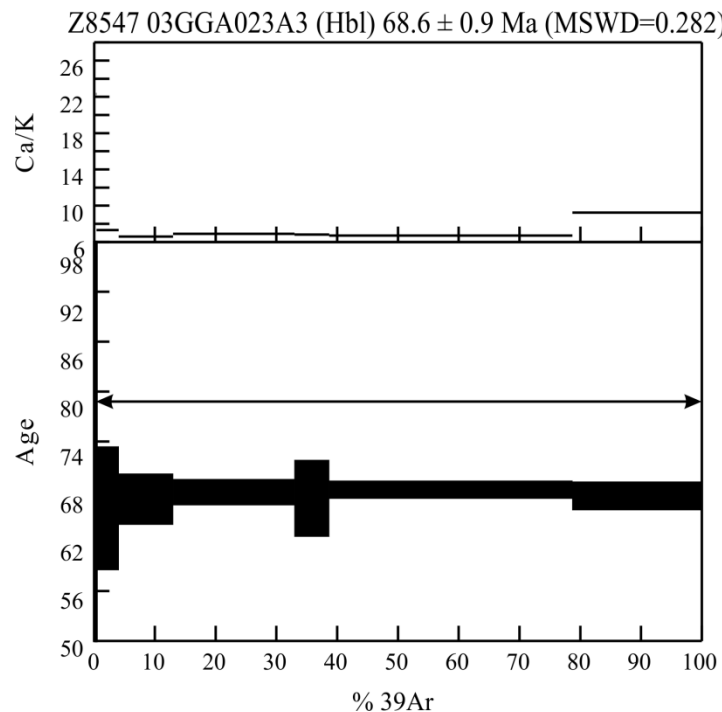
Date analyzed: October 27-28, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 03GGAC014A1

Lithology: Andesite

Mineral analyzed: Hornblende

Age: 68.5 ± 1.1 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 8549

Argon Number: 2413

Location: 9.441 km bearing 206° 25' from Haystack Mountain

UTM Zone 7 - 586417 E 7051539 N; NTS sheet 1150/11

Unit Name (if available): Carmacks Group

Geologist: S. Gordey

Sample Description:

Hornblende- and feldspar-phyrlic andesite. The analyzed aliquot consisted of seven black fresh grains (500-700 μ m each).

Results:

One aliquot analyzed, giving a flat, multistep plateau containing 98% of gas (MSWD=0.180). The sample had low gas content, resulting in small signal sizes, so the error is slightly larger than normal.

Analytical details:

Irradiation Batch: GSC #51

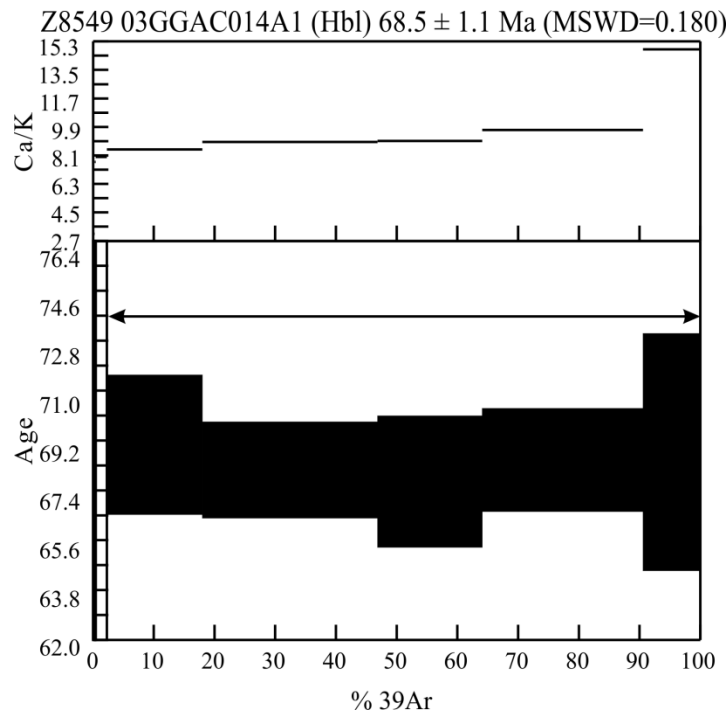
Date analyzed: October 28, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 03RAY110A1

Lithology: Andesite

Mineral analyzed: Biotite

Age: 68.6 ± 0.8 Ma (± 0.7 Ma without J-error)

Interpretation: Igneous Crystallization

Geochronology Lab Number: 8551

Argon Number: 2424

Location: on top of Henderson Dome

UTM Zone 7 - 597615 E 7040584 N; NTS sheet 1150/6

Unit Name (if available): Carmacks Group

Geologist: S. Gordey

Sample Description:

Hornblende-phyric andesite. The aliquot that was analyzed included two large thin books 800 μ m in size.

Results:

One aliquot analyzed, giving a flat, multistep plateau comprising 100% of the released gas, MSWD=0.228.

Analytical details:

Irradiation Batch: GSC #51

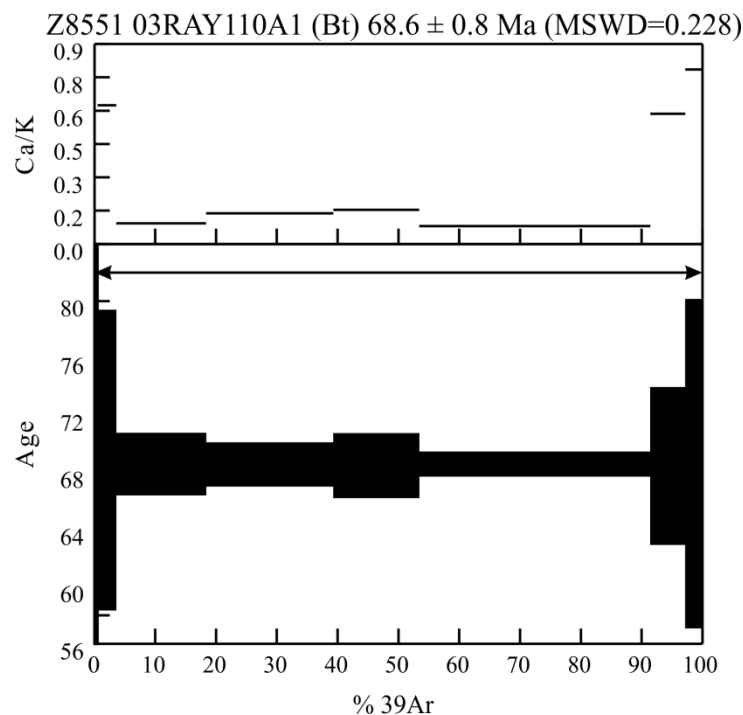
Date analyzed: October 25, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 03RAY110A1

Lithology: Andesite

Mineral analyzed: Hornblende

Age: 68.4 ± 1.0 Ma (± 1.0 Ma without J-error)

Interpretation: Igneous Crystallization

Geochronology Lab Number: 8551

Argon Number: 2423

Location: on top of Henderson Dome

UTM Zone 7 - 597615 E 7040584 N; NTS sheet 1150/6

Unit Name (if available): Carmacks Group

Geologist: S. Gordey

Sample Description:

Hornblende-phyric andesite. The analyzed aliquot consisted of ten clean and fresh black grains (300-700 μ m each).

Results:

One aliquot analyzed, giving a flat, multistep plateau comprising 99% of the released gas, MSWD=0.439.

Analytical details:

Irradiation Batch: GSC #51

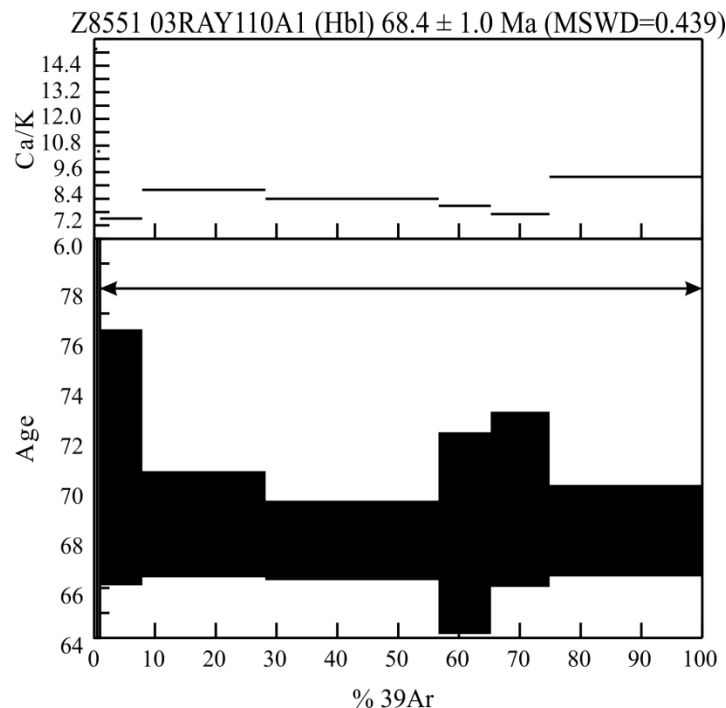
Date analyzed: October 25-26, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 96CH-MN1

Yukon Minfile 115I 064

Lithology: Dacite porphyry

Mineral analyzed: Whole Rock

Age: 68.5 ± 1.2 Ma

Interpretation: Igneous Crystallization or possibly Reset

Geochronology Lab Number: 4609

Argon Number: 908

Location: Brown-McDade deposit

UTM Zone 8 - 380982 E 6885680 N; NTS sheet 115I/3

Unit Name (if available): Mt. Nansen dykes

Geologist: C. J. R. Hart

Sample Description:

Unaltered, medium grey, slightly vitreous dacite porphyry dyke, weak flow lines, up to 10% translucent green feldspar with good crystal faces; age expected to be about 100 Ma. The analyzed grains were grey to black, fine-grained, sugary textured fragments with tiny black speckles evenly disseminated throughout.

Results:

Two aliquots analyzed (spectra in Fig. A below). Aliquot A had a flat 4-step plateau at 68.5 Ma but with final step at 75 Ma. Aliquot B was slightly hump-shaped, but most steps were in the age range of the Aliquot A plateau. Age is from pseudo-plateau regions of both runs, 79.5% of gas. Inverse isochron including most steps from both aliquots gave the same age (Fig. B). The age results are younger than had been expected.

Analytical details:

Irradiation Batch: GSC #23

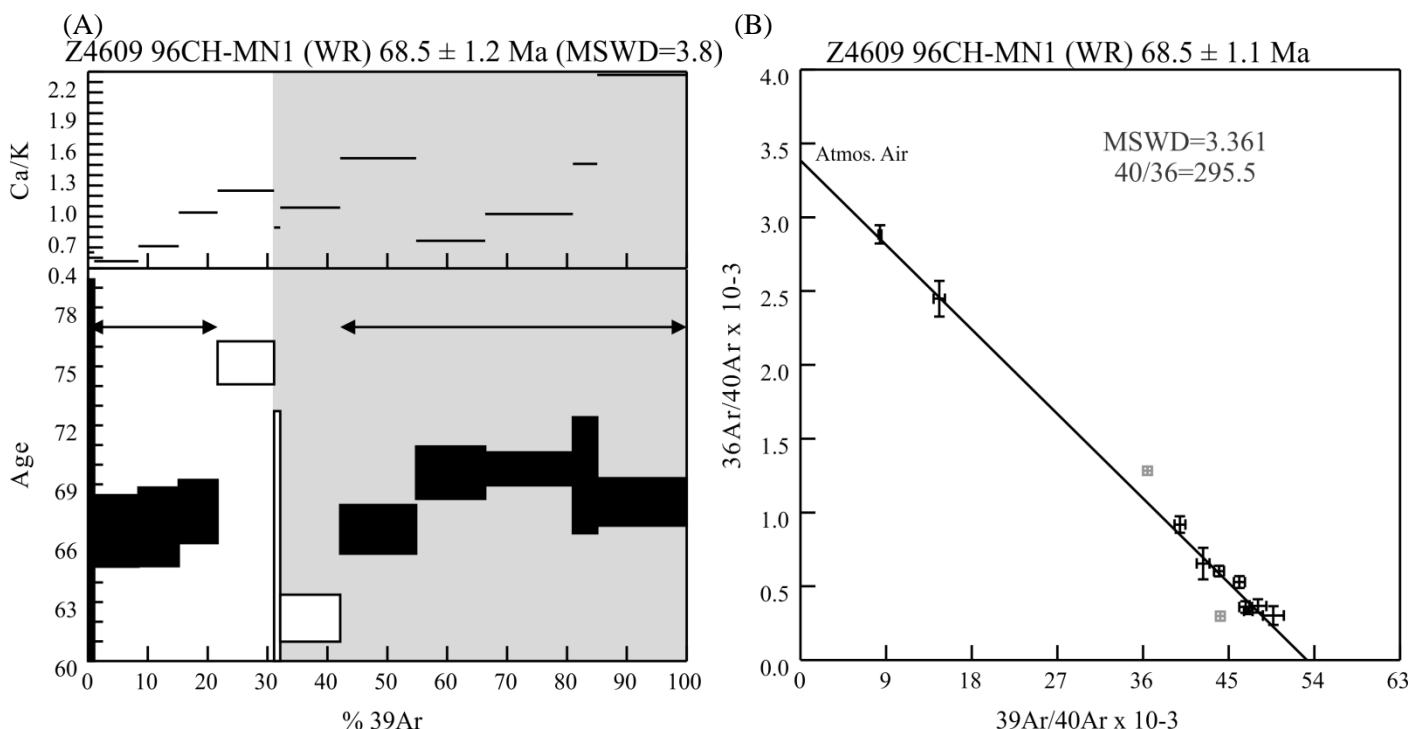
Date analyzed: July 31, 1997

Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 97CH-25-1A

Yukon Minfile 115J 017

Lithology: Granodiorite

Mineral analyzed: Biotite

Age: 67.6 ± 1.0 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 4709

Argon Number: 981

Location: Mt. Cockfield, collected from drill core

UTM Zone 7 - 628721 E 6952419 N; NTS sheet 115J/9

Unit Name (if available): Cockfield Porphyry

Geologist: C. J. R. Hart

Sample Description:

Fine- to medium-grained, slightly porphyritic hornblende granodiorite, disseminated and fracture coatings of chalcopyrite and pyrite. The analyzed biotite grains were small, anhedral, fragile, thin black flakes.

Results:

Age is based on combined multistep flat plateaus for two aliquots, comprising 100.0 % of released ^{39}Ar gas, MSWD=0.455

Analytical details:

Irradiation Batch: GSC #25

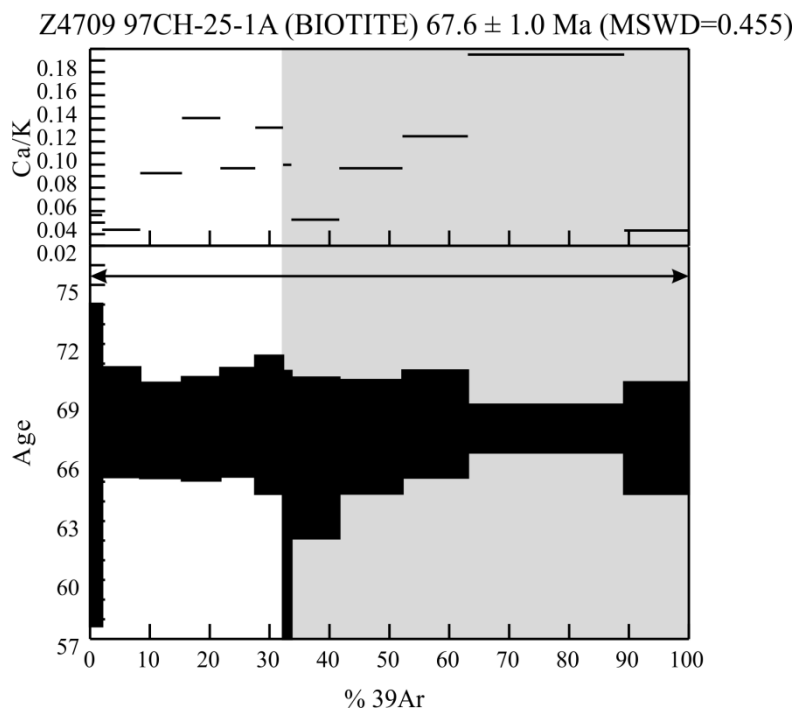
Date analyzed: February 10, 1998

Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 97CH-25-1b
Lithology: Biotite quartz monzonite
Mineral analyzed: Biotite
Age: 68.2 ± 0.8 Ma
Interpretation: Igneous Cooling

Yukon Minfile 115J 017

Geochronology Lab Number: 4710
Argon Number: 982
Location: Mt. Cockfield, collected from drill core
UTM Zone 7 - 628721 E 6952419 N; NTS sheet 115J/9
Unit Name (if available): Cockfield Porphyry
Geologist: C. J. R. Hart

Sample Description:

Main phase K-feldspar porphyritic biotite quartz monzonite. Biotite grains selected for analysis were large, anhedral, shiny black flakes.

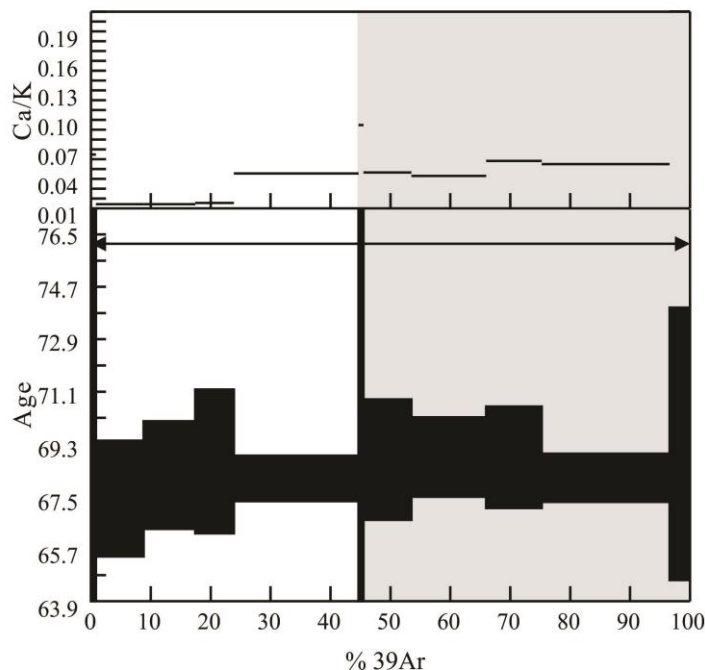
Results:

Two aliquots were run, both giving flat reproducible multistep plateaus comprising 100.0% of ^{39}Ar gas released. The age is based on all gas steps from both aliquots, MSWD=0.295.

Analytical details:

Irradiation Batch: GSC #25
Date analyzed: February 11, 1998
Monitor used: FCT-San
Laser used: Weck® CO₂ 45W surgical laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module

Z4710 97CH-25-1b (BIOTITE) 68.2 ± 0.8 Ma (MSWD=0.295)



Sample Number: VN-02-K06
Lithology: Biotite syenite
Mineral analyzed: Biotite
Age: 69.1 ± 0.5 Ma
Interpretation: Igneous Crystallization

Geochronology Lab Number: 7571
Argon Number: 2008
Location: On ridge to the east of creek head below Apex Mountain
UTM Zone 7 - 652466 E 6929561 N; NTS sheet 115J/8
Unit Name (if available): Prospector Mountain suite
Geologist: C. J. R. Hart

Sample Description:

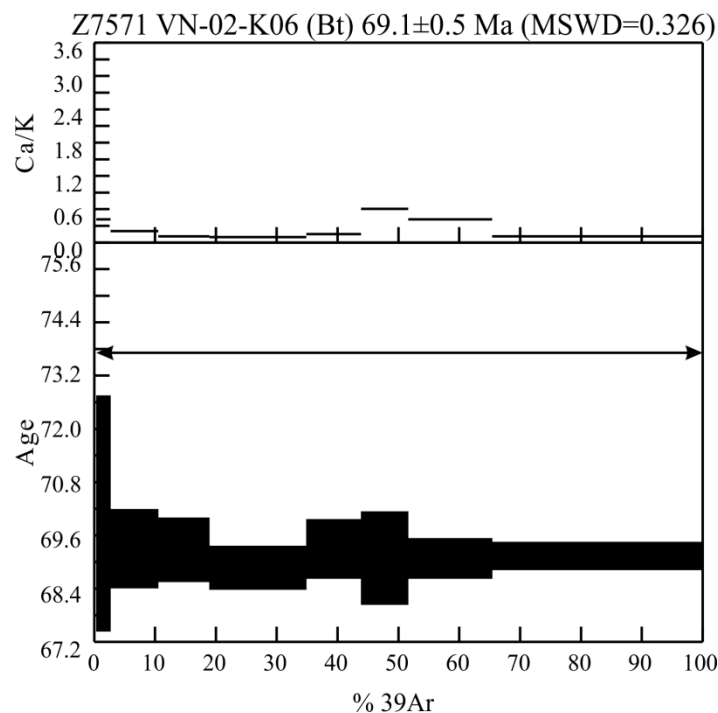
Previously unmapped biotite syenite, intruding Carmacks Volcanics. Grains selected for analysis were excellent quality thick dark brown books, many of which were euhedral.

Results:

Robust multi-step plateau gives age of 69.1 ± 0.5 Ma, including 99% of released ^{39}Ar gas on one aliquot, MSWD = 0.326.

Analytical details:

Irradiation Batch: GSC #45
Date analyzed: December 23, 2003
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Paleocene - Eocene rocks

The Rhyolite Creek complex (referred to in the Stewart River sheet by Gordey and Ryan (2005) as the Ross Group), occurs sporadically as hypabyssal intrusions (commonly north-south trending dykes) across west-central Yukon Plateau (Fig. 10). Four samples from this suite (Appendix 1) all yielded ages between 57 and 55 Ma. These rocks are generally not known to be mineralized across west-central Yukon plateau, suggesting that most economic mineral-forming events are pre-Eocene. However, recent work in the Ruby Range in the Kluane Lake region (eg. Israel et al., 2011) demonstrated that the Ruby Range batholith and the Rhyolite Creek complex are consanguineous, and in that area appear to have good porphyry and epithermal mineral potential.

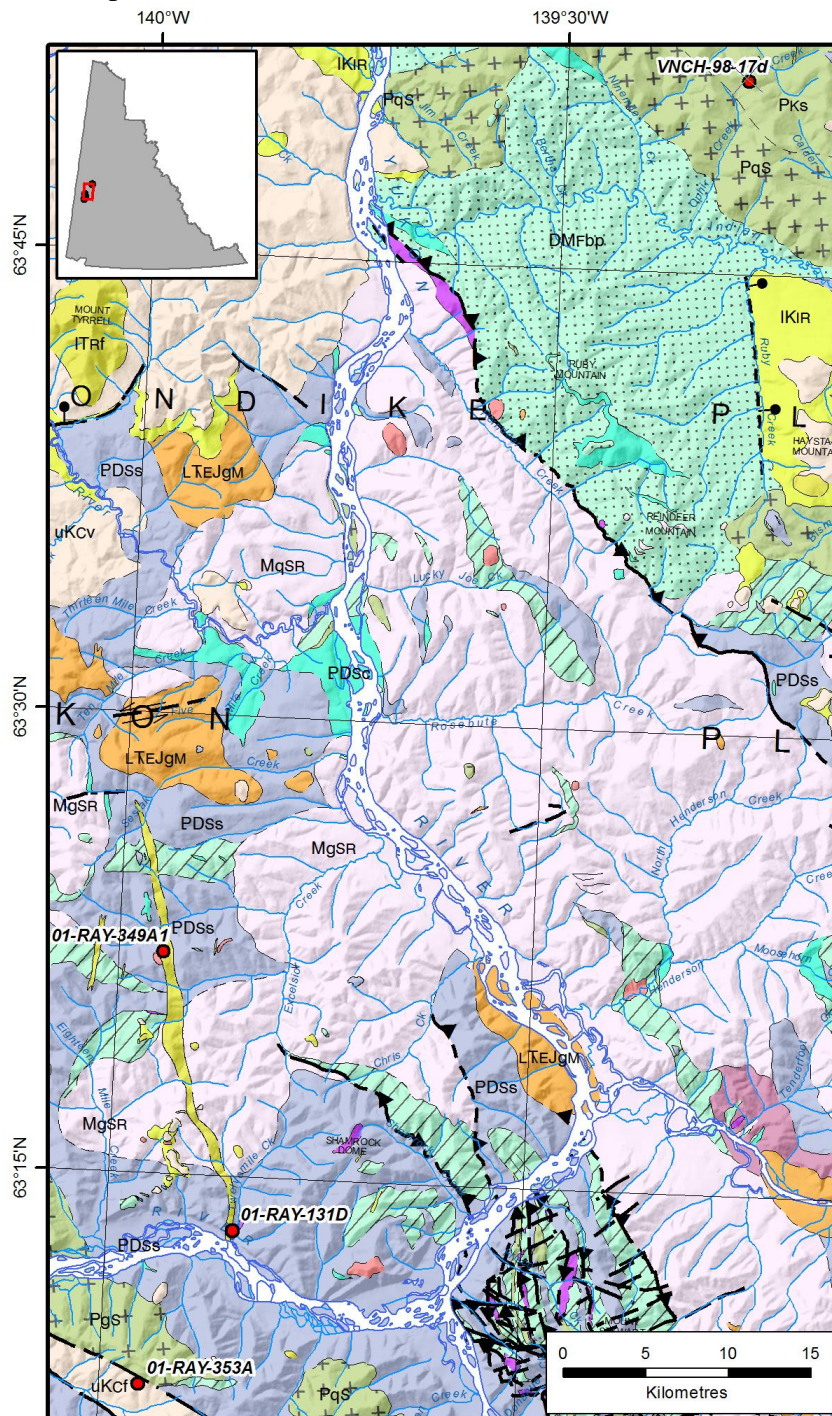


Figure 10. Geological map of part of the Stewart River area showing location of samples yielding Paleocene-Eocene ages. Geology from Yukon Geological Survey, www.geology.gov.yk.ca.

Sample Number: VNCH-98-17d

Yukon Minfile 1150 073

Lithology: Diabase dyke

Mineral analyzed: Whole Rock

Age: 57.6 ± 0.4 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 5884

Argon Number: 1388

Location: Klondike; Violet Veins

UTM Zone 7 - 584579 E 7081973 N; NTS sheet 1150/14

Unit Name (if available): Rhyolite Creek assemblage

Geologist: C. J. R. Hart

Sample Description:

Diabase dyke; the whole rock grains that were analyzed were dark to black fragments with clear inclusions.

Results:

Five aliquots were run with four heating steps each. Age is based on the fusion steps of each aliquot only, representing ~41% of total ^{39}Ar released, MSWD=2.428. Excess ^{40}Ar was seen in lower temperature steps. Inverse isochron age is slightly younger at 56.7 ± 0.8 Ma, MSWD=4.885, $^{40}\text{Ar}/^{36}\text{Ar}=343 \pm 5$. The 57.6 ± 0.4 Ma age is, therefore, probably a maximum age of crystallization.

Analytical details:

Irradiation Batch: GSC #32

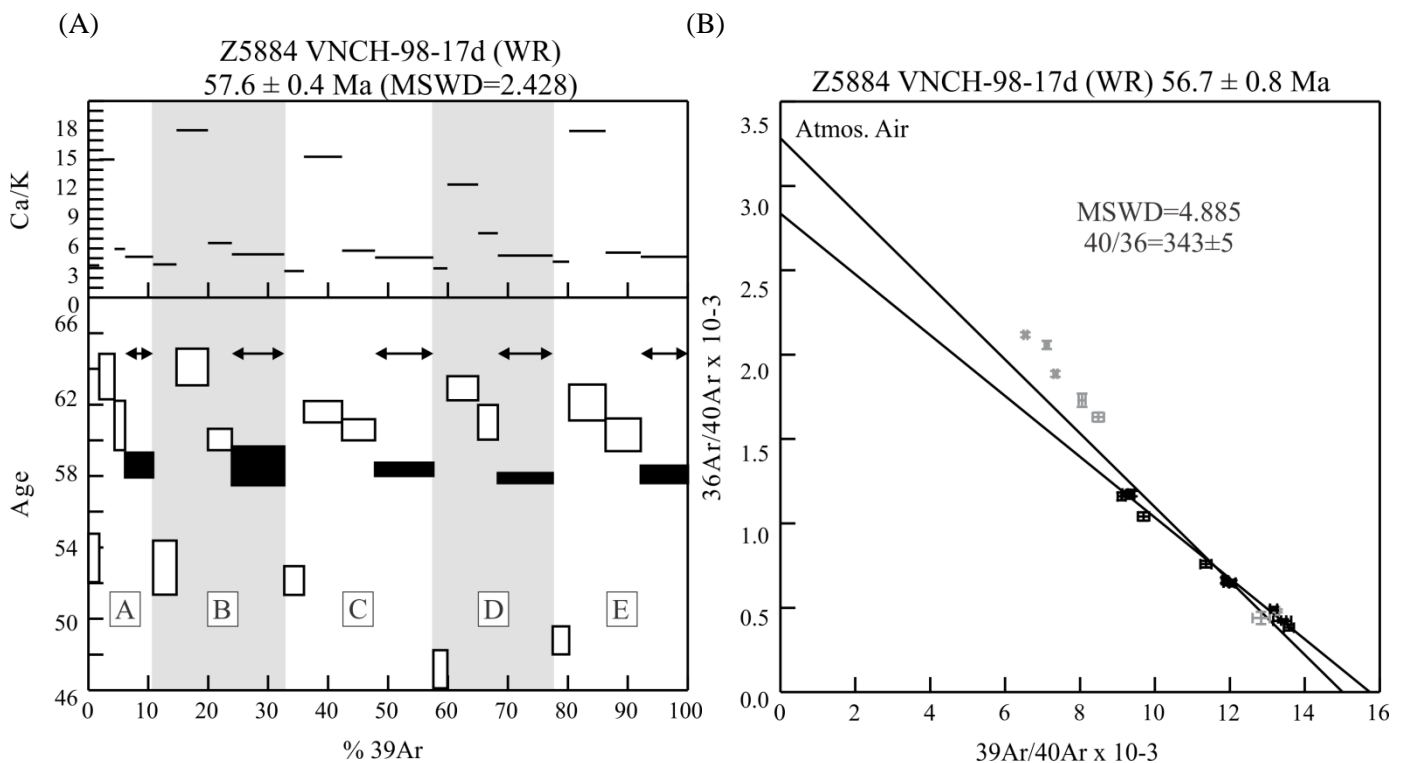
Date analyzed: February 7-9, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 01-RAY-131D
Lithology: Quartz-feldspar porphyry
Mineral analyzed: K-feldspar
Age: 55.1 ± 0.4 Ma
Interpretation: Igneous Crystallization

Geochronology Lab Number: 7370
Argon Number: 2408
Location: Los Angeles Creek
UTM Zone 7 - 557774 E 7010692 N; NTS sheet 1150/4
Unit Name (if available): Rhyolite Creek assemblage
Geologist: J. J. Ryan

Sample Description:

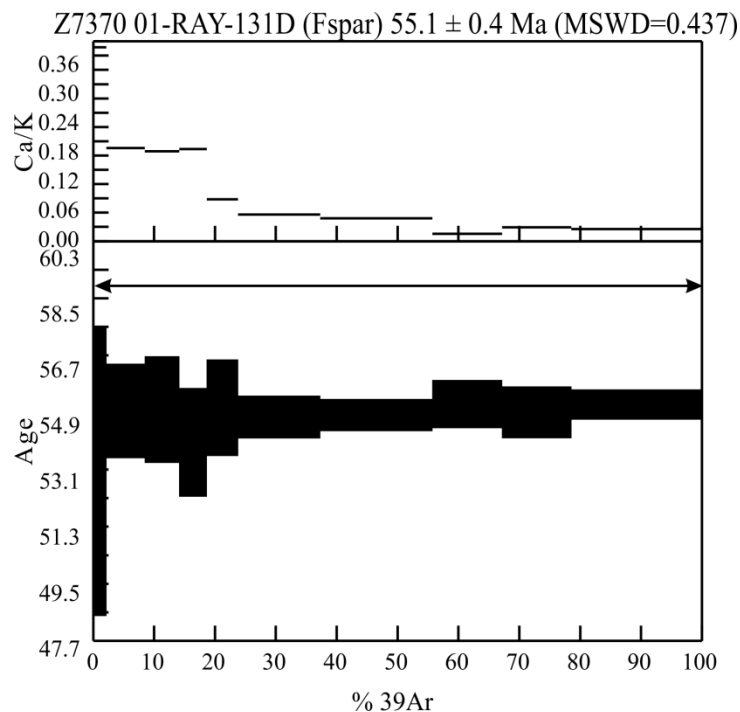
Hypabyssal quartz-feldspar porphyry; the least sericitized feldspar grains were selected for analysis.

Results:

One aliquot of 5 grains was analyzed, giving a flat, multistep plateau consisting of 100% of the released ^{39}Ar gas (MSWD=0.437).

Analytical details:

Irradiation Batch: GSC #51
Date analyzed: October 5 & 7, 2005
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: 01-RAY-349A1

Lithology: Rhyolite

Mineral analyzed: Whole Rock

Age: 55.9 ± 0.4 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 7374

Argon Number: 2436

Location: Excelsior Creek

UTM Zone 7 - 552564 E 7027287 N; NTS sheet 1150/5

Unit Name (if available): Rhyolite Creek assemblage

Geologist: J. J. Ryan

Sample Description:

Quartz-eye porphyritic rhyolite. The analyzed aliquot consisted of ten 300-500 μ m milky white fragments with minor rusty staining and tiny black inclusions.

Results:

One aliquot was analyzed, giving a flat, multistep plateau, with some irregularity in the lowest temperature steps. Age is calculated by integrating medium and high temperature steps, consisting of 79% of released ^{39}Ar gas (MSWD=0.257).

Analytical details:

Irradiation Batch: GSC #51

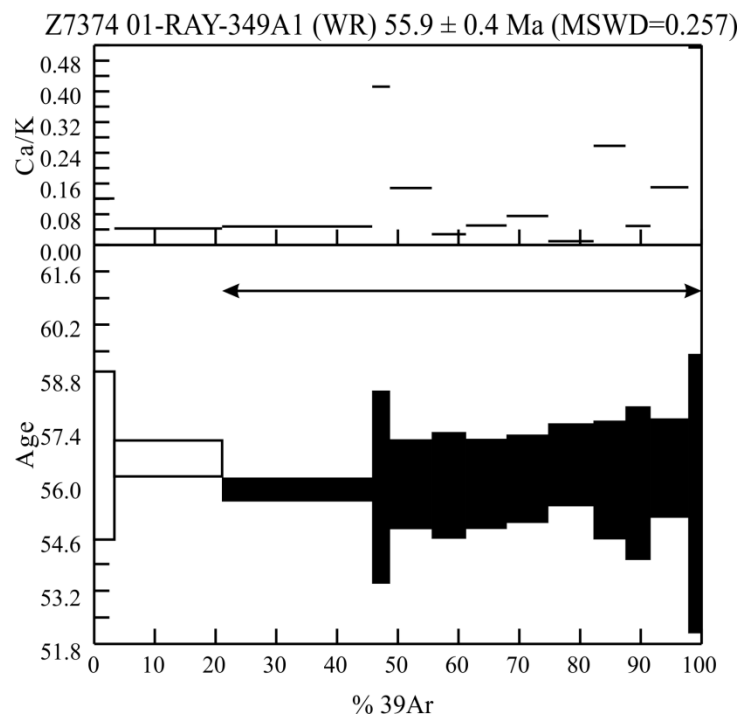
Date analyzed: October 28 & 31, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 01-RAY-353A

Lithology: Felsic volcanic

Mineral analyzed: Biotite

Age: 55.7 ± 0.4 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 7375

Argon Number: 1903

Location: Los Angeles Creek

UTM Zone 7 - 552672 E 7001118 N; NTS sheet 1150/4

Unit Name (if available): Rhyolite Creek assemblage

Geologist: J. J. Ryan

Sample Description:

Highly aphanitic felsic volcanic presumed to be from Carmacks Group. Good quality thick brown biotite was selected for analysis.

Results:

Multi-step, well-defined plateau age consisting of 100.0% of gas released from one aliquot, MSWD=0.683. Age is much younger than the age of Carmacks Group volcanics.

Analytical details:

Irradiation Batch: GSC #45

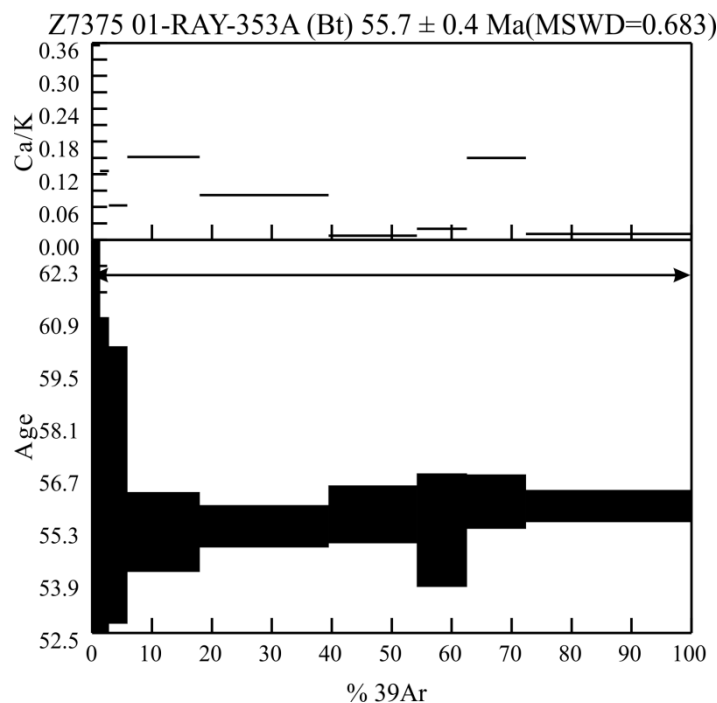
Date analyzed: November 24, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Selkirk Volcanics

Age determinations for two samples from the recent Selkirk Volcanics (Fig. 11) augments previous dating by Nelson et al. (2009) and Jackson et al. (2012) and indicates more complexity than originally considered for this volcanic sequence. Samples VNCH-98-10 and VNCH-98-08a are from flows at Volcano Mountain and yielded ages of 0.5 Ma and 0.1 Ma, respectively, somewhat younger than previous results obtained along the Yukon River. A detailed account of the stratigraphy, and several more ages from the Selkirk Group volcanics can be found in Nelson et al. (2009) and Jackson et al. (2012).

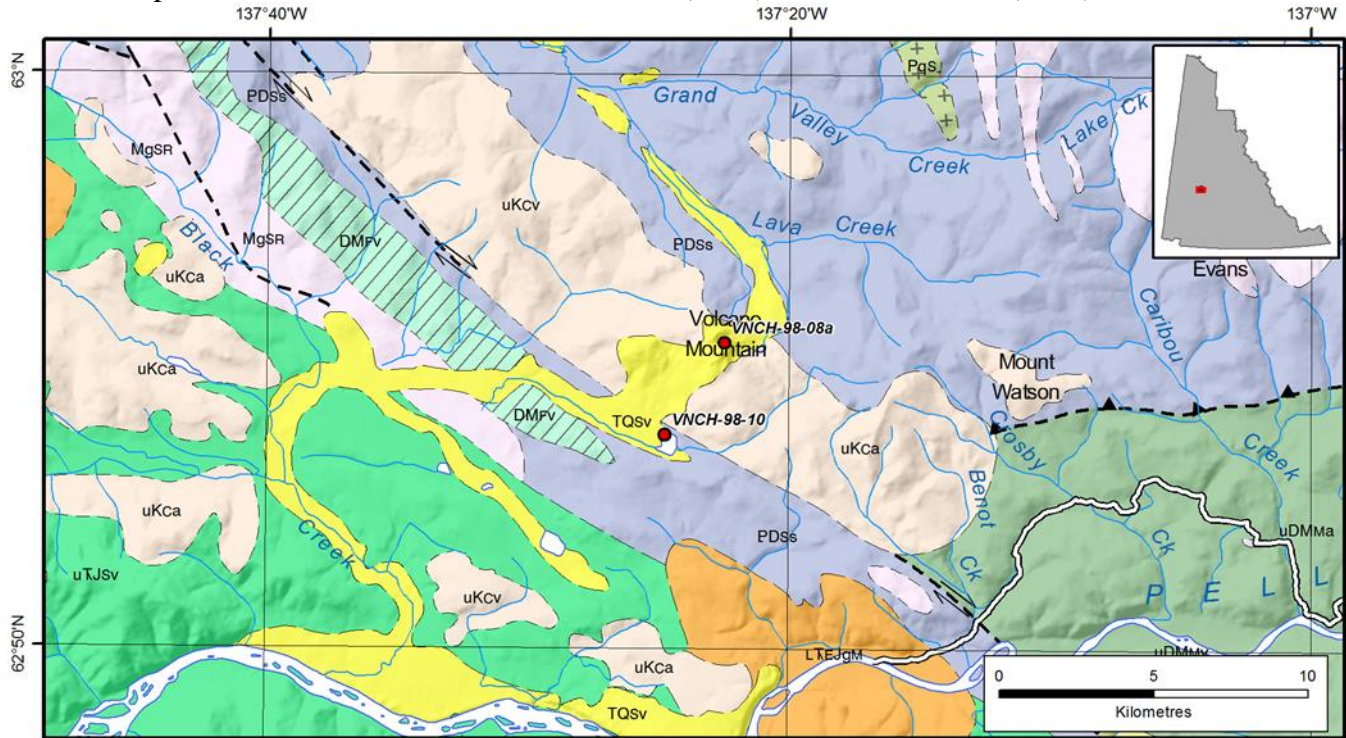


Figure 11. Geological map of Volcano Mountain area showing location of two samples from basalt of the Selkirk Volcanics. Geology from Yukon Geological Survey, www.geology.gov.yk.ca.

Sample Number: VNCH-98-10

Lithology: Basalt Aa flow

Mineral analyzed: Whole Rock

Age: 0.56 ± 0.09 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 5887

Argon Number: 1383

Location: Near small lake in valley

UTM Zone 8 - 377259 E 6976290 N; NTS sheet 115I/14

Unit Name (if available): Fort Selkirk lavas

Geologist: C. J. R. Hart

Sample Description:

Large clinker blocks and bombs collected from near the toe of an Aa flow. Non-vesicular chunk of rare flow material.

Results:

Five aliquots (A-E) were run in total (Fig. A). The first aliquot was slightly disturbed with two highest-temperature heating steps older than 2 Ma. Four additional aliquots with four heating steps each gave flat reproducible plateaus, consistent in age with that of the 3.4% and 4.4% steps in Aliquot A. All five aliquots showed increasing Ca/K with each heating increment. Age is based on the combined plateau regions from all five aliquots (90% of total ^{39}Ar , MSWD=0.600) (also consistent with the inverse isochron age in Fig. B).

Analytical details:

Irradiation Batch: GSC #32

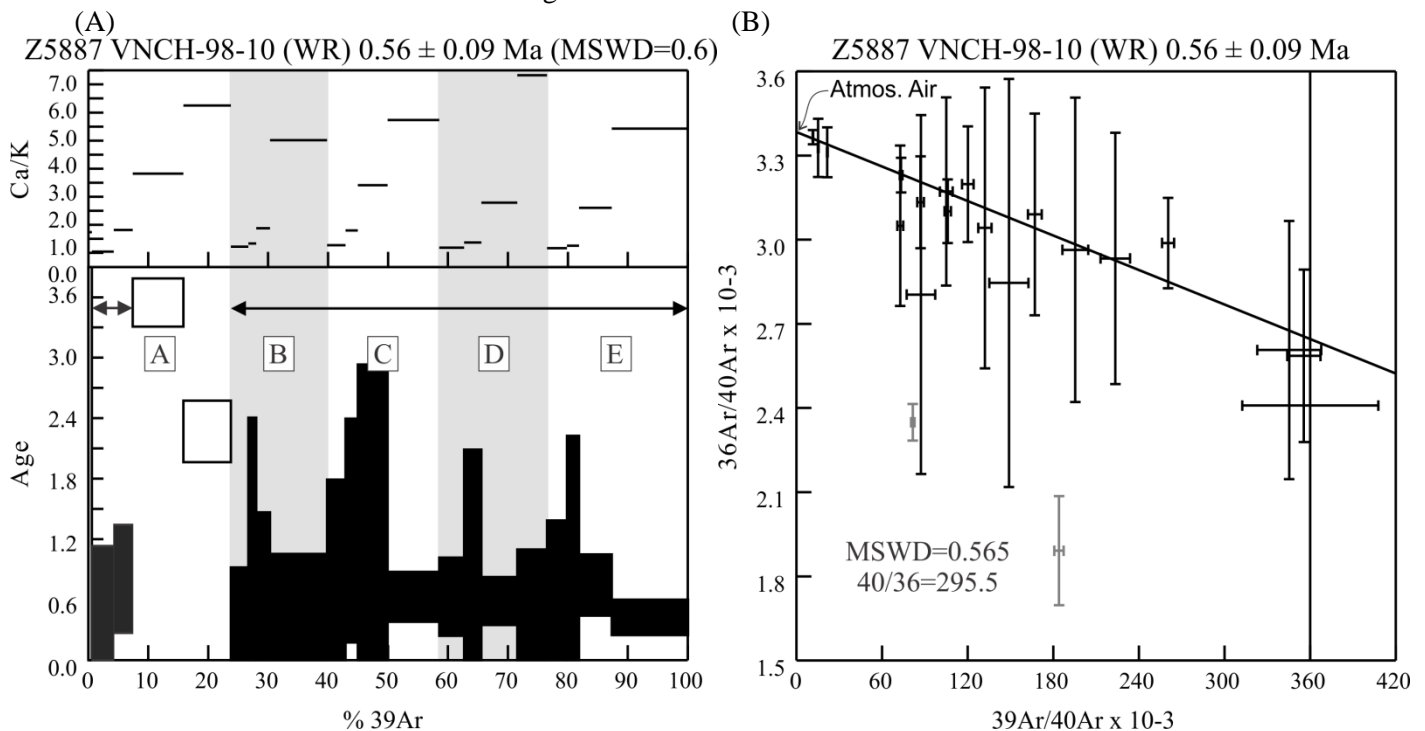
Date analyzed: November 23, 1999

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VNCH-98-08a
Lithology: Basalt flow
Mineral analyzed: Whole Rock
Age: 0.078 ± 0.031 Ma
Interpretation: Igneous Crystallization

Geochronology Lab Number: 5896
Argon Number: 1409
Location: Volcano Mountain, north side of saddle connecting two peaks
 UTM Zone 8 - 379284 E 6979204 N; NTS sheet 115I/14
Unit Name (if available): Selkirk Lavas
Geologist: C. J. R. Hart

Sample Description:

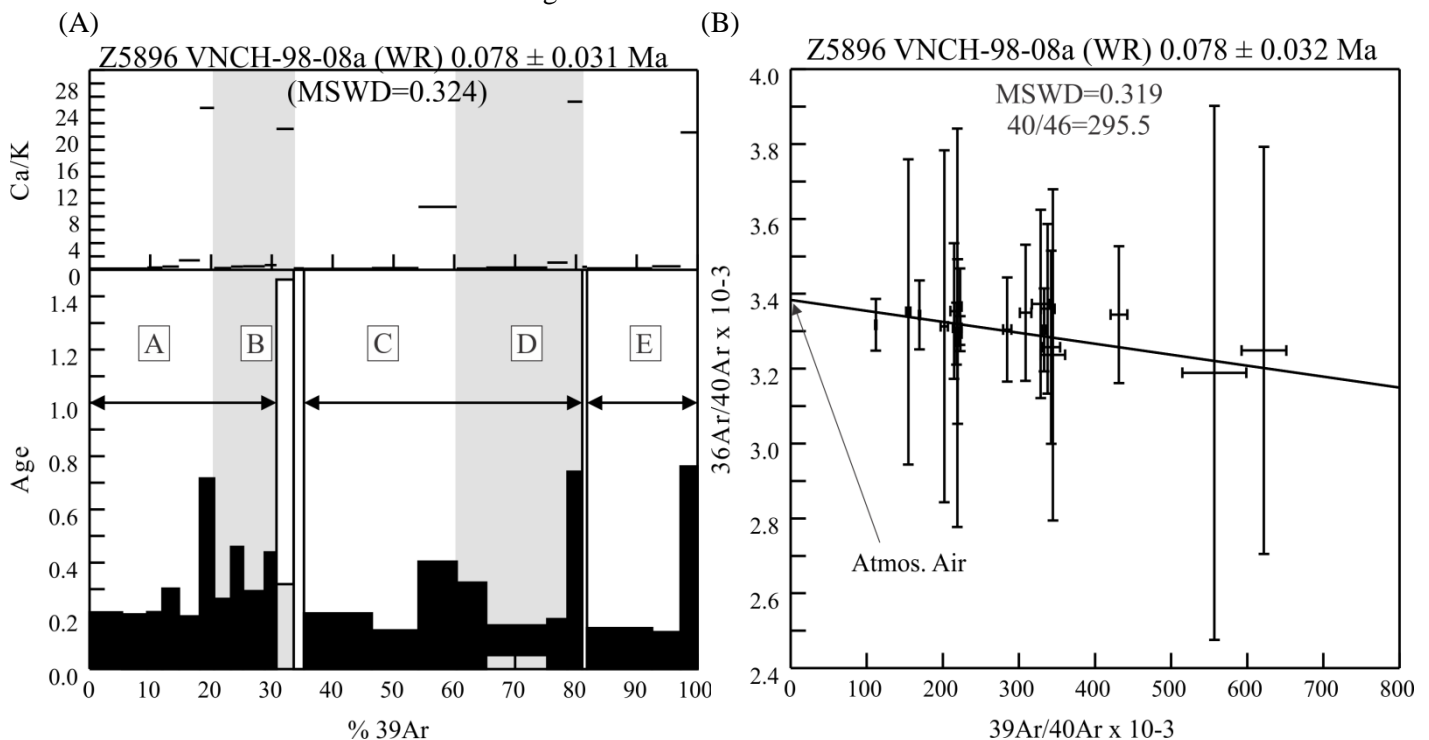
Youngest flow at Volcano Mountain, lying in incised cinder cone. Massive, phenocryst-poor, less dense, but slightly altered flow. Grains selected for analysis were dark brown with white to clear inclusions.

Results:

Five aliquots were run, with 4 to 6 heating steps carried out for each (Fig. A). All five aliquots contained elevated atmospheric argon in all steps, and high Ca/K in their final fusion steps. Age is based on 95% of ^{39}Ar released from plateau regions of all five aliquots, MSWD=0.324. Data on the inverse isochron plot (Fig. B) fall along the atmospheric line clustering close to the y-intercept, yielding an age indistinguishable from the plateau age. Imprecision of the age is due to low radiogenic ^{40}Ar content of the sample (between 8×10^{-9} and 8×10^{-7} nmoles), and large errors (0.5% to 10% at 2σ) in the measurement of small ^{36}Ar peaks (between 5×10^{-9} and 7×10^{-8} nmoles).

Analytical details:

Irradiation Batch: GSC #32
 Date analyzed: November 24-25, 1999
 Monitor used: FCT-San
 Laser used: Merchantek® MIR-10 CO_2 laser
 Instrument used for analysis: GSC VG3600
 Data reduction software used: GSC GRID Argon module



Mineralization events

In this report, we present age results for samples that were collected specifically to constrain the timing of mineralization events across west-central to southeast Yukon. The results are described below, broken out by areas or mineral camps:

Dawson Range

Carmacks Copper at Williams Creek

Sample VNCH-98-14a is hydrothermal biotite that preferentially formed along the margins of a pegmatite near Williams Creek and yields an age of 197 Ma, which is identical to ages of magmatism (U-Pb zircon) obtained by Tafti and Mortensen (2004) and Hood (2012) for the Minto suite (see earlier section). It is not clear if this directly dates hydrothermal activity associated with mineralization at Carmacks Copper, or if it is merely dating magmatism.

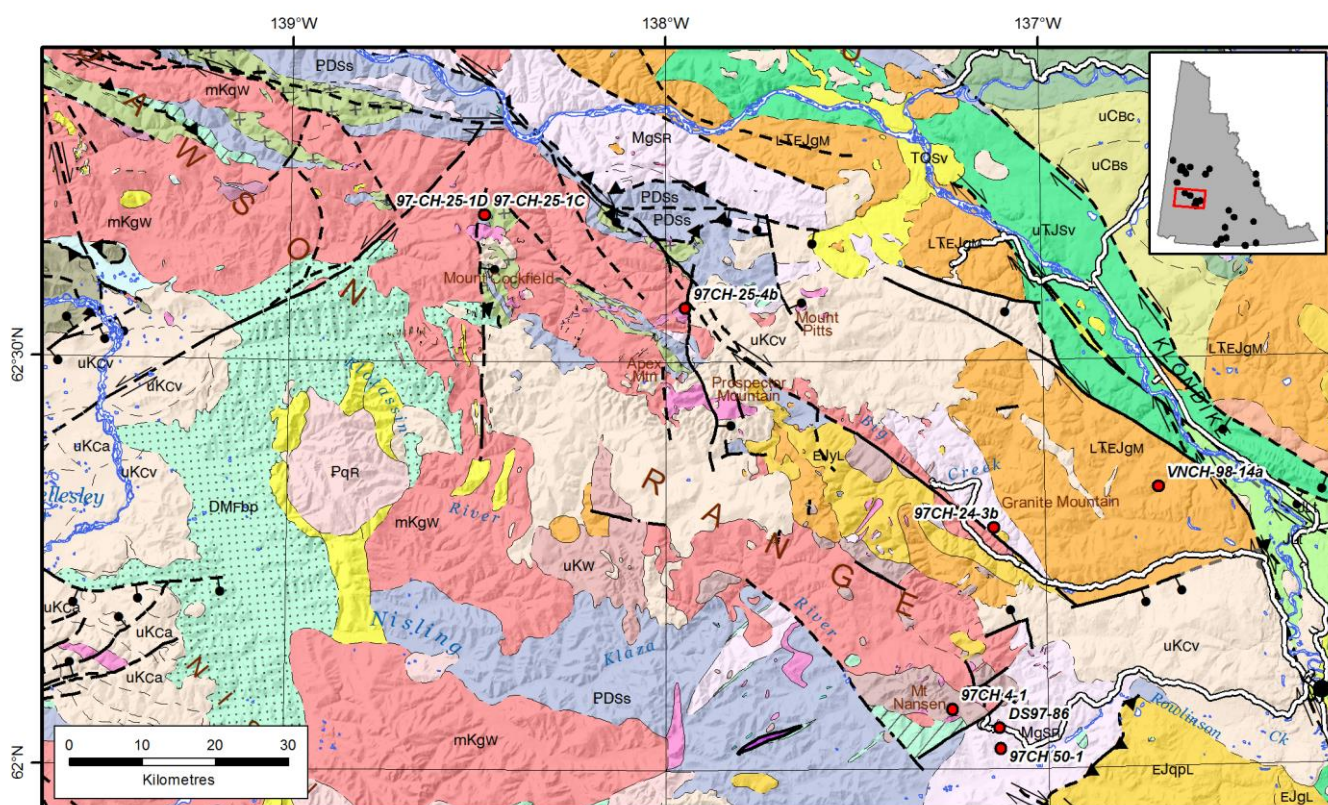


Figure 12. Geological map of eastern Dawson Range showing location of samples collected from mineralized occurrences. Geology from Yukon Geological Survey, www.geology.gov.yk.ca.

Mount Nansen

Several samples from the Mount Nansen mineral district were collected to unravel the complex magmatic and mineralization history of this important region. The few samples and analyses provided here emphasize that diversity and complexity. The Mount Nansen volcanic complex is known to be mid-Cretaceous in age, and exemplifies the complexity of this region's mineralization (Hart and Langdon, 1998). The mineralization age is also mid-Cretaceous, having been constrained using U-Pb methods by Mortensen

et al. (2003). The $^{40}\text{Ar}/^{39}\text{Ar}$ ages provided here indicate the potential for a late Cretaceous intrusive and mineralizing event between 80 and 65 Ma; possibly attributable to either or both Casino suite or Prospector Mountain suite events. Biotite from gneiss of underlying Yukon-Tanana terrane retains a Jurassic age, indicating that it has not been overprinted by thermal effects from the younger mineralizing events.

Revenue/Nucleus

Samples analyzed from this region were to enhance our understanding of the complex magmatic and metallogenic evolution of this region. The samples yield five Late Cretaceous ages that confirm similar timing between leucocratic magmatism and mineralization at the Revenue and Nucleus deposits. These ages are consistent with findings of other workers in this region (e.g. Bennett et al., (2010), Allan et al., (2013)) and indicate the importance of Late Cretaceous Casino suite magmatism as a regional mineralization event.

Mount Freegold

Mineralization in the Mount Freegold area is variably associated with different magmatic events, but constraining the ages of both magmas and ores has been difficult and complex. The age of the skarn mineralization at the Augusta deposit is best constrained by the age of the most proximal intrusion which yields biotite and hornblende ages of ca. 97 Ma. The hornblende age of 121 Ma from sample 97CH-24-3b is older than the skarn mineralization. The gas release spectra were slightly humped for this sample, which is often indicative of excess ^{40}Ar ; however, the data fell along the atmospheric line on the inverse isochron diagram and, therefore, the anomalously old age cannot be attributed to presence of excess ^{40}Ar . The 121 Ma hornblende may, thus, be xenocrystic. At the Antoniuk deposit, the dyke cutting the breccia is older than 92 Ma and constrains the age of this deposit to mid-Cretaceous. The Laforma epithermal gold deposit clearly indicates a Late Cretaceous age, similar to the Casino suite.

Mount Cockfield and TAD

There are various types of mineralization in western Dawson Range (Fig. 12). The Casino deposit and associated Patton Porphyry are clearly 74 Ma, and anchor the age of the Casino suite regionally. The Mount Cockfield intrusion and related mineralization appear to be younger, at about 69 Ma. The 76 Ma age for biotite from a Sonora Gulch porphyry intrusion (sample 97CH 31-4) is consistent with four U-Pb ages on dykes and stocks at Sonora Gulch published by Bennett et al. (2010), and confirms its association with the Casino magmatic event. The TAD porphyry yielded an unexpected age of ca. 85 Ma (imprecise inverse isochron biotite age); however, the analyzed grains were slightly altered in appearance and gave hump-shaped release spectra, which calls into question as to whether it is a meaningful age. The TAD porphyry is clearly younger than the host coarse-grained Coffee Creek quartz monzonite which is 101 Ma, and is similar in appearance to porphyries at Sonora Gulch. The oldest mineralization in this region appears to be that in the Patt pluton at ca. 107 Ma which is a weakly-developed molybdenum porphyry in a leucogranite with hornblende-bearing marginal phases.

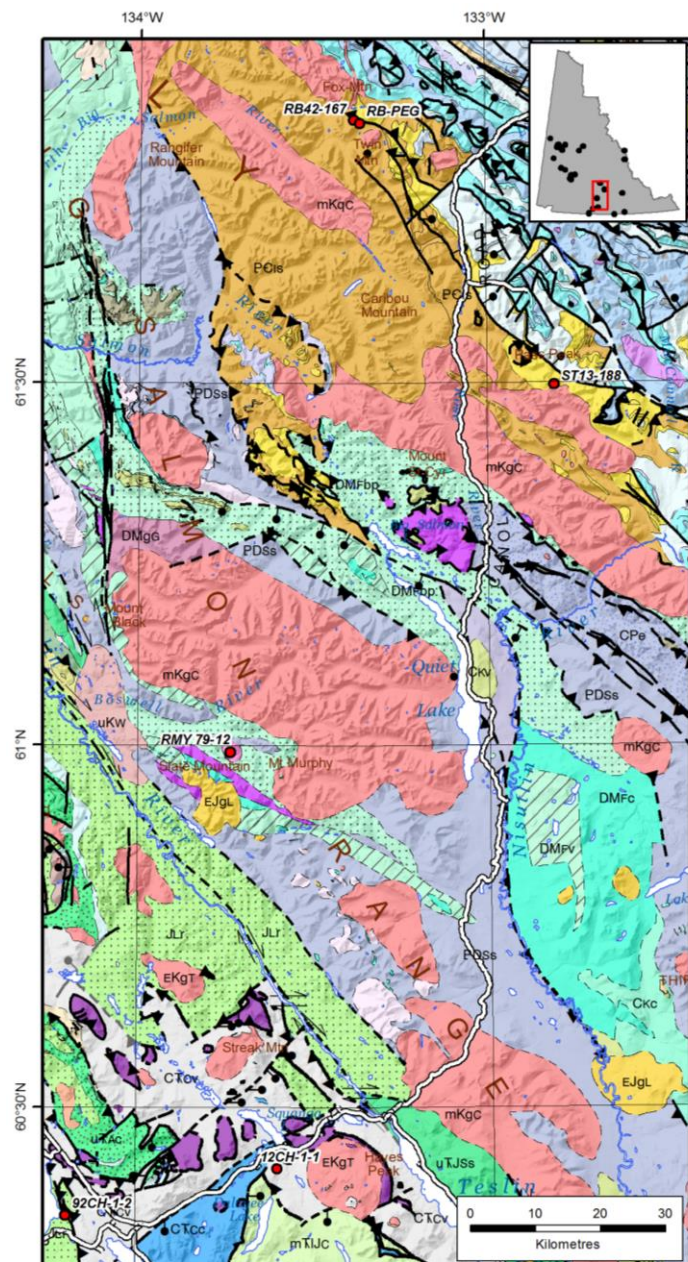
Klondike

Efforts to confidently constrain the ages of gold mineralization in the Klondike region (**Fig. 13**) are notoriously challenged by the region's complex thermal and cooling history as indicated in Mortensen (1990), Hunt and Roddick (1992), Breitsprecher and Mortensen (2004), and J. Mortensen (unpublished data, 2012). Results for Klondike samples presented herein reflect this tectonothermal complexity, as the ages for mineralization range from ~180 Ma at the Virgin and Violet occurrences at the older end of the spectrum, to ~162 Ma at Bear Creek, to ~152 Ma at the Lloyd occurrence and to ~145 Ma for the Sheba and Mitchell occurrences at the younger end. The older ages are not dissimilar to 186-175 Ma ages for pegmatite phases. The overall range of mineralization ages is not dissimilar to the range of ages for regional cooling, with the exception of the comparatively younger 134-138 Ma ages from the Lower Dominion area. Ages for fuchsite, a mineral that forms in carbonated mafic rocks (listwaenites), provide indications of a young thermal or cooling history at ca. 115-90 Ma.

Red Mountain Moly

The Red Mountain molybdenum deposit represents a large mineral deposit in an isolated pluton (Fig. 14). Sinclair (1986) originally reported dates of 87 Ma for the Red Mountain molybdenum deposit; however, biotite and whole rock aliquots from three samples of similar porphyritic rocks presented here yield $^{40}\text{Ar}/^{39}\text{Ar}$ ages of 81 Ma (biotite), 79 Ma (whole rock) and 74 Ma (whole rock). The biotite analysis showed minor Ar loss but otherwise gave robust flat multi-step plateaus at 81.2 ± 0.9 Ma. The 74 Ma whole rock age for the fresh porphyry was unexpected because the rock is lithologically similar to the older mineralized phases. The age is considered robust, as it yields a concordant inverse isochron age; this unit probably represents a much younger phase which may be responsible for much of the partial resetting that the other rocks have undergone.

Figure 14. Geological map of south-central Yukon showing location of samples collected from mineralized occurrences. Geology from Yukon Geological Survey, www.geology.gov.yk.ca.



Montana Mountain Massif

This region is largely underlain by the Montana Mountain volcanic complex which has been shown to be mid-Cretaceous in age (97 Ma) but locally includes late felsic volcanism at 84.4 Ma (Hart, 1995) (Fig. 15). The massif is peppered with auriferous and argentiferous polymetallic quartz-sulphide veins. The largest of these, the Venus vein, gives a $^{40}\text{Ar}/^{39}\text{Ar}$ age of 71 Ma and the nearby Arctic Caribou yields a similar age of 69 Ma, indicating that mineralization here is Late Cretaceous in age and not related to the mid-Cretaceous volcanic event that formed the rocks that created the mountain. The nearby Carcross pluton is approximately 68 Ma, similar to the age of the Prospector Mountain suite.

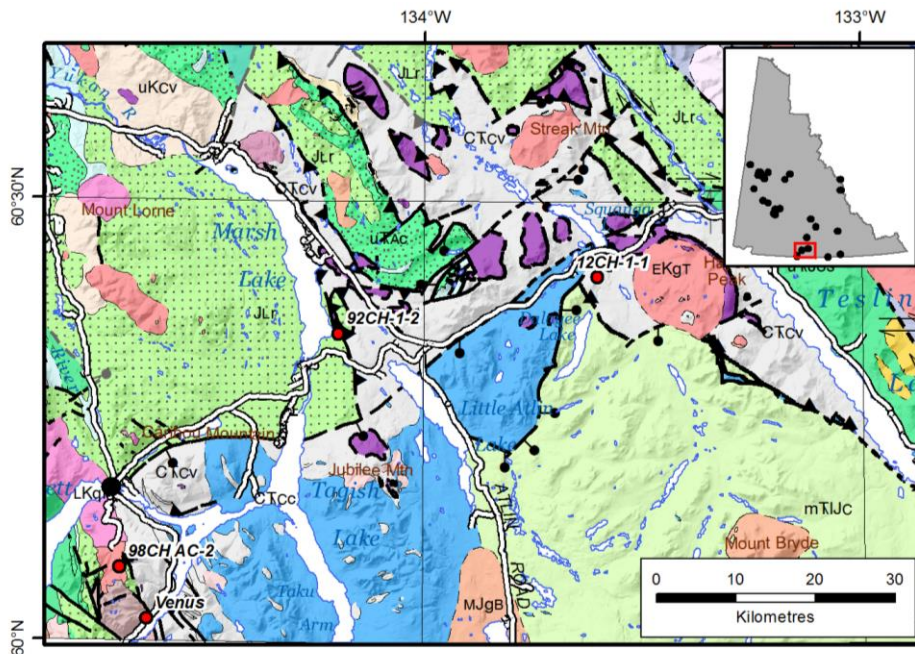


Figure 15. Geological map of Tagish Lake area showing location of samples collected from mineralized occurrences. Geology from Yukon Geological Survey, www.geology.gov.yk.ca.

South Yukon (Jake's Corner) Listwaenite

The TOG and BUG localities are highly metasomatized basalts and ultramafic rocks that are likely parts of the Cache Creek terrane (Figs. 14 and 15). These rocks have been altered as a result of interactions with carbonic fluids associated with gold mineralization. These listwaenite zones of alteration are characterized by bright green Cr-fuchsitic micas. The fuchsite $^{40}\text{Ar}/^{39}\text{Ar}$ ages obtained for BUG and TOG were 84 Ma and 112 Ma, respectively, which suggest a general Cretaceous timing for this fluid event. Considering that the generally-accepted timing of obduction of the Cache Creek terrane is in the early Jurassic, these Cretaceous ages suggest the fuchsite may have been subjected to later thermal disturbances, in which case they would not be considered reliable for dating the original gold mineralizing event. Masliwec et al. (1985) and Smith et al. (1993) have reported cases in which fuchsite samples from listwaenites in the Abitibi Greenstone Belt have yielded $^{40}\text{Ar}/^{39}\text{Ar}$ ages that significantly post-date mineralization. See Hart (1996) for a description of the TOG.

Tombstone Gold Belt

A number of samples were collected from the Tombstone Gold belt for $^{40}\text{Ar}/^{39}\text{Ar}$ dating to constrain ages of magmatism and mineralization and to compare to U-Pb zircon ages from similar rocks (Fig. 16). The Dublin Gulch pluton age is slightly older at ca. 97 Ma, in comparison to other plutons in the region. The age of Scheelite Dome mineralization is confirmed at 92 Ma. The Big Creek pluton yields a ca. 91 Ma age that is similar to the ages of other plutons in the Clear Creek area. Additional information on the geochronology of these rocks can be found in the PhD theses of Mair (2004) and Hart (2004), and in Marsh et al. (2003).

The Brewery Creek samples (Figs. 13 and 16) unfortunately exhibit complex ^{39}Ar release systematics and in most cases, did not return meaningful results. Roscoelite occurs as an alteration mineral formed in direct association with the hydrothermal event; however, the roscelite samples from this study yield ages that are much older than anticipated (>304 Ma and 343 Ma). The roscelite likely pseudomorphed pre-existing detrital biotite, and the ages reflect both partial preservation of the inherited component, and the thermal overprint by the significantly younger hydrothermal event. Hydrothermal muscovite from within a quartz vein yielded a 92.9 ± 0.6 Ma age for this event.

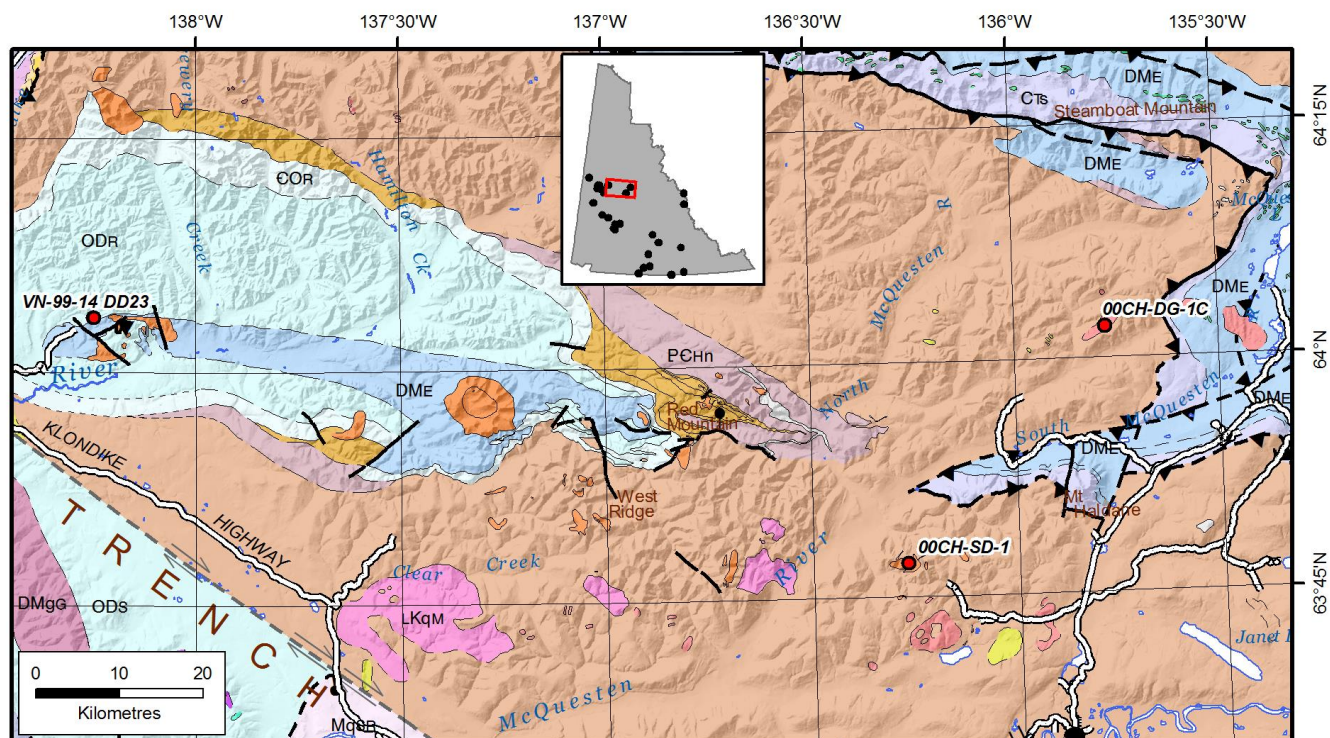
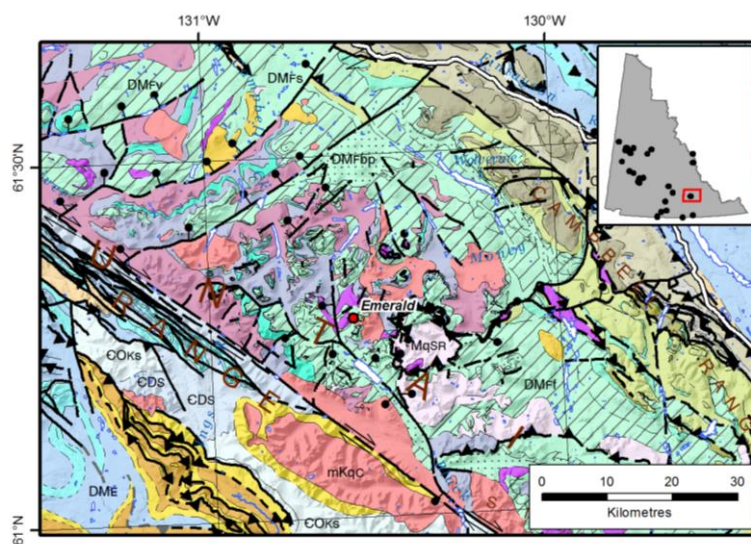
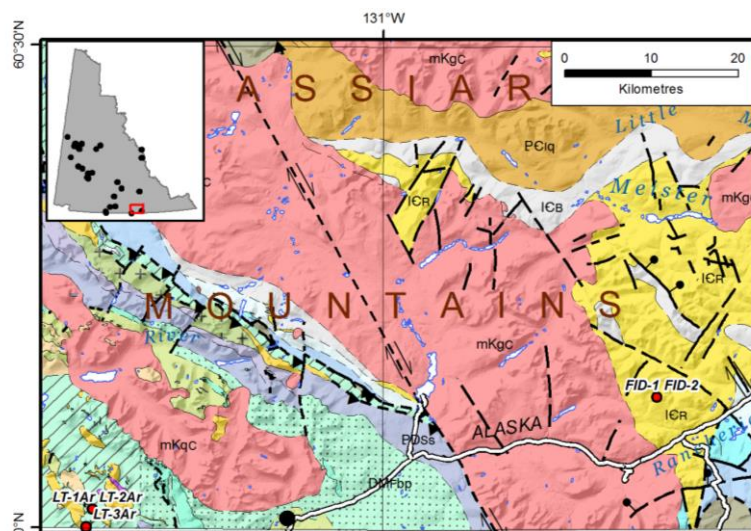
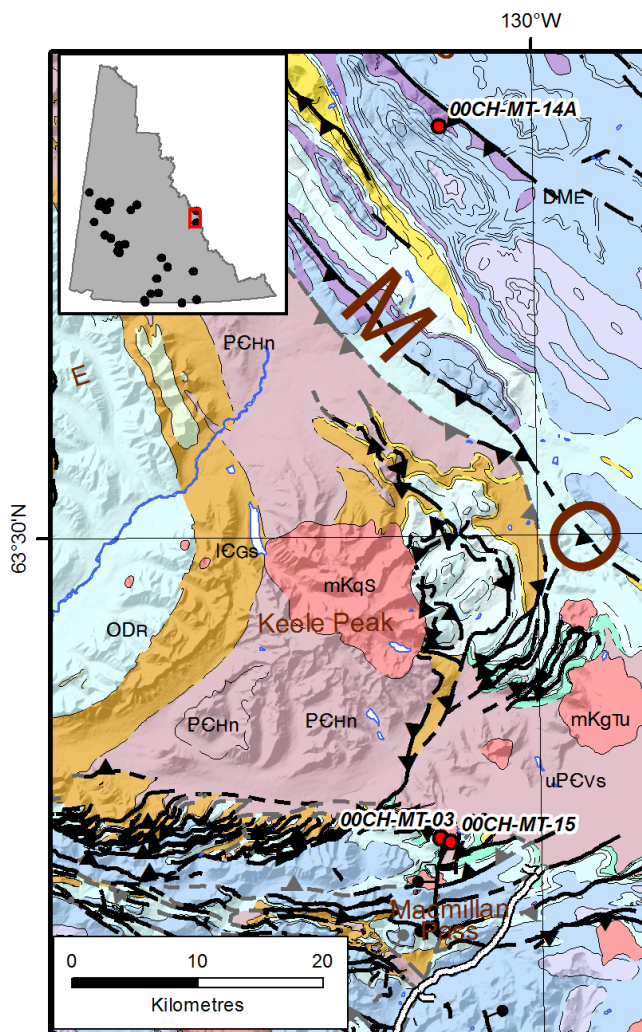


Figure 16. Geological map of the northern Selwyn basin showing location of samples collected from mineralized occurrences associated with the Tombstone intrusions. Geology from Yukon Geological Survey, www.geology.gov.yk.ca.

Yukon Tungsten, Molybdenum and Beryl Deposits

This section summarizes the results of samples from several localities of tungsten and molybdenum mineralization that were analyzed to better constrain the timing of these events. Several of these localities have also benefited from U-Pb zircon dating (e.g. Mortensen et al., 2007). Mactung skarns, veins and greisens (Fig. 17) all yield $^{40}\text{Ar}/^{39}\text{Ar}$ ages between ca. 97 and 95 Ma. The Twin Mountain pluton on the south side of the Risby tungsten deposit (Fig. 14) yields biotite and amphibole ages of 108 Ma (sample TWIN144b) which are similar to the ages obtained for the Logtung veins, greisens and magmatic vugs (Fig. 18).

Samples from a few localities were dated to constrain the timing of hydrothermal beryl mineralization related to emerald and topaz formation. Feldspar from a Northern Dancer emerald-bearing pegmatite gave an age of 85 Ma which is younger than the age of the adjacent 108 Ma Logtung pluton, and may reflect the low temperature thermal resetting of the feldspar. Coarse muscovite from the Pluto veins containing aquamarine, quartz and molybdenite give an age of 68 Ma. Topaz veins from the Marker Lake batholith give an age of 103 Ma, which approximates the age of the pluton and of the Cassiar plutonic suite. An emerald-bearing quartz-muscovite-tourmaline vein in the Finlayson Lake area (Fig. 19) gave an age of 108 Ma.



Sample Number: 92CH-1-1

Yukon Minfile 105C 028

Lithology: Gold-bearing vein

Mineral analyzed: Fuchsite

Age: 111.7 ± 1.1 Ma

Interpretation: Hydrothermal or possibly Reset

Geochronology Lab Number: 4612

Argon Number: 950

Location: Jake's Corner; Dalayee/Tog Deposit

UTM Zone 8 - 576738 E 6698442 N; NTS sheet 105C/5

Unit Name (if available): Cache Creek

Geologist: C. J. R. Hart

Sample Description:

Listwaenite-hosted fuchsite in gold vein. Collected to constrain timing of mineralization. Fuchsite grains selected for analysis were dark- to light-green fine-grained fragments.

Results:

Aliquot A showed significant argon loss in early to mid-temperature steps, and reached a narrow pseudo-plateau in 3 last steps. Aliquot B showed a classic argon loss profile, forming a plateau at mid- to high-temperature steps. Age is based on pseudo-plateau and plateau regions of both aliquots, 42% of gas, MSWD=0.698.

Analytical details:

Irradiation Batch: GSC #23

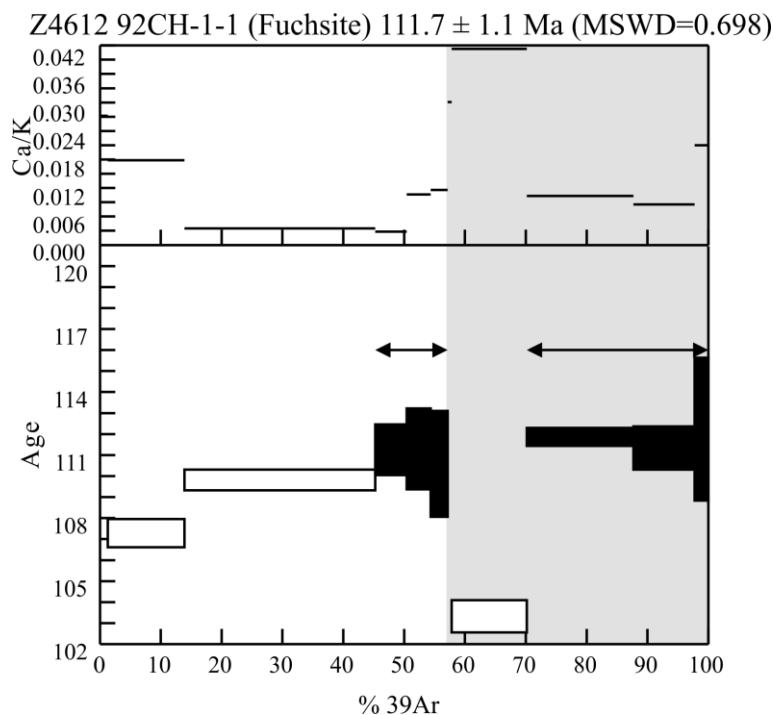
Date analyzed: August 11, 1997

Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 92CH-1-2

Yukon Minfile 105D 069

Lithology: Gold-bearing vein

Mineral analyzed: Fuchsite

Age: ca. 84 Ma

Interpretation: Hydrothermal or possibly Reset, estimate

Geochronology Lab Number: 4613

Argon Number: 951

Location: Jake's Corner; Marsh/Bug deposit

UTM Zone 8 - 544333 E 6690661 N; NTS sheet 105D/8

Unit Name (if available): Cache Creek

Geologist: C. J. R. Hart

Sample Description:

Listwaenite-hosted fuchsite in gold-bearing vein. Collected to constrain timing of mineralization. Grains selected for Aliquot A were 7 small fine-grained fragments of dark green fuchsite (best quality), and those for Aliquot B were 4 large, lower-quality fragments with vein-like fuchsite anastomosing throughout.

Results:

Aliquot A consisted of only four heating steps, and gave an up-stepping age profile, with the three highest-temperature steps giving an age of ~82 Ma (MSWD = 3.5). Aliquot B had better gas splits, but was humped with three steps slightly older than the pseudo-plateau in Aliquot A (two of the steps were consecutive). Age is at best an estimate, based on these six steps, comprising 56% of the total ^{39}Ar for both aliquots, MSWD=10.3. Inverse isochron data were scattered and inconclusive (not shown).

Analytical details:

Irradiation Batch: GSC #23

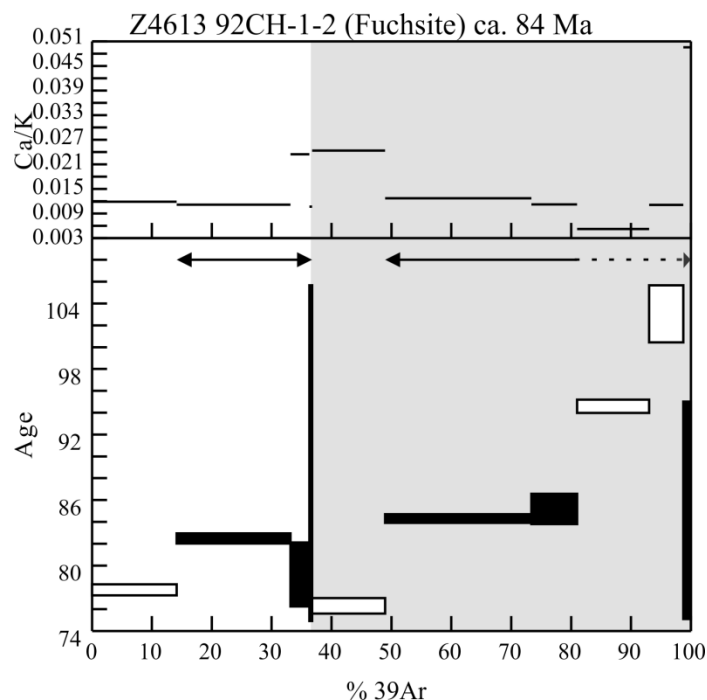
Date analyzed: August 12, 1997

Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: Venus
Lithology: Quartz vein
Mineral analyzed: Whole Rock
Age: 71.0 ± 0.8 Ma
Interpretation: Hydrothermal

Yukon Minfile 105D 005

Geochronology Lab Number: 4614
Argon Number: 952
Location: Montana Mountain; Venus Au-Ag deposit adit
UTM Zone 8 - 520994 E 6654255 N; NTS sheet 105D/2
Unit Name (if available): Venus deposit
Geologist: C. J. R. Hart

Sample Description:

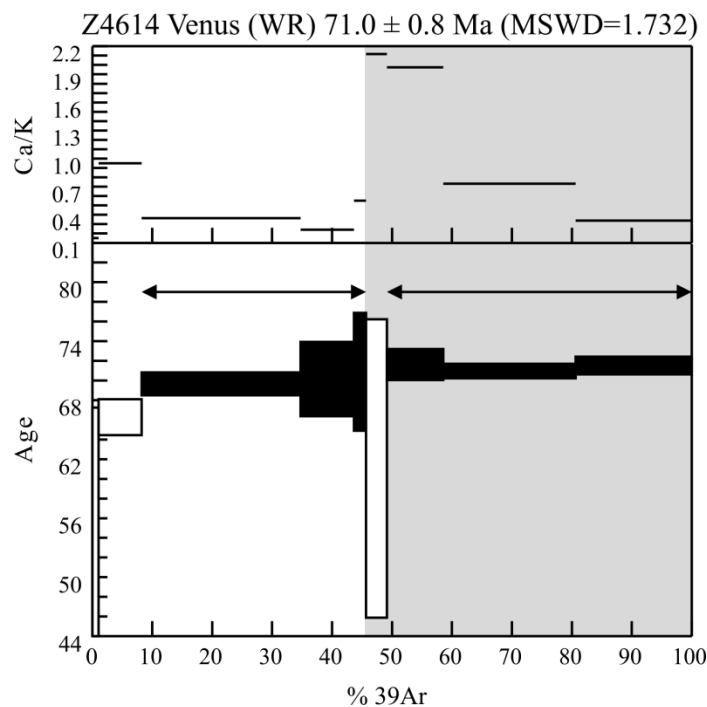
Hydrothermally-altered Au-Ag quartz vein with illite/muscovite. Collected to constrain timing of mineralization. Grains selected for analysis were fine-grained yellow-ish fragments containing sericite finely disseminated throughout.

Results:

Two aliquots were run, with minor argon loss in early heating steps for both. Both aliquots gave flat multistep plateaus comprising 88.3 % of total ^{39}Ar released. MSWD=1.732.

Analytical details:

Irradiation Batch: GSC #23
Date analyzed: August 12, 1997
Monitor used: FCT-San
Laser used: Weck® CO₂ 45W surgical laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: 97CH-25-4b

Yukon Minfile 115I 031

Lithology: Porphyry

Mineral analyzed: Biotite

Age: 84.9 ± 4.3 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 4716

Argon Number: 990

Location: Hayes Creek/TAD deposit

UTM Zone 8 - 348382 E 6940681 N; NTS sheet 115I/12

Unit Name (if available): TAD Porphyry

Geologist: C. J. R. Hart

Sample Description:

TAD porphyry, light grey fine-grained matrix with K-feldspar, biotite, quartz and hornblende phenocrysts, also contains weakly disseminated pyrite and sphalerite. The biotite grains in the sample were black, thin fragile, and slightly altered.

Results:

Two biotite aliquots gave hump-shaped spectra (Fig. A). Age is from the inverse isochron for both aliquots (Fig. B; not including low temperature steps), MSWD = 1.979, $^{40}\text{Ar}/^{36}\text{Ar} = 344 \pm 18$.

Analytical details:

Irradiation Batch: GSC #25

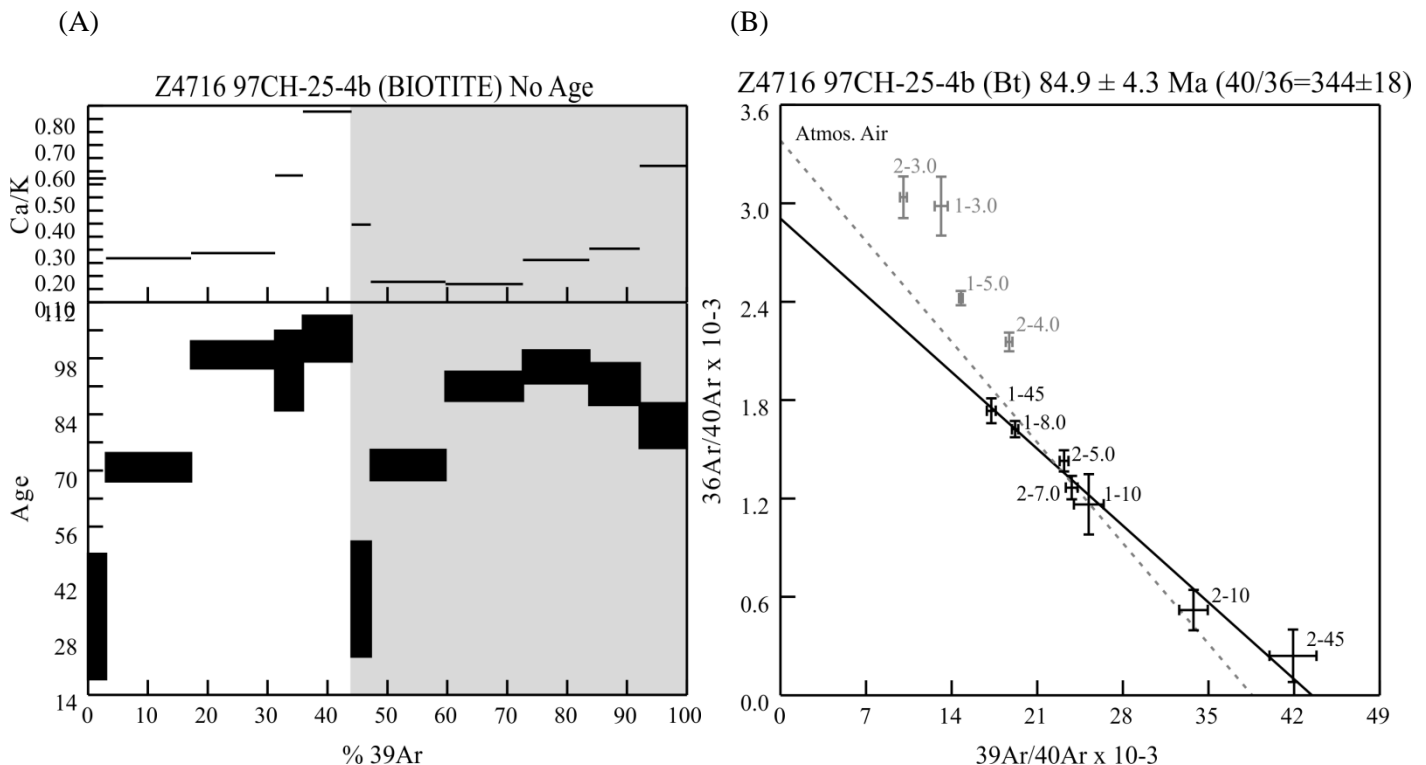
Date analyzed: February 24-25, 1998

Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 97CH-24-3b
Lithology: Gneiss
Mineral analyzed: Hornblende
Age: 120.6 ± 2.4 Ma
Interpretation: Metamorphic Cooling

Yukon Minfile 115I 053

Geochronology Lab Number: 4717
Argon Number: 991
Location: Mt Freegold - Augusta skarn deposit
UTM Zone 8 - 389132 E 6908881 N; NTS sheet 115I/6
Unit Name (if available): Augusta Skarn
Geologist: C. J. R. Hart

Sample Description:

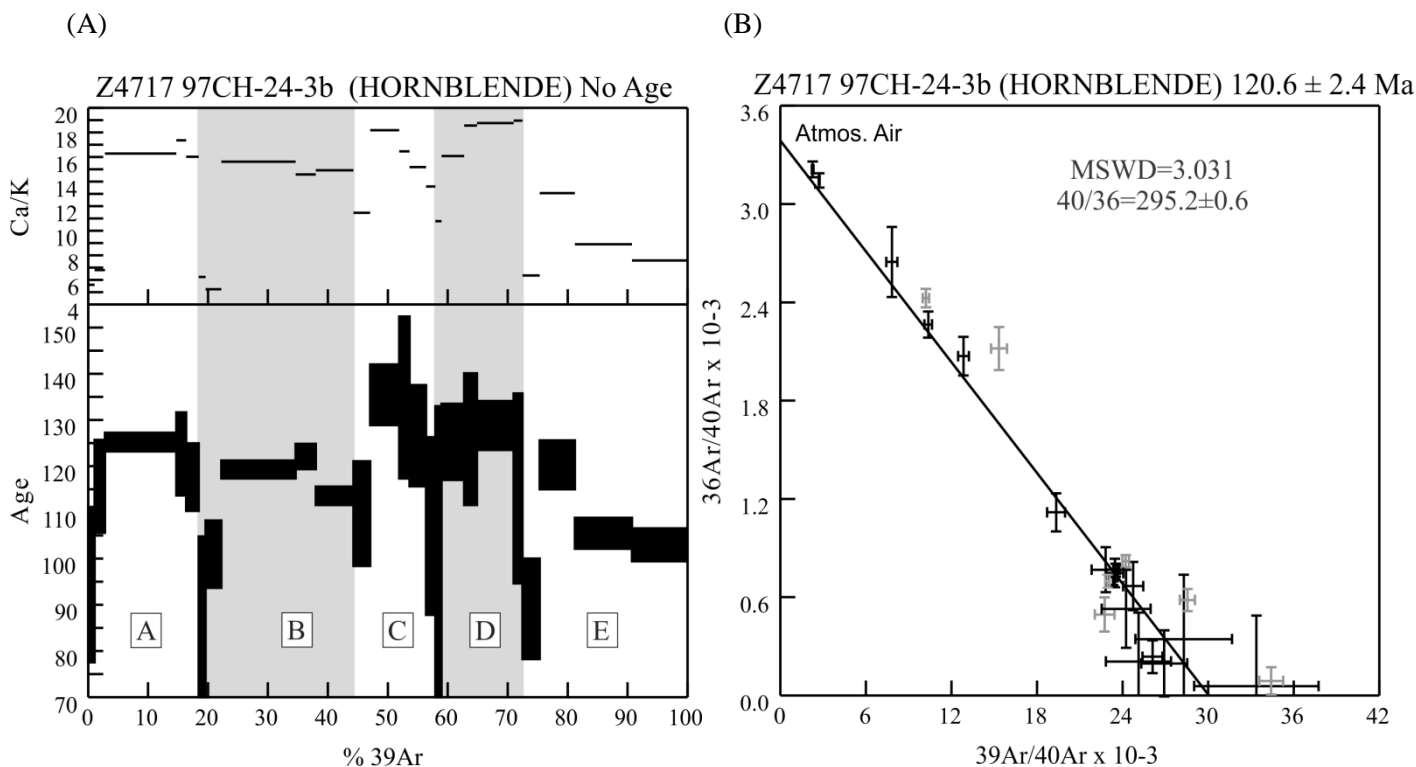
Hornblende from a hornblende-biotite-plagioclase gneiss; the grains were subhedral, large, fibrous green aggregates with no visible inclusions.

Results:

Five aliquots of hornblende were analyzed; all gave hump-shaped spectra, none in agreement with each other (Fig. A). Each aliquot also had a different Ca/K signature reflecting variable composition. Age is based on inverse isochron for all five aliquots, using 17 of 24 steps, MSWD = 3.031, $^{40}\text{Ar}/^{36}\text{Ar} = 295.2 \pm 0.6$ (Fig. B).

Analytical details:

Irradiation Batch: GSC #24
Date analyzed: January 16 & February 26, 1998
Monitor used: FCT-San
Laser used: Weck® CO₂ 45W surgical laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: 97-CH-25-1D

Yukon Minfile 115J 017

Lithology: Hornblende porphyry

Mineral analyzed: Biotite

Age: 69.0 ± 0.7 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 4787

Argon Number: 1031

Location: Mount Cockfield deposit

UTM Zone 7 - 628721 E 6952419 N; NTS sheet 115J/9

Unit Name (if available): Mount Cockfield deposit

Geologist: C. J. R. Hart

Sample Description:

Possibly hornblende segregation intergrown with chalcopyrite in veinlet within a hornblende porphyry. Minor biotite was also associated with these veinlets; the grains selected for dating were large, black anhedral flakes.

Results:

Two aliquots were run, both giving flat reproducible multistep plateaus comprising 99.4% of the total ^{39}Ar gas released, MSWD=0.915.

Analytical details:

Irradiation Batch: GSC #24

Date analyzed: January 15, 1998

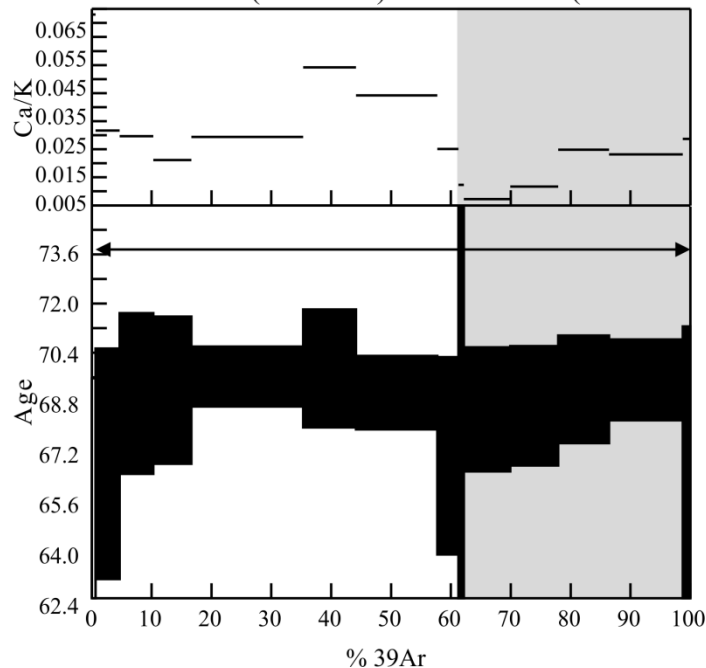
Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module

Z4787 97-CH-25-1D (BIOTITE) 69.0 ± 0.7 Ma (MSWD=0.915)



Sample Number: 97-CH-25-1C

Yukon Minfile 115J 017

Lithology: Quartz vein

Mineral analyzed: Biotite

Age: 68.5 ± 0.5 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 4788

Argon Number: 1030

Location: Mount Cockfield deposit

UTM Zone 7 - 628721 E 6952419 N; NTS sheet 115J/9

Unit Name (if available): Mount Cockfield deposit

Geologist: C. J. R. Hart

Sample Description:

Secondary biotite from fine-grained grey quartz vein cutting biotite porphyry. Possibly hydrothermal biotite? The analyzed grains were large, bent, subhedral, fragile black flakes.

Results:

Two aliquots were run, with argon loss evident in the early heating steps. Both aliquots settle into concordant plateaus, both of which were used to calculate the age. Plateau regions comprise 84.8% of released ^{39}Ar , MSWD=1.417.

Analytical details:

Irradiation Batch: GSC #24

Date analyzed: January 30 & February 2, 1998

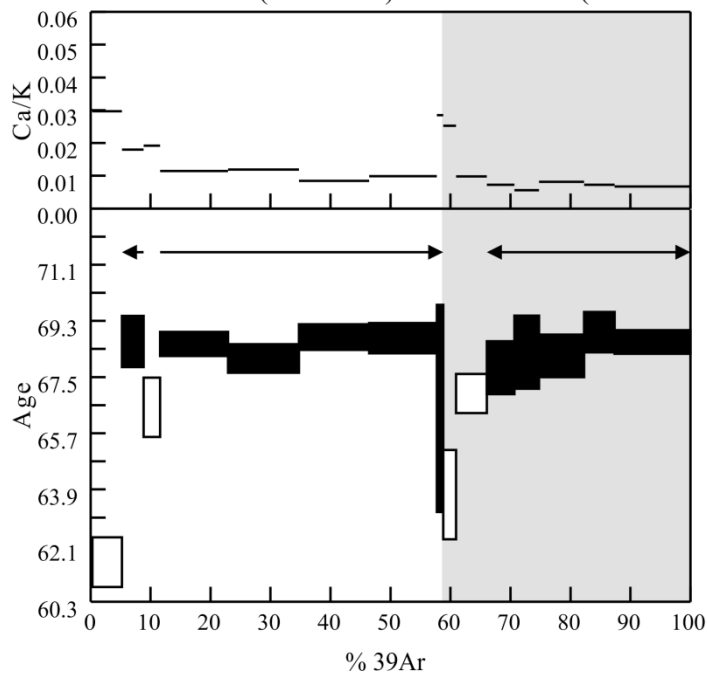
Monitor used: FCT-San

Laser used: Weck® CO₂ 45W surgical laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module

Z4788 97-CH-25-1C (BIOTITE) 68.5 ± 0.5 Ma (MSWD=1.417)



Sample Number: 97CH 50-1

Yukon Minfile 115I 054

Lithology: Altered granite

Mineral analyzed: Illite

Age: 76.7 ± 0.8 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 5013

Argon Number: 1075

Location: Mt. Freegold-Laforma deposit

UTM Zone 8 - 388681 E 6878766 N; NTS sheet 115I/3

Unit Name (if available): Laforma gold deposit

Geologist: C. J. R. Hart

Sample Description:

Illite, scraped from intensively altered, granitic wall rock adjacent to a gold-bearing vein. Grains were fragile, chalky, milky white, cryptocrystalline fragments (homogeneous colouration).

Results:

Two aliquots were run, yielding slightly disturbed spectra that show ^{40}Ar loss in lowest-temperature heating steps of both aliquots. Age is based on combined plateau regions for both aliquots, 78.8% of released ^{39}Ar , MSWD=2.543

Analytical details:

Irradiation Batch: GSC #26

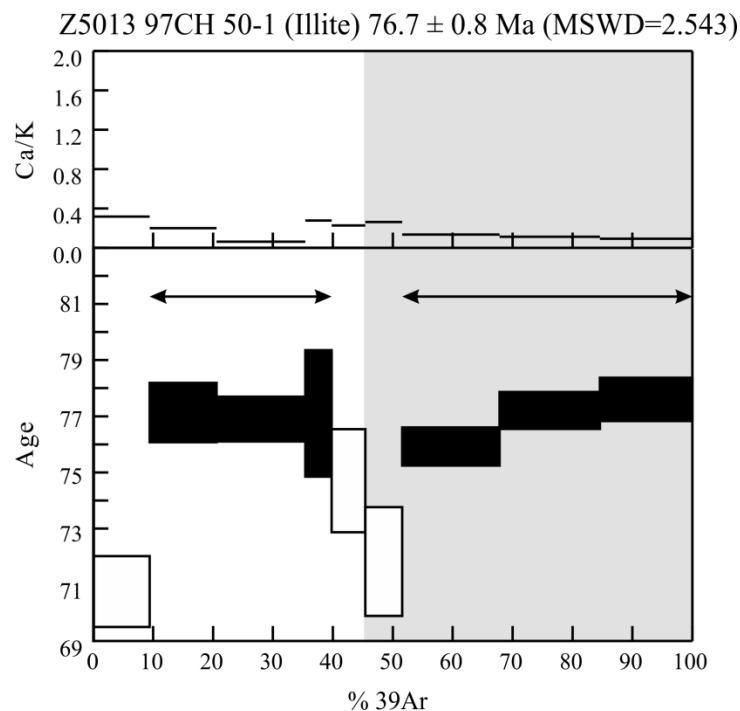
Date analyzed: September 1, 1998

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO_2 laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: RMY 79-12

Yukon Minfile 105C 009

Lithology: Porphyry

Mineral analyzed: Biotite

Age: 81.2 ± 0.9 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 5014

Argon Number: 1076

Location: Red Mountain molybdenite deposit

UTM Zone 8 - 568183 E 6762494 N; NTS sheet 105C/13

Unit Name (if available): Red Mountain molybdenite deposit

Geologist: C. J. R. Hart

Sample Description:

Mineralized porphyry with disseminated and stringers of pyrite and molybdenite, sampled from drill core.

Lithologically similar to RMY 80-18, except mineralized. K-Ar on hydrothermal biotite reported in Stevens et al.

(1982) at 95.6 ± 2.8 Ma (sample SYA79-56). This same sample was re-analyzed a few years later, and was reported in Hunt and Roddick (1987) with an age of 87.3 ± 2.0 Ma. Grains selected for analysis were brownish black, ragged-looking anhedral flakes.

Results:

Age is based on plateau ages for two aliquots of biotite, comprising 86.4% of the released ^{39}Ar gas; MSWD=1.212.

Minor ^{40}Ar loss in the lowest-temperature steps. Compare to 78.7 ± 0.9 Ma age on whole rock age for this same sample.

Analytical details:

Irradiation Batch: GSC #26

Date analyzed: August 20, 1998

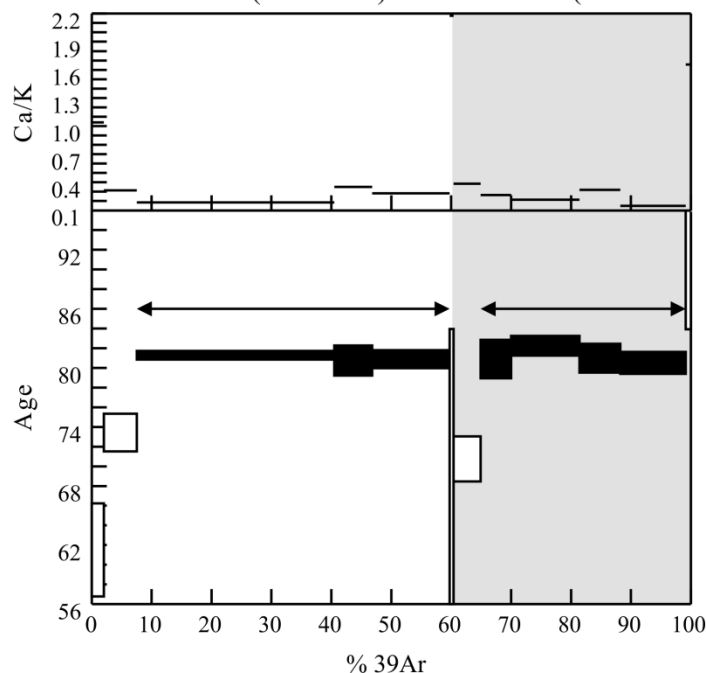
Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module

Z5014 RMY 79-12 (BIOTITE) 81.2 ± 0.9 Ma (MSWD=1.212)



Sample Number: RMY 79-12
Lithology: Porphyry
Mineral analyzed: Whole Rock
Age: 78.7 ± 0.9 Ma
Interpretation: Hydrothermal

Yukon Minfile 105C 009

Geochronology Lab Number: 5014
Argon Number: 1082
Location: Red Mountain molybdenite deposit
UTM Zone 8 - 568183 E 6762494 N; NTS sheet 105C/13
Unit Name (if available): Red Mountain molybdenite deposit
Geologist: C. J. R. Hart

Sample Description:

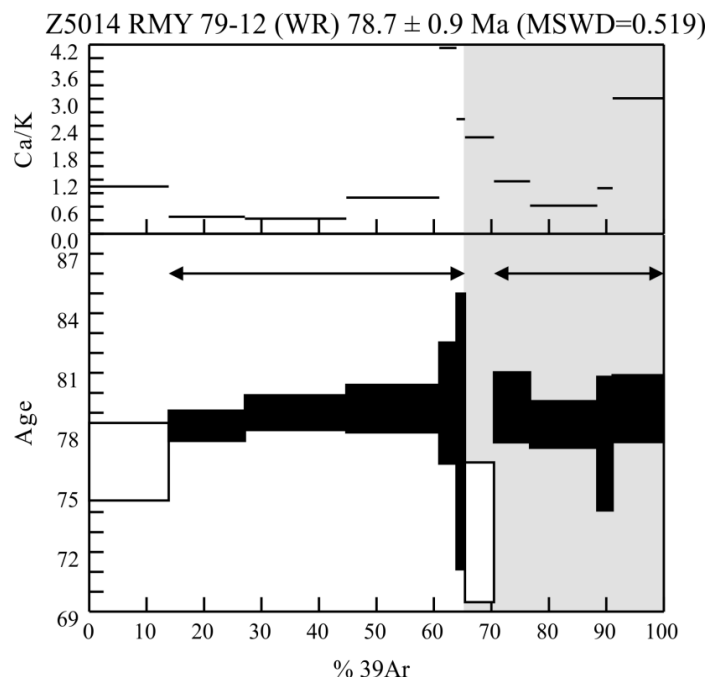
Mineralized porphyry with disseminated and stringers of pyrite and molybdenite, sampled from drill core. Lithologically similar to RMY 80-18, except mineralized. K-Ar on hydrothermal biotite reported in Stevens et al. (1982) at 95.6 ± 2.8 Ma (sample SYA79-56). This same sample was re-analyzed a few years later, and was reported in Hunt and Roddick (1987) with an age of 87.3 ± 2.0 Ma (K-Ar). Grains selected for analysis were milky white cryptocrystalline fragments with tiny black inclusions disseminated throughout.

Results:

Two whole rock aliquots were analyzed, both showing minor argon loss in first steps. Age is based on plateau regions for both aliquots, comprising 84.3% of gas released; MSWD=0.519. Compare to 81.2 ± 0.9 Ma age on biotite. Younger age on whole rock might suggest partial resetting.

Analytical details:

Irradiation Batch: GSC #26
Date analyzed: August 26-27, 1998
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: RMY 80-18

Yukon Minfile 105C 009

Lithology: Porphyry

Mineral analyzed: Whole Rock

Age: 74.4 ± 0.8 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 5015

Argon Number: 1074

Location: Red Mountain molybdenite deposit from drill hole RMY 80-18

UTM Zone 8 - 568183 E 6762494 N; NTS sheet 105C/13

Unit Name (if available): Red Mountain molybdenite deposit

Geologist: C. J. R. Hart

Sample Description:

Crowded porphyry to granophytic big clear quartz phenocrysts, crowded plagioclase and variably chloritized biotite, sampled from drill core. Unmineralized post-ore rock. Analyzed grains were milky white cryptocrystalline fragments with small black inclusions disseminated throughout. Phlogopite from another post-ore phase at Red Mountain was reported in Stevens et al. (1982) with a K-Ar age of 87.4 ± 1.9 Ma (sample SYA80-33). Re-analysis of same phlogopite material gave 79.0 ± 1.8 Ma (K-Ar; Hunt and Roddick, 1987).

Results:

Relatively flat, reproducible spectra on two aliquots, comprising 89.9% of gas in plateau regions, MSWD=0.376 (Fig. A). On the inverse isochron, all data points fell along the atmospheric line and gave a concordant age of 74.2 ± 0.8 Ma (Fig. B).

Analytical details:

Irradiation Batch: GSC #26

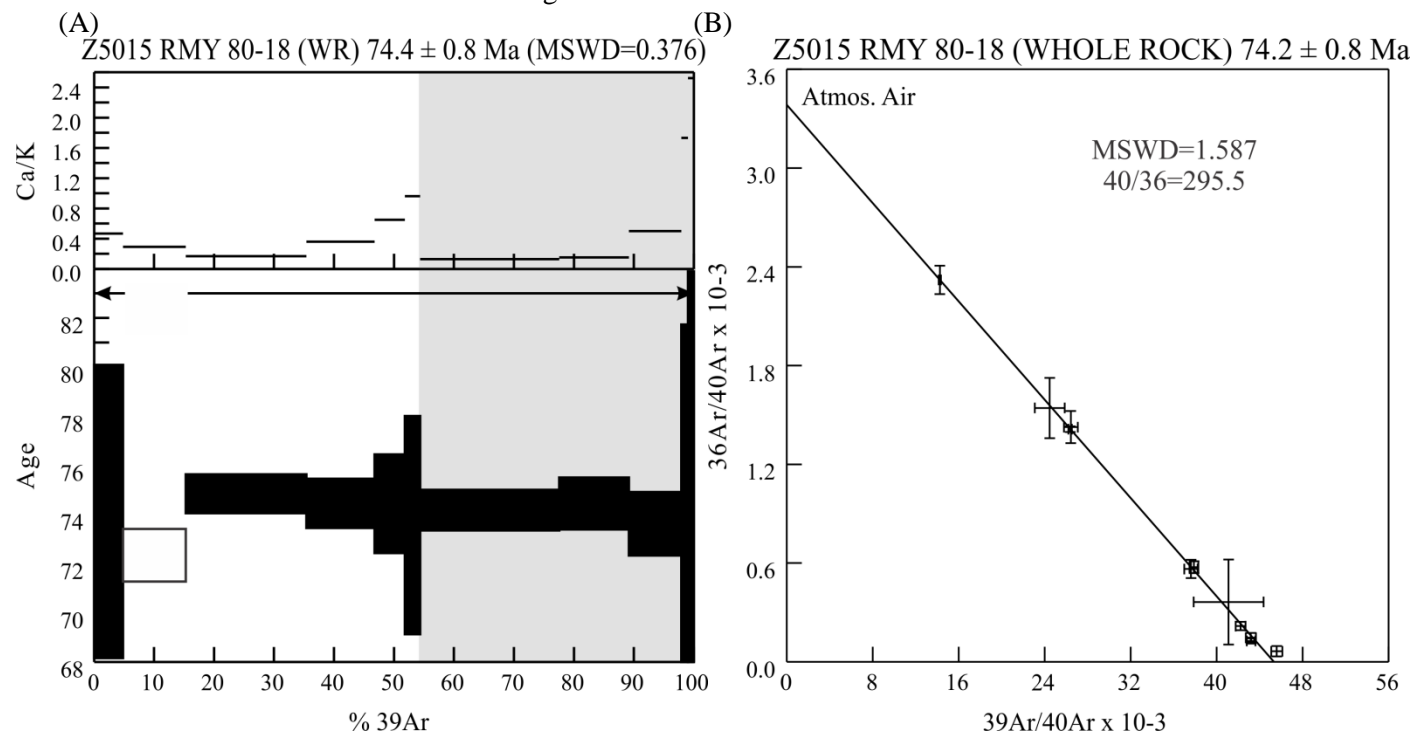
Date analyzed: September 1, 1998

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 97CH 4-1

Yukon Minfile 115I 096

Lithology: Silicified rhyolite breccia

Mineral analyzed: K-feldspar

Age: 65.0 ± 0.8 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 5016

Argon Number: 1073

Location: RUSK mineral showing

UTM Zone 8 - 382335 E 6884554 N; NTS sheet 115I/3

Unit Name (if available):

Geologist: C. J. R. Hart

Sample Description:

For this sample, the mineral intended to be used for dating was pale green microcrystalline muscovite or illite that was observed in vugs of medium-grained quartz crystals, in silicified rhyolite breccia. However during mineral separation, the muscovite/illite was deemed unsuitable for dating, and the milky white K-feldspar phenocrysts from the rhyolite were sampled instead.

Results:

Two aliquots were run; both gave flat multistep plateaus. Age is derived from the combined plateau age for both aliquots, 100.0% of the gas, MSWD=0.969.

Analytical details:

Irradiation Batch: GSC #26

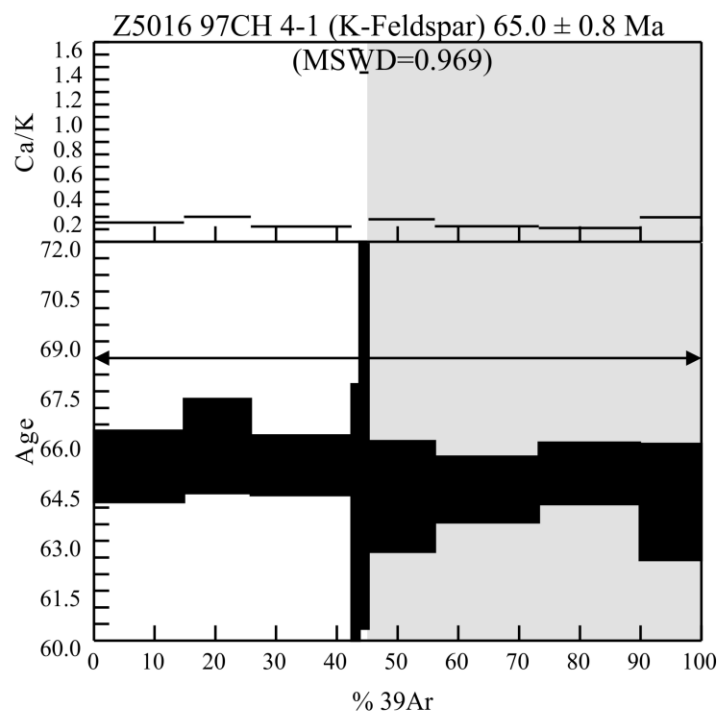
Date analyzed: September 2, 1998

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: DS97-86

Yukon Minfile 115I 064

Lithology: Oxidized and potassically altered stock

Mineral analyzed: Biotite

Age: 72.9 ± 0.5 Ma

Interpretation: Igneous Cooling

Geochronology Lab Number: 5752

Argon Number: 1516

Location: Mt. Nansen Au-Ag deposit, DDH 97-6 core

UTM Zone 8 - 388810 E 6881510 N; NTS sheet 115I/3

Unit Name (if available): Brown-McDade deposit

Geologist: C. J. R. Hart

Sample Description:

This sample was collected from the central potassic zone of Mt. Nansen area, and was oxidized. Biotite grains selected for analysis were very tiny and thin brown flakes.

Results:

Two aliquots gave reproducible, multi-step plateaus (77.9% of released ^{39}Ar , MSWD=0.720). Aliquot A shows older apparent ages (excess ^{40}Ar ?) on two low-temperature steps, but the bulk of the gas falls within the plateau. Aliquot B only shows initial ^{40}Ar loss in lowest temperature steps.

Analytical details:

Irradiation Batch: GSC #36

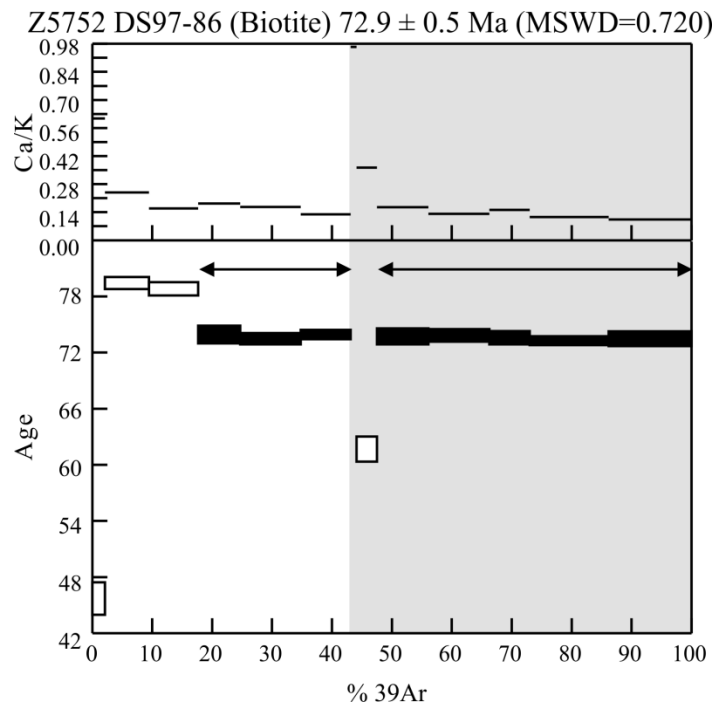
Date analyzed: November 21, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 98CH AC-2

Yukon Minfile 105D 009

Lithology: Phyllic alteration zone

Mineral analyzed: Illite

Age: 68.5 ± 0.4 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 5753

Argon Number: 1517

Location: Arctic Caribou mine in southern Yukon

UTM Zone 8 - 517540 E 6660750 N; NTS sheet 105D/2

Unit Name (if available): Arctic Caribou mineral occurrence

Geologist: C. J. R. Hart

Sample Description:

Illite was sampled from an intense phyllic alteration zone adjacent to a vein. The grains were large, yellow, lustrous, inclusion-free and very fragile.

Results:

Two aliquots were run, both giving flat multistep plateaus, all except for the fusion step of Aliquot B which was slightly older. Age is based on plateau regions for both aliquots, 90% of gas, MSWD=2.209. This result is intended to be compared to the $^{40}\text{Ar}/^{39}\text{Ar}$ illite age from the nearby Venus mine to test whether all the gold veins in the camp are approximately the same age.

Analytical details:

Irradiation Batch: GSC #36

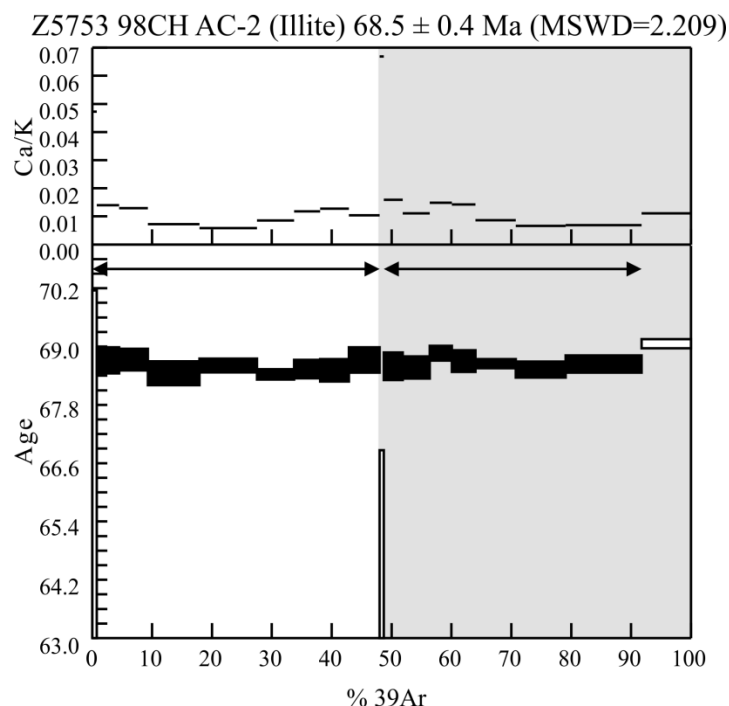
Date analyzed: November 22, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 99CH Virgin-1

Yukon Minfile 116B 007

Lithology: Quartz Vein

Mineral analyzed: Illite

Age: NO AGE

Interpretation: No Age

Geochronology Lab Number: 6138

Argon Number: 1518

Location: Virgin veins, Klondike

UTM Zone 7 - 586270 E 7098495 N; NTS sheet 116B/3

Unit Name (if available): Virgin veins

Geologist: C. J. R. Hart

Sample Description:

Gold-bearing quartz vein with illite selvage, from upper trench

Results:

No consistency or reproducible plateaus between the four aliquots analyzed. All spectra were hump-shaped, and the data on the inverse isochron plot was scattered and inconclusive (not shown). The slight spread of data along the x-axis of the inverse isochron plot could be indicative of ^{39}Ar recoil problems due to fine grain size of the sample. Analyzed grains were small, granular and yellowish in colour.

Analytical details:

Irradiation Batch: GSC #35

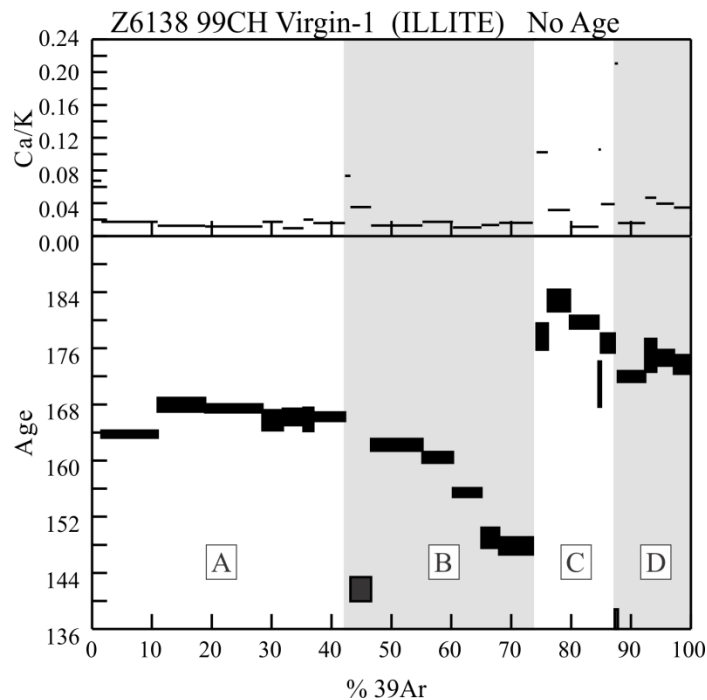
Date analyzed: June 8 & July 4-5, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 99CH-Virgin-2

Yukon Minfile 115J 017

Lithology: Schist

Mineral analyzed: Muscovite

Age: 178.0 ± 1.4 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6139

Argon Number: 1519

Location: Virgin veins, Klondike

UTM Zone 7 - 586270 E 7098495 N; NTS sheet 116B/3

Unit Name (if available): Klondike Schist

Geologist: C. J. R. Hart

Sample Description:

Mica schist wall rock fragments in quartz barite +/- pyrite-galena vein, other fragments are altered/oxidized. Muscovite grains selected for analysis were very small thin greenish flakes.

Results:

One aliquot (B) shows reasonable plateau, other (A) seems to indicate some excess ^{40}Ar . Plateau age for Aliquot B is 178.7 ± 1.1 Ma (MSWD=4.829). Most of data points for both aliquots A and B are quite radiogenic, so the age is relatively unaffected by choice of $^{40}\text{Ar}/^{36}\text{Ar}$. The assigned age is the inverse isochron age including data from both aliquots. MSWD = 4.351, $^{40}\text{Ar}/^{36}\text{Ar} = 379 \pm 35$.

Analytical details:

Irradiation Batch: GSC #35

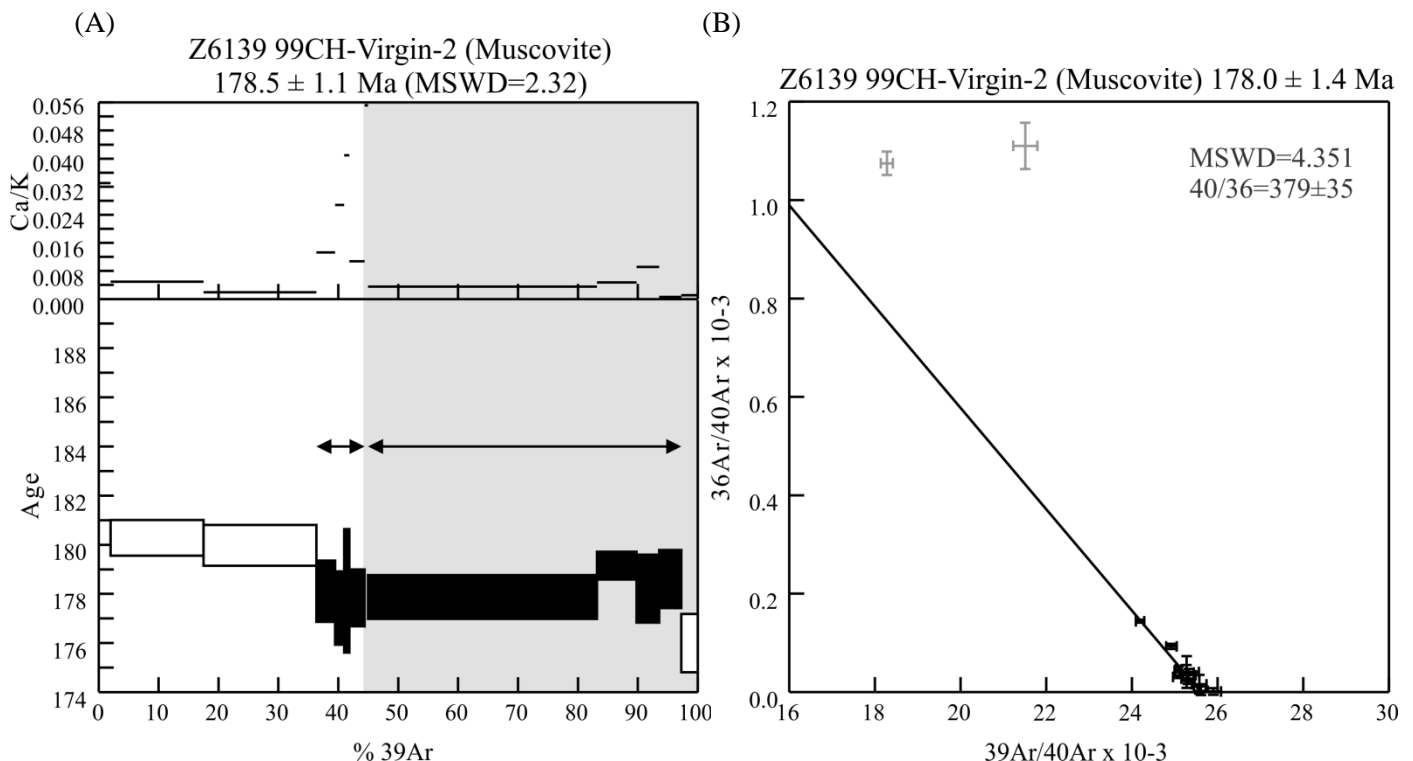
Date analyzed: May 31, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 99Virgin Peg
Lithology: Pegmatite
Mineral analyzed: Muscovite
Age: 185.6 ± 1.1 Ma
Interpretation: Metamorphic Cooling

Yukon Minfile 116B 007

Geochronology Lab Number: 6140
Argon Number: 1520
Location: Virgin veins, Klondike
UTM Zone 7 - 586270 E 7098495 N; NTS sheet 116B/3
Unit Name (if available): Klondike Schist
Geologist: C. J. R. Hart

Sample Description:

Pegmatite with coarse-grained dark green micas. Age of the pegmatite would presumably date the timing of peak metamorphism. Muscovite grains selected for analysis were large thin green flakes.

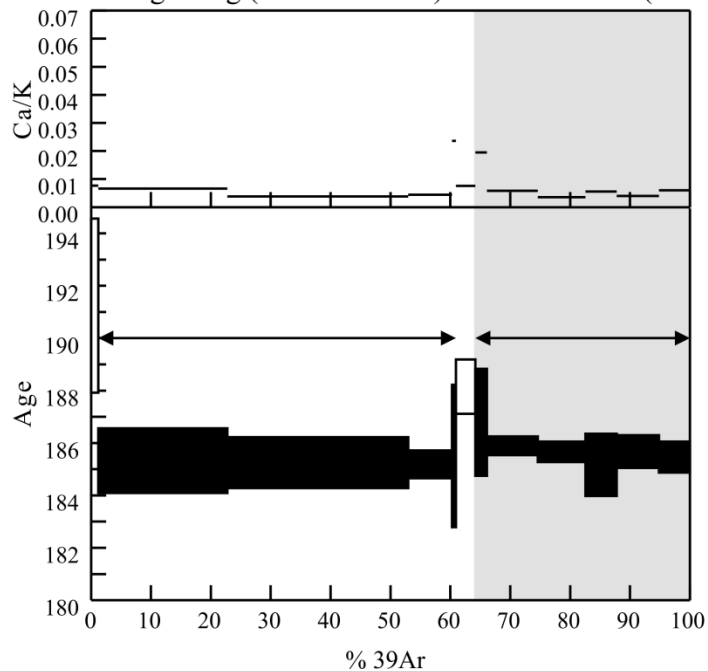
Results:

Two aliquots gave flat, multi-step reproducible plateaus comprising 95.5% of released ^{39}Ar gas; MSWD= 1.337.

Analytical details:

Irradiation Batch: GSC #35
Date analyzed: May 31 & June 1, 2000
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module

Z6140 99Virgin Peg (MUSCOVITE) 185.6 ± 1.1 Ma (MSWD=1.337)



Sample Number: 99CH KL-1

Lithology: Listwaenite

Mineral analyzed: Fuchsite

Age: NO AGE

Interpretation: No Age

Geochronology Lab Number: 6141

Argon Number: 1521

Location: Klondike, Hunker Road outcrop intersection to Last Chance creek

UTM Zone 7 - 592640 E 7100350 N; NTS sheet 116B/3

Unit Name (if available):

Geologist: C. J. R. Hart

Sample Description:

Fuchsite in tectonized listwaenite from near a quartz vein on Hunker road outcrop. Grains were large, thin and green.

Results:

Three aliquots were analyzed (alternately shaded in figure below), all exhibiting extreme amounts of argon loss, and upward-stepping ages. Highest temperature steps were in the 160-165 Ma range. Data on release spectra and inverse isochron diagrams were inconclusive.

Analytical details:

Irradiation Batch: GSC #35

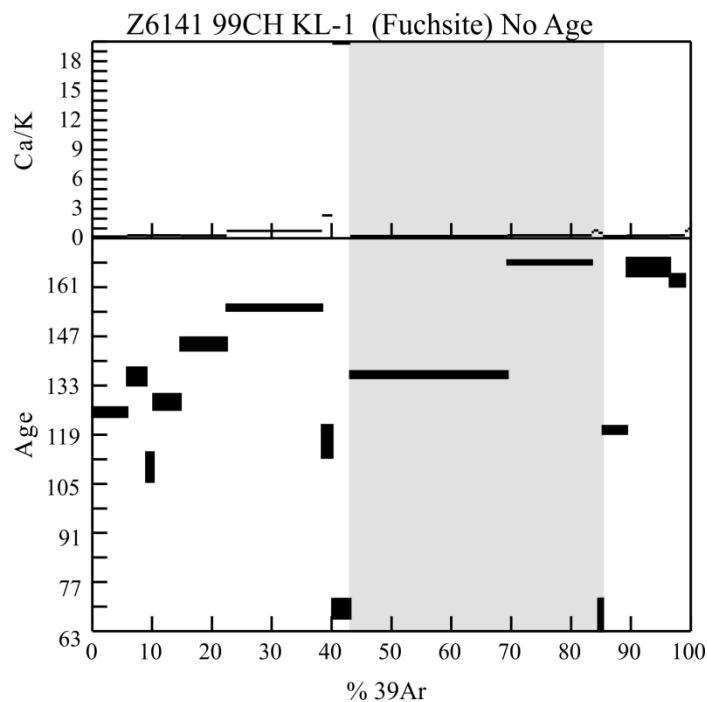
Date analyzed: June 9, 13, 29-30, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 99CH KL-2

Lithology: Listwaenite

Mineral analyzed: Fuchsite

Age: 92-115 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 6142

Argon Number: 1522

Location: Klondike, Hunker Road outcrop intersection to Last Chance creek

UTM Zone 7 - 592630 E 7100340 N; NTS sheet 116B/3

Unit Name (if available):

Geologist: C. J. R. Hart

Sample Description:

Fuchsite in tectonized listwaenite from below adit. The fuchsite was poor quality, brownish-green in colour, with abundant cream-coloured inclusions.

Results:

Three aliquots all show downward-stepping spectra, suggesting excess ^{40}Ar is present (Fig. A). Age based on plateau regions for Aliquots B and C is 115.1 ± 1.0 Ma, 42.4% of total gas, MSWD=0.1. Inverse isochron plot for all three aliquots shows multiple excess compositions (Fig. B), with the two best regressions at 108 ± 7 Ma ($^{40}\text{Ar}/^{36}\text{Ar}=320 \pm 8$), 92 ± 3 Ma ($^{40}\text{Ar}/^{36}\text{Ar}=413 \pm 11$).

Analytical details:

Irradiation Batch: GSC #35

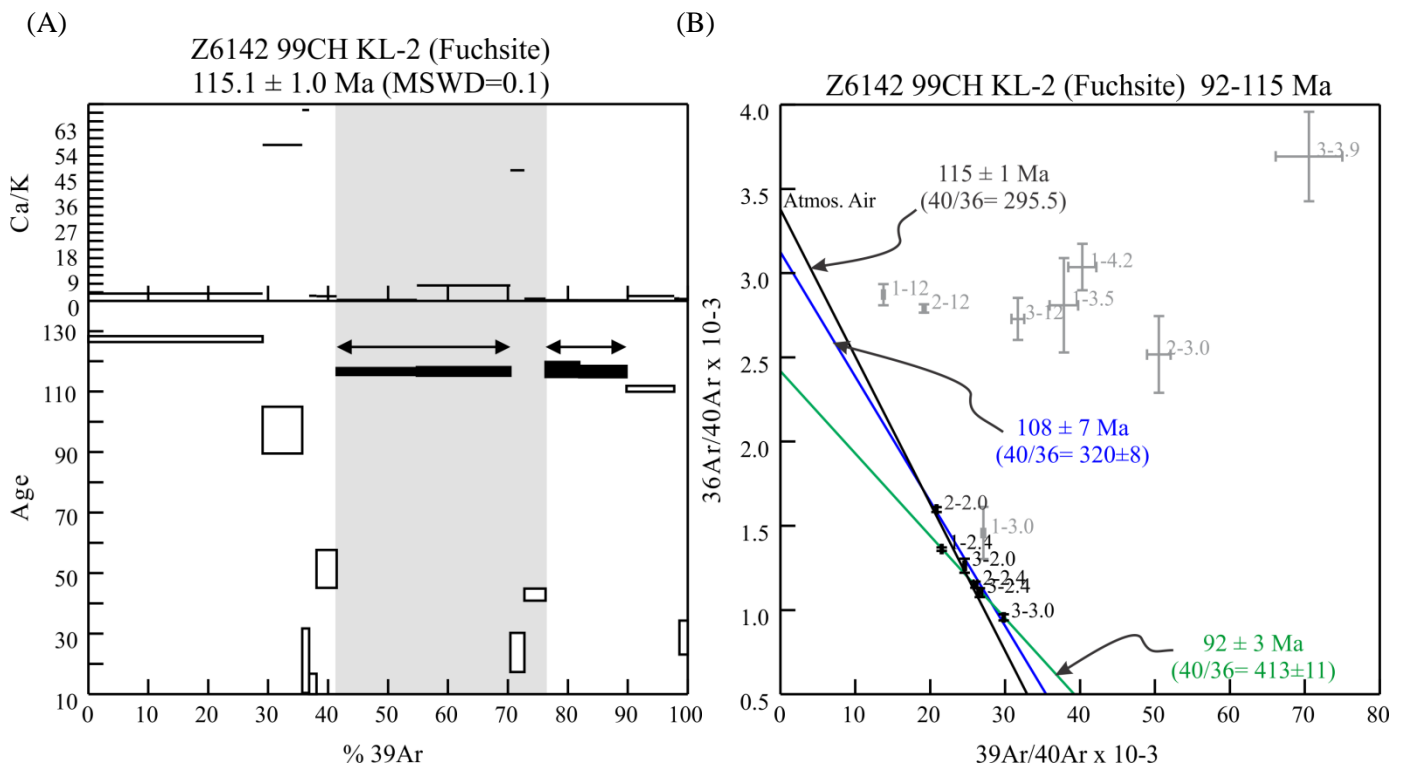
Date analyzed: June 13 & 29, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO_2 laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: DD19

Yukon Minfile 116B 160

Lithology: Breccia

Mineral analyzed: Roscoelite

Age: NO AGE

Interpretation: No Age

Geochronology Lab Number: 6143

Argon Number: 1551

Location: Brewery Creek deposit, Moosehead Zone, from drill core DD19

UTM Zone 7 - 634170 E 7106480 N; NTS sheet 116B/1

Unit Name (if available): Breccia in altered Earn Group

Geologist: C. J. R. Hart

Sample Description:

Breccia with lots of quartz cement and open space; the analyzed grains were large, beer bottle-brown, inclusion-free books, with slightly chalky lustre on the grain surfaces.

Results:

Two aliquots were run. Both generated upward-stepping spectra with ages between ~130 and 304 Ma. No plateaus obtained. The fusion step in Aliquot A was over 35 million years younger than that of Aliquot B.

Analytical details:

Irradiation Batch: GSC #35

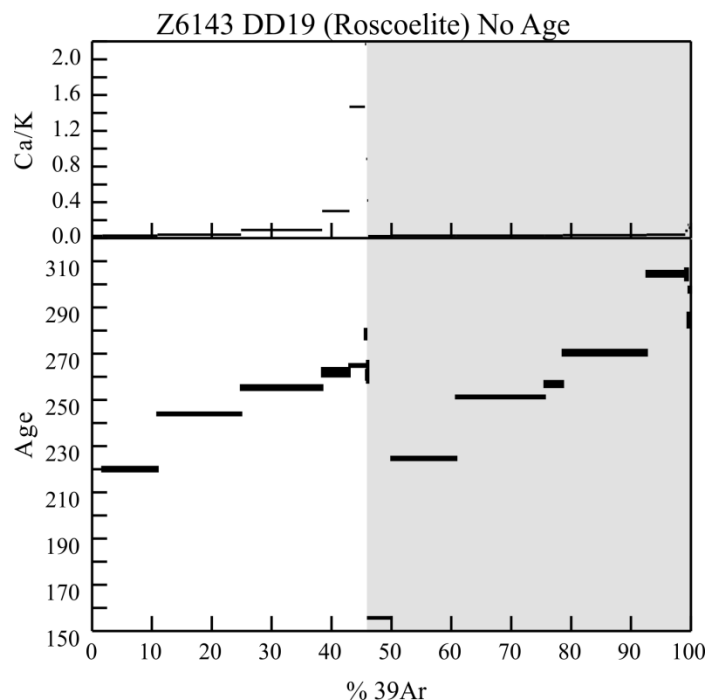
Date analyzed: July 11-13, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: DD23

Yukon Minfile 116B 160

Lithology: *no description available*

Mineral analyzed: Roscoelite

Age: 343 ± 2 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 6144

Argon Number: 1565

Location: Brewery Creek deposit, Moosehead Zone, from drill core DD23

UTM Zone 7 - 634170 E 7106480 N; NTS sheet 116B/1

Unit Name (if available): altered Earn Group

Geologist: C. J. R. Hart

Sample Description:

Altered. The grains that were analyzed were large, dark brown, inclusion-free books, with slightly chalky lustre on the grains surfaces.

Results:

Two aliquots were run, both showing upward stair-stepping spectra possibly indicative of extreme ^{40}Ar loss. The very highest temperature steps for Aliquots A and B (17.5% of ^{39}Ar released for both aliquots combined) give a pseudo-plateau age of 343 ± 2 Ma, MSWD=3.160.

Analytical details:

Irradiation Batch: GSC #35

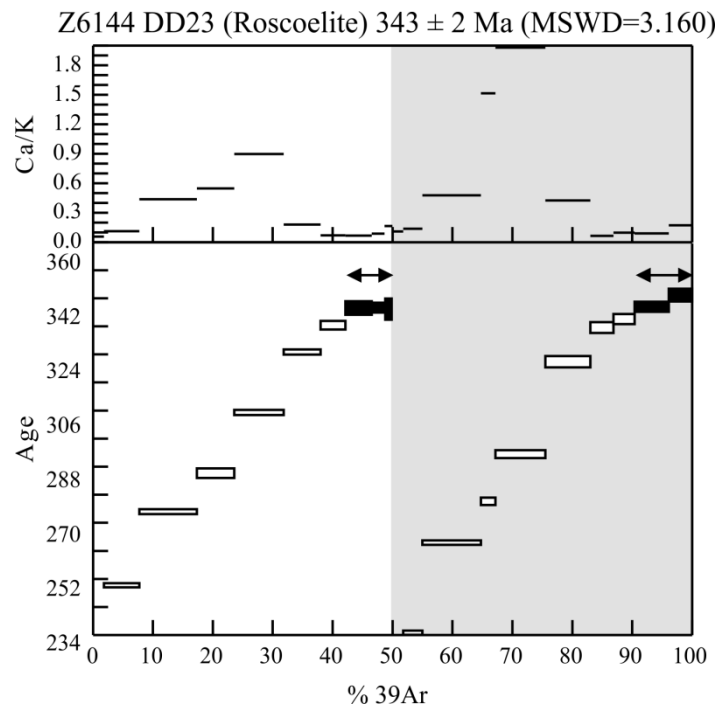
Date analyzed: July 12-13, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: Aquamarine
Lithology: Quartz vein
Mineral analyzed: Muscovite
Age: 67.5 ± 0.4 Ma
Interpretation: Hydrothermal

Yukon Minfile 116C 137

Geochronology Lab Number: 6147
Argon Number: 1523
Location: Pluto claims north of Dawson
UTM Zone 7 - 531370 E 7135160 N; NTS sheet 116C/8
Unit Name (if available): Pluto veins
Geologist: C. J. R. Hart

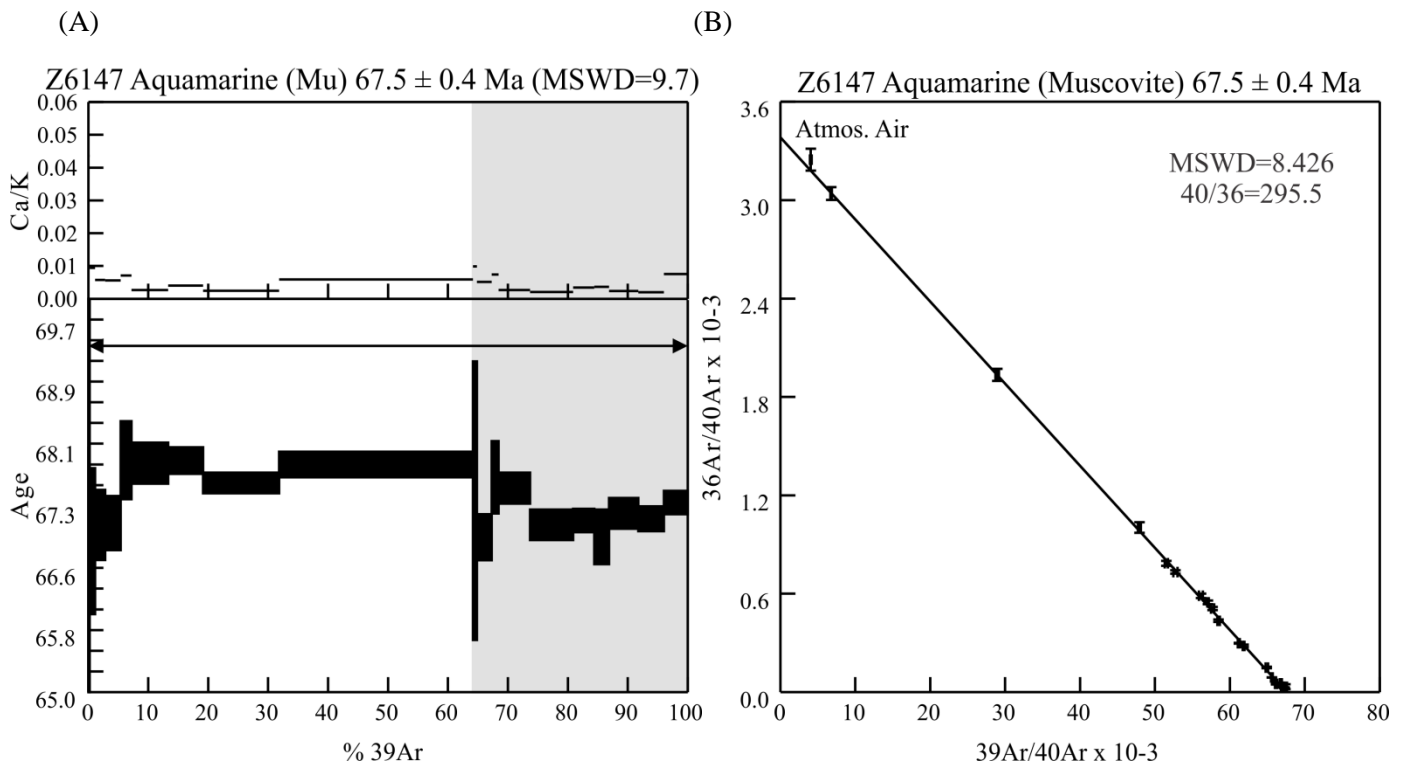
Sample Description: Coarse-grained, clear, slightly green muscovite from a vug in aquamarine-quartz-molybdenite-vein

Results:

Two aliquots were run, and did not agree. One plateau fell at 67.2 ± 0.4 Ma, one at 67.8 ± 0.4 Ma. Age is the inverse isochron for both aliquots, MSWD = 8.426, $^{40}\text{Ar}/^{36}\text{Ar} = 295.5$, concordant with the integrated age for all steps of both aliquots at 67.5 ± 0.4 (MSWD=9.7).

Analytical details:

Irradiation Batch: GSC #35
Date analyzed: May 30, 2000
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: Emerald
Lithology: Quartz vein
Mineral analyzed: Muscovite
Age: 108.2 ± 1.1 Ma
Interpretation: Hydrothermal

Yukon Minfile 105G 147

Geochronology Lab Number: 6148
Argon Number: 1524
Location: Tsa da Glisza, Goal Net claims, Finlayson Lake area
UTM Zone 9 - 414730 E 6794470 N; NTS sheet 105G/7
Unit Name (if available): Yukon Tanana schist
Geologist: C. J. R. Hart

Sample Description:

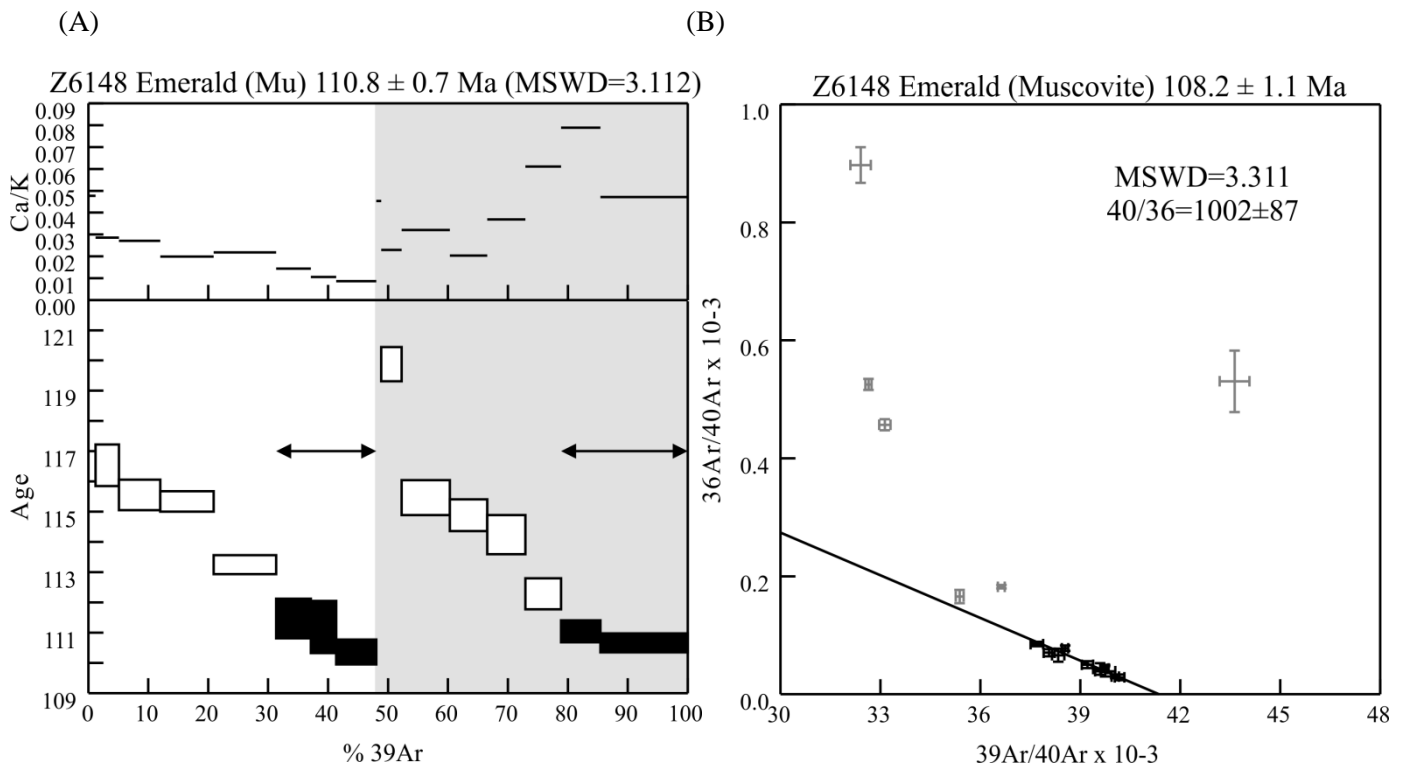
Muscovite/phlogopite from between tourmaline crystals on selvage or quartz-tourmaline emerald vein. The analyzed grains were large, thin, light brown flakes.

Results:

Two aliquots were run; both showed excess argon and down-stepping throughout most of the heating schedules (Fig. A). Highest temperature steps bottomed out at ca. 110 Ma. The assigned age is the inverse isochron age for data from both aliquots, MSWD = 3.311, $^{40}\text{Ar}/^{36}\text{Ar} = 1002 \pm 87$.

Analytical details:

Irradiation Batch: GSC #35
Date analyzed: May 29, 2000
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-99-14
Lithology: Quartz vein
Mineral analyzed: Muscovite
Age: 92.9 ± 0.6 Ma
Interpretation: Hydrothermal

Yukon Minfile 116B 160

Geochronology Lab Number: 6231
Argon Number: 1568
Location: Brewery Creek deposit, from drill core
UTM Zone 7 - 634200 E 7106500 N; NTS sheet 116B/1
Unit Name (if available): Earn Group breccia
Geologist: C. J. R. Hart

Sample Description:

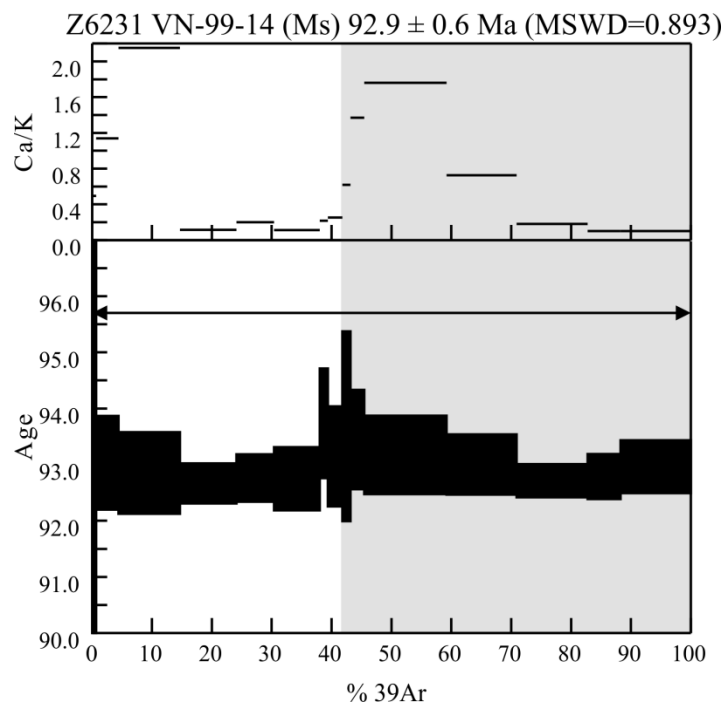
Muscovite was sampled from a vein, and the analyzed grains were thin, clear, colourless, and fragile with minor tiny black inclusions.

Results:

Two aliquots were run, both giving flat reproducible multistep plateaus comprising 100.0% of released ^{39}Ar gas, MSWD=0.893.

Analytical details:

Irradiation Batch: GSC #36
Date analyzed: December 4-5, 2000
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VN-99-15
Lithology: Muscovite alteration zone
Mineral analyzed: Muscovite
Age: ca. 162 Ma
Interpretation: Hydrothermal, estimate

Geochronology Lab Number: 6232
Argon Number: 1535
Location: Klondike, near old placer mining operation on Bear Creek Road
UTM Zone 7 - 585746 E 7100596 N; NTS sheet 116B/3
Unit Name (if available): Bear Creek Quartz vein
Geologist: C. J. R. Hart

Sample Description:

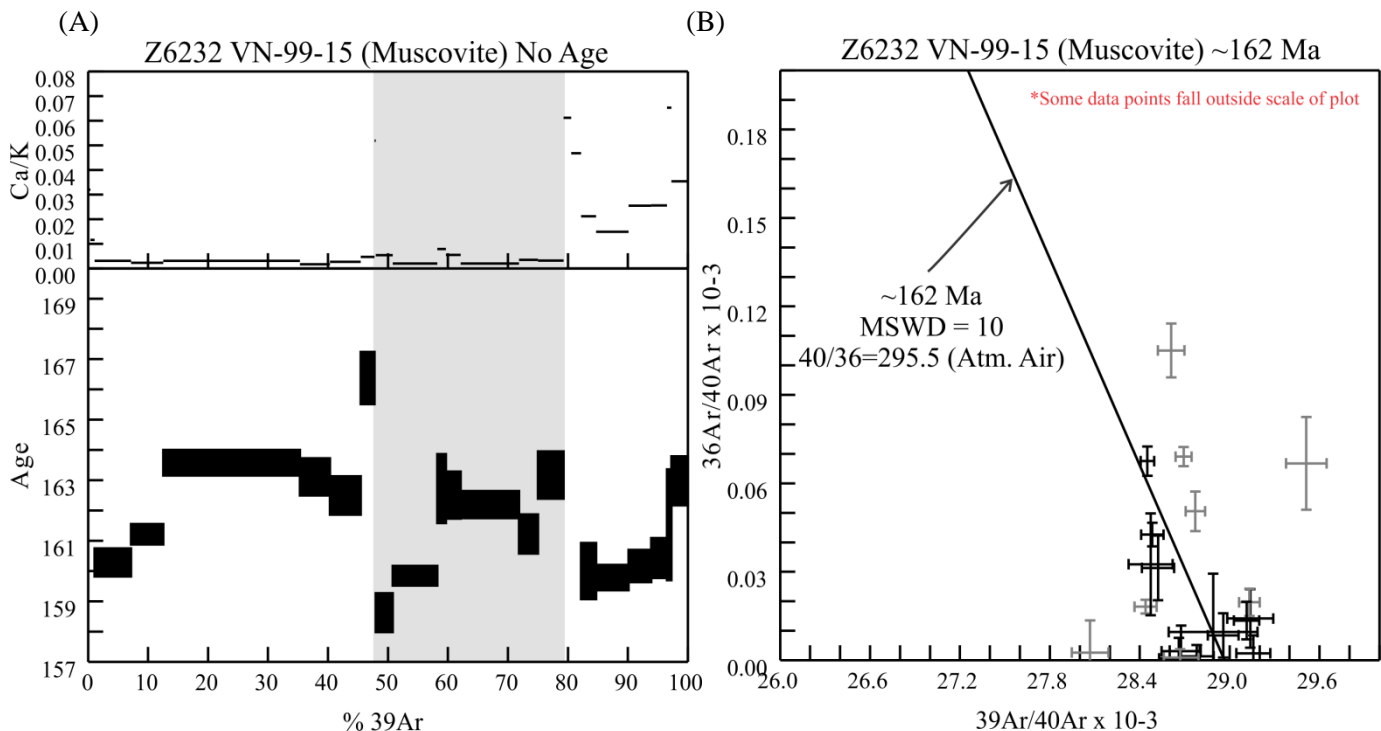
Muscovite formed by intrusion of late quartz vein that crosscuts Klondike schist. Vein contains pyrrhotite and enclaves of schist that are reacting to form coarse muscovite. Muscovite was pale green with minor tiny black inclusions.

Results:

Three aliquots were run, and none were in agreement with each other. All three spectra were disturbed (Fig. A), but most heating steps yielded ages within the 160-164 Ma range. Data on the inverse isochron plot was a scattered cloud at the x-axis (Fig. B), with approximately 162 Ma age, MSWD=10 ($^{40}\text{Ar}/^{36}\text{Ar} = 295.5$).

Analytical details:

Irradiation Batch: GSC #36
Date analyzed: July 31, August 10, & November 7, 2000
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: VNCH-98-17b

Yukon Minfile 1150 073

Lithology: K-feldspar-quartz-biotite pegmatite dyke

Mineral analyzed: Biotite

Age: 183.4 ± 1.3 Ma

Interpretation: Igneous Cooling/Hydrothermal

Geochronology Lab Number: 6268

Argon Number: 1561

Location: Violet Veins, Klondike

UTM Zone 7 - 584399 E 7082184 N; NTS sheet 1150/14

Unit Name (if available): Violet Vein

Geologist: C. J. R. Hart

Sample Description:

K-feldspar-quartz-biotite pegmatite dyke; biotite grains were coarse, thick and of good quality.

Results:

Reproducible, multi-step plateaus on two aliquots, MSWD=0.757, comprising 67% of gas in plateau regions of both aliquots. Aliquot A was slightly hump-shaped with minor decrease in age for the two highest- temperature steps.

Aliquot B displayed classic ^{40}Ar loss profile in early steps, with a plateau across 7 of 9 steps, and has more variable Ca/K than Aliquot A.

Analytical details:

Irradiation Batch: GSC #36

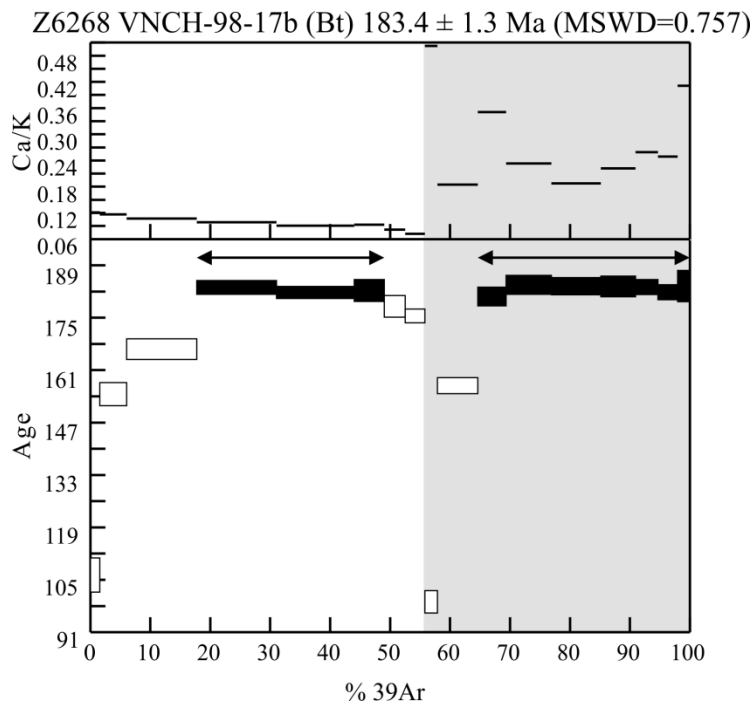
Date analyzed: August 10, 2000 & January 26 & 29, 2001

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VNCH-98-16c

Yukon Minfile 1150 068

Lithology: Muscovite schist

Mineral analyzed: Muscovite

Age: 158-162 Ma

Interpretation: Metamorphic Cooling, estimate

Geochronology Lab Number: 6270

Argon Number: 1560

Location: Sheba vein, Klondike

UTM Zone 7 - 600960 E 7085101 N; NTS sheet 1150/15

Unit Name (if available): Sheba muscovite schist

Geologist: C. J. R. Hart

Sample Description:

Muscovite schist from below and about 2 m away from Sheba vein. The muscovite grains were thin, with brown staining and minor black inclusions.

Results:

Three aliquots were run, all giving hump-shaped spectra, with apparent ages generally between 158 and 163 Ma (Fig. A). The inverse isochron gave 3 regressions (Fig. B): 162 ± 1 Ma ($^{40}\text{Ar}/^{36}\text{Ar}=295.5$), 160 ± 2 Ma ($^{40}\text{Ar}/^{36}\text{Ar}=401 \pm 23$), and 158 ± 1 Ma ($^{40}\text{Ar}/^{36}\text{Ar}=541 \pm 47$). MSWD's = 4, 28, and 16, respectively. The range of excess argon compositions precludes any precise age determination, and thus the age is best estimated between ~158 and 162 Ma as suggested by the inverse isochron results.

Analytical details:

Irradiation Batch: GSC #36

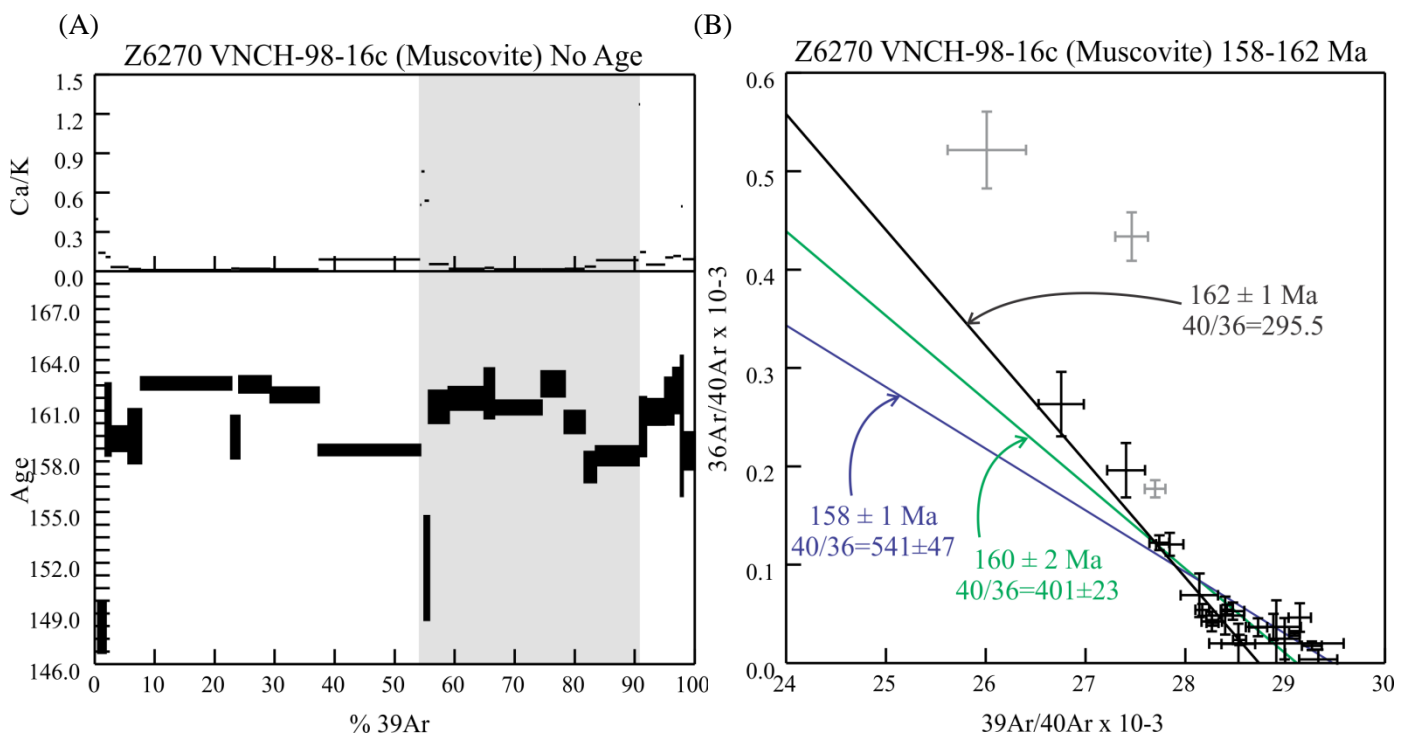
Date analyzed: August 8-9, December 11, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VNCH-98-16b

Yukon Minfile 1150 068

Lithology: Biotite schist

Mineral analyzed: Muscovite

Age: 148 ± 4 Ma

Interpretation: Hydrothermal, estimate

Geochronology Lab Number: 6271

Argon Number: 1559

Location: Sheba vein, Klondike

UTM Zone 7 - 600960 E 7085101 N; NTS sheet 1150/15

Unit Name (if available): Sheba biotite schist

Geologist: C. J. R. Hart

Sample Description:

Biotite schist from just above the vein; appears to have secondary biotite. Muscovite grains were clear and colourless with slight brown staining.

Results:

Two aliquots were run, and both had severely hump-shaped spectra, both with final fusion steps at ~152 Ma (Fig. A). The estimated 148 ± 4 Ma age is based on an inverse isochron regression through data points from both aliquots ($n=16/22$), $\text{MSWD} = 4.429$, $^{40}\text{Ar}/^{36}\text{Ar} = 4723 \pm 1200$. The inverse isochron diagram in Fig. B is zoomed in to the main cluster of data points; four other data points fall off the scale of the plot above both the excess ^{40}Ar regression line and the atmospheric line.

Analytical details:

Irradiation Batch: GSC #36

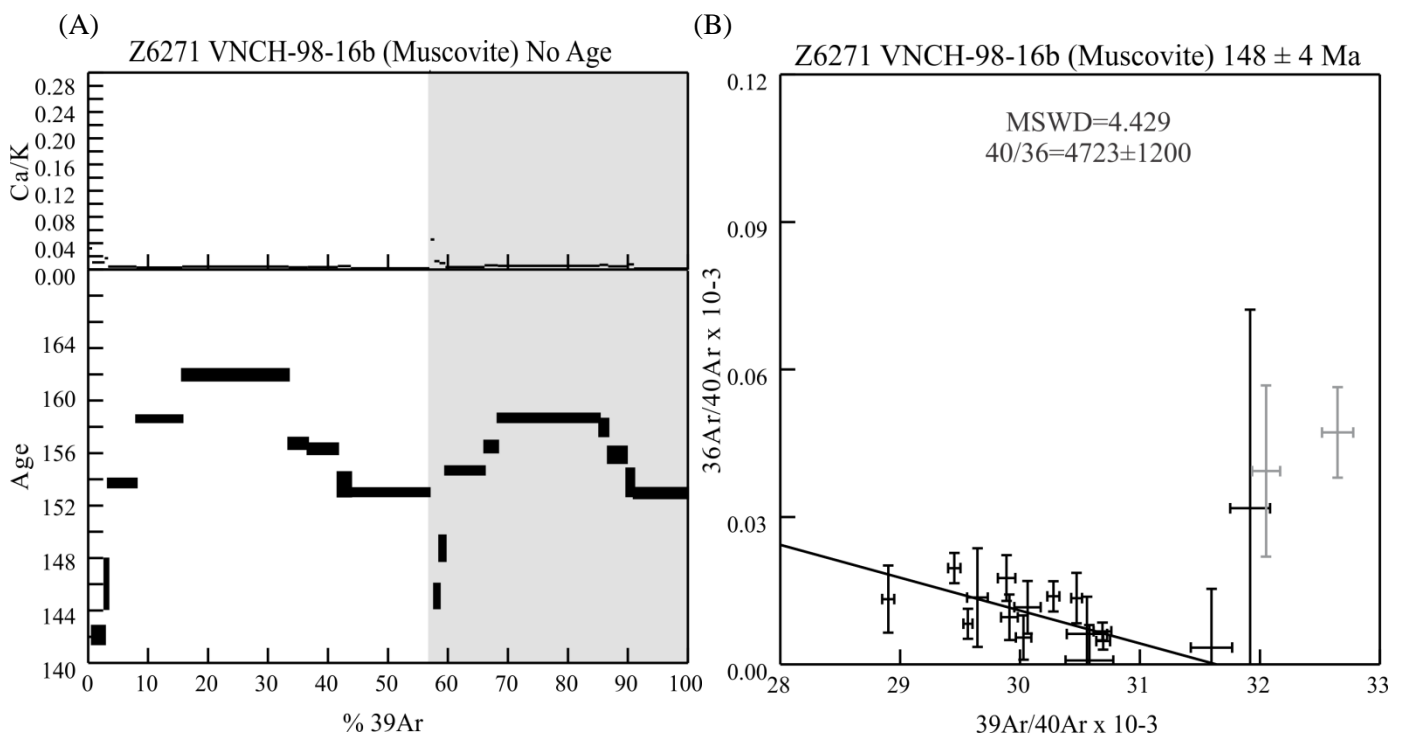
Date analyzed: August 4 & 8, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VNCH-98-16a

Yukon Minfile 115O 068

Lithology: Quartz vein

Mineral analyzed: Sericite

Age: 144.5 ± 0.8 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 6272

Argon Number: 1558

Location: Sheba Vein, Klondike

UTM Zone 7 - 600960 E 7085101 N; NTS sheet 115O/15

Unit Name (if available): Sheba Vein

Geologist: C. J. R. Hart

Sample Description:

Quartz vein containing muscovite/sericite. Sericite grains were yellow/gold-coloured flakes with minor iron oxide staining.

Results:

Four aliquots were analyzed, all reproducible with traditional low temperature ^{40}Ar -loss profiles (Cretaceous?) and flat multi-step plateaus at middle and highest temperatures of heating. Age is based on plateau regions for all four aliquots, comprising 70.9% of ^{39}Ar gas, MSWD=1.022.

Analytical details:

Irradiation Batch: GSC #36

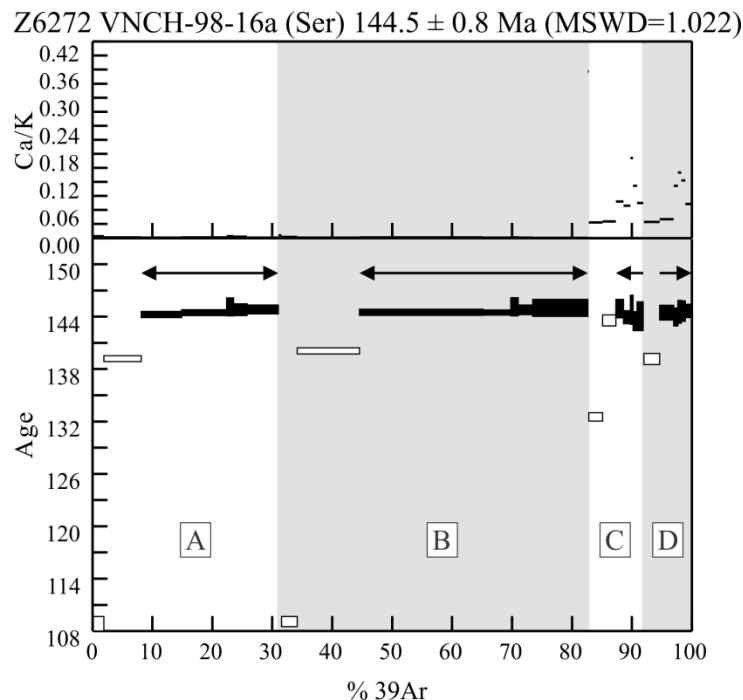
Date analyzed: August 3 & 15, December 13, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VNCH-98-15c

Yukon Minfile 1150 068

Lithology: Schist

Mineral analyzed: Muscovite

Age: 141.3 ± 0.8 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 6273

Argon Number: 1557

Location: Mitchell vein, Klondike

UTM Zone 7 - 600971 E 7086169 N; NTS sheet 1150/15

Unit Name (if available): Klondike Schist

Geologist: C. J. R. Hart

Sample Description:

Coarse muscovite, probably of hydrothermal origin, sampled from schist. The grains were slightly yellow with minor tiny black inclusions.

Results:

Three aliquots were analyzed. For each, the bulk of the gas came out in three or four heating steps, and the atmospheric Ar content was elevated. Aliquot A gave a short, mid-temperature pseudo-plateau (2 steps) then rose in age at highest temperature. Aliquot B rose to a three-step high-temperature plateau. Aliquot C showed a plateau but the final fusion step was older. Plateau regions for all aliquots agree, and were all used in the age calculation, 67% of ^{39}Ar released, MSWD=1.508.

Analytical details:

Irradiation Batch: GSC #36

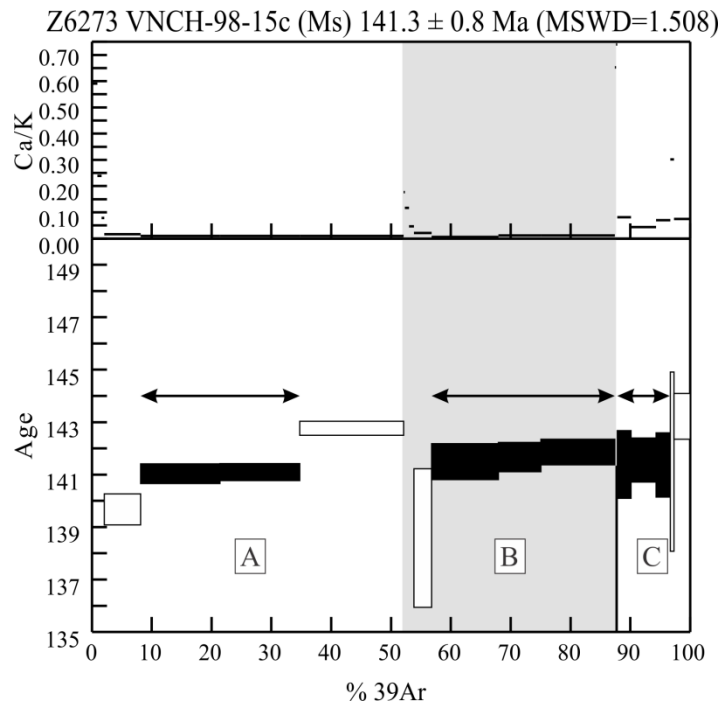
Date analyzed: August 1 & 15, December 11, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VNCH-98-15b

Yukon Minfile 1150 068

Lithology: Biotite schist

Mineral analyzed: Biotite

Age: 126.1 ± 1.8 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 6274

Argon Number: 1556

Location: Mitchell vein, Klondike

UTM Zone 7 - 600971 E 7086169 N; NTS sheet 1150/15

Unit Name (if available): Klondike Schist

Geologist: C. J. R. Hart

Sample Description:

Biotite schist with hydrothermal or recrystallized biotite along a felsic knot (most likely recrystallized). Biotite grains were very dark green (nearly black) in colour.

Results:

Three aliquots were analyzed. They all had very small amounts of gas for the sample size, and high atmospheric ^{40}Ar content. Each aliquot had 2-4 steps in the pseudo-plateau or plateau region, with ages reproducible at highest temperatures for all aliquots. 73.5 % of ^{39}Ar gas in plateau regions, MSWD=0.819.

Analytical details:

Irradiation Batch: GSC #36

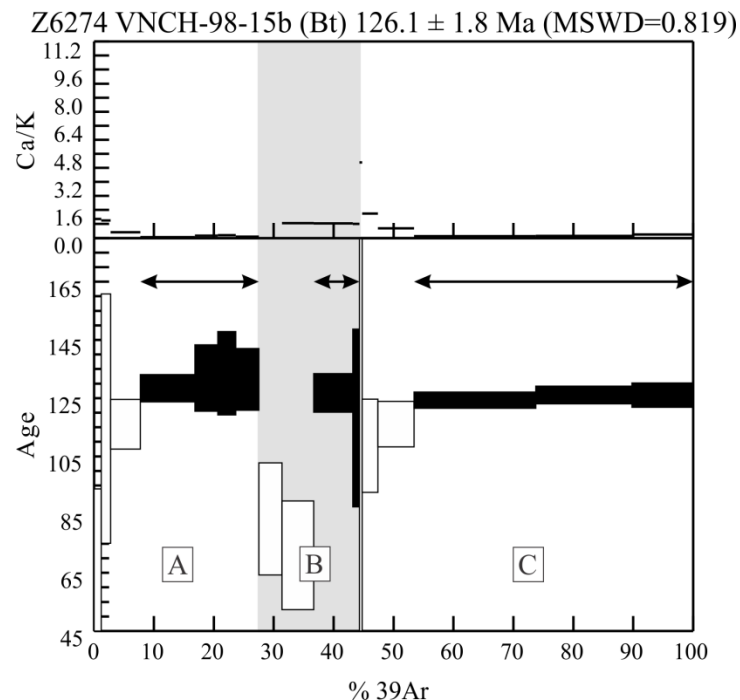
Date analyzed: August 1 & 22-23, November 9, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VNCH-98-15a

Yukon Minfile 1150 068

Lithology: Quartz Vein

Mineral analyzed: Sericite

Age: 144.4 ± 0.9 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 6275

Argon Number: 1555

Location: Mitchell vein, Klondike

UTM Zone 7 - 600971 E 7086169 N; NTS sheet 1150/15

Unit Name (if available): Mitchell vein

Geologist: C. J. R. Hart

Sample Description:

The sericite was sampled from a quartz vein of hydrothermal origin. Grains were pale yellow ragged flakes with minor rusty discolouration and tiny black and red inclusions.

Results:

Four aliquots were analyzed. Aliquots A and B gave the most disturbed spectra with significant ^{40}Ar loss in early heating steps (not shown below). Age is based on plateau regions of Aliquots C and D, which were the most reproducible, comprising 98.5% of released ^{39}Ar gas, MSWD=5.411. The fusion steps from both Aliquots A and B were within error of 144.4 ± 0.9 Ma.

Analytical details:

Irradiation Batch: GSC #36

Date analyzed: November 8, 2000

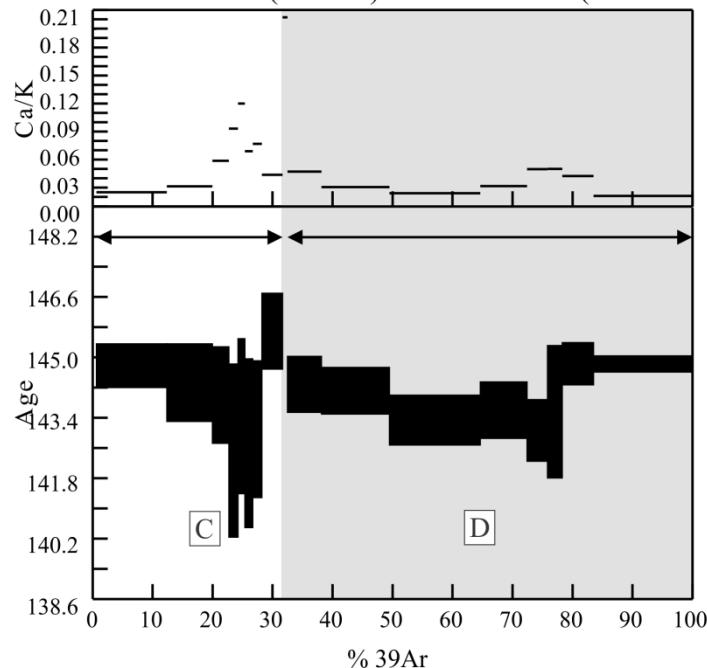
Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO_2 laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module

Z6275 VNCH-98-15a (Sericite) 144.4 ± 0.9 Ma (MSWD=5.411)



Sample Number: VNCH-98-14a

Yukon Minfile 115I 008

Lithology: Pegmatite

Mineral analyzed: Biotite

Age: 197.1 ± 1.2 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 6276

Argon Number: 1552

Location: Williams Creek/Carmacks Copper; from drill hole 1-50-91, at depth of 150 feet

UTM Zone 8 - 412040 E 6913490 N; NTS sheet 115I/7

Unit Name (if available): Williams Creek pegmatite

Geologist: C. J. R. Hart

Sample Description:

Dark brown hydrothermal biotite was sampled from along the margin of the pegmatite.

Results:

Two aliquots were run. Aliquot A was hump-shaped, and Aliquot B showed ^{40}Ar loss in early steps, otherwise giving a flat multistep plateau comprising 83.6 % of gas. Age is based on the plateau of Aliquot B only. MSWD=2.206. Age is considered to reflect igneous crystallization because it is indistinguishable from U-Pb zircon ages obtained by Tafti and Mortensen (2004) and Hood (2012) for Minto Suite plutons.

Analytical details:

Irradiation Batch: GSC #36

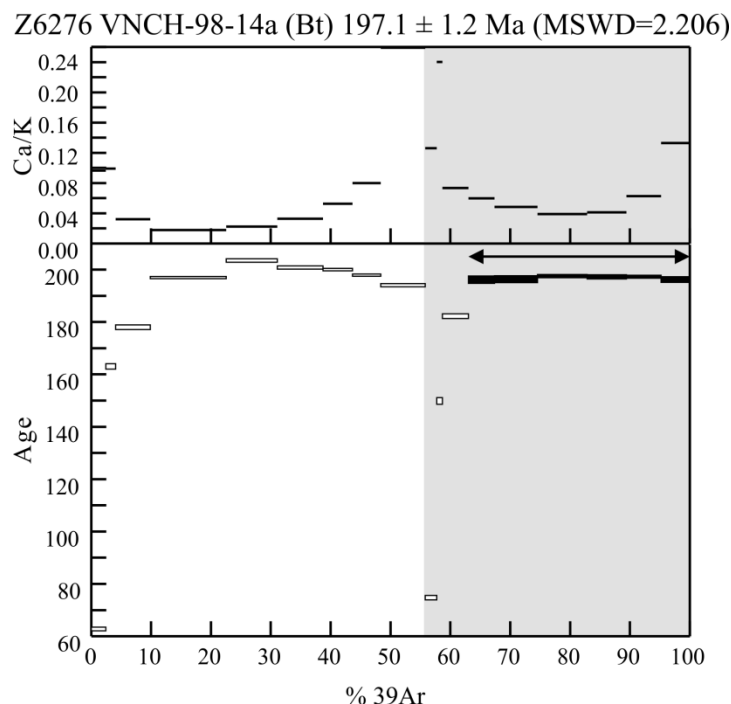
Date analyzed: December 6, 2000

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 00CH-KD2

Lithology: Biotite schist

Mineral analyzed: Biotite

Age: 133.8 ± 1.3 Ma

Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6928

Argon Number: 1763

Location: South Klondike, bottom of lower Dominion road, cliff face north of road

UTM Zone 7 - 620396 E 7066786 N; NTS sheet 115O/10

Unit Name (if available): Klondike Schist

Geologist: C. J. R. Hart

Sample Description:

Coarse-grained biotite schist in hanging wall of vein. Biotite was fresh and dark green.

Results:

Age is calculated from the combined flat multistep plateaus comprising 100% of gas for two aliquots of biotite.

MSWD = 1.229

Analytical details:

Irradiation Batch: GSC #40

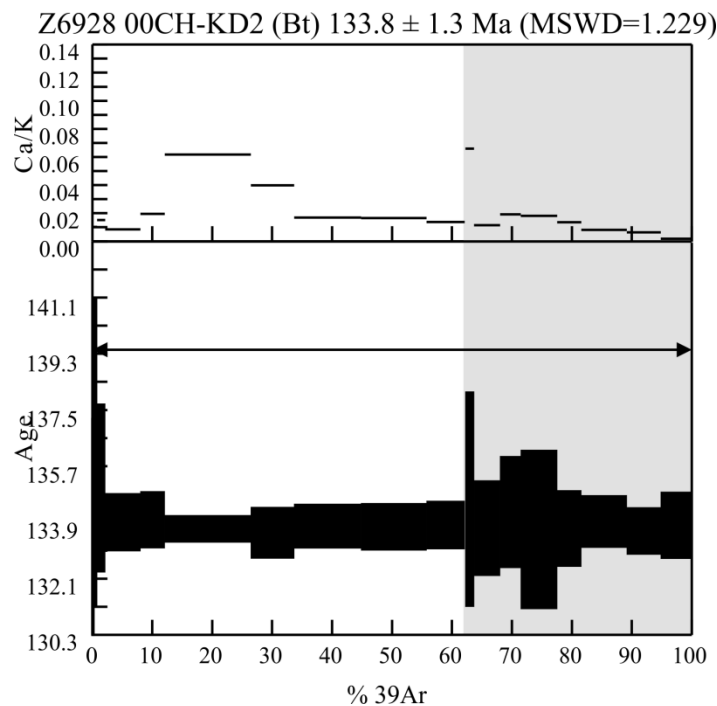
Date analyzed: August 29-30 & September 17-18, 2001

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 00CH-KD3
Lithology: Muscovite-quartz schist
Mineral analyzed: Muscovite
Age: 138.4 ± 1.6 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 6929

Argon Number: 1764

Location: South Klondike, bottom of lower Dominion road, cliff face north of road

UTM Zone 7 - 620396 E 7066786 N; NTS sheet 1150/10

Unit Name (if available): Klondike Schist

Geologist: C. J. R. Hart

Sample Description:

Clear, colourless coarse-grained muscovite from schist in the footwall of a vein.

Results:

Four aliquots were analyzed, all giving down-stepping spectra suggesting presence of excess ^{40}Ar (Fig. A). No plateaus were obtained. Age is from inverse isochron plot using data from all aliquots (Fig. B), MSWD= 2.240, $^{40}\text{Ar}/^{36}\text{Ar}=2144\pm170$.

Analytical details:

Irradiation Batch: GSC #40

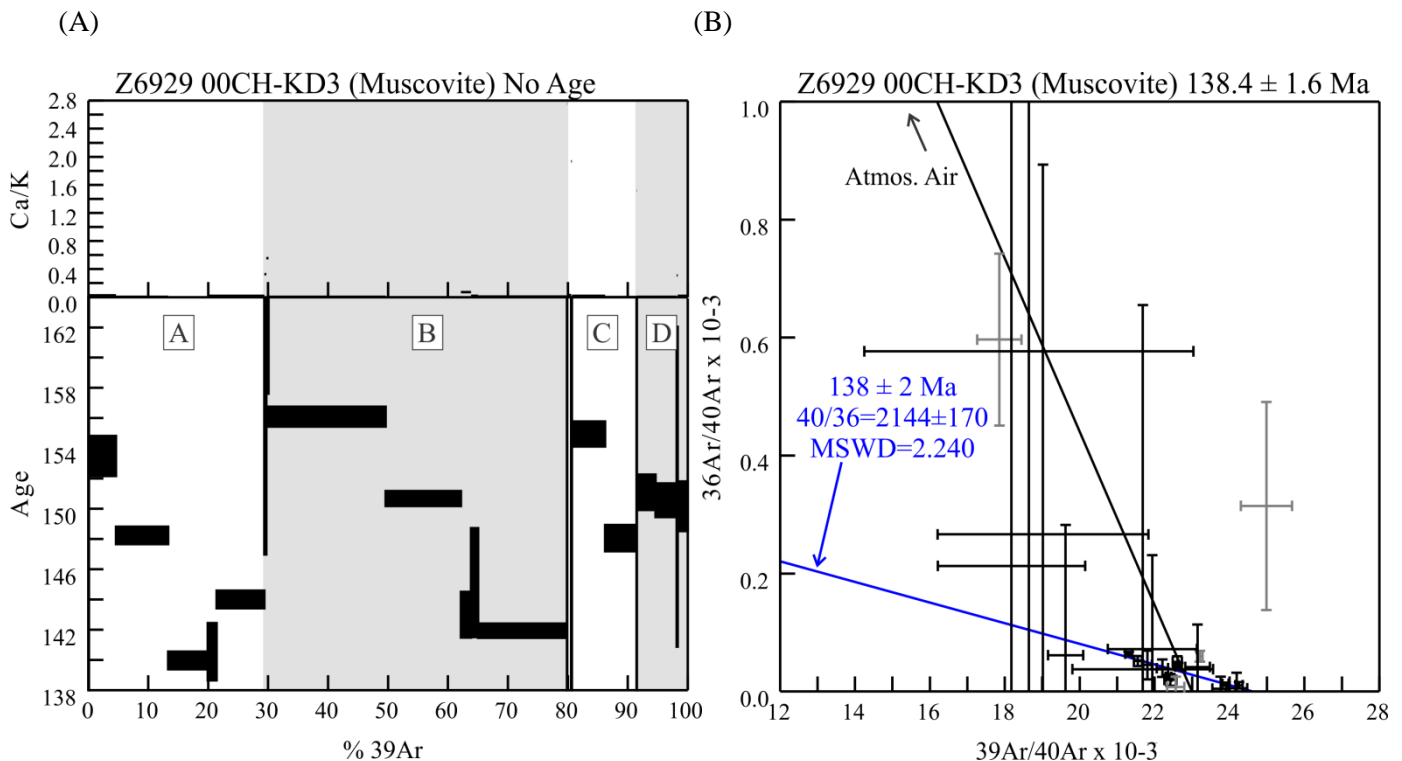
Date analyzed: October 24-25 & November 7-8, 2001

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO_2 laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-01-10
Lithology: Fuchsite schist
Mineral analyzed: Fuchsite
Age: 80.0 ± 0.6 Ma
Interpretation: Metamorphic Cooling

Geochronology Lab Number: 7048
Argon Number: 1840
Location: Near mouth of White River
UTM Zone 7 – 572021 E 7006178 N; NTS sheet 115O/4
Unit Name (if available):
Geologist: J. J. Ryan

Sample Description:

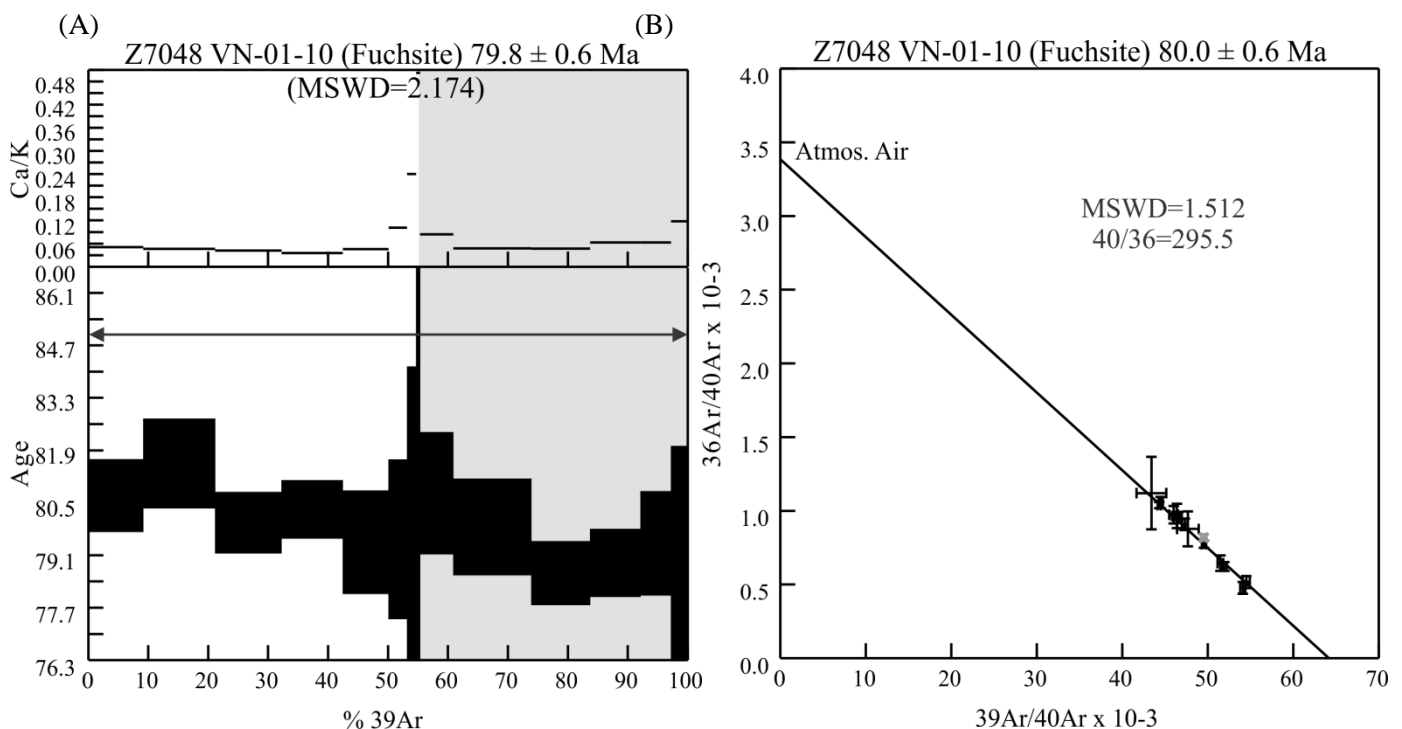
In outcrop, the sample consists of quartz-rich fuchsite schist with well-formed mm-sized flakes of emerald green fuchsite found adjacent to a fine-grained aplitic dyke. Area was staked on the basis of “malachite”, which was instead likely the fuchsite. The grains analyzed were thin, ragged-looking, with some mottled brown and clear patches.

Results:

Two aliquots gave slightly disturbed spectra, with all heating steps at approximately the same age (Fig. A). The plateau age including all steps from both aliquots was 79.8 ± 0.6 Ma, with a slightly elevated MSWD of 2.174. The data points are collinear along the atmospheric line in the inverse isochron plot, except for one outlier step not included in the inverse isochron age calculation (Fig. B; 80.0 ± 0.6 Ma, MSWD=1.512).

Analytical details:

Irradiation Batch: GSC #43
Date analyzed: January 21, 2003
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: 00CH-MT-03

Yukon Minfile 105O 002

Lithology: Skarn

Mineral analyzed: Biotite

Age: 96.7 ± 0.6 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 7317

Argon Number: 1893

Location: Mactung mine NTS 105O/8. Sample taken from mine dump.

UTM Zone 9 - 441709 E 7017871 N; NTS sheet 105O/8

Unit Name (if available): Mactung skarn

Geologist: C. J. R. Hart

Sample Description:

This sample was collected from a biotite-rich zone in W-skarn indicative of potassic alteration. Biotite is coarse-grained and intergrown with pyrrhotite. Fresh, inclusion-free, dark brown grains were selected for dating.

Results:

Flat multistep plateaus were obtained for two aliquots of biotite, comprising 85.5 % of released ^{39}Ar . The age is calculated using the combined plateau regions for both aliquots, MSWD = 1.094. Minor ^{40}Ar loss occurred in the lowest-temperature heating steps.

Analytical details:

Irradiation Batch: GSC #43

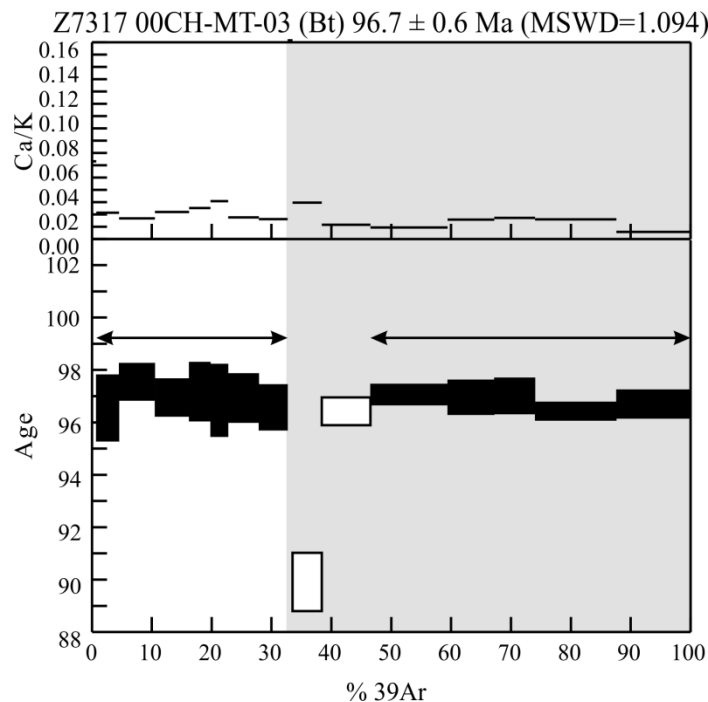
Date analyzed: December 9, 2002

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 00CH-MT-14A

Yukon Minfile 105O 002

Lithology: Quartz vein

Mineral analyzed: Muscovite

Age: 95.5 ± 0.6 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 7318

Argon Number: 1894

Location: Mactung mine area, about 1.1 km north of the adit

UTM Zone 9 - 442227 E 7018690 N; NTS sheet 105O/8

Unit Name (if available): Mactung skarn

Geologist: C. J. R. Hart

Sample Description:

Coarse-grained, excellent quality muscovite in quartz-tourmaline-muscovite-molybdenite veins cutting hornfels.

Results:

Two aliquots of muscovite were analyzed, both giving multi-step flat plateaus comprising 98.5 % of the released ^{39}Ar gas, MSWD=0.886.

Analytical details:

Irradiation Batch: GSC #43

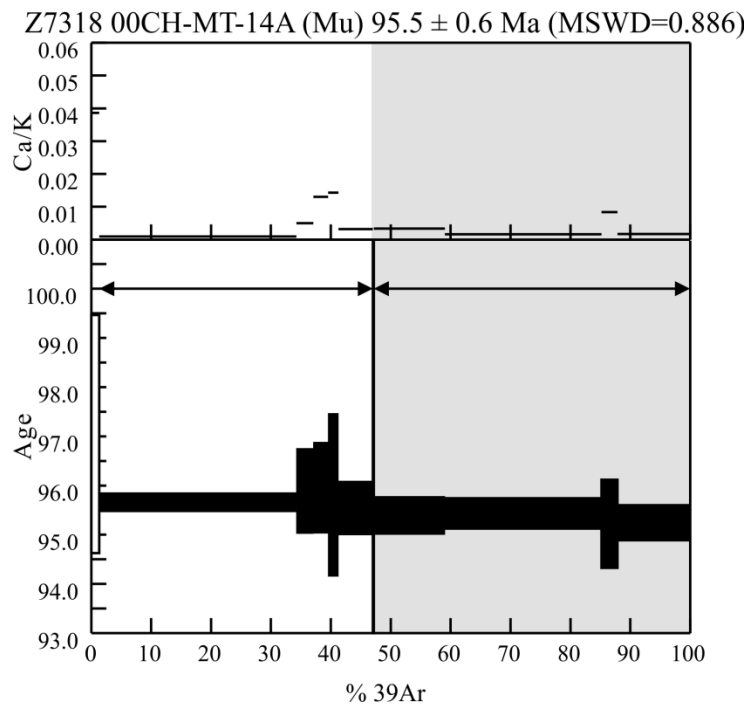
Date analyzed: December 10, 2002

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 00CH-MT-15

Yukon Minfile 105O 002

Lithology: Greisen

Mineral analyzed: Muscovite

Age: 95.2 ± 0.6 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 7319

Argon Number: 1895

Location: Mactung mine area, about 300 m east of the adit

UTM Zone 9 - 442540 E 7017514 N; NTS sheet 105O/8

Unit Name (if available): Mactung pluton

Geologist: C. J. R. Hart

Sample Description:

Muscovite in greisen on quartz-tourmaline-coated joints in Mactung pluton. Grains selected for analysis were coarse, thin, fresh and inclusion-free.

Results:

Two aliquots of muscovite were analyzed, both giving multi-step flat plateaus comprising 99.4 % of gas, MSWD=0.462.

Analytical details:

Irradiation Batch: GSC #43

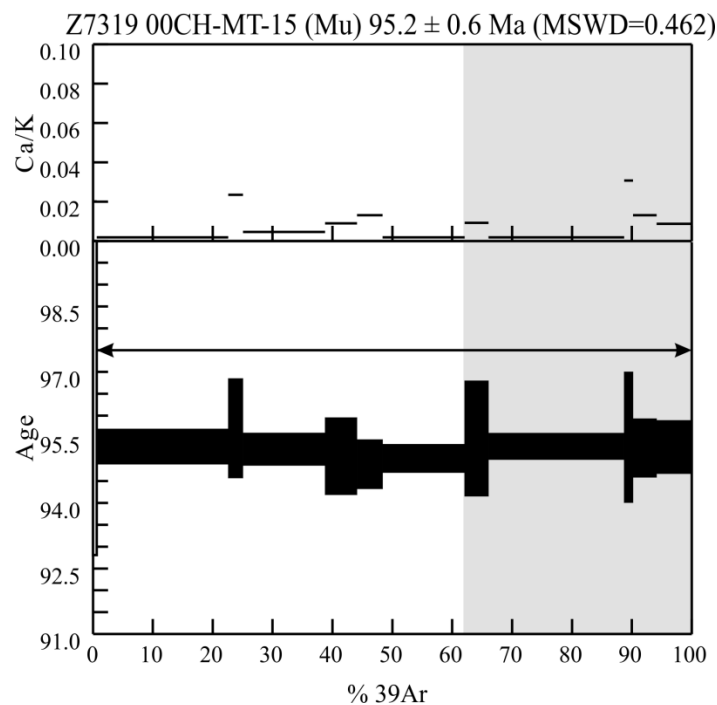
Date analyzed: December 11, 2002

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 00CH-DG-1C

Yukon Minfile 106D 025

Lithology: Quartz vein

Mineral analyzed: Biotite

Age: 96.5 ± 0.8 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 7320

Argon Number: 1896

Location: Dublin Gulch deposit; east side of upper Olive Gulch

UTM Zone 8 - 461882 E 7101031 N; NTS sheet 106D/4

Unit Name (if available): Dublin Gulch pluton

Geologist: C. J. R. Hart

Sample Description:

Coarse-grained biotite in quartz-molybdenite vein in granite. Biotite grains were fairly poor quality - chlorite intergrowths were difficult to avoid during grain selection for analysis.

Results:

Spectra for two aliquots were both hump-shaped (Fig. A). The two highest temperature fusion steps were ca. 98 Ma. The inverse isochron age, using 10 collinear data points (of a total 18 data points) was 96.5 ± 0.8 Ma, MSWD = 2.509, $^{40}\text{Ar}/^{36}\text{Ar} = 311 \pm 2$ (Fig. B).

Analytical details:

Irradiation Batch: GSC #43

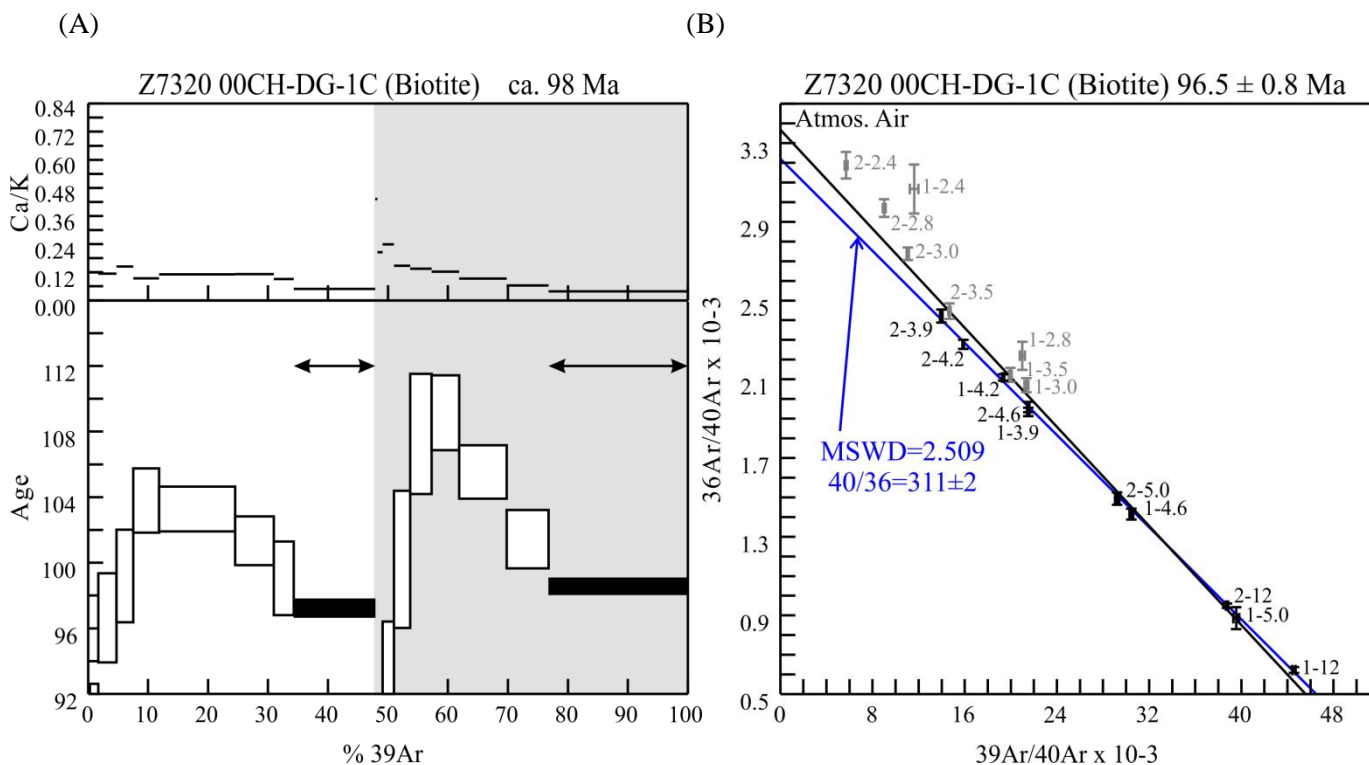
Date analyzed: January 6-7, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: 00CH-SD-1

Yukon Minfile 115P 004

Lithology: Quartz vein

Mineral analyzed: Biotite

Age: 91.5 ± 0.6 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 7321

Argon Number: 1897

Location: Scheelite Dome; sheeted zone on north side of gulch.

UTM Zone 8 – 437232 E 7073831 N; NTS sheet 115P/16

Unit Name (if available): Scheelite Dome pluton

Geologist: C. J. R. Hart

Sample Description:

Coarse-grained biotite in quartz-molybdenite vein in granite (crystals were up to 2cm in size). Grains selected for analysis were fresh, thin, light brown books.

Results:

Two aliquots of biotite were analyzed, both giving flat multi-step plateaus comprising 94.4 % of released ^{39}Ar , MSWD=0.373.

Analytical details:

Irradiation Batch: GSC #43

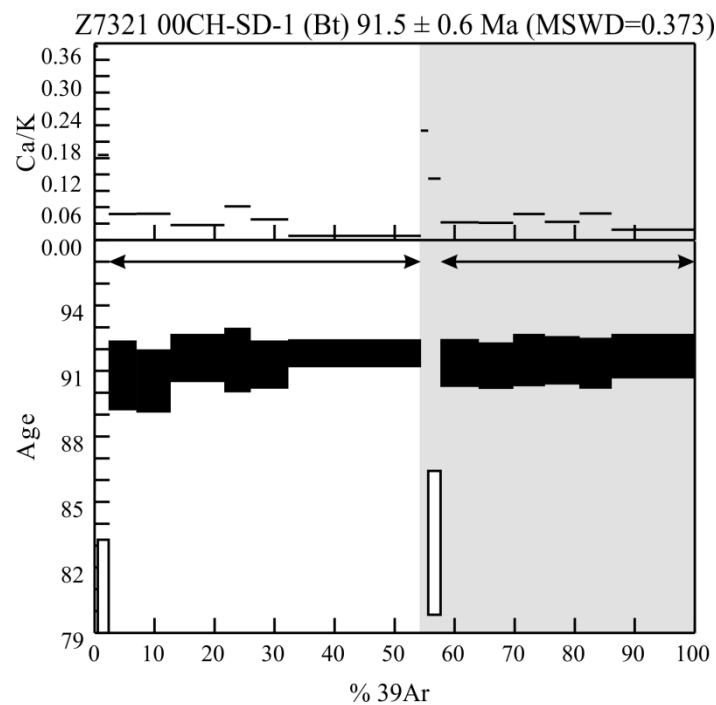
Date analyzed: January 7-8, 2003

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-02-K01

Yukon Minfile 1150 066

Lithology: Quartz vein

Mineral analyzed: Muscovite

Age: 162.8 ± 1.1 Ma

Interpretation: Minimum age for intrusion of vein (Hydrothermal)

Age: 173 ± 1 Ma

Interpretation: Metamorphic Cooling, estimate

Geochronology Lab Number: 7566

Argon Number: 2002

Location: On narrow road east off Sulphur Creek road approximately 0.5 km along first saddle from junction with Quartz Creek road. At Tiger claim shaft showing, from a rubble pile next to the shaft.

UTM Zone 7 - 603628 E 7081053 N; NTS sheet 1150/15

Unit Name (if available):

Geologist: C.J.R. Hart

Sample Description:

Folioform quartz vein. In muscovite-rich schist, new muscovite growth along and within vein. Likely formed synchronous with metamorphism that formed the schist. Grains selected for analysis were clear, pale apple-green thick robust books, with some minor orange staining at rims.

Results:

This sample was included in two irradiation batches, and a total of three aliquots were analyzed.

GSC#45 Results:

Two aliquots were analyzed, and both gave downward-stepping patterns on the release spectra, indicating presence of excess ^{40}Ar (Fig. A). On the inverse isochron plot (Fig. B), there appear to be two ages of muscovite; each aliquot (of 3 grains each) seems to give internally consistent ages that are distinguishable (162.8 ± 1.1 Ma and 171.2 ± 4.4 Ma). Both show evidence for excess Ar (Aliquot A $^{40}\text{Ar}/^{36}\text{Ar} = 950 \pm 180$; Aliquot B = 833 ± 48). Either 1) 163 Ma is the age of veining and 171 Ma represents contamination, or 2) 171 Ma is the age of regional metamorphism or veining and 163 Ma represents partial ^{40}Ar loss that is difficult to assess because of presence of excess ^{40}Ar . In either case, 163 Ma is minimum age for intrusion of vein.

GSC#51 Results:

One aliquot was analyzed (3 grains), giving a downward-stepping spectrum similar to the two aliquots previously run, but with relatively tighter range of ages (most fall between 170 and 175 Ma; Fig. A). On the inverse isochron plot (Fig. C), the data fall along an excess argon regression line that gives an age of $\sim 173 \pm 1$ Ma, $\text{MSWD} = 1.861$, $^{40}\text{Ar}/^{36}\text{Ar} = 405 \pm 88$. This age is in agreement with the ca. 171 Ma age obtained for Aliquot A from the GSC#45 dataset, which suggest 171-173 Ma is the age of the regional metamorphism. Thus the 163 Ma age likely constrains the timing of the veining event at Tiger.

Analytical details:

Irradiation Batch: GSC #45, and GSC#51

Dates analyzed: December 16, 2003 & March 19, 2004, and again February 17 & 20, 2006

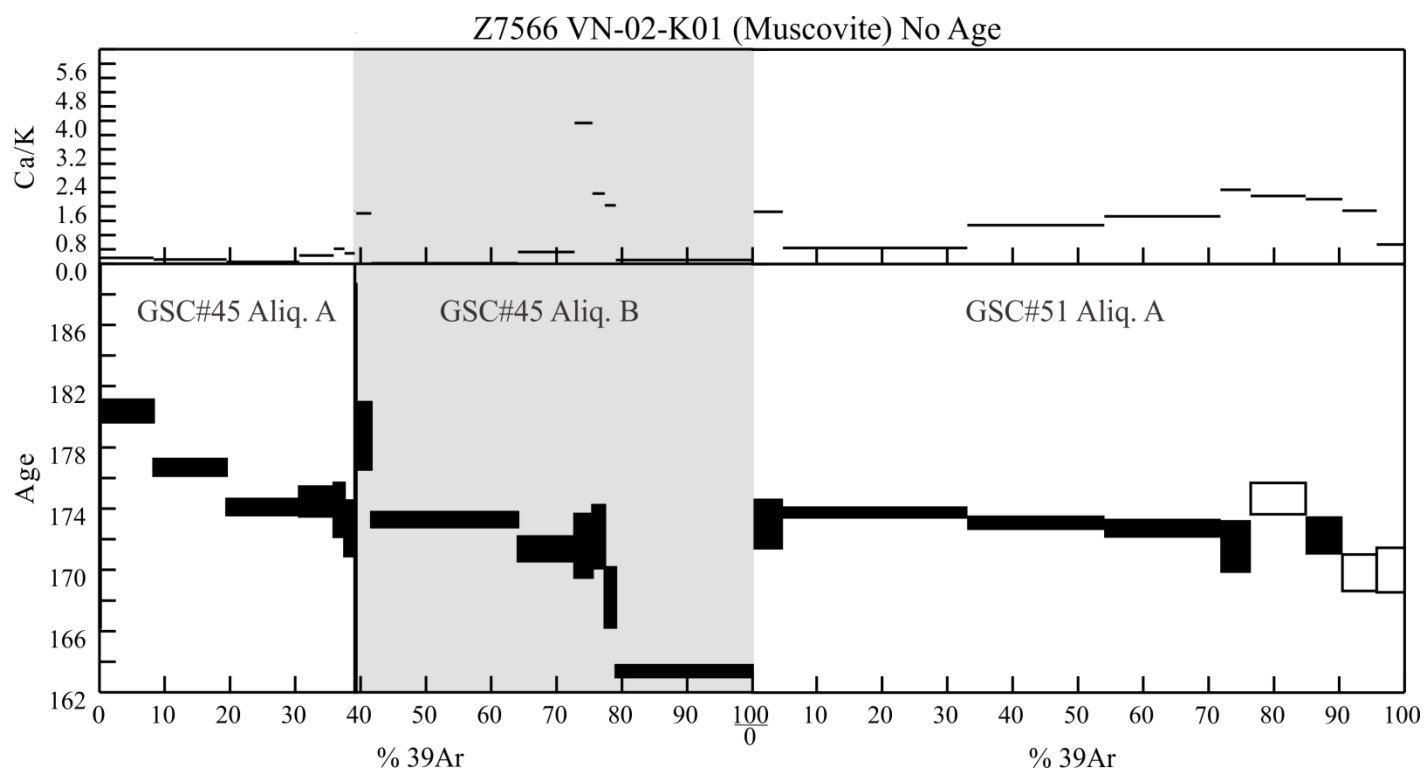
Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

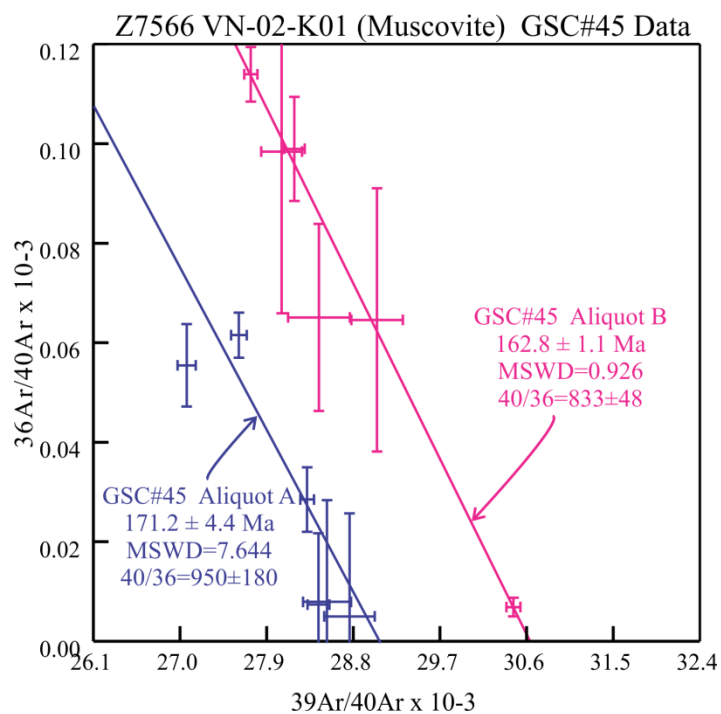
Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module

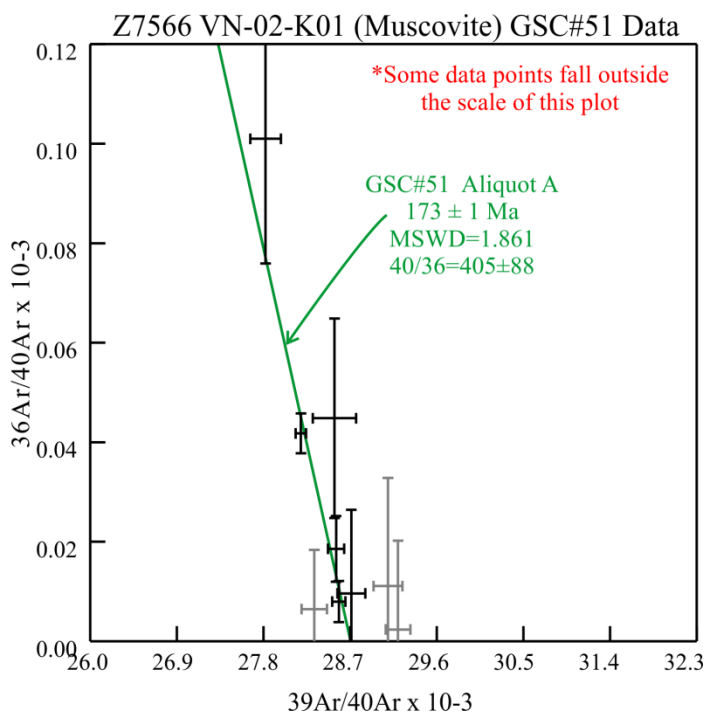
(A)



(B)



(C)



Sample Number: VN-02-K02
Lithology: Quartz vein
Mineral analyzed: Muscovite
Age: 152 ± 14 Ma
Interpretation: Hydrothermal, estimate

Yukon Minfile 1150 066

Geochronology Lab Number: 7567

Argon Number: 2004

Location: Klondike, road near junction with old road, next to large decrepit cabin. Lloyd Deposit.

UTM Zone 7 - 604673 E 7079498 N; NTS sheet 1150/15

Unit Name (if available): Lloyd Vein

Geologist: C.J.R. Hart

Sample Description:

Large quartz vein cutting mica-rich (secondary) foliated granodiorite. Protolith was possibly feldspar-phyric. Fragments of wall rock cut at high angle to foliation and as xenoliths. Muscovite selected for analysis was clear, thin, fragile and colourless with abundant yellow staining.

Results:

Very poor underlying analytical results were obtained for two aliquots. Spectra were complex, showing both Ar-loss and excess ^{40}Ar (Fig. A). High temperature steps were very radiogenic, with little spread on the excess Ar line (Fig. B); they give an imprecise estimate of age. $\text{MSWD}=0.889$, $^{40}\text{Ar}/^{36}\text{Ar}=10980 \pm 8700$.

Analytical details:

Irradiation Batch: GSC #45

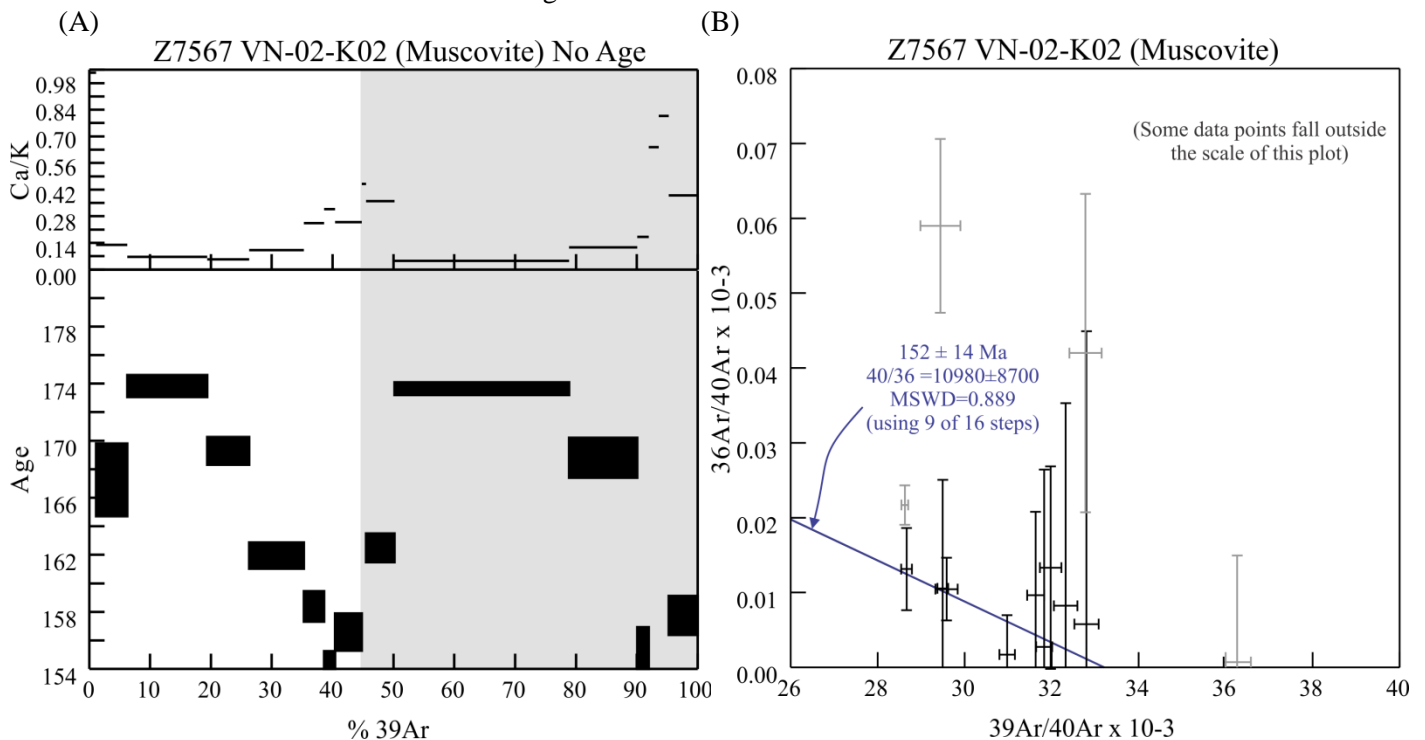
Date analyzed: Dec. 16, 2003 and Jan. 6, 2004

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO_2 laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: VN-02-K02
Lithology: Quartz vein
Mineral analyzed: Phlogopite
Age: 175.3 ± 1.2 Ma
Interpretation: Hydrothermal

Yukon Minfile 115O 066

Geochronology Lab Number: 7567

Argon Number: 2003

Location: Klondike, road near junction with old road, next to large decrepit cabin. Lloyd Deposit.

UTM Zone 7 - 604673 E 7079498 N; NTS sheet 115O/15

Unit Name (if available): Lloyd Vein

Geologist: C.J.R. Hart

Sample Description:

Large quartz vein cutting mica-rich (secondary) foliated granodiorite. Protolith possibly feldspar-phyric. Fragments of wall rock cut at high angle to foliation and as xenoliths. Phlogopite grains selected for analysis were excellent quality pale grey-green thick books.

Results:

One aliquot was analyzed, giving a flat multistep plateau that comprised 91.8% of the gas, MSWD=0.223.

Analytical details:

Irradiation Batch: GSC #45

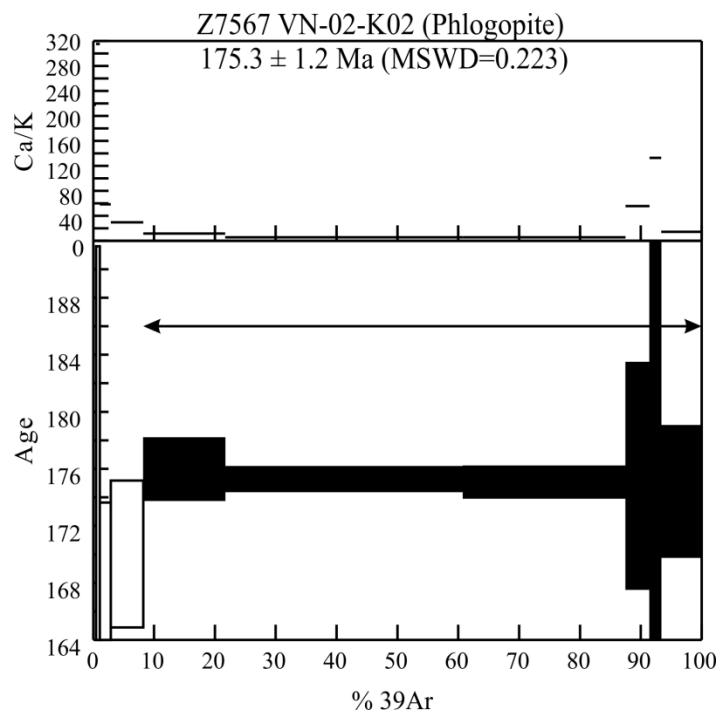
Date analyzed: June 1, 2004

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: BC-3
Lithology: Monzonite
Mineral analyzed: Roscoelite
Age: No Age
Interpretation: No Age

Yukon Minfile 116B 160

Geochronology Lab Number: 7660
Argon Number: 2025
Location: Brewery Creek deposit, Moosehead Zone, from drill hole DD95-64
UTM Zone 7 - 634170 E 7106480 N; NTS sheet 116B/1
Unit Name (if available): Brewery Creek Sills
Geologist: C. J. R. Hart

Sample Description:

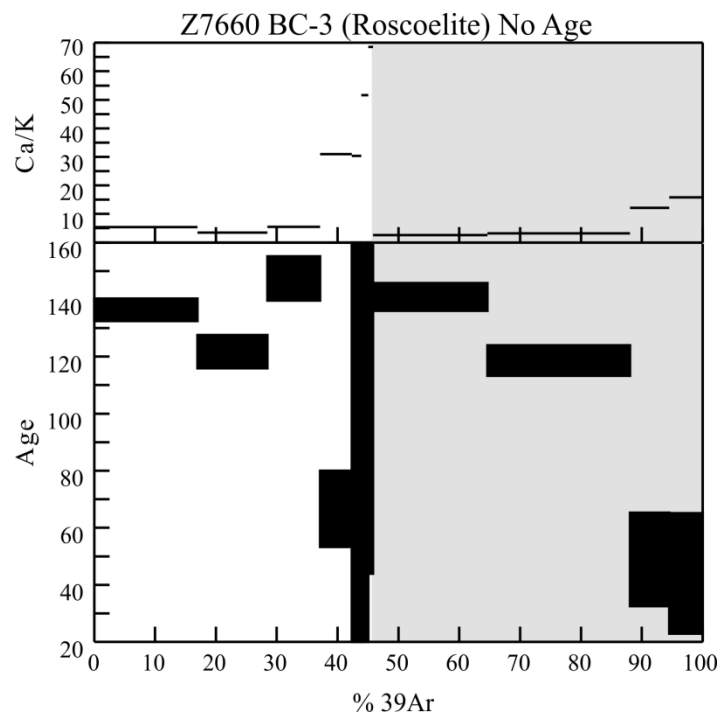
Pervasively altered monzonite dyke, with orange weathering and carbonate alteration. Biotite in the rock is pseudomorphed by green roscoelite (V-muscovite), the age of which is intended to help constrain timing of hydrothermal mineralization. Roscoelite occurs as emerald green amorphous grains and is unavoidably intergrown and/or encrusted with white or pale yellow carbonate. Grains were washed in 1N HNO₃ for 12 minutes and rinsed with deionized water prior to irradiation to minimize carbonate contamination.

Results:

Two aliquots were analyzed. Complex and clearly disrupted isotopic systematics preclude any age interpretation from the release spectra or the inverse isochron diagram (not shown). Removal of carbonate alteration by nitric wash may have further disrupted systematics.

Analytical details:

Irradiation Batch: GSC #45
Date analyzed: February 23, 2004
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: BC-5

Yukon Minfile 116B 160

Lithology: K-feldspar-biotite monzonite

Mineral analyzed: Biotite

Age: No Age

Interpretation: No Age

Geochronology Lab Number: 7662

Argon Number: 2017

Location: Brewery Creek deposit, Moosehead Zone, from drill hole DD95-64

UTM Zone 7 - 634170 E 7106480 N; NTS sheet 116B/1

Unit Name (if available): Brewery Creek Sills

Geologist: C. J. R. Hart

Sample Description:

Fresh K-feldspar-biotite monzonite dyke with some late low-temperature carbonate veining, no alteration. Biotite appeared fresh in hand sample. When the biotite was being picked, however, it was challenging to recover pure grains. The biotite occurs as composite polycrystalline clusters (~90% biotite and ~10% quartzofeldspathic material), commonly interlaced with sulphide phases, which was difficult to avoid.

Results:

Two aliquots were analyzed. Complex and clearly disrupted isotopic systematics preclude age interpretation. Disturbances may be due to fine polycrystalline nature of the biotite and possible intergrowths with other mineral phases. Data was scattered on the inverse isochron plot (not shown), and equally unresolvable.

Analytical details:

Irradiation Batch: GSC #45

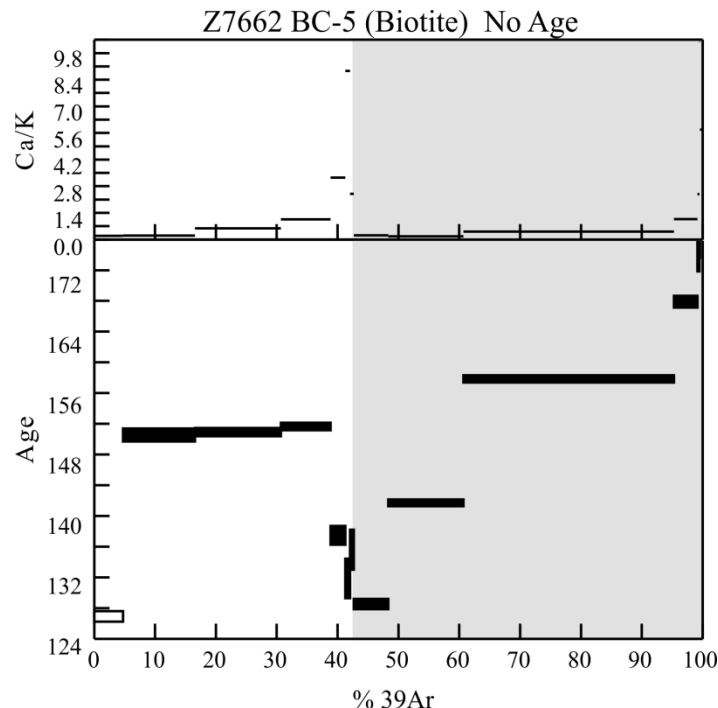
Date analyzed: February 17, & March 1, 2004

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: LT-1Ar

Yukon Minfile 105B 039

Lithology: Quartz-carbonate vein

Mineral analyzed: Muscovite

Age: 107.3 ± 0.7 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 8015

Argon Number: 2184

Location: Logtung tungsten deposit. Sample from ore dump.

UTM Zone 9 - 355069 E 6656406 N; NTS sheet 105B/4

Unit Name (if available): Logtung skarn

Geologist: C. J. R. Hart

Sample Description:

Muscovite from surface of late vuggy vein of quartz-muscovite-late calcite cutting molybdenite-bearing felsite that is in turn cut by a thick quartz-molybdenite (chalcopyrite) vein. Age should provide constraint on timing of youngest hydrothermal event (W-Mo mineralization). Muscovite grains were large, clear and colourless (500-700 μ m each).

Results:

One aliquot of muscovite (2 grains) was analyzed, giving a flat multistep plateau comprising 94.8% of released ^{39}Ar gas, MSWD = 0.523.

Analytical details:

Irradiation Batch: GSC #51

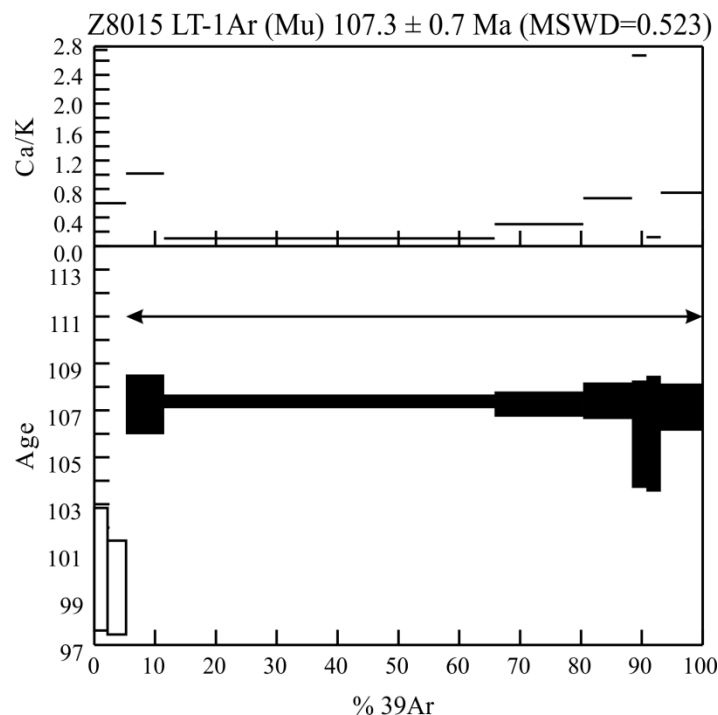
Date analyzed: December 23, 2005

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: LT-2Ar

Yukon Minfile 105B 039

Lithology: Felsite

Mineral analyzed: Muscovite

Age: 106.2 ± 0.8 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 8016

Argon Number: 2185

Location: Logtung tungsten deposit. Sample from drill core, actual position unknown.

UTM Zone 9 - 355069 E 6656406 N; NTS sheet 105B/4

Unit Name (if available): Logtung skarn

Geologist: C. J. R. Hart

Sample Description:

Coarse-grained muscovite in vug in quartz-eye porphyry felsite. Muscovite presumed to give late magmatic age. Muscovite grains were large, euhedral, clear and pale yellow (400-700 μ m each).

Results:

One aliquot of muscovite (2 grains) was analyzed, and it gave a flat multistep plateau comprising 96.8 % of gas, MSWD = 0.157.

Analytical details:

Irradiation Batch: GSC #51

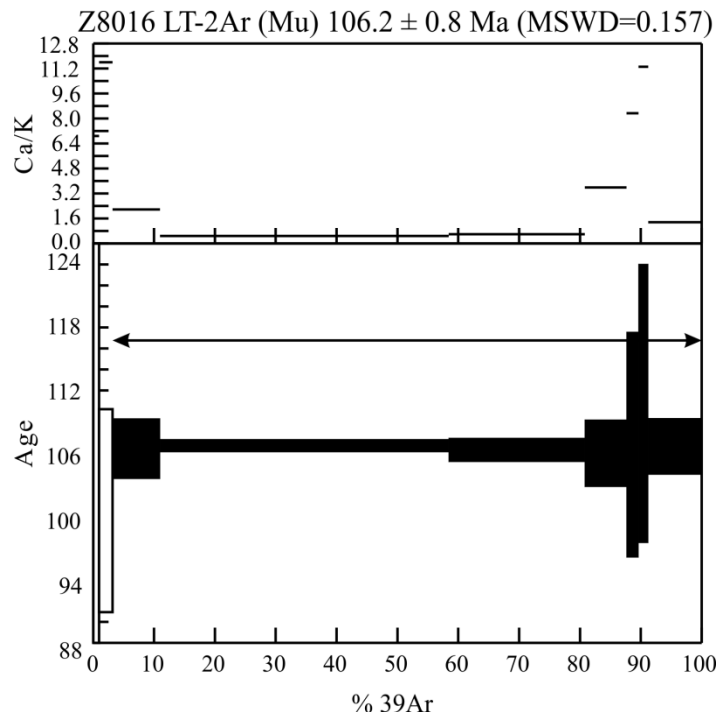
Date analyzed: January 5, 2006

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: LT-3Ar
Lithology: K-feldspar pegmatite
Mineral analyzed: Feldspar
Age: 85.3 ± 0.6 Ma
Interpretation: Hydrothermal

Yukon Minfile 105B 039

Geochronology Lab Number: 8017
Argon Number: 2186
Location: Northern Dancer beryl trenches on side of hill south of tungsten deposit
UTM Zone 9 - 354280 E 6654419 N; NTS sheet 105B/4
Unit Name (if available): Logtung pegmatite
Geologist: C. J. R. Hart

Sample Description:

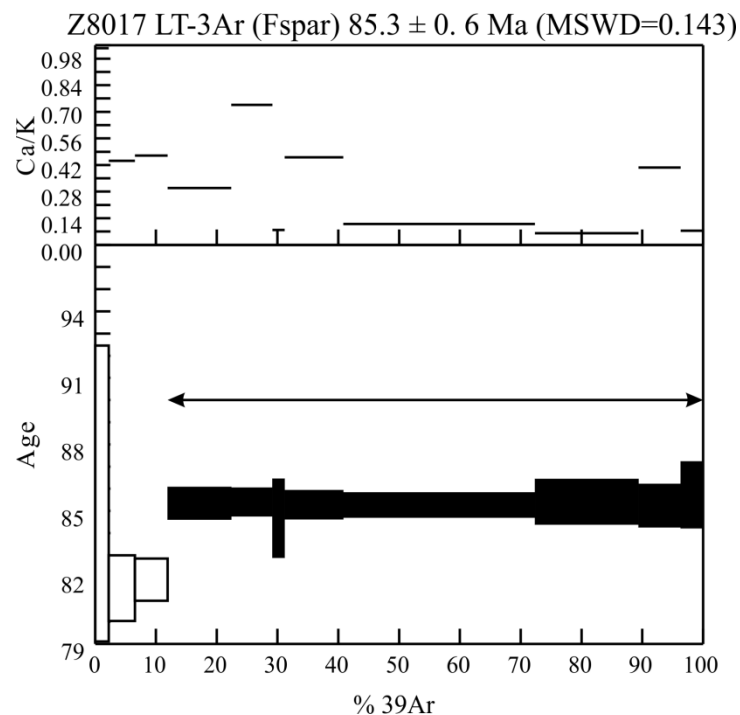
Pegmatite with K-feldspar, cockscomb quartz, and pale green beryl. Sample was collected to constrain age of beryl mineralization. Four grains were selected for the aliquot; they were large laths up to 1mm in length, and were white and clouded in appearance.

Results:

One aliquot of feldspar was analyzed, giving a flat multistep plateau comprising 88.1% of the released ^{39}Ar gas, MSWD = 0.143. High-temperature steps had very high atmospheric argon content.

Analytical details:

Irradiation Batch: GSC #51
Date analyzed: January 4-5, 2006
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: LT-4Ar
Lithology: Greisen
Mineral analyzed: Muscovite
Age: 108.4 ± 0.7 Ma
Interpretation: Hydrothermal

Yukon Minfile 105B 039

Geochronology Lab Number: 8018

Argon Number: 2187

Location: Near Northern Dancer beryl trenches on side of hill south of tungsten deposit

UTM Zone 9 - 354280 E 6654419 N; NTS sheet 105B/4

Unit Name (if available): Logtung greisen

Geologist: C. J. R. Hart

Sample Description:

Coarse grained muscovite greisen from quartz-amethyst veins in beryl-rich trenches. Sample was collected to help constrain age of beryl mineralization. Two grains were loaded for analysis; they were light brown and perfect euhedral little hexagons ($\sim 700\mu\text{m}$), with growth zoning that looked similar to tree rings.

Results:

One aliquot of muscovite was analyzed, and gave a flat multistep plateau comprising 99.6 % of gas, MSWD=0.781.

Analytical details:

Irradiation Batch: GSC #51

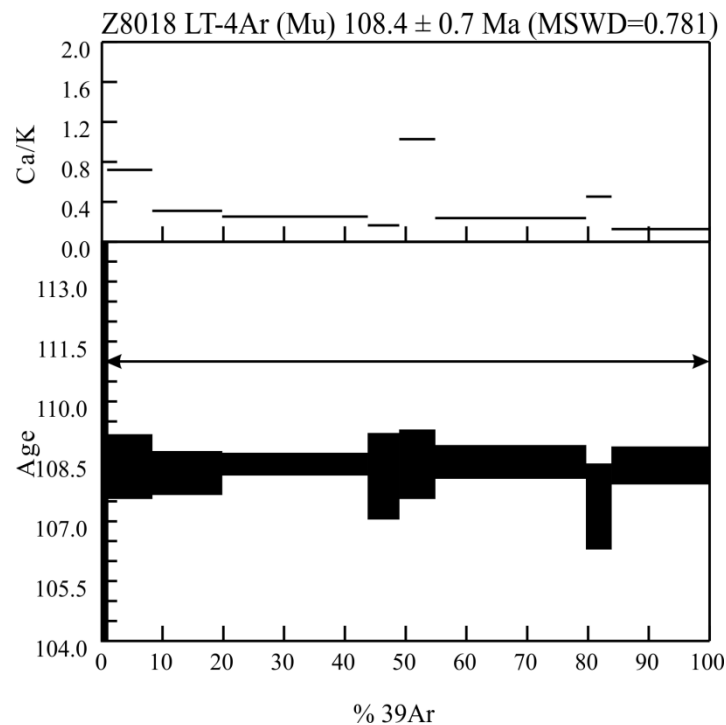
Date analyzed: January 5-6, 2006

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: FID-1

Yukon Minfile 105B 004

Lithology: Felsite

Mineral analyzed: Biotite

Age: 52.7 ± 0.6 Ma

Interpretation: Igneous Crystallization

Geochronology Lab Number: 8066

Argon Number: 2188

Location: Fiddler W-Sn vein-breccia deposit

UTM Zone 9 - 420346 E 6667528 N; NTS sheet 105B/1

Unit Name (if available): Fiddler intrusion

Geologist: C. J. R. Hart

Sample Description:

Leucocratic medium-grained biotite felsite. Collected to constrain age of magmatism beneath mineralization. Aliquot analyzed consisted of two large thin brown grains (400-500 μ m).

Results:

One aliquot was analyzed, giving a flat multistep plateau comprising 87.8 % of the ^{39}Ar gas, MSWD=0.123.

Analytical details:

Irradiation Batch: GSC #51

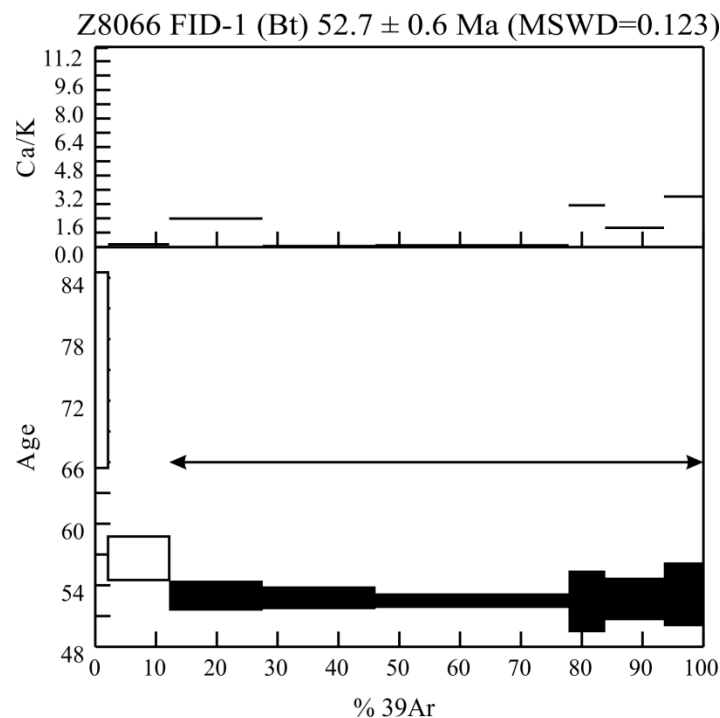
Date analyzed: January 6, 2006

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: FID-2

Yukon Minfile 105B 004

Lithology: Greisen

Mineral analyzed: Muscovite

Age: 53.1 ± 0.4 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 8067

Argon Number: 2189

Location: Fiddler W-Sn vein-breccia deposit

UTM Zone 9 - 420346 E 6667528 N; NTS sheet 105B/1

Unit Name (if available): Fiddler ore

Geologist: C. J. R. Hart

Sample Description:

Coarse-grained, slightly green lepidolitic (?) muscovite and cassiterite-quartz-wolframite-tourmaline vein, with minor fluorite. Sampled to determine the age of mineralization. The grains selected for analysis were ~500 μ m, colourless, with a somewhat frosted appearance.

Results:

One aliquot was analyzed (2 grains), giving a flat multistep plateau comprising 90.9 % of the released ^{39}Ar gas, MSWD=0.169.

Analytical details:

Irradiation Batch: GSC #51

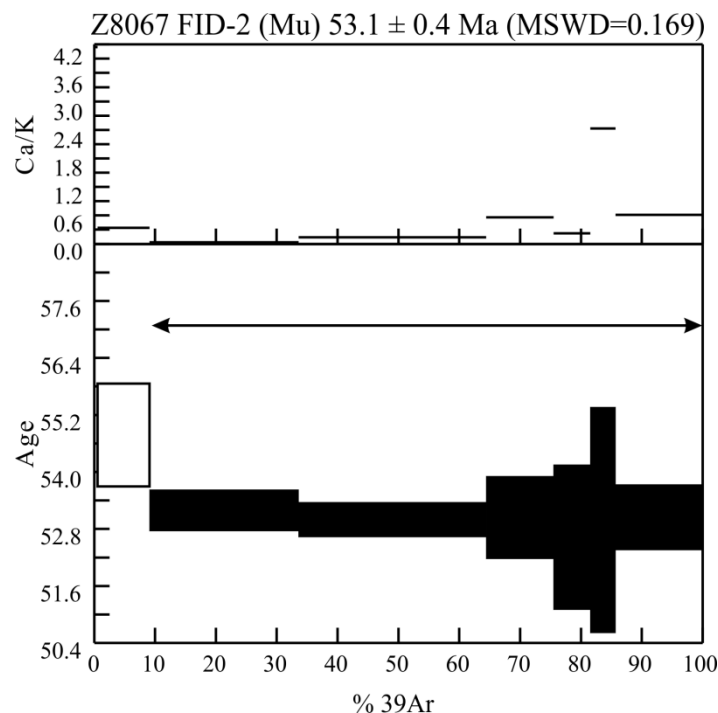
Date analyzed: January 9, 2006

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: RB42-167

Yukon Minfile 105F 034

Lithology: Quartz vein

Mineral analyzed: Biotite

Age: 107.5 ± 0.7 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 8069

Argon Number: 2190

Location: Risby Tungsten Deposit

UTM Zone 8 - 585007 E 6859931 N; NTS sheet 105F/14

Unit Name (if available): Risby skarn

Geologist: C. J. R. Hart

Sample Description:

Quartz-pyrrhotite vein with selvage of coarse-grained biotite. Lots of pyrrhotite skarn present in adjacent rock. Analyzed aliquot consisted of two very large dark brown clean grains (700-900 μ m each).

Results:

One aliquot was analyzed, giving a flat multistep plateau comprising 98.5% of gas, MSWD=0.129.

Analytical details:

Irradiation Batch: GSC #51

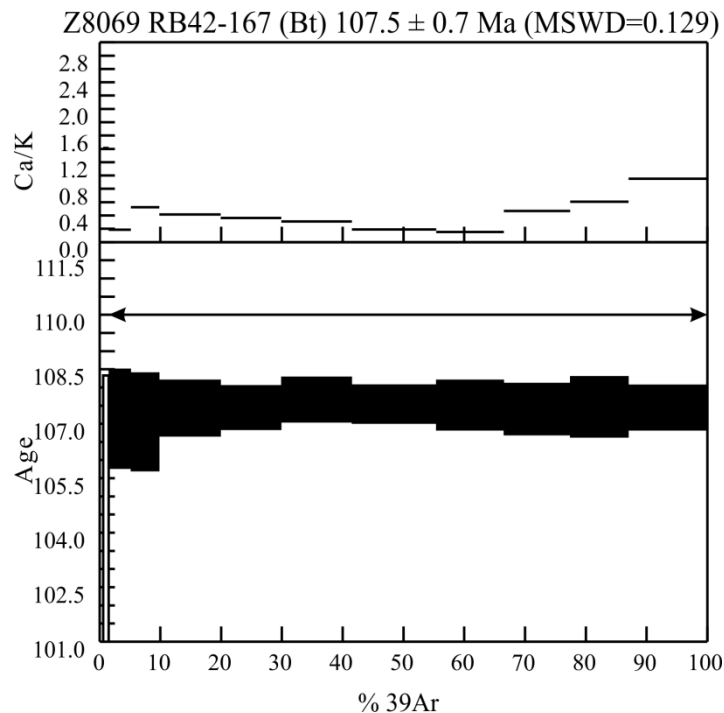
Date analyzed: January 9-10, 2006

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



Sample Number: RB-PEG
Lithology: Pegmatite
Mineral analyzed: Muscovite
Age: 107.1 ± 0.7 Ma
Interpretation: Hydrothermal

Yukon Minfile 105F 034

Geochronology Lab Number: 8070
Argon Number: 2191
Location: Risby tungsten deposit
UTM Zone 8 - 585940 E 6859515 N; NTS sheet 105F/14
Unit Name (if available): Risby skarn
Geologist: C. J. R. Hart

Sample Description:

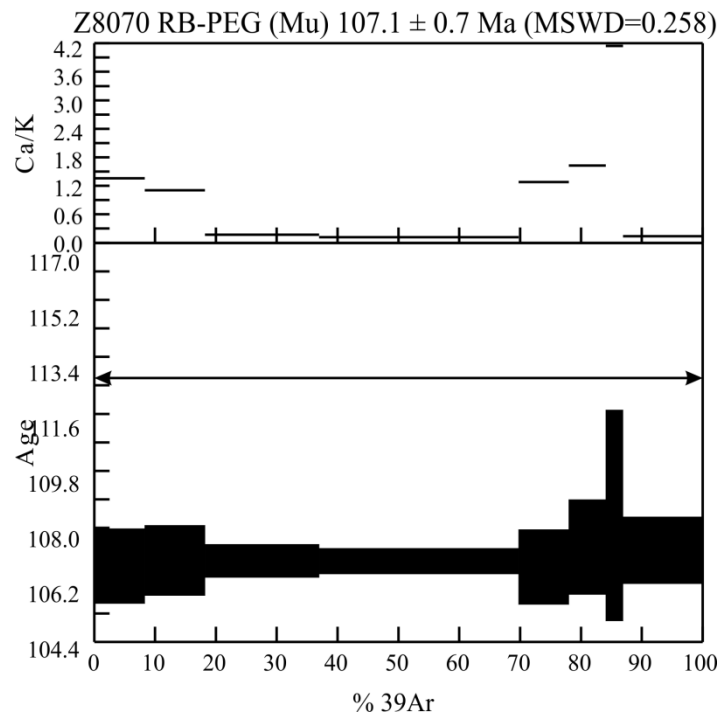
Thin muscovite-K-feldspar-quartz pegmatite cutting foliated biotite granodiorite. Analyzed aliquot consisted of two very large clear, clean, colourless grains (500-700 μ m each).

Results:

One aliquot of muscovite was analyzed, giving a flat multistep plateau comprising 100.0% of gas, MSWD=0.258.

Analytical details:

Irradiation Batch: GSC #51
Date analyzed: January 10, 2006
Monitor used: FCT-San
Laser used: Merchantek® MIR-10 CO₂ laser
Instrument used for analysis: GSC VG3600
Data reduction software used: GSC GRID Argon module



Sample Number: ST13-188

Yukon Minfile 105F 011

Lithology: Pegmatite

Mineral analyzed: Biotite

Age: 106.7 ± 1.3 Ma

Interpretation: Hydrothermal

Geochronology Lab Number: 8077

Argon Number: 2199

Location: Stormy

UTM Zone 8 - 616655 E 6820182 N; NTS sheet 105F/7

Unit Name (if available): Stormy ore

Geologist: C. J. R. Hart

Sample Description:

Biotite-tourmaline-quartz pegmatite. Analyzed aliquots consisted of large dark brown clean grains (600-1000 μ m each).

Results:

Two aliquots were analyzed, both showing significant ^{40}Ar loss in early- to mid-heating steps. Ca/K profiles for the two aliquots differed significantly. Aliquot A (2 grains) was disturbed with no reproducible ages in its heating steps. The assigned age is based on the plateau from Aliquot B (4 grains) which comprised 5 steps and 63.6 % of the released ^{39}Ar , MSWD = 0.163.

Analytical details:

Irradiation Batch: GSC #51

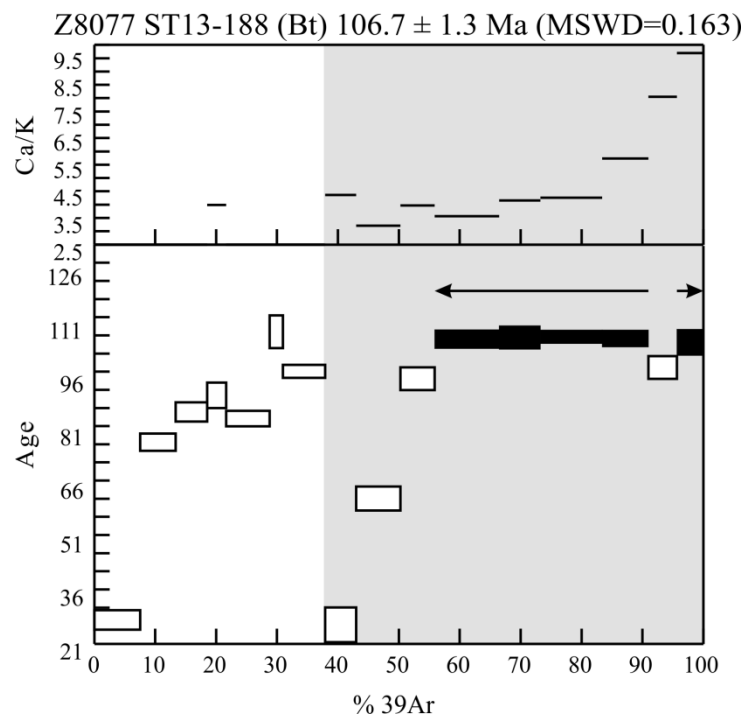
Date analyzed: March 1-2, 2006

Monitor used: FCT-San

Laser used: Merchantek® MIR-10 CO₂ laser

Instrument used for analysis: GSC VG3600

Data reduction software used: GSC GRID Argon module



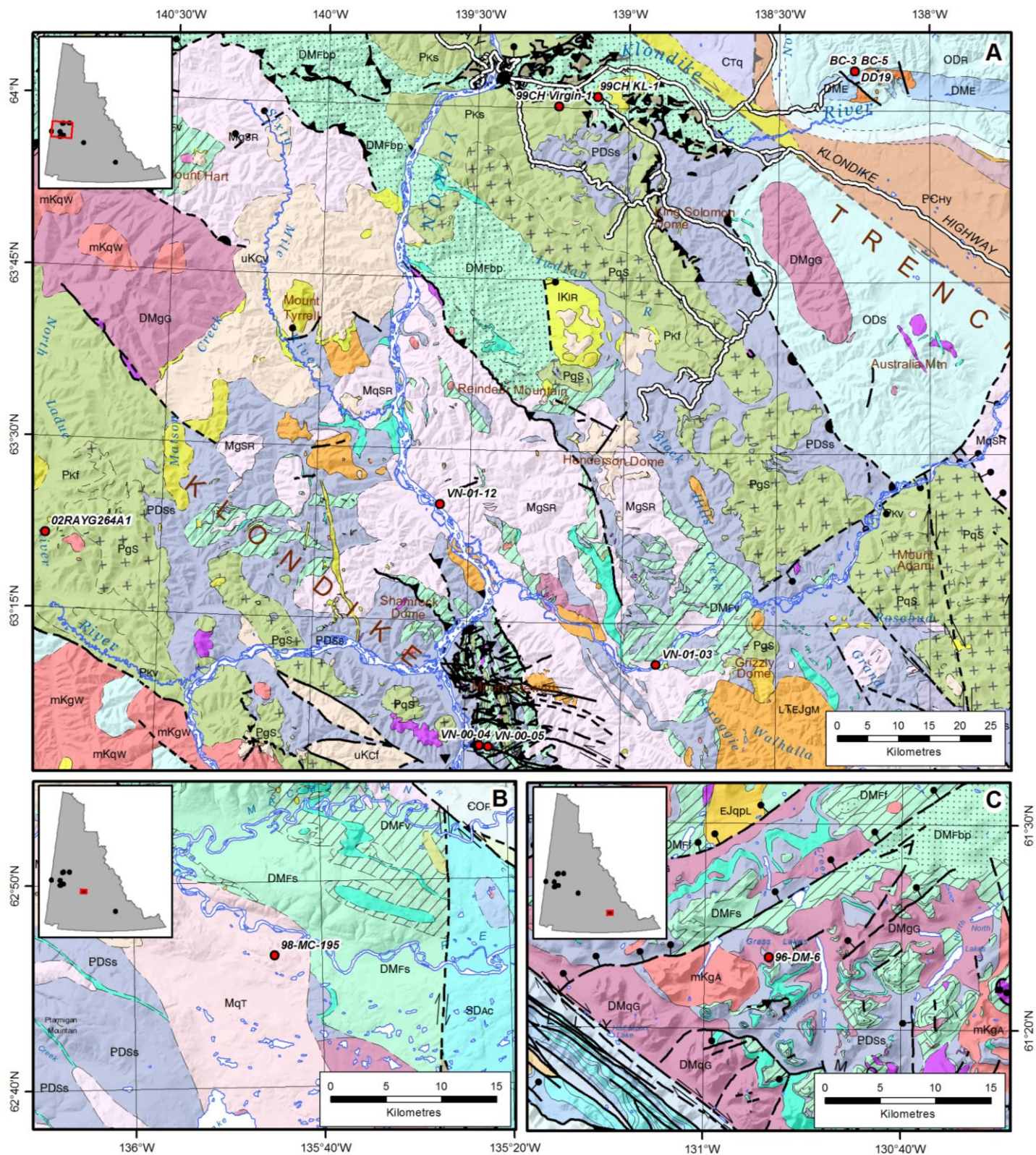


Figure 20. Location of samples for which no age was resolved. A) western Yukon; B) Tatlain batholith, central Yukon; C) Finlayson Lake area, southeastern Yukon. Geology from Yukon Geological Survey, www.geology.gov.yk.ca.

Acknowledgments

Release of this dataset was made possible with the support of the Geological Survey of Canada's Geomapping for Energy and Minerals (GEM) Program. Too many people to mention individually have assisted in some way with the collection, preparation and analysis of these samples over the years. In particular, Mike Villeneuve and Steve Gordey are singled out for thanks. Jan Peter is thanked for permission to include the data from the Lucky Joe samples. Fred Quigg, Ron Christie, Anastasia Turner and the late Gerry Gagnon are gratefully acknowledged for their help with sample preparation and analyses at the GSC Geochronology Lab. Dustin Liikane and Linda Cataldo are thanked for their assistance with compiling the sample files, data plots and tables. Dawn Kellett provided a constructive review. This has been a journey to remember.

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