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AGE DETERMINATIONS AND GEOLOGICAL STUDIES
K-Ar Isotopic Ages, Report 13

R.K. WANLESS, R.D. STEVENS
G.R. LACHANCE and R.N. DELABIO

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L.M. Cumming

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AGE DETERMINATIONS AND GEOLOGICAL STUDIES
K-Ar Isotopic Ages, Report 13

Abstract

Two hundred and forty-eight potassium-argon age determinations carried out on Canadian rocks and minerals are reported. Each age determination is accompanied by a description of the rock and mineral concentrate used; brief interpretative comments regarding the geological significance of each age are also provided. The experimental procedures employed are described in brief outline and the constants used in the calculation of ages are listed. Two geological time-scales are reproduced in tabular form for ready reference and an index of all published GSC K-Ar age determinations by primary NTS quadrangle has been prepared.

Résumé

L'auteur présente 248 datations au potassium-argon effectuées sur des roches et des minéraux d'origine canadienne. Chaque datation est accompagnée d'une description de la roche ou du concentré mineral utilise ainsi que d'une brève interpretation touchant l'aspect géologique. Les méthodes expérimentales qui ont servi aux datations sont aussi résumées et l'auteur joint une liste des constantes utilisées dans les calculs. Deux échelles des temps géologiques sont reproduites sous forme de tableau ce qui facilite les références et l'on a préparé, par quadrilatère du SRCN, un index de toutes les datations au potassium-argon publiées par la Commission géologique du Canada.

INTRODUCTION

This is the thirteenth report of potassium-argon age measurements completed in the Geochronological Laboratories of the Geological Survey of Canada. Two hundred and forty-eight determinations are reported, bringing the total number of published ages to 2233.

Since the reports in the series have not followed the same numerical sequence, the list following will serve to identify the complete series:—

GSC 60-17, Report No. 1 — determination 59-1 to 59-98
GSC 61-17, Report No. 2 — determinations 60-1 to 60-152
GSC 62-17, Report No. 3 — determinations 61-1 to 61-204
GSC 63-17, Report No. 4 — determinations 62-1 to 62-190
GSC 64-17, Report No. 5 — determinations 63-1 to 63-184
GSC 65-17, Report No. 6 — determinations 64-1 to 64-165
GSC 66-17, Report No. 7 — determinations 65-1 to 65-153
GSC 67-2A, Report No. 8 — determinations 66-1 to 66-176
GSC 69-2A, Report No. 9 — determinations 67-1 to 67-146
GSC 71-2, Report No. 10 — determinations 70-1 to 70-156
GSC 73-2, Report No. 11 — determinations 72-1 to 72-163
GSC 74-2, Report No. 12 — determinations 73-1 to 73-198
GSC 77-2, Report No. 13 — determinations 76-1 to 76-248

Comparison of ages determined for pairs of minerals concentrated from the same rock specimens

Age determinations presented in this report include results obtained for 58 mineral pairs (47 biotite-hornblende and 11 biotite-muscovite), spanning the age range from 34 m.y. to 2684 m.y. The data for the various geographical regions, age groupings and rock types are displayed in Figure 1, and Tables 1 and 2 summarize the statistical information.

Thirty-four mineral pairs (59%) yielded ages that agree within the assigned 2σ limits of uncertainty whereas the remaining 41% exhibit age discordances ranging to a high value of 95% (see Fig. 1 and individual age determination reports), however the majority (76%) have differences of less than 15%. Those pairs exhibiting very large age differences have been excluded from the calculations since the minerals probably did not crystallize at the same time although loss or gain of radiogenic argon could conceivably have produced the observed irregularities for coeval minerals. As anticipated, hornblende and muscovite samples generally yielded the higher age; 78% of the hornblende ages were greater than ages for the associated biotite while 82% of the muscovite results were found to exceed the biotite ages.

Ratios of ages determined for the 34 sample pairs with age differences of less than 15% have been calculated (Fig. 1, Tables 1, 2). While the distribution of results within regions and age groupings is admittedly uneven, it is seen that, on the average, hornblende ages are 4% greater than biotite ages and it is noteworthy that the very limited sampling of biotite-muscovite pairs indicates a shift to higher muscovite ages of comparable magnitude.

This limited sampling indicates a surprisingly constant difference between the age results for the two pairs of mineral species regardless of the age range indicated, and for specimens selected from a wide range of rock types (Fig. 1). This is even more dramatic when one considers that the radiogenic ^{40}Ar deficiency observed for biotites, whether it is due to expulsion of the gas or results from later closure of the isotopic system as the critical biotite isotherm is passed, is not a constant percentage of the gas produced through radioactive decay within the crystal lattice. The gas loss required to produce a 5% age reduction at 2500 m.y. is about 100 times greater than that required to produce a similar age reduction at 100 m.y.

Considering that the Precambrian specimens represent material that has remained in high temperature-pressure conditions for periods many orders of magnitude longer than the total time indicated by the Cordilleran specimens it is not surprising that the absolute gas deficiency is very much larger; what is intriguing is the realization that the net effect on the biotite results remains unchanged.

Geological Time-Scales

The Phanerozoic time-scales of the Geological Society of London (1964) and Holmes (1959) are summarized in tabular form in Figure 2. For appropriate stage and series names the reader is referred to the Geological Society of London publications 'The Phanerozoic Time-Scale' p. 260-262 and 'The Phanerozoic Time-Scale — A Supplement' page 7.

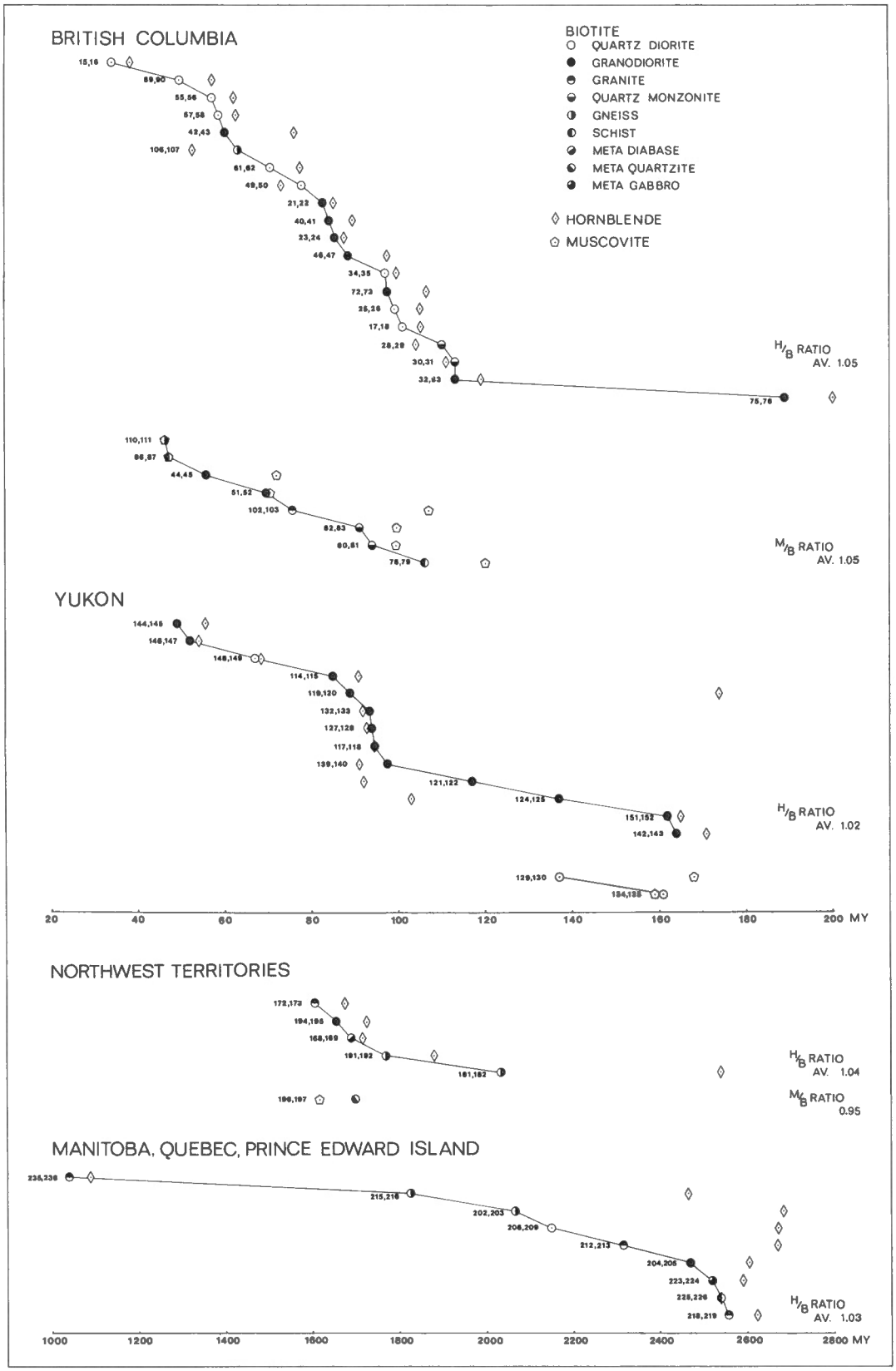

Figure 1. Comparison of ages determined for biotite-hornblende and biotite-muscovite mineral pairs.

Table 1

Comparison of Biotite-Hornblende Age Determinations

Region	No. of mineral pairs	No. of ages within 2σ limits	Frequency of highest ages H	B	Average age ratio for pairs with age differences <15%	No. of sample pairs averaged	Range of biotite ages (m.y.)
British Columbia	20	13	16	4	1.05	18	34 to 189
Yukon	13	9	8	5	1.02	10	50 to 164
Northwest Territories	5	3	5	—	1.04	4	1603 to 2034
Manitoba, Quebec, Prince Edward Island	9	4	8	1	1.03	5	1043 to 2552
Total	47	29	37	10		37	
					Weighted average 1.04		

Table 2

Comparison of Biotite-Muscovite Age Determinations

Region	No. of mineral pairs	No. of ages within 2σ limits	Frequency of highest age M	B	Average age ratio with age difference <15%	No. of samples averaged	Range of biotite ages (m.y.)
British Columbia	8	4	8	—	1.05	6	47 to 106
Yukon	2	1	1	1	—	—	137 to 161
Northwest Territories	1	0	—	1	—	—	1700
Total	11	5	9	2			

A revised time-scale, after Stockwell (1973), is given in Figure 3 for the Precambrian of the Canadian shield. Stockwell has prepared the following explanatory notes. As in earlier publications, the close of orogeny[1] is chosen as the boundary between time-units of Eon, Era, and Sub-Era rank but a distinction is now made between orogenic ages and immediately following cooling ages. Precision in estimating individual age determinations is impossible because of very large analytical errors, uncertainty in decay constants, and the generally obscure effect of geological factors but, in an effort to minimize or cancel out the analytical uncertainties, average values are used here, the averages being for clusters of similar ages as determined by each method on each mineral or rock-type within a structural province chosen as a type region. On this basis, boundaries between the named time-units are placed within a narrow time interval between the latest phase of orogeny and the earliest stage of the immediately following cooling period. The latest orogenic phase is given best by U-Pb methods (and with some exceptions by the Rb-Sr whole-rock isochron method) on late orogenic granitic rocks or pegmatite, while the earliest datable stage of subsequent cooling is given by K-Ar ages on orogenic amphibole and by Rb-Sr ages on orogenic muscovite.

A good example is found in the Grenville structural province which is the type region for the Grenvillian Orogeny, for the post-Grenvillian cooling period, and for the boundary between the Neohelikian and the Hadrynian. In this province, the boundary is estimated, in round numbers, at 1000 m.y., on the U-Pb scale. It is placed within a narrow time-range between the latest phase of the orogeny, which is given by a cluster of 29 Pb^{207}/Pb^{206} ages of pegmatite averaging 1011 m.y. old (and of 16 concordant and concordia ages on pegmatite averaging 1035 m.y.), and the earliest stage of the post-Grenvillian cooling period which is given by a cluster of 22 K-Ar ages on orogenic amphiboles averaging 963 m.y. Incidentally, the peak of igneous activity within the Grenvillian Orogeny is indicated by granitic intrusions clustering around an average of 1074 m.y. by the 207-206 method, and of 1104 m.y. by the concordant and concordia methods. A late stage of the cooling period is indicated by a cluster of 98 K-Ar ages on biotite averaging 924 m.y. and an indeterminate stage, by a cluster of 20 K-Ar ages on muscovites averaging 943 m.y.

The presently estimated isotopic age of each boundary is subject to change as more dates become available and as their interpretation is improved, but such changes will not alter the nomenclature nor definition of the time-units because these are based on rocks in type regions. In most regions of the Shield the boundaries set apart very important episodes in earth history for they lie along contacts between deeply eroded basement and unconformably overlying sedimentary and volcanic sequences.

Experimental Procedures

The concentration of potassium in mica samples was routinely determined using X-ray fluorescence methods (Lachance, in Wanless et al., 1965, p. 4-7), and the reliability of this technique has been demonstrated (Wanless et al., 1966, Table 1, p. 2). For amphibole concentrates and whole-rock samples the potassium content was determined using isotope dilution techniques and solid-source, triple-filament mass spectrometry (Wanless et al., 1968, p. 1-6).

[1] The term "orogeny" is used here to denote a process of mountain-building accompanied by important folding that affected large segments of the crust and was commonly associated with virtually contemporaneous regional metamorphism and the emplacement of granitic bodies and pegmatite. The term "orogenic materials" is used to denote those minerals and rocks that formed in conjunction with this process.

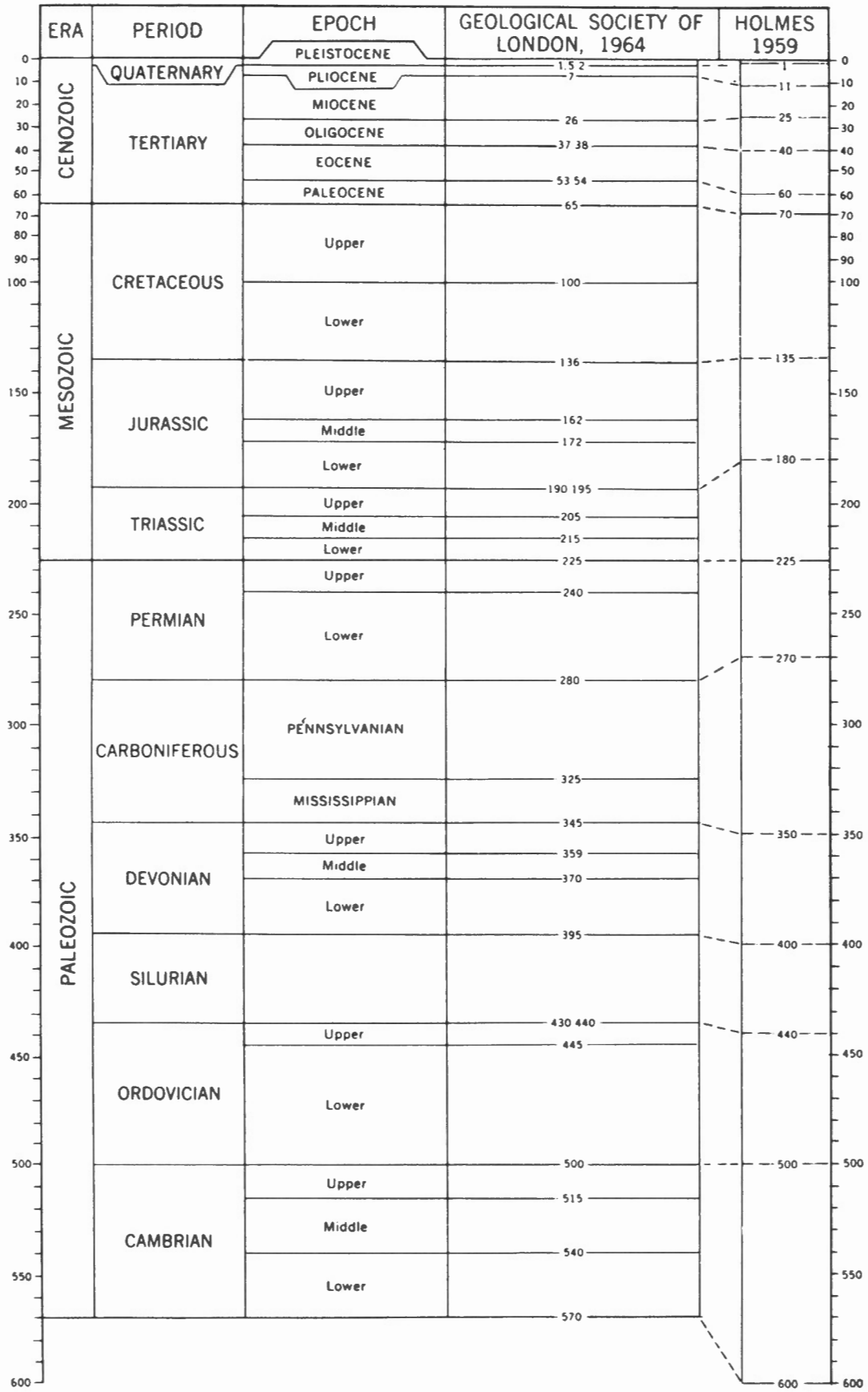

Figure 2. Phanerozoic time-scale.

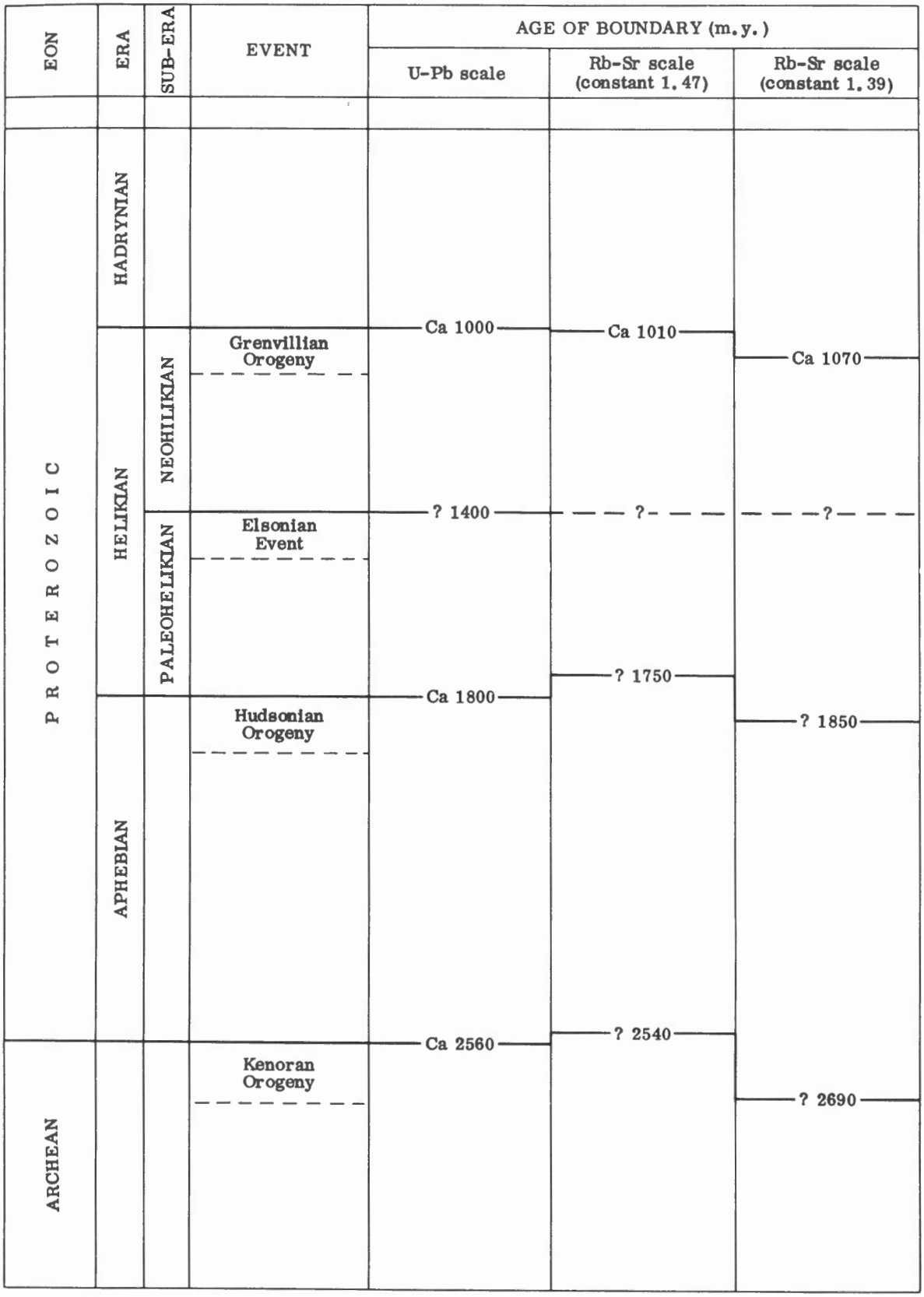

Figure 3. Precambrian time-scale.

Radio-frequency induction heating was employed to fuse the samples in vacuo. A precisely determined quantity of enriched argon-38 was added to the liberated gas which was then purified by passage through cold-traps, hot copper oxide, and over a titanium sponge getter. Isotopic analyses were carried out in modified A.E.I. MS-10 mass spectrometers operated in the static mode.

The various factors to be considered in assigning experimental error limits to individual age determinations have been discussed in detail in Report 5 (Wanless et al., 1965, p. 1-4). All reported errors are at the 95 per cent confidence level.

Constants Employed in Age Calculations

The constants employed to calculate the ages are as follows: $\lambda_\beta = 4.72 \times 10^{-10} yr^{-1}$; $\lambda_\varepsilon = 0.585 \times 10^{-10} yr^{-1}$; ^{40}K atomic abundance = 1.19×10^{-4}.

Appendix 1 comprises an updated index of published GSC K-Ar age determinations listed according to the primary NTS quadrangle to facilitate rapid retrieval.

References

Geological Society of London
1964: The Phanerozoic time-scale; Quart. J. Geol. Soc. London, v. 120 S, p. 260-262.

1971: The Phanerozoic time-scale – a supplement; Special publication No. 5, Geol. Soc. London, p. 7.

Holmes, A.
1959: A revised geological time-scale; Trans. Edinburgh Geol. Soc., v. 17, Pt. 3, p. 183-216.

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Wanless, R.K., Stevens, R.D., Lachance, G.R., and Rimsaite, J.Y.H.
1965: Age determinations and geological studies, Pt. 1 – Isotopic ages, Report 5; Geol. Surv. Can., Paper 64-17, p. 1-126.

1966: Age determinations and geological studies, K-Ar isotopic ages, Report 6; Geol. Surv. Can., Paper 65-17.

Wanless, R.K., Stevens, R.D., Lachance, G.R., and Edmonds, C.M.
1968: Age determinations and geological studies, K-Ar isotopic ages, Report 8; Geol. Surv. Can., Paper 67-2, Pt. A.

Wanless, R.K., Stevens, R.D., and Loveridge, W.D.
1970: Anomalous parent-daughter isotopic relationships in rocks adjacent to the Grenville Front near Chibougamau, Quebec; Eclogae geol. Helv., v. 63/1, p. 345-364.

ERRATA

GSC Paper 66-17

Determination GSC 65-9:
Lat. and long. should read 49°06'45"N, 120°36'W.

GSC Paper 67-2A

Determination GSC 66-10:
Long. should read 129°15'30"W.

Determination GSC 66-13:
Age should read 70 ± 14 m.y.

Determination GSC 66-47:
NTS should read 83D.

Determination GSC 66-63:
NTS should read 120G.

Determination GSC 66-64:
NTS should read 340E.

Determination GSC 66-65:
NTS should read 340E.

Determination GSC 66-68:
Rock type should read "from biotite schist".

Determination GSC 66-82:
MC 36-6J should read MC 36-65.

Determination GSC 66-95:
NTS should read 33M.

Determination GSC 66-122:
Mineral dated should read BIOTITE.

GSC Paper 69-2A

Determination GSC 67-13:
Lat. should read 59°10'N.

Determination GSC 67-36:
Sample identification at top of p. 22 should read GSC 67-36.

Determination GSC 67-138:
Interpretation should read: "Sample is from a coarse grained, feldspar-biotite pegmatite dyke cutting the quartzofeldspathic gneisses which underlie much of the area north of Churchill River. The age of 853 ± 32 m.y. for the pegmatite suggests that the most recent major orogeny to have been near the close of the Grenville in this locality and provides a minimum age for metamorphism of the gneiss".

Determination GSC 66-139:
Granite gneiss should read chilled diabase.

GSC Paper 71-2

Determination GSC 70-4:
Lat. should read 59°12'N.

Determination GSC 70-33:
NTS should read 104I.

Determination GSC 70-34:
NTS should read 104I and long. should read 129°47.5'W.

Determination GSC 70-35:
NTS should read 104I.

GSC Paper 73-2

Determination GSC 72-113:
Last line of p. 83, age of sample GSC 72-111 should read 486 ± 20 m.y.

GSC Paper 74-2

Determination GSC 73-69:
NTS should read 48C.

Determination GSC 73-71:
NTS should read 48C.

Determination GSC 73-105:
Concentrate description should read "Clean, pleochroic, olive-brown to bluish green hornblende with no visible impurity".

Determination GSC 73-132:
lé 42% should read 1.42%.

Determination GSC 73-183:
K-Ar age should read 2582 ± 145 m.y., K = 0.701%, $^{40}Ar/^{40}K = 0.3235$.

British Columbia
(GSC 76-1 to 76-113)

GSC 76-1 Hornblende, K-Ar age **169 ± 17 m.y.**

K = 0.264%, $^{40}Ar/^{40}K$ = 0.01036, radiogenic Ar = 61.6%.
Concentrate: Pleochroic, brown to green hornblende with trace of chlorite contamination.

From granodiorite
(92 B) Road-cut near top of Mount Newton, Saanich Peninsula, Vancouver Island, British Columbia, 48°36'55"N, 123°26'20"W. Sample MEKA74-2, collected and interpreted by J.E. Muller.

The rock is medium grained, medium coloured, biotite-hornblende granodiorite and forms part of the Saanich Granodiorite. The date confirms that this most easterly discrete intrusive body is part of the Jurassic Island Intrusions and that these are present from the northwestern to the southeastern tip of Vancouver Island.

GSC 76-2 Hornblende, K-Ar age **182 ± 8 m.y.**

K = 0.385%, $^{40}Ar/^{40}K$ = 0.01121, radiogenic Ar = 80.7%.
Concentrate: Pleochroic, light green to light brown hornblende with some attached chlorite and quartz contamination.

From hornblende quartz diorite
(92 B) Hydro transmission line on Malahat Ridge, east of Shawnigan Lake, Vancouver Island, British Columbia, 48°34'45"N, 123°33'30"W. Sample WN-18-74, collected by R.K. Wanless and J.E. Muller and interpreted by J.E. Muller.

The rock is fine- to medium-grained hornblende quartz diorite of the Wark Diorite (a basic orthogneiss) that together with the Colquitz Gneiss (a lighter coloured paragneiss) may be considered to be basement complex of Vancouver Island. Preliminary results of U-Pb dating of zircons from this sample indicate that the protolith was early Paleozoic. The Early Jurassic K-Ar date indicates that the rock was reheated and recrystallized for the last time during the Jurassic major plutonic event that affected the Insular Belt.

GSC 76-3 Hornblende, K-Ar age **163 ± 7 m.y.**

K = 0.333%, $^{40}Ar/^{40}K$ = 0.00997, radiogenic Ar = 62.0%.
Concentrate: Clean, fresh and unaltered, pleochroic light brown to green hornblende with no visible contamination.

From amphibolite
(92 B) Access road, Greater Victoria Water District, 1.6 km north of Butchard Lake, southern Vancouver Island, British Columbia, 48°33'30"N, 123°39'25"W. Sample MEKA74-1, collected and interpreted by J.E. Muller.

The rock is fine grained amphibolite with mainly hornblende and minor plagioclase, magnetite and quartz. It is probably a metabasalt and has been mapped as Wark Diorite. Like GSC 76-2 its age of recrystallization is apparently Jurassic, though 20 m.y. younger, but the rock is derived from Paleozoic or perhaps Triassic basalt.

GSC 76-4 Hornblende, K-Ar age **163 ± 7 m.y.**

K = 0.476%, $^{40}Ar/^{40}K$ = 0.00999, radiogenic Ar = 63.9%.
Concentrate: Relatively clean, pleochroic, light brown to dark green hornblende, with a trace of chlorite contamination.

From hornblende quartz diorite
(92 C) South side of Spilling Island, Barkley Sound, southwestern Vancouver Island, British Columbia, 48°58'55"N, 125°22'25"W. Sample MEKA73-6, collected and interpreted by J.E. Muller.

The rock is fine grained diorite hornblende-plagioclase hornfels from a (synplutonic?) dyke in the Westcoast Complex.

See GSC 76-5 for description and interpretation.

GSC 76-5 Hornblende, K-Ar age **115 ± 5 m.y.**

K = 0.367%, $^{40}Ar/^{40}K$ = 0.00693, radiogenic Ar = 60.2%.
Concentrate: Clean, fresh and unalatered, pleochroic light brown to dark green hornblende with no visible contamination.

From hornblende-plagioclase gneiss
(92 C) Howell Island, Barkley Sound, southern Vancouver Island, British Columbia, 48°51'25"N, 125°20'20"W. Sample MEKA73-4, collected and interpreted by J.E. Muller.

The rock is hornblende-plagioclase gneiss that is well foliated and occurs together with diorite and agmatite. GSC 76-4 and 76-5 are from the Westcoast Complex, a basic migmatite complex of quartz diorite and amphibolite, occurring in the outcrop in discrete irregular bodies and in various types of agmatite. They are derived from Paleozoic and perhaps Triassic volcanic rocks and are probably an intermediate stage in the formation of the Jurassic Island Intrusions. The Middle Jurassic age (163 m.y.) of GSC 76-4 probably represents the age of migmatization of the complex. The Early Cretaceous age of GSC 76-5 (115 m.y.) may be anomalous and a result of resetting due to late Mesozoic faulting along the Westcoast Fault that probably runs close to the southwest side of Howell Island.

GSC 76-6 Whole rock, K-Ar age **58.8 ± 3.1 m.y.**
59.8 ± 3.1 m.y.

K = 0.883%, $^{40}Ar/^{40}K = \frac{0.00349}{0.00356}$, radiogenic

Ar = $\frac{83.8\%}{89.7\%}$.

From ribbon chert
(92 B) Hill supporting hydro towers on east side of Malahat Highway, 5.6 km north of Goldstream and just west of Sawluctus Island in Finlayson Arm, British Columbia, 48°30'15"N, 123°33'10"W. Sample MEKA74-6, collected and interpreted by J.E. Muller.

The sample is from a vertically dipping, due east striking sequence of black-grey, light grey weathering ribbon chert occurring in lenticular beds, 2 to 5 cm thick, separated by thin laminae of black argillite. These form a small part of the Leech River Formation (see GSC 76-13). Unlike other dated samples of that formation, the cherts are well removed from Leech River Fault. The sample was submitted to determine (1) if radiometric dating is applicable to cherts and (2) if the cherts are Paleozoic, as in the adjacent San Juan Islands, or late Mesozoic, as in the Pacific Rim Complex of west Vancouver Island. Reproducible results show that dating is indeed possible. Recently (1975) radiolarians indicating Upper Jurassic, Tithonian age have been discovered in red, unrecrystallized cherts in San Juan and Pacific Rim areas. A similar age, about 135 m.y., is now probable for this sample

and the apparent early Eocene value of 59 m.y. is probably a metamorphic age. The date may record the time of underthrusting of Leech River rocks along San Juan Fault. It apparently pre-dates by about 20 m.y. metamorphism of Leech River rocks in the vicinity of Leech River Fault (see GSC 76-13).

GSC 76-7 Whole rock, K-Ar age **92.7 ± 4.3 m.y.**

K = 0.354%, $^{40}Ar/^{40}K$ = 0.00556, radiogenic Ar = 62.4%.

From pillow lava

(92 B) Beach at the foot of Stewart Street, Victoria Esquimalt, British Columbia, 48°27'05"N, 123°26'30"W. Sample MEKA 74-5, collected and interpreted by J.E. Muller.

The rock is fine grained basalt. Two great sequences of tholeiitic basalt, consisting largely of pillow lavas, are well known on Vancouver Island. Though not dated isotopically their geological ages are well established by fossils in enclosing and enclosed sedimentary rocks. The Metchosin Volcanics, only present on the south tip of the island, south of Leech River Fault, are early Eocene. The Karmutsen Formation, present north of the fault throughout the island, is Late Triassic, late Ladinian to early Karnian. The sample locality is about one mile north of the fault, as projected below Esquimalt Harbour. The apparent age seems to rule out assignment of the basalt to Metchosin Volcanics. However, an original Triassic age is conceivable as farther west rocks near the fault show increasing evidence of a thermal event, well dated at about 40 m.y. (GSC 76-13, 40.0 ± 2.2 m.y.). There it induced metamorphism to greenschist and amphibolite grade and perhaps a lesser rise in temperature at the sample location could have caused partial argon loss. Alternatively the pillows are perhaps indeed Lower Cretaceous in age, a conclusion that is somewhat encouraged by a recently reported Early Cretaceous age for pillow lavas on southern Lopez Island in the neighbouring San Juan Islands (Wheeten et al., 1976).

Reference

Whetten, J.T., Zartman, R.E., Cowan, D.S., Glassley, W.E., Jones, D.L., and Pessagno, E.A.
1976: New dates and their significance from the San Juan Islands, Washington; Geol. Soc. Am., Abstr., 1976, Ann. Meet., p. 1166.

GSC 76-8 Biotite, K-Ar age **40.6 ± 1.9 m.y.**

K = 7.48%, $^{40}Ar/^{40}K$ = 0.00240, radiogenic Ar = 59%.
Concentrate: Light brown biotite with approximately 8% chlorite alteration.

From quartz-biotite schist

(92 B) Jordan River, just upstream from bridge on Jordan main logging road, southern Vancouver Island, British Columbia, 48°30'55"N, 123°56'10"W. Sample MEKA 70-5, collected and interpreted by J.E. Muller.

The rock is a fine grained, dark brown and white laminated and complexly folded biotite schist.

See GSC 76-13 for interpretation.

GSC 76-9 Biotite, K-Ar age **41.2 ± 2.2 m.y.**

K = 6.71%, $^{40}Ar/^{40}K$ = 0.00244, radiogenic Ar = 86.0%.
Concentrate: Clean, fresh and unaltered, light brownish orange biotite with no visible contamination.

From quartz-biotite schist

(92 B) Pacific Logging Co. Branch J 50, north fork of Jordan River, southern Vancouver Island, British Columbia, 48°33'50"N, 123°56'05"W. Sample MEKA 73-2, collected and interpreted by J.E. Muller.

The rock is a fine grained faintly schistose quartz-feldspar-biotite schist.

See GSC 76-13 for interpretation.

GSC 76-10 Actinolite, K-Ar age **41.1 ± 2.8 m.y.**

K = 0.511%, $^{40}Ar/^{40}K$ = 0.00243, radiogenic Ar = 33.7%.
Concentrate: Clean, fresh and unaltered, pleochroic, light green to bluish green actinolite with no visible contamination.

From actinolite schist

(92 B) Just north of junction of West Main and Leech Main logging roads and 0.8 km southwest of West Leech Falls, southern Vancouver Island, British Columbia, 48°30'25"N, 123°49'15"W. Sample WN-14-74, collected by R.K. Wanless and J.E. Muller, interpreted by J.E. Muller.

The rock is a medium green, fine grained, very finely laminated and lineated actinolite schist.

See GSC 76-13 for interpretation.

GSC 76-11 Biotite, K-Ar age **38.2 ± 2.2 m.y.**

K = 7.37%, $^{40}Ar/^{40}K$ = 0.00226, radiogenic Ar = 87.9%.
Concentrate: Clean, fresh and unaltered, light brownish orange biotite with no visible contamination.

From biotite-plagioclase gneiss

(92 B) Jordan River, just upstream from bridge on Jordan Main logging road, southern Vancouver Island, British Columbia, 48°30'55"N, 123°56'10"W. Sample WN-15-74, collected by R.K. Wanless and J.E. Muller and interpreted by J.E. Muller.

The rock is medium grained, muscovite-biotite-quartz-plagioclase gneiss, apparently intrusive into garnet-biotite schist of the Leech River Formation.

See GSC 76-13 for interpretation.

GSC 76-12 Biotite, K-Ar age **36.7 ± 2.6 m.y.**

K = 8.57%, $^{40}Ar/^{40}K$ = 0.00217, radiogenic Ar = 88.5%.
Concentrate: Somewhat impure, brownish orange biotite with approximately 9% chlorite alteration.

From biotite-plagioclase gneiss

(92 B) Just north of junction of West Main and Leech Main logging roads and 0.8 km southwest of West Leech Falls, southern Vancouver Island, British Columbia, 48°30'25"N, 123°49'15"W. Sample WN-13-74, collected by R.K. Wanless and J.E. Muller and interpreted by J.E. Muller.

The rock occurs as light coloured sills within actinolite schist, just north of Leech River Fault.

See GSC 76-13 for interpretation.

GSC 76-13 Muscovite, K-Ar age **40.0 ± 2.2 m.y.**

K = 8.41%, $^{40}Ar/^{40}K$ = 0.00236, radiogenic Ar = 51.4%.
Concentrate: Clean, fresh and unaltered muscovite with no visible contamination.

From pegmatite

(92 B) Spur off Walker Main Road, 0.8 km north of Diversion Reservoir, southern Vancouver Island, British Columbia, 48°30'30"N, 123°59'45"W. Sample WN-16-74, collected by R.K. Wanless and J.E. Muller and interpreted by J.E. Muller.

The rock is coarse grained pegmatite with tourmaline and muscovite up to about 10 cm dimension. The determinations tabulated below are all from locations just north of Leech River Fault, which is a fundamental fault separating metamorphosed clastic sediments considered to be late Mesozoic continental slope and trench deposits (Leech River Formation) from Eocene oceanic basalts (Metchosin Volcanics). Their foliation is well aligned with the fault and their metamorphism is considered to be related to northward underthrusting of Metchosin below Leech River Formation. Samples GSC 76-8 and 9 represent Leech River metasediment and GSC 76-10 is volcanic rock, either interbedded with the sediments or derived from Metchosin Volcanics, tectonically mixed with Leech River sediments. GSC 76-11 and 12 are granitoid intrusions into GSC 76-8, 9 and 10 that became involved in deep fault movement, GSC 76-13 is a pegmatite developed during attendant migmatization. It seems likely that underthrusting or subduction caused migmatization and formation of schist and gneiss, concordant with the faulting. It is doubtful that the slightly younger K-Ar age of the gneiss samples is significant and the major tectonic event is considered to have occurred about 40 m.y. ago, at the close of Eocene time.

Sample No.	Rock type	Age (m.y.)
GSC 76-8	Biotite schist	40.6 ± 1.9
GSC 76-9	Biotite schist	41.2 ± 2.2
GSC 76-10	Actinolite schist	41.1 ± 2.8
GSC 76-11	Biotite gneiss	38.2 ± 2.2
GSC 76-12	Biotite gneiss	36.7 ± 2.6
GSC 76-13	Muscovite pegmatite	40.0 ± 2.2

Reference

Muller, J.E.
1975: Victoria map-area, British Columbia; in Report of Activities, Pt. A, Geol. Surv. Can., Paper 75-1A, p. 21-26.

GSC 76-14 Hornblende, K-Ar age **46.9 ± 7.0 m.y.**

K = 0.162%, $^{40}Ar/^{40}K$ = 0.00278, radiogenic Ar = 22.5%.
Concentrate: Clean fresh and unaltered, pleochroic, light brown to green hornblende with no visible contamination.

From amphibolite

(92 C) Road from River Jordan to Port Renfrew, just west of Newmarch Creek, southern Vancouver Island, British Columbia, 48°27'55"N, 124°12'25"W. Sample MEKA 73-1, collected and interpreted by J.E. Muller.

The rock is dark coloured, fine grained (0.1-0.3 mm) plagioclase amphibolite and is part of the rock group of Eocene Metchosin Volcanics and Sooke Intrusions that occur south of Leech River Fault. Amphibolite and hornblende-plagioclase gneiss are known in the Westcoast Complex where they yield Jurassic K-Ar ages (see GSC 76-4 and 5). The date confirms that a Tertiary basic migmatite derived from Eocene Metchosin Volcanics, and distinct from the similar looking Westcoast Complex, is present on southern Vancouver Island.

GSC 76-15 Biotite, K-Ar age **33.8 ± 2.1 m.y.**

K = 7.35%, $^{40}Ar/^{40}K$ = 0.00199, radiogenic Ar = 69.9%.
Concentrate: Light brown biotite with approximately 2% chlorite alteration.

From quartz diorite

(92 E) Road-cut on logging road, 0.8 km northwest of Malaspina Lake, central Vancouver Island, British Columbia, 49°51'45"N, 126°34'25"W. Sample MEKA 74-11, collected and interpreted by J.E. Muller.

See GSC 76-16 for description and interpretation.

GSC 76-16 Hornblende, K-Ar age **38.0 ± 2.8 m.y.**

K = 0.517%, $^{40}Ar/^{40}K$ = 0.00225, radiogenic Ar = 40.1%.
Concentrate: Pleochroic, light brown to bluish green hornblende with approximately 2% biotite and a trace of chlorite as impurities.

From quartz diorite

(92 E) Details as for GSC 76-15.

The rock is equigranular, fine grained, medium coloured hornblende-biotite quartz diorite and is part of a pluton, about 2 km in diameter, that intrudes Upper Triassic to Lower Jurassic volcanic and sedimentary rocks. The age-pair confirms that this body, like the one to the northwest near Zeballos, and the ones to the southeast adjacent to Sydney Inlet, is of apparent Oligocene age. In the latter locality ages of a granodiorite with biotite 36.6 ± 2.1 m.y. (GSC 73-6) and hornblende 32.5 ± 3.9 m.y. (GSC 73-5) are very similar to those of the Malaspina pluton, although there the hornblende is "younger". That age is the youngest of a group of determined ages of Tertiary plutons, ranging from 59 to 32 m.y. See discussion under GSC 73-9 in Wanless et al., 1974.

Reference

Wanless, R.K., Stevens, R.D., Lachance, G.R., and Delabio, R.N.D.
1974: Age determinations and geological studies, K-Ar Isotopic Ages, Report 12; Geol. Surv. Can., Paper 74-2, p. 8.

GSC 76-17 Biotite, K-Ar age **101 ± 4 m.y.**

K = 7.58%, $^{40}Ar/^{40}K$ = 0.00609, radiogenic Ar = 85.6%.
Concentrate: Clean, fresh and unaltered, very light greenish brown biotite with no visible contamination.

From quartz diorite

(92 M) On south shore of Greaves Island, 5 km west of Cape Anne, British Columbia, 51°17'23"N, 127°24'46"W. Map-unit 3, Geol. Surv. Can., Paper 68-1A, p. 37-41. Sample Rd67-10540, collected by J.A. Roddick and interpreted by G.J. Woodsworth and J.A. Roddick.

See GSC 76-18 for description and interpretation.

GSC 76-18 Hornblende, K-Ar age **105 ± 5 m.y.**

K = 0.536%, $^{40}Ar/^{40}K$ = 0.00632, radiogenic Ar = 64.7%.
Concentrate: Clean, fresh and unaltered, pleochroic, light brown to dark green hornblende with no visible contamination.

From quartz diorite

(92 M) Details as for GSC 76-17.

The sample is a medium grained, massive quartz diorite, composed of about 57% plagioclase, 2% K-feldspar, 28% quartz, 6% hornblende, 2% biotite, and minor epidote, opaques, and chlorite. The biotite is slightly chloritized.

This sample is from a quartz diorite body that cuts the migmatitic complexes that characterize the west side of the Coast Plutonic Complex in Rivers Inlet map-area. These are the only two ages yet obtained from the Coast Mountains between 51° and 52°N. They are similar to the 99 to 110 m.y. ages obtained from the west side of the Coast Plutonic Complex about 200 km southwest (GSC 76-29), and also to the 96 to 115 m.y. ages to the northwest (Hutchison, 1970). These two dates indicate that the Early Cretaceous dates found along the west side of the central and southern Coast Plutonic Complex are also present in the intervening area.

Reference

Hutchison, W.W.
1970: Metamorphic framework and plutonic styles in the Prince Rupert region of the Central Coast Mountains, British Columbia; Can. J. Earth Sci., v. 7, no. 2, Pt. 1, p. 376-405.

GSC 76-19 Biotite, K-Ar age $\begin{matrix}\textbf{79.9 ± 3.0 m.y.}\\ \textbf{78.1 ± 3.0 m.y.}\end{matrix}$

K = 7.82%, $^{40}Ar/^{40}K = \begin{matrix}0.00477\\ 0.00467\end{matrix}$, radiogenic Ar = $\begin{matrix}83.8\%\\ 79.6\%\end{matrix}$.
Concentrate: Relatively clean concentrate of light brownish biotite with less than 1% chlorite as an alteration product of the mica.

From granodiorite
(92 K) About 15 km west of Axe Point and 11 km northwest of Ahnuhati Point, British Columbia, 50°56'24"N, 125°46'00"W. Sample Rd70-30229, collected by W.W. Hutchison and interpreted by G.J. Woodsworth and J.A. Roddick.

The sample is a moderately foliated, medium grained granodiorite. Modal composition is: 59.0% plagioclase, 13.5% K-feldspar, 10.8% quartz, 12.7% biotite, 0.2% hornblende, 1.8% sphene, 0.7% opaques, 0.9% epidote, 0.4% apatite, and traces of chlorite and zircon.

See GSC 76-24 for interpretation.

GSC 76-20 Biotite, K-Ar age **73.2 ± 2.7 m.y.**

K = 7.68%, $^{40}Ar/^{40}K$ = 0.00437, radiogenic Ar = 80.5%.
Concentrate: Clean, fresh and unaltered, greenish brown biotite with no visible contamination.

From quartz diorite
(92 K) About 10 km northeast of Mount Lang, and 11 km east-southeast of Wahkash Point, British Columbia, 50°56'04"N, 125°23'15"W. Sample Rd70-40498, collected by G.J. Woodsworth and interpreted by G.J. Woodsworth and J.A. Roddick.

The sample is a medium- to coarse-grained, massive quartz diorite, with modal composition: 47.5% plagioclase, 42.4% quartz, 1.6% K-feldspar, 7.3% biotite, 0.3% hornblende, 0.7% sericite, and 0.2% opaques.

See GSC 76-24 for interpretation.

GSC 76-21 Biotite, K-Ar age **82.6 ± 3.1 m.y.**

K = 7.18%, $^{40}Ar/^{40}K$ = 0.00494, radiogenic Ar = 82.5%.
Concentrate: Light brown, somewhat altered biotite with approximately 5% chloritization.

From granodiorite
(92 K) East shore of Knight Inlet, 4 km northeast of Mount Wakefield, British Columbia, 50°48'03"N, 125°35'26"W. Sample Rd72-20233, collected by S.B. Reamsbottom and interpreted by G.J. Woodsworth and J.A. Roddick.

See GSC 76-22 for description and GSC 76-24 for interpretation.

GSC 76-22 Hornblende, K-Ar age **84.9 ± 3.9 m.y.**

K = 0.718%, $^{40}Ar/^{40}K$ = 0.00508, radiogenic Ar = 70.8%.
Concentrate: Clean, fresh and unaltered, pleochroic, brown to dark green hornblende with no visible contamination.

From granodiorite
(92 K) Details as for GSC 76-21.

The sample is a massive, medium- to coarse-grained granodiorite, consisting of 59.5% plagioclase, 14.1% quartz, 6.6% K-feldspar, 9.0% biotite, 8.8% hornblende, 0.6% opaques, 0.5% epidote, 0.5% chlorite (after biotite), 0.2% apatite, and 0.2% sphene.

See GSC 76-24 for interpretation.

GSC 76-23 Biotite, K-Ar age **85.5 ± 3.2 m.y.**

K = 7.46%, $^{40}Ar/^{40}K$ = 0.00512, radiogenic Ar = 79.4%.
Concentrate: Light brown biotite with approximately 4% chlorite alteration.

From granodiorite.
(92 K) East shore of Knight Inlet about 6 km northeast of Adeane Point and 4 km southwest of GSC 76-21, British Columbia, 50°45'54"N, 125°36'28"W. Sample Rd72-20237, collected by S.B. Reamsbottom and interpreted by G.J. Woodsworth and J.A. Roddick.

See GSC 76-24 for description and interpretation.

GSC 76-24 Hornblende, K-Ar age **87.4 ± 4.1 m.y.**

K = 0.432%, $^{40}Ar/^{40}K$ = 0.00523, radiogenic Ar = 56.0%.
Concentrate: Relatively clean, fresh and unaltered, pleochroic, olive-brown to dark green hornblende with less than 1% biotite contamination.

From granodiorite
(92 K) Details as for GSC 76-23.

The sample is a medium grained, massive granodiorite, consisting largely of plagioclase, with lesser quartz, and about 8% K-feldspar, 10% biotite, 5% hornblende, 2% sphene, and minor epidote, opaques, chlorite, and apatite. Biotite forms conspicuous books and is slightly chloritized.

Ages 76-19 to 76-24 are from four samples from plutons lying near the axis of the Coast Plutonic Complex. Samples GSC 76-21, 22, 23 and 24 are from a large granodiorite body situated southwest of the axis of the Coast Plutonic Complex. These four ages are concordant within the stated error limits and average about 85 m.y. Sample GSC 76-19 is from an extensive complex of quartz diorite and granodiorite north-northwest of the granodiorite of GSC 76-21 to 23 that appears to cut strata of the Central Gneiss Complex. The age from this complex is only slightly younger than the granodiorite pluton, although limited field data suggest that the granodiorite body is the younger.

GSC 76-20 is from a small quartz diorite pluton to the northeast of the quartz diorite and granodiorite bodies discussed above. This pluton cuts dioritic and quartz dioritic complexes near the axis of the Coast Plutonic Complex in this area. The 73 m.y. age obtained from this pluton is significantly younger than the ages obtained from the quartz diorite and granodiorite bodies to the southwest, but is similar to 71 m.y. ages from the Bishop River pluton about 75 km to the east (GSC 73-20 and 21). The data, although meager, suggest that a belt of 70 m.y. ages lies northeast of the axis of the southern Coast Mountains, with 80 to 85 m.y.

ages situated to the southwest. These ages are younger than the 99 to 110 m.y. ages found along the western fringe of the Coast Plutonic Complex (see GSC 76-29).

GSC 76-25 Biotite, K-Ar age **99.3 ± 3.7 m.y.**

K = 7.44%, $^{40}Ar/^{40}K$ = 0.00597, radiogenic Ar = 86.2%.
Concentrate: Light brown biotite with approximately 3% chlorite alteration.

From quartz diorite
(92 K) Road-cut about 1 km southeast of Tom Browne Lake and 0.5 km north of Shannon Lake, British Columbia, 50°35'56"N, 125°45'45"W. Sample Rd70-10059, collected by J.A. Roddick and interpreted by G.J. Woodsworth and J.A. Roddick.

See GSC 76-26 for description and GSC 76-29 for interpretation.

GSC 76-26 Hornblende, K-Ar age **105 ± 5 m.y.**

K = 0.381%, $^{40}Ar/^{40}K$ = 0.00634, radiogenic Ar = 65.9%.
Concentrate: Clean, fresh and unaltered, pleochroic, brown to dark green hornblende with no visible contamination.

From quartz diorite
(92 K) Details as for GSC 76-25.

The sample is a massive, medium- to coarse-grained quartz diorite. Modal composition is 42.8% plagioclase, 30.3% quartz, 19.4% biotite, 4.8% hornblende, 0.4% K-feldspar, 0.7% epidote, 0.7% opaques, 0.7% chlorite (alteration of biotite), and 0.2% apatite.

See GSC 76-29 for interpretation.

GSC 76-27 Biotite, K-Ar age **104 ± 4 m.y.**

K = 6.87%, $^{40}Ar/^{40}K$ = 0.00628, radiogenic Ar = 85.9%.
Concentrate: Somewhat altered, light brown biotite with approximately 6% chloritization.

From granodiorite
(92 K) Northern shore of Quadra Island, Okisollo Channel, on point north of Chonat Bay, British Columbia, 50°17'38"N, 125°18'54"W. Sample Rd72-10077, collected by J.A. Roddick and interpreted by G.J. Woodsworth and J.A. Roddick.

The sample is a massive, fine- to medium-grained granodiorite, consisting of 54.9% plagioclase, 25.9% quartz, 7.9% K-feldspar, 9.9% biotite, 0.3% epidote, 0.5% opaques, 0.4% chlorite (alteration of biotite), 0.2% sericite, and traces of apatite, rutile, and zircon.

See GSC 76-29 for interpretation.

GSC 76-28 Biotite, K-Ar age **110 ± 4 m.y.**

K = 6.96%, $^{40}Ar/^{40}K$ = 0.00663, radiogenic Ar = 82.1%.
Concentrate: Light brown biotite with approximately 2% chlorite alteration.

From quartz monzonite
(92 K) Northeast shore of Vancouver Island, at Slab Point on Discovery Channel, British Columbia, 50°19'17"N, 125°26'25"W. Sample Rd72-30091, collected by W.W. Hutchison and interpreted by G.J. Woodsworth and J.A. Roddick.

See GSC 76-29 for description and interpretation.

GSC 76-29 Hornblende, K-Ar age **104 ± 5 m.y.**

K = 0.578%, $^{40}Ar/^{40}K$ = 0.00624, radiogenic Ar = 60.1%.
Concentrate: Clean, fresh and unaltered, pleochroic, brown to dark green hornblende with no visible contamination.

From quartz monzonite
(92 K) Details as for GSC 76-28.

The sample is a massive, medium grained quartz monzonite. Modal composition is 37.0% plagioclase, 24.5% K-feldspar, 24.0% quartz, 7.1% biotite, 5.1% hornblende, 0.9% pyroxene, 0.7% chlorite, 0.4% opaques, and 0.3% apatite. The chlorite is an alteration product of biotite.

Samples GSC 76-25, 26, 27, 28 and 29 are all from plutons in the westernmost part of the southern Coast Plutonic Complex. The first four ages are all equivalent within the given error limits; GSC 76-28 is slightly discordant with 29, but both are similar to the 112 ± 5 (hornblende, GSC 73-16) and 105 ± 10 (biotite, GSC 73-17) ages obtained from the same pluton about 4 km to the northwest. These ages agree well with the numerous 96 to 115 m.y. ages obtained from the western side of the Coast Plutonic Complex about 350 to 550 km to the northwest (Hutchison, 1970). These dates suggest that the belt of Early Cretaceous dates first found in the Prince Rupert area may fringe the western side of the Coast Plutonic Complex throughout much of its length.

Reference

Hutchison, W.W.
1970: Metamorphic framework and plutonic styles in the Prince Rupert region of the central Coast Mountains, British Columbia; Can. J. Earth Sci., v. 7, p. 376-405.

GSC 76-30 Biotite, K-Ar age **113 ± 4 m.y.**

K = 7.18%, $^{40}Ar/^{40}K$ = 0.00681, radiogenic Ar = 88.0%.
Concentrate: Clean, fresh and unaltered, light brownish biotite with no visible contamination.

From quartz monzonite
(92 K) South shore of Teakerne Arm, West Redonda Island, about 9 km west of Church Point, British Columbia, 50°10'28"N, 124°53'21"W. Sample Rd72-20519, collected by S.B. Reamsbottom and interpreted by G.J. Woodsworth and J.A. Roddick.

See GSC 76-31 for description and GSC 76-33 for interpretation.

GSC 76-31 Hornblende, K-Ar age **111 ± 12 m.y.**

K = 0.294%, $^{40}Ar/^{40}K$ = 0.00670, radiogenic Ar = 44.4%.
Concentrate: Pleochroic, olive-brown to light green hornblende with some alteration to chlorite.

From quartz monzonite
(92 K) Details as for GSC 76-30.

The sample is a massive, medium grained quartz monzonite. Modal composition is 43.5% plagioclase, 22.8% quartz, 25.1% K-feldspar, 4.7% biotite, 2.2% hornblende, 1.0% opaques, 0.5% chlorite (alteration of hornblende), and 0.2% sphene.

See GSC 76-33 for interpretation.

GSC 76-32 Biotite, K-Ar age **113 ± 4 m.y.**

K = 7.87%, $^{40}Ar/^{40}K$ = 0.00679, radiogenic Ar = 86.4%.
Concentrate: Fresh and unaltered, light greenish brown biotite with no visible contamination.

From granodiorite
(92 G) Road-cut about 6.5 km east of Four Mile Point and 7 km northeast of Sechelt, British Columbia, 49°31'14"N, 123°41'22"W. Sample Rd70-40161, collected by G.J. Woodsworth and interpreted by G.J. Woodsworth and J.A. Roddick.

See GSC 76-33 for description and interpretation.

GSC 76-33 Hornblende, K-Ar age **119 ± 5 m.y.**

K = 0.711%, $^{40}Ar/^{40}K$ = 0.00717, radiogenic Ar = 71.0%.
Concentrate: Clean, fresh and unaltered, pleochroic, brown to dark green hornblende with no visible contamination.

From granodiorite
(92 G) Details as for GSC 76-32

The sample is a medium grained, moderately foliated granodiorite, with a modal composition of 59.0% plagioclase, 31.0% quartz, 6.2% K-feldspar, 1.8% biotite, 0.8% hornblende, 0.4% sphene, 0.4% epidote, 0.2% opaques, 0.2% sericite, and a trace of zircon. The mafics are fresh and unaltered.

Samples GSC 76-30 and 31 come from one of several small quartz monzonite plutons lying near the west margin of the Coast Plutonic Complex. A quartz monzonite on Campania Island (Douglas Channel map-area) yielded a biotite age of 115 ± 6 m.y. (GSC 67-23). The dates from these two quartz monzonite plutons indicate widespread potash-rich plutonism during or prior to the Early Cretaceous. The foliated plutons cut by the massive quartz monzonite bodies are presumably older.

Samples GSC 76-32 and 33 are from a large granodiorite and quartz monzonite body near the southwestern margin of the Coast Plutonic Complex about 100 km southwest of GSC 76-30 and 31. The ages from this body are in good accord with those from the West Redonda and Campania quartz monzonite bodies, and confirm that Early Cretaceous or older plutons are abundant along the southwest side of the southern Coast Plutonic Complex.

GSC 76-34 Biotite, K-Ar age **97.1 ± 3.6 m.y.**

K = 7.01%, $^{40}Ar/^{40}K$ = 0.00583, radiogenic Ar = 84.9%.
Concentrate: Relatively clean, light brownish biotite with approximately 2% chlorite alteration.

From quartz diorite
(92 K) East shore of Bute Inlet, about 6 km south of Fawn Bluff, British Columbia, 50°25'26"N, 125°03'35"W. Sample Rd70-30360, collected by W.W. Hutchison and interpreted by G.J. Woodsworth and J.A. Roddick.

See GSC 76-35 for description and GSC 76-38 for interpretation.

GSC 76-35 Hornblende, K-Ar age **99.4 ± 4.6 m.y.**

K = 0.326%, $^{40}Ar/^{40}K$ = 0.00597, radiogenic Ar = 31.4%.
Concentrate: Fresh and unaltered, pleochroic, brown to dark green hornblende with no visible contamination.

From quartz diorite
(92 K) Details as for GSC 76-34.

The sample is a medium grained, massive quartz diorite composed of about 50% plagioclase, 20% quartz, 1% K-feldspar, 15% biotite, 12% hornblende, and minor chlorite, opaques, zircon, and apatite. Biotite is slightly chloritized.

See GSC 76-38 for interpretation.

GSC 76-36 Biotite, K-Ar age **97.0 ± 4.5 m.y.**

K = 6.89%, $^{40}Ar/^{40}K$ = 0.00582, radiogenic Ar = 87.8%.
Concentrate: Somewhat altered, light brown biotite with approximately 10% chloritization.

From quartz monzonite
(92 K) About 8 km southeast of Orford Bay, British Columbia, 50°33'53"N, 124°45'01"W. Sample Rd70-30307, collected by W.W. Hutchison and interpreted by G.J. Woodsworth and J.A. Roddick.

The sample is a coarse grained, massive, equigranular quartz monzonite consisting of about 44% plagioclase, 22% K-feldspar, 22% quartz, 12% biotite (and minor chlorite alteration), and accessory apatite, rutile, and opaques.

See GSC 76-38 for interpretation.

GSC 76-37 Biotite, K-Ar age **93.6 ± 4.3 m.y.**

K = 7.49%, $^{40}Ar/^{40}K$ = 0.00561, radiogenic Ar = 84.2%.
Concentrate: Clean, fresh and unaltered, light brown biotite with no visible contamination.

From porphyritic granodiorite
(92 K) Top of knoll 5 km north of Elizabeth Island, Pryce Channel, British Columbia, 50°20'49"N, 124°51'23"W. Sample Rd70-10234, collected by J.A. Roddick and interpreted by G.J. Woodsworth and J.A. Roddick.

The rock is a fine- to medium-grained, massive quartz monzonite. The sample has a distinctive porphyritic texture and a modal composition of about 32% plagioclase, 35% quartz, 22% K-feldspar, 11% biotite, and minor hornblende. The biotite is fresh and unaltered.

See GSC 76-38 for interpretation.

GSC 76-38 Hornblende, K-Ar age **82.2 ± 8.7 m.y.**

K = 0.286%, $^{40}Ar/^{40}K$ = 0.00491, radiogenic Ar = 21.4%.
Concentrate: Clean, fresh and unaltered, pleochroic, light greenish brown to light bluish green hornblende.

From volcanic breccia
(92 K) Summit of Mount Hayes, British Columbia, 50°21'14"N, 124°54'44"W. Sample Rd70-10233, collected by J.A. Roddick and interpreted by G.J. Woodsworth and J.A. Roddick.

The sample is from the matrix of a volcanic breccia, and consists largely of plagioclase and hornblende phenocrysts in a fine grained groundmass. The breccia is fresh and unmetamorphosed, and contains fragments of the granodiorite body to the southwest.

Samples GSC 76-34, 35, 36, 37 and 38 are from a complex of volcanic and plutonic rocks in the Quatam River area of the Coast Plutonic Complex. GSC 76-34 and 35, concordant at about 98 m.y., are from a large quartz diorite body that lies about midway between the axis of the Coast Mountains and the western edge. GSC 76-36, 97 m.y., is from a large, predominantly quartz monzonite body that cuts older diorite and metamorphosed rhyolite breccia, but its relation to nearby Quatam pluton is unknown. The Quatam pluton (GSC 76-37, 93.6 m.y.) is a porphyritic granodiorite that cuts metamorphosed rhyolite breccia and the quartz diorite of GSC 76-34. The Quatam pluton appears to be a high-level intrusion, unlike and younger than most of the plutons in the Coast Mountains in this area. Volcanic breccia (GSC 76-38, 82 m.y.) forms several neck-like bodies that cut the Quatam pluton and the quartz diorite. The volcanics are fresh and unmetamorphosed, and were originally thought to be possibly Tertiary in age.

Except for the date from the volcanic breccia, the dates from this area average about 97 m.y. and are equivalent within the error limits. The ages agree well with dates from the Squamish granodiorite (94 m.y.; Mathews, 1968) about 170 km to the southwest and about the same distance from the southwestern margin of the Coast Mountains.

The 82 m.y. age from the unmetamorphosed volcanic neck is significantly younger than the ages from the nearby plutonic rocks, but the significance of the age is not known. A much younger age for the volcanics is possible, as the breccias contain fragments of older plutonic rock that may have contaminated the sample.

Reference

Mathews, H.H. (editor)
1968: Guidebook for geological field trips in southwestern British Columbia; Univ. Brit. Columbia, Dept. Geol., Rep. 6.

GSC 76-39 Biotite, K-Ar age **82.0 ± 3.1 m.y.**

K = 7.80%, $^{40}Ar/^{40}K$ = 0.00491, radiogenic Ar = 85.7%.
Concentrate: Fresh and unaltered, dark greenish biotite with no visible contamination.

From granodiorite
(92 K) Ridge crest about 12 km east of mouth of McMillan Creek where it enters Powell Lake, British Columbia, 50°10'03"N, 124°11'25"W. Sample Rd70-10267, collected by J.A. Roddick and interpreted by G.J. Woodsworth and J.A. Roddick.

The sample is a medium- to coarse-grained, massive granodiorite. Modal composition is 54.0% plagioclase, 29.5% quartz, 9.1% K-feldspar, 6.6% biotite, 0.4% sphene, 0.4% opaques, and traces of sericite, chlorite, epidote, and apatite.

See GSC 76-41 for interpretation.

GSC 76-40 Biotite, K-Ar age **83.6 ± 3.1 m.y.**

K = 7.44%, $^{40}Ar/^{40}K$ = 0.00500, radiogenic Ar = 81.7%.
Concentrate: Light greenish brown biotite with approximately 2% chlorite alteration.

From granodiorite
(92 K) Ridge crest about 5 km northeast of the head of Goat Lake and 8 km south-southeast of sample GSC 76-39, British Columbia, 50°05'47"N, 124°09'24"W. Sample Rd70-30059, collected by W.W. Hutchison and interpreted by G.J. Woodsworth and J.A. Roddick.

See GSC 76-41 for description and interpretation.

GSC 76-41 Hornblende, K-Ar age **89.6 ± 4.2 m.y.**

K = 0.625%, $^{40}Ar/^{40}K$ = 0.00537, radiogenic Ar = 61.7%.
Concentrate: Fresh and unaltered, pleochroic, light brown to dark green hornblende with no visible contamination.

From granodiorite
(92 K) Details as for GSC 76-40.

The sample is a medium grained, faintly foliated granodiorite, with mode of 51.1% plagioclase, 25.4% quartz, 10.8% biotite, 9.0% hornblende, 3.5% K-feldspar, 0.2% opaques, and a trace of apatite.

Sample GSC 76-39 is from the largest discrete pluton in Bute Inlet map-area. This pluton intrudes a complex of quartz diorite and granodiorite; GSC 76-40 and 41 are from this complex about 4 km south of the contact with the large discrete pluton. The 82 m.y. date on biotite from the pluton is not significantly different from the 83.6 m.y. date from the older complex to the south. The 89.6 m.y. hornblende age from the complex is considerably older than the biotite dates, but the significance of this age with respect to the large discrete pluton is not known. These three ages correspond well with 80 to 87 m.y. ages obtained from plutons in the northwest corner of Bute Inlet map-area (GSC 76-24) and from the Quatam River volcanic breccia (GSC 76-38).

GSC 76-42 Biotite, K-Ar age **60.0 ± 2.2 m.y.**

K = 6.82%, $^{40}Ar/^{40}K$ = 0.00357, radiogenic Ar = 82.4%.
Concentrate: Somewhat impure, very light brown biotite with approximately 8% chlorite contamination. The chlorite occurs both as free flakes and as an alteration product of the mica.

From granodiorite
(92 J) Ridge crest about 5 km northwest of the terminus of Bishop Glacier, British Columbia, 50°50'39"N, 123°59'55"W. Map-unit 3, Geol. Surv. Can., Paper 75-1A, p. 37-40. Sample Rd74-44143, collected by G.J. Woodsworth and interpreted by G.J. Woodsworth and J.A. Roddick.

See GSC 76-43 for description and GSC 76-45 for interpretation.

GSC 76-43 Hornblende, K-Ar age **75.8 ± 8.1 m.y.**

K = 0.252%, $^{40}Ar/^{40}K$ = 0.00453, radiogenic Ar = 35.1%.
Concentrate: Fresh and unaltered, pleochroic, light brown to green hornblende with no visible contamination.

From granodiorite
(92 J) Details as for GSC 76-42.

The sample is a massive, medium grained granodiorite, consisting of about 67% plagioclase (stubby subhedral grains with strong oscillatory zoning), 16% quartz, 5% K-feldspar, 10% biotite, 2% hornblende, and minor chlorite, epidote, opaques, and apatite. Biotite, as subhedral books, is partly chloritized; hornblende is free of alteration. Chlorite also forms discrete patches throughout the rock.

See GSC 76-45 for interpretation.

GSC 76-44 Biotite, K-Ar age **55.5 ± 9.5 m.y.**

K = 7.81%, $^{40}Ar/^{40}K$ = 0.00329, radiogenic Ar = 60.2%.
Concentrate: Fresh and unaltered, greenish brown biotite with no visible contamination.

From granodiorite
(92 J) Immediately north of the Elaho Glacier, British Columbia, 50°30'35"N, 123°42'48"W. Map-unit 3, Geol. Surv. Can., Paper 75-1A, p. 37-40. Sample Rd74-14276, collected by J.A. Roddick and interpreted by G.J. Woodsworth and J.A. Roddick.

See GSC 76-45 for description and interpretation.

GSC 76-45 Muscovite, K-Ar age **73.8 ± 2.8 m.y.**

K = 9.04%, $^{40}Ar/^{40}K$ = 0.00441, radiogenic Ar = 77.1%.
Concentrate: Clean, clear, fresh and unaltered muscovite with no visible contamination.

From granodiorite
(92 J) Details as for GSC 76-44.

The sample is a massive, fine- to medium-grained granodiorite, consisting of about 63% plagioclase (strong oscillatory-normal zoning, with some sericitization), 18% quartz, 12% K-feldspar (as irregular patches), 6% biotite, 1% muscovite, and minor chlorite, epidote, apatite, and opaques.

Samples GSC 76-42 and 43 are from a granodiorite pluton lying near the axis of the southern Coast Plutonic Complex that cuts metamorphosed Lower Cretaceous(?) strata. GSC 76-44 and 45 are from a large granodiorite pluton in the western part of the Coast Plutonic Complex. This pluton, one of the largest yet recognized in the southern Coast Mountains, cuts foliated quartz diorite and migmatite. Both plutons give highly discordant ages, with the biotite ages

being younger than the muscovite and hornblende ages. The reasons for the discordancies, which are the largest yet found in the southern Coast Mountains, are not known. The northern pluton (GSC 76-42 and 43) has field and petrographic characteristics similar to the Bishop River pluton about 20 km northwest that gives concordant biotite and hornblende ages of 55 m.y. (see GSC 72-22, 23), but it is not known if the two bodies represent the same pluton.

GSC 76-46 Biotite, K-Ar age **88.6 ± 3.3 m.y.**

K = 7.53%, $^{40}Ar/^{40}K$ = 0.00531, radiogenic Ar = 88.1%.
Concentrate: Fresh and unaltered, dark brown biotite with no visible contamination.

From granodiorite
(92 G) Ridge crest about 5 km northwest of Tzoonie Mountain, British Columbia, 49°54'10"N, 123°38'03"W. Sample Rd74-14395, collected by J.A. Roddick and interpreted by G.J. Woodsworth and J.A. Roddick.

See GSC 76-47 for description and interpretation.

GSC 76-47 Hornblende, K-Ar age **97.5 ± 4.5 m.y.**

K = 0.700%, $^{40}Ar/^{40}K$ = 0.00586, radiogenic Ar = 64.2%.
Concentrate: Pleochroic, dark brown to green hornblende with approximately 4% free biotite contamination.

From granodiorite
(92 G) Details as for GSC 76-46

The sample is a massive, medium grained, grey granodiorite composed of about 7% K-feldspar, 5% biotite and 3% hornblende in a matrix of coarser grained quartz (12%) and plagioclase (73%). Biotite forms ragged grains up to 2 mm long that are commonly slightly bent. Hornblende occurs as patchy aggregates of small grains that commonly are associated with biotite. Both mafics are associated with opaques, epidote, and apatite. Biotite is commonly slightly chloritized. Grain boundaries in this rock are highly sutured.

This sample is from a large pluton, predominantly granodiorite, that is typical of this part of the southern Coast Mountains. The biotite (88.6 m.y.) and hornblende (97.5 m.y.) ages are discordant, as are ages from several other plutons in the southern Coast Mountains (see, for example, GSC 76-44 and 41). Moderately discordant K-Ar ages seem to be more abundant in the southern Coast Plutonic Complex than in the Prince Rupert area some 600 km to the northwest.

The 88.6 and 97.5 m.y. ages from this pluton are similar to ages of 94 to 97 m.y. obtained from the Squamish and Caulfeild granodiorite bodies about 40 and 60 km to the southeast, and are part of a belt of Late Cretaceous K-Ar ages along the western side of the southern Coast Mountains.

GSC 76-48 Biotite, K-Ar age **54.6 ± 2.4 m.y.**

K = 7.47%, $^{40}Ar/^{40}K$ = 0.00324, radiogenic Ar = 78.3%.
Concentrate: Dark brown biotite with approximately 3% chlorite alteration.

From granodiorite
(92 J) Approximately 6 km south of the terminus of the Lord Glacier, British Columbia, 50°52'59"N, 123°38'28"W. Map-unit 3, Geol. Surv. Can., Paper 75-1A, p. 37-40. Sample Rd74-14368, collected by J.A. Roddick and interpreted by G.J. Woodsworth and J.A. Roddick.

The sample is a medium grained, massive granodiorite, composed of about 70% plagioclase, 15% quartz, 8% K-feldspar (microcline), 6% biotite, and minor apatite, opaques, chlorite, and muscovite. Quartz, plagioclase and microcline form equant grains several millimetres across; other minerals are smaller and interstitial. Biotite is very slightly chloritized.

This sample is from the middle of a large granodiorite pluton that underlies much of map-area 92J(W 1/2) near the northwest margin of the southern Coast Plutonic Complex. The pluton cuts quartz diorite and migmatite of unknown age. The 55 m.y. age from this pluton agrees well with 55 to 57 m.y. ages obtained from similar-appearing plutons to the west (see GSC 63-7 and 73-22), and with 57 to 58 m.y. ages obtained from the Bendor Intrusions about 75 km east-southeast (GSC 76-59). Plutons giving K-Ar ages of 55 to 60 m.y. appear to be widespread in the northeastern part of the southern Coast Mountains. These ages are significantly older than the 44 ± 3 m.y. ages characteristic of the northeast part of the Coast Plutonic Complex about 500 km to the northwest.

GSC 76-49 Biotite, K-Ar age **77.8 ± 2.9 m.y.**

K = 7.37%, $^{40}Ar/^{40}K$ = 0.00464, radiogenic Ar = 80.7%.
Concentrate: Light greenish brown biotite with approximately 2% chlorite alteration.

From quartz diorite
(92 J) Ridge crest about 12 km northwest of Birkenhead Lake and 9km northeast of Tenquille Lake, British Columbia, 50°35'51"N, 122°50'11"W. Map-unit P3, Geol. Surv. Can., Paper 73-17. Sample Rd70-10517, collected by J.A. Roddick and interpreted by G.J. Woodsworth and J.A. Roddick.

See GSC 76-50 for description and GSC 76-53 for interpretation.

GSC 76-50 Hornblende, K-Ar age **72.9 ± 3.6 m.y.**

K = 0.356%, $^{40}Ar/^{40}K$ = 0.00435, radiogenic Ar = 55.2%.
Concentrate: Fresh and unaltered, light brown to dark green hornblende with no visible contamination.

From quartz diorite
(92 J) Details as for GSC 76-49.

The sample is a coarse grained, massive quartz diorite, with modal composition: plagioclase, 55.9%; quartz, 20.8%; biotite, 11.3%; hornblende, 9.0%; K-feldspar, 0.4%; chlorite, 1.0%; epidote, 0.9%; opaques, 0.5%; and apatite, 0.2%. The biotite forms conspicuous books and is slightly chloritized.

See GSC 76-53 for interpretation.

GSC 76-51 Biotite, K-Ar age **69.6 ± 2.7 m.y.**

K = 7.10%, $^{40}Ar/^{40}K$ = 0.00415, radiogenic Ar = 86.7%.
Concentrate: Light brown biotite with approximately 5% chlorite alteration.

From granodiorite
(92 J) Ridge crest about 8 km northwest of Mount Samson, British Columbia, 50°40'50"N, 123°11'59"W. Map-unit 3, Geol. Surv. Can., Paper 75-1A, p. 37-40. Sample Rd74-44187, collected by G.J. Woodsworth and interpreted by G.J. Woodsworth and J.A. Roddick.

See GSC 76-52 for description and GSC 76-53 for interpretation.

GSC 76-52 Muscovite, K-Ar age **70.1 ± 2.6 m.y.**

K = 7.91%, $^{40}Ar/^{40}K$ = 0.00418, radiogenic Ar = 76.5%.
Concentrate: Clear, fresh and unaltered muscovite with no visible contamination.

From granodiorite
(92 J) Details as for GSC 76-51.

The sample is a medium grained, massive granodiorite. The modal composition is roughly 71% plagioclase, 18% quartz, 6% K-feldspar, and 5% biotite and muscovite. Biotite and epitaxially-related muscovite form large polygonalized grains; biotite is partly chloritized. Plagioclase is moderately saussuritized. Epidote, opaques, and apatite are minor constituents of the rock.

See GSC 76-53 for interpretation.

GSC 76-53 Biotite, K-Ar age **69.6 ± 2.7 m.y.**

K = 7.80%, $^{40}Ar/^{40}K$ = 0.00415, radiogenic Ar = 89.1%.
Concentrate: Relatively clean, fresh and unaltered, very light brown biotite with less than 1% chlorite contamination.

From granodiorite
(92 J) Ridge crest about 6 km south of the junction of Bridge River and McParlon Creek, British Columbia, 50°45'48"N, 123°12'04"W. Map-unit 3, Geol. Surv. Can., Paper 75-1A, p. 37-40. Sample Rd74-44215, collected by G.J. Woodsworth and interpreted by G.J. Woodsworth and J.A. Roddick.

The sample is a fine grained granodiorite, consisting of approximately 72% plagioclase (subhedral stubby grains), 13% quartz (small equant grains), 10% K-feldspar (irregularly distributed patches), and 5% biotite (slightly chloritized).

Samples GSC 76-49 and 50 are from a large quartz diorite pluton that cuts Upper Triassic strata. The pluton appears to represent a continuation of that represented by GSC 76-61 and 62 about 80 km to the southeast, with which it is continuous except for a 5 km-wide zone of Upper Triassic strata near Birken. The 73 to 78 m.y. ages are also very similar to ages obtained from the Scuzzy pluton (GSC 72-5) still farther southeast.

Samples GSC 76-51 and 52 are from a small granodiorite pluton intrusive into Upper Triassic strata that is situated about 25 km west-northwest of GSC 76-49 and 50. Sample GSC 76-53 is from a small, high-level granodiorite pluton that intrudes quartz diorite. The approximately 70 m.y. ages obtained from these plutons are similar to the ages obtained from the larger pluton (GSC 76-49, 50) to the southeast and from the Scuzzy pluton. The available dates indicate that quartz diorite and granodiorite plutons correlative with the Scuzzy pluton extend northwest from the Fraser River near Hell's Gate nearly continuously for at least 160 km. The age of GSC 76-53 indicates that the large quartz diorite body cut by the 69.6 m.y. old granodiorite pluton must be older than 70 m.y.

GSC 76-54 Biotite, K-Ar age **57.4 ± 2.3 m.y.**

K = 7.70%, $^{40}Ar/^{40}K$ = 0.00341, radiogenic Ar = 80.3%.
Concentrate: Fresh and unaltered, light greenish brown biotite with no visible contamination.

From granodiorite.
(92 J) Ridge crest 5 km south of Mount Bobb, British Columbia, 50°45'17"N, 122°36'52"W. Map-unit P4 (Bendor pluton), Geol. Surv. Can., Paper 73-17. Sample Rd70-30643, collected by W.W. Hutchison and interpreted by G.J. Woodsworth and J.A. Roddick.

The rock is a massive, equigranular granodiorite, consisting of 54.5% plagioclase, 19.8% quartz, 11.7% K-feldspar, 13.0% biotite, 0.5% hornblende, 0.5% chlorite (after biotite), and a trace of accessory minerals.

See GSC 76-59 for interpretation.

GSC 76-55 Biotite, K-Ar age **57.2 ± 2.7 m.y.**

K = 7.84%, $^{40}Ar/^{40}K$ = 0.00340, radiogenic Ar = 77.0%.
Concentrate: Fresh and unaltered, light greenish brown biotite with no visible contamination.

From quartz diorite
(92 J) Road-cut about 10 km southwest of Seton Portage, British Columbia, 50°39'32"N, 122°24'25"W. Map-unit P3, Geol. Surv. Can., Paper 73-17. Sample Rd70-40749, collected by G.J. Woodsworth and interpreted by G.J. Woodsworth and J.A. Roddick.

See GSC 76-56 for description and GSC 76-59 for interpretation.

GSC 76-56 Hornblende, K-Ar age **62.1 ± 3.1 m.y.**

K = 0.619%, $^{40}Ar/^{40}K$ = 0.00370, radiogenic Ar = 56.9%.
Concentrate: Pleochroic, light brown to dark green hornblende with approximately 2% free biotite contamination.

From quartz diorite
(92 J) Details as for GSC 76-55.

The sample is a well foliated, medium- to coarse-grained quartz diorite, consisting largely of plagioclase and quartz, with about 8% biotite, 1% hornblende, and minor K-feldspar and accessories. The mafic minerals are fresh and unaltered.

See GSC 76-59 for interpretation.

GSC 76-57 Biotite, K-Ar age **58.4 ± 2.3 m.y.**

K = 7.12%, $^{40}Ar/^{40}K$ = 0.00347, radiogenic Ar = 77.9%.
Concentrate: Light greenish brown biotite with approximately 3% chlorite alteration.

From quartz diorite
(92 J) Southeast shore of Anderson Lake about 4 km southwest of mouth of Valley Creek, British Columbia, 50°39'08"N, 122°22'44"W. Map-unit P3, Geol. Surv. Can., Paper 73-17. Sample Rd70-40845, collected by G.J. Woodsworth and interpreted by G.J. Woodsworth and J.A. Roddick.

See GSC 76-58 for description and GSC 76-59 for interpretation.

GSC 76-58 Hornblende, K-Ar age **62.6 ± 3.1 m.y.**

K = 0.618%, $^{40}Ar/^{40}K$ = 0.00372, radiogenic Ar = 55.1%.
Concentrate: Fresh and unaltered, pleochroic, light brown to dark green hornblende with no visible contamination.

From quartz diorite
(92 J) Details as for GSC 76-57.

The sample is a medium grained slightly foliated quartz diorite, consisting largely of plagioclase (slightly sericitized and epidotized) and quartz, with 3.1% biotite, 0.9% hornblende, 1.8% K-feldspar, and minor epidote, apatite, opaques, sphene, and chlorite. Biotite is slightly chloritized.

See GSC 76-59 for interpretation.

GSC 76-59 Hornblende, K-Ar age **41.2 ± 2.9 m.y.**

K = 0.382%, $^{40}Ar/^{40}K$ = 0.00244, radiogenic Ar = 34.5%.
Concentrate: Fresh and unaltered, pleochroic, greenish brown to brown hornblende with no visible contamination.

From hornblende-feldspar porphyry
(92 J) Road-cut, approximately 2 km west of McGillivray Falls on Anderson Lake, British Columbia, 50°37'02"N, 122°27'13"W. Map-unit P6, Geol. Surv. Can., Paper 73-17. Sample Rd70-40754, collected by G.J. Woodsworth and interpreted by G.J. Woodsworth and J.A. Roddick.

The rock is massive, with hornblende and plagioclase phenocrysts in a fine grained matrix. The mineral composition is 85.6% plagioclase, 4.7% quartz, 9.1% hornblende, 0.6% opaques, and a trace of apatite.

Sample GSC 76-54 is from Bendor pluton and GSC 76-55, 56, 57 and 58 are from similar plutons southwest of Bendor pluton. These three granodiorite and quartz diorite plutons are typical of those marking the eastern limit of the Coast Plutonic Complex in the Pemberton map-area. GSC 76-59 represents a high-level miarolitic pluton of quartz dioritic to granitic composition lying south of the Bendor intrusions.

The biotite ages of 57.4, 57.2, and 58.4 m.y. from the three Bendor intrusions are equivalent within the stated error limits but are slightly younger than the two hornblende ages of 62.1 and 62.6 m.y. The ages are significantly younger than the Scuzzy pluton (70 m.y., GSC 72-5) that lies along the eastern margin of the Coast Plutonic Complex in Hope (92H) map-area, but are older than the 45 ± 3 m.y. plutons (Hutchison, 1970) in the eastern part of the Coast Plutonic Complex about 500 km to the northwest. The ages are similar, though, to the 55 to 57 m.y. ages (GSC 73-22, 23, 27) obtained from the Bishop River pluton that forms the eastern margin of the Coast Plutonic Complex about 100 km west-northwest, and suggest that the Bendor intrusions and the Bishop River pluton may be correlative.

The hornblende age of 41.2 m.y. from the Anderson Lake porphyry body is younger than ages from the Bendor intrusions. The age is equivalent within the error limits to the 43.6 m.y. age (GSC 76-63) obtained from the Rexmount Porphyry about 30 km to the north, and the two bodies may have been emplaced at about the same time.

Reference

Hutchison, W.W.
1970: Metamorphic framework and plutonic styles in the Prince Rupert region of the central Coast Mountains, British Columbia; Can. J. Earth Sci., v. 7, p. 376-405.

GSC 76-60 Biotite, K-Ar age **66.1 ± 2.6 m.y.**

K = 7.33%, $^{40}Ar/^{40}K$ = 0.00394, radiogenic Ar = 76.9%.
Concentrate: Fresh and unaltered, light brown biotite with no visible contamination.

From quartz diorite
(92 J) About 14 km east of D'Arcy in the Cayoosh Range, British Columbia, 50°32'54"N, 122°17'20"W. Map-unit P4, Geol. Surv. Can., Paper 73-17. Sample Rd70-10449, collected by J.A. Roddick and interpreted by G.J. Woodsworth and J.A. Roddick.

The sample is a massive medium- to coarse-grained quartz diorite, with modal composition plagioclase, 54.3%; quartz, 26.0%; biotite, 13.1%; hornblende, 0.4%; K-feldspar, 0.2%; sericite, 2.1%; epidote, 3.1%; apatite, 0.2%; and opaques, 0.2%. The biotite forms large equant books and is slightly chloritized.

See GSC 76-62 for interpretation.

GSC 76-61 Biotite, K-Ar age **70.2 ± 2.7 m.y.**

K = 7.00%, $^{40}Ar/^{40}K$ = 0.00419, radiogenic Ar = 77.6%.
Concentrate: Very light brown biotite with approximately 2% chlorite alteration.

From quartz diorite
(92 J) About 9 km east-southeast of the junction of Rutledge Creek and Stein River, British Columbia, 50°08'31"N, 122°00'11"W. Map-unit P3, Geol. Surv. Can., Paper 73-17. Sample Rd70-20568, collected by W.W. Hutchison and interpreted by G.J. Woodsworth and J.A. Roddick.

See GSC 76-62 for description and interpretation.

GSC 76-62 Hornblende, K-Ar age **77.5 ± 3.7 m.y.**

K = 0.464%, $^{40}Ar/^{40}K$ = 0.00463, radiogenic Ar = 53.8%.
Concentrate: Fresh and unaltered, pleochroic, light green to brown hornblende with a trace of biotite contamination.

From quartz diorite
(92 J) Details as for GSC 76-61.

The sample is a medium grained, faintly foliated quartz diorite with modal composition plagioclase, 52.0%; quartz, 16.0%,; hornblende, 19.5%; biotite, 11.2%; K-feldspar, 0.6%; and opaques, sericite, and accessories, 0.5%. The mafic minerals are slightly chloritized.

Samples GSC 76-61 and 62 are from a large quartz diorite body that extends southeast of Pemberton map-area and that appears to be the northeast continuation of the Scuzzy pluton in Hope map-area. The 70.2 ± 2.7 and 77.5 ± 3.7 m.y. ages are equivalent within stated error limits to the age for the Scuzzy pluton (70 ± 4 m.y. on biotite; GSC 72-5).

GSC 76-60 is from a circular pluton that is similar to, and lies southeast of the Bendor intrusions. The 66.1 ± 2.6 m.y. age for this pluton is older than the 57 to 62 m.y. ages obtained from the Bendor intrusions (See GSC 76-59) but is slightly younger than the 70 m.y. dates for biotites from the Scuzzy pluton.

Unlike the eastern part of the Coast Mountains about 500 km northwest where all plutons give K-Ar ages of 45 ± 3 m.y. (Hutchison, 1970), these plutons from the eastern part of the southern Coast Mountains give distinctly different, slightly discordant, and generally older ages. The available dates suggest that the K-Ar dates in the southern Coast Mountains may reflect time of emplacement rather than time of regional uplift and unroofing.

Reference

Hutchison, W.W.
1970: Metamorphic framework and plutonic styles in the Prince Rupert region of the central Coast Mountains, British Columbia; Can. J. Earth Sci., v. 7, p. 376-405.

GSC 76-63 Biotite, K-Ar age **43.6 ± 2.4 m.y.**

K = 7.14%, $^{40}Ar/^{40}K$ = 0.00258, radiogenic Ar = 69.7%.
Concentrate: Somewhat altered light brown biotite with approximately 9% chloritization.

From quartz monzonite
(92 J) Shulaps Range, about 16 km north of Seton Portage, British Columbia, 50°51'09"N, 122°20'08"W. Map-unit 12a (Rexmount Porphyry), Geol. Surv. Can., Paper 73-17. Sample Rd70-30582, collected by W.W. Hutchison and interpreted by G.J. Woodsworth and J.A. Roddick.

The rock is a massive, medium grained, quartz monzonite consisting of 35.8% plagioclase, 39.2% quartz, 20.2% K-feldspar, 2.8% biotite, 0.2% hornblende, 1.0% chlorite (after biotite and hornblende), and 0.8% opaques, apatite, and epidote.

The sample is from the Rexmount Porphyry, a long narrow body cutting Middle Triassic strata along the crest of the Shulaps Range. The intrusion has long been thought to be Tertiary; the K-Ar age suggests an Eocene age. A similar age (41.2 ± 2.9 m.y.) has been obtained from a high-level pluton about 30 km south of the Rexmount Porphyry (see GSC 76-59), and the two bodies may be the same age.

GSC 76-64 Hornblende, K-Ar age **16.3 ± 2.7 m.y.**

$K = 0.386\%$, $^{40}Ar/^{40}K = 0.000956$, radiogenic Ar = 15.1%.
Concentrate: Fresh and unaltered, pleochroic, light green to light brown hornblende.

From granodiorite
(92 J) Ridge between Roger and Gowan Creeks, about 14 km south of Lizzie Lake, British Columbia, 50°00'16"N, 122°24'09"W. Map-unit P4a, Geol. Surv. Can., Paper 73-17. Sample Rd70-30676, collected by W.W. Hutchison and interpreted by G.J. Woodsworth and J.A. Roddick.

The rock is a porphyritic granodiorite, with a modal composition of 58.8% plagioclase, 12.5% K-feldspar, 18.0% quartz, 7.0% hornblende, 1.4% opaques, 1.4% chlorite (after hornblende), 0.7% epidote, and 0.2% zircon.

The sample is from the Roger Creek stock, a high-level miarolitic body of granodiorite and syenodiorite which is overlain by silicic volcanic rocks. This pluton appears to be part of a chain of high-level Miocene plutons extending northwest from the Chilliwack and Mount Barr batholiths near Hope to Bella Coola. The 16 m.y. age from this pluton is equivalent to the youngest ages obtained from the Mount Barr batholith, about 100 km to the southeast (Richards and McTaggart, 1976). The age is also equivalent to that obtained from a small dacite body about 70 km northwest (GSC 76-65), but the relation of this pluton to the dacite is not known.

Reference

Richards, T.A. and McTaggart, K.C.
1976: Granitic rocks of the southern Coast Plutonic Complex and northern Cascades of British Columbia; Geol. Soc. Am., Bull., v. 87, p. 935-953.

GSC 76-65 Whole-rock, K-Ar age **17.1 ± 1.5 m.y.**

$K = 1.84\%$, $^{40}Ar/^{40}K = 0.00101$, radiogenic Ar = 53.4%.
Concentrate: Crushed whole-rock.

From dacite
(92 J) Road cut on north side of Lillooet River, about 14 km northwest of Pemberton Meadows, British Columbia, 50°30'53"N, 123°00'56"W. Map-unit 11, Geol. Surv. Can., Paper 73-17. Sample Rd74-44283, collected by G.J. Woodsworth and interpreted by G.J. Woodsworth and J.A. Roddick.

The sample is a light greenish grey dacite. Alteration has largely obscured the original textures; the rock now consists of relict plagioclase phenocrysts and abundant calcite, chlorite, and sericite, with lesser opaques, epidote, and rutile.

See GSC 76-66 for interpretation.

GSC 76-66 Whole-rock, K-Ar age **19.8 ± 1.8 m.y.**

$K = 0.559\%$, $^{40}Ar/^{40}K = 0.00116$, radiogenic Ar = 68.6%.
Concentrate: Crushed whole-rock.

From basalt
(92 J) Ridge crest about 2 km southwest of Mount Noel, British Columbia, 50°41'51"N, 122°52'39"W. Map-unit 13, Geol. Surv. Can., Paper 73-13. Sample Rd74-44205, collected by G.J. Woodsworth and interpreted by G.J. Woodsworth and J.A. Roddick.

The rock is a dark grey basalt containing fresh, strongly zoned plagioclase phenocrysts, smaller anhedral, highly zoned clinopyroxene phenocrysts, and rare olivine phenocrysts. The matrix is largely fine grained plagioclase, opaques, and pyroxene.

These two samples are from volcanic rocks that appear to post-date most of the rocks in the Coast Plutonic Complex. GSC 76-65 is from one of several small bodies of andesite, dacite, and volcanic breccia in an area near Tenquille Lake. These volcanics are flat lying or moderately dipping, and commonly are somewhat altered. The 17 m.y. age obtained for these volcanics is similar to the 16 m.y. age (GSC 76-64) for the Roger Creek high-level stock about 70 km to the southeast and to the younger ages from the Chilliwack batholith still farther southeast (Richards and McTaggart, 1976). The volcanics appear to be part of a chain of Miocene high-level plutons and volcanics that extends northwest through the southern Coast Mountains.

GSC 76-66 is from the basal flow in one of three remnants of flat lying basalt flows capping ridges north and south of Mount Noel. These flows were thought to be equivalent to the plateau basalts to the north of late Miocene or Pliocene age, but the 20 m.y. age for the Mount Noel flow is older than the 10 to 13 ± 2 m.y. ages obtained from the plateau basalts (Mathews and Rouse, 1963). The age is similar to the 17 m.y. age for the Tenquille Lake volcanics (GSC 76-65) about 25 km to the south, and the two areas may once have been part of a more extensive mid-Miocene volcanic complex.

References

Mathews, W.H. and Rouse, G.E.
1963: Late Tertiary volcanic rocks and plant-bearing deposits in British Columbia; Geol. Soc. Am., Bull., v. 74, p. 55-60.

Richards, T.A. and McTaggart, K.C.
1976: Granitic rocks of the southern Coast Plutonic Complex and the northern Cascades of British Columbia; Geol. Soc. Am., Bull., v. 87, p. 935-953.

GSC 76-67 Whole-rock, K-Ar age **69.4 ± 3.3 m.y.**

$K = 0.418\%$, $^{40}Ar/^{40}K = 0.00413$, radiogenic Ar = 35.7%.
Concentrate: Crushed whole-rock.

From basalt
(92 G) Upper Levels Highway, 0.5 km east of Cypress Creek bridge, British Columbia, 49°20'57"N, 123°14'07"W. Cuts map-unit H2, Geol. Surv. Can., Mem. 335. Sample Rd74-44298, collected by G.J. Woodsworth and interpreted by G.J. Woodsworth and J.A. Roddick.

The rock is a black, fine grained basalt dyke, consisting of euhedral, strongly zoned clinopyroxene phenocrysts (6%), and zoned, slightly saussuritized plagioclase phenocrysts (15%) in a matrix of felted plagioclase and very fine grained indeterminate material. Blebs of radiating calcite crystals are common.

See GSC 76-70 for interpretation.

GSC 76-68 Whole-rock, K-Ar age **91.4 ± 4.2 m.y.**

$K = 0.689\%$, $^{40}Ar/^{40}K = 0.00548$, radiogenic Ar = 85.8%.
Concentrate: Crushed whole-rock.

From basalt
(92 G) Highway 99, 50 m north of the north end of Montizambert Creek bridge, British Columbia, 49°24'30"N, 123°14'24"W. Cuts map-unit H1, Geol. Surv. Can., Mem. 335. Sample Rd74-44299, collected by G.J. Woodsworth and interpreted by G.J. Woodsworth and J.A. Roddick.

See GSC 76-69 for description and GSC 76-70 for interpretation.

GSC 76-69 Hornblende, K-Ar age **103 ± 5 m.y.**

K = 0.631%, $^{40}Ar/^{40}K$ = 0.00618, radiogenic Ar = 69.8%.
Concentrate: Fresh and unaltered, pleochroic, light brown to green hornblende with no visible contamination.

From basalt
(92 G) Details as for GSC 76-68.

The rock is a dark grey basaltic dyke. The original minerals have been largely destroyed by recrystallization and alteration. Zoning in plagioclase phenocrysts has largely been obliterated. Pale green-brown hornblende and ragged brown biotite grains have developed from primary mafic minerals, none of which remain. Anhedral epidote and opaques each form about 4% of the rock volume.

See GSC 76-70 for interpretation.

GSC 76-70 Whole-rock, K-Ar age **32.9 ± 2.4 m.y.**

K = 1.37%, $^{40}Ar/^{40}K$ = 0.00194, radiogenic Ar = 71.1%.
Concentrate: Crushed whole-rock.

From basalt
(92 G) At base of west wall of Stawamus Chief Mountain, just west of Highway 99, British Columbia, 49°41'09"N, 123°09'00"W. Cuts map-unit 13b, Geol. Surv. Can., Map 42-1963. Sample Rd74-44301, collected by G.J. Woodsworth and interpreted by G.J. Woodsworth and J.A. Roddick.

The rock is an altered, fine grained, black basaltic dyke, composed largely of a trachytic mat of 0.5 mm-long plagioclase laths. These have been albitized, and original zoning has been destroyed. Very fine grained greenish biotite, epidote, opaques, and other materials fill interstices between the feldspar grains.

The above three samples are from dykes cutting plutonic rocks of the Coast Plutonic Complex. GSC 76-67 is from a fresh, unaltered dyke that cuts the Caulfield granodiorite, dated at 97 m.y. (K-Ar on biotite; Mathews, 1968.) The 69 m.y. age suggests a latest Cretaceous or early Paleocene age for the dyke; the very fresh nature of the dyke indicates that metamorphism in this part of the southern Coast Mountains had concluded by that time.

GSC 76-68 and 69 are from one of several conspicuous dykes that cut altered pink granite. Granodiorite bodies immediately north and south of the granite give K-Ar ages of 117 ± 4 m.y. on hornblende and 113 ± 3 m.y. on biotite (Caron, 1974), but age relations with the pink granite are not known. The 113 m.y. biotite age from this dyke must be regarded as a minimum age for the dyke, as the biotite formed during alteration and recrystallization of the original mafic minerals. One possible interpretation of these ages is that the dykes are feeders for nearby volcanics in the Lower Cretaceous Gambier Group and that alteration of the dykes is due to the low-grade metamorphic event that affected the Gambier Group strata.

GSC 76-70 is from a conspicuous dyke cutting the Squamish granodiorite, dated at 94 m.y. (K-Ar on biotite; Mathews, 1968). The 33 m.y. age suggests an Oligocene age for this dyke.

References

Caron, M.E.
1974: Geology and geochronology of the Strachan Creek area, Howe Sound, southwestern British Columbia; unpub. B.Sc. thesis, Univ. British Columbia.

Mathews, W.H. (editor)
1968: Guidebook for geological field trips in southwestern British Columbia; Univ. British Columbia, Dept. Geol., Rep. 6.

GSC 76-71 Hornblende, K-Ar age **144 ± 6 m.y.**

K = 0.461%, $^{40}Ar/^{40}K$ = 0.00875, radiogenic Ar = 65.0%.
Concentrate: Fresh and unaltered, pleochroic, yellow-brown to dark green hornblende with no visible contamination.

From granodiorite
(103 H) At shoreline, north end of Trutch Island, south side of Otter Passage, British Columbia, 53°08'10"N, 129°42'05"W. Map-unit 9b, Geol. Surv. Can., Paper 70-41. Sample SAA-7409506, collected and interpreted by D.T.A. Symons.

The available K-Ar age dates for plutonic rocks in the Coast Mountains form three distinct age zones that parallel the trend of the mountains: namely, an eastern zone with K-Ar ages of 40 to 50 m.y., a median zone of 64 to 79 m.y., and a western zone of 84 to 139 m.y. (Hutchison, 1970). This age of 144 ± 6 m.y. comes from the western edge of the western zone and it is the oldest date reported from the Coast Plutonic Complex.

The sample was collected from biotite hornblende granodiorite (Unit 9b, Roddick, 1970) on Trutch Island. Trutch and Banks islands are the westernmost major islands of the Coast Plutonic Complex. They are bounded on the east by the Principe-Laredo fault which separates them from the rest of the western K-Ar age zone. Excluding the Gil Island complex, all other plutonic rocks from the western zone give ages between 84 and 115 m.y. Samples from biotite hornblende granodiorite on the opposite side of Principe Channel from Trutch Island give ages of 103, 104 and 111 m.y., and samples from biotite quartz monzonite give 115 m.y. The circular Gil Island complex is composed of biotite hornblende diorite and gives K-Ar ages of 139 ± 7 (biotite) and 133 ± 22 (hornblende) (GSC 66-10, 11). The complex is an unusually large and mafic pluton for the Coast Plutonic Complex and it appears to be a distinctly anomalous structure within the western zone. The conclusion reached from this 144 ± 6 m.y. age is that it dates the emplacement (Symons, 1974) of a fourth, westernmost zone to be added to Hutchison's (1970) sequence. The zone is bounded on the east by the Principe-Laredo fault and on the west by Hecate Strait, gives K-Ar ages in the 133 to 144 m.y. range, and includes the Gil Island complex as an outlier. Hutchison's western zone is then limited to the 84 to 115 m.y. age range.

Sample No.	Rock Type	Mineral	Age	Reference
GSC 64-5	Granodiorite	Biotite	103±6	Geol. Surv. Can., Paper 65-17, p. 10
GSC 64-6	"	"	111±6	Geol. Surv. Can., Paper 65-17, p. 10
GSC 66-4	"	"	96±5	Geol. Surv. Can., Paper 67-2(A), p. 12
GSC 66-5	"	Hornblende	101±15	Geol. Surv. Can., Paper 67-2(A), p. 13
GSC 67-21	"	Biotite	84±4	Geol. Surv. Can., Paper 69-2(A), p. 13
GSC 67-23	Qtz. monzonite	"	115±6	Geol. Surv. Can., Paper 69-2(A), p. 14
GSC 67-24	Qtz. diorite	"	104±4	Geol. Surv. Can., Paper 69-2(A), p. 15
GSC 67-26	Granodiorite	"	109±5	Geol. Surv. Can., Paper 69-2(A), p. 16
GSC 67-27	Gabbro	Hornblende	100±6	Geol. Surv. Can., Paper 69-2(A), p. 17
GSC 67-28	"	Biotite	90±4	Geol. Surv. Can., Paper 69-2(A), p. 17

References

Hutchison, W.W.
1970: Metamorphic framework and plutonic styles in the Prince Rupert region of the Central Coast Mountains, British Columbia; Can. J. Earth Sci., v. 7, p. 376-405.

Roddick, J.A.
1970: Douglas Channel – Hecate Strait map-area, British Columbia; Geol. Surv. Can., Paper 70-41, 56 p.

Symons, D.T.A.
1974: Age and tectonic implications from plutons near Prince Rupert, British Columbia; J. Geophys. Res., v. 79, p. 2690-2698.

GSC 76-72 Biotite, K-Ar age **98.0 ± 3.7 m.y.**

K = 7.75%, $^{40}Ar/^{40}K$ = 0.00589, radiogenic Ar = 85.5%.
Concentrate: Relatively clean, greenish brown biotite with approximately 3% chlorite alteration.

From granodiorite
(104 I) Close to the confluence of Kutcho Creek with Turnagain River, British Columbia, 58°30 1/2'N, 128°45 1/2'W. Geol. Surv. Can., Map 29-1962, unit 15a. Sample GA-72-T1, collected by T. Clark (Queens University) and interpreted by H. Gabrielse.

See GSC 76-73 for description and interpretation.

GSC 76-73 Hornblende, K-Ar age **107 ± 5 m.y.**

K = 0.959%, $^{40}Ar/^{40}K$ = 0.00642, radiogenic Ar = 74.5%.
Concentrate: Relatively clean, pleochroic, light green to dark green hornblende with a slight trace of biotite contamination.

From granodiorite
(104 I) Details as for GSC 76-72.

The sample was obtained from the western edge of Cassiar Batholith and is a medium grained, very weakly foliated, mid-grey, relatively homogeneous, fresh, porphyritic hornblende-biotite granodiorite. It is composed of quartz (25.5%), sodic plagioclase (39%), orthoclase (18%), biotite (10%), hornblende (5%), myrmekite (10%) and accessory chlorite, sphene, epidote, zircon, apatite, and opaque ore(s). Phenocrysts (2-5%) consist of both orthoclase and plagioclase. The weak foliation, apparently mainly the result of mild to moderate post-crystalline cataclastic deformation, has given rise to some granulation of felsic minerals and shredding of biotite, together with the formation of fine, sinuous quartz-filled shears. The mafic minerals form in clotted aggregates. Biotite is greenish brown and displays mild chloritic alteration only. Hornblende is dark green and fairly fresh.

The ages are in good agreement with a number of determinations made previously on granitic rocks of the Cassiar Batholith farther northwest in north-central British Columbia and south-central Yukon Territory. They also further confirm the apparent widespread occurrence of mid-Cretaceous granitic rocks in the eastern Omineca Crystalline Belt.

GSC 76-74 Hornblende, K-Ar age **186 ± 8 m.y.**

K = 0.447%, $^{40}Ar/^{40}K$ = 0.01143, radiogenic Ar = 78.8%.
Concentrate: Fresh and unaltered, pleochroic, light brown to light green hornblende with no visible contamination.

From quartz monzonite
(94 E) Approximately 8.4 km northwest of Drybrough Peak, just to northwest of small lake ("Black Lake"), Toodoggone River map-area, British Columbia, 57°14'36"N, 127°02'54"W. Sample GA-73-44, collected and interpreted by H. Gabrielse.

Rock is a very weakly foliated, homogeneous, medium- to coarse-grained biotite-hornblende quartz monzonite.

See GSC 76-75, 76 for interpretation of sample from same batholith.

GSC 76-75 Biotite, K-Ar age **189 ± 7 m.y.**

K = 6.40%, $^{40}Ar/^{40}K$ = 0.01161, radiogenic Ar = 94.6%.
Concentrate: Light brown biotite with approximately 5% chlorite alteration.

From granodiorite
(94 E) On east bank of Sturdee River some 2.8 km above its confluence with Firesteel River, Toodoggone River map-area, British Columbia, 57°09'54"N, 127°02'12"W. Sample GAF-73-61A, collected by F. Foster and interpreted by H. Gabrielse.

See GSC 76-76 for description and interpretation.

GSC 76-76 Hornblende, K-Ar age **200 ± 9 m.y.**

K = 0.459%, $^{40}Ar/^{40}K$ = 0.01232, radiogenic Ar = 83.8%.
Concentrate: Fresh and unaltered, pleochroic, light brown to dark green hornblende with no visible contamination.

From granodiorite
(94 E) Details as for GSC 76-75.

The mineral pair was obtained from a sample of coarse- to medium-grained, homogeneous, biotite-hornblende granodiorite believed representative of a batholith that trends northwesterly across Finlay River.

The batholith is spatially related to volcanic rocks of the Takla and Hazelton groups and may be genetically related to the latter. The suggested Early Jurassic age is in accord with this concept.

See GSC 76-74 for comparison.

GSC 76-77 Hornblende, K-Ar age **179 ± 8 m.y.**

K = 0.864%, $^{40}Ar/^{40}K$ = 0.01097, radiogenic Ar = 75.5%.
Concentrate: Fresh and unaltered, pleochroic, dark brown to dark green hornblende with no visible contamination.

From dacite
(94 E) Ridge top just north of Attycelly Creek, some 7.6 km southwest of Giegerich Peak, Toodoggone River map-area, British Columbia, 57°08'N, 126°42'18"W. Sample GAW-73-78A, collected by G.J. Woodsworth and interpreted by H. Gabrielse.

The sample was collected from an assemblage of pink, grey, and maroon weathering andesitic to rhyodacitic volcanic rocks probably correlative with volcanic rocks in the Hazelton Group farther south. The K-Ar age is in accord with an Early Jurassic age for the Hazelton rocks.

GSC 76-78 Biotite, K-Ar age **106 ± 4 m.y.**

K = 7.66%, $^{40}Ar/^{40}K$ = 0.00639, radiogenic Ar = 86.2%.
Concentrate: Relatively clean, fresh, orange biotite with less than 1% chlorite contamination.

From banded meta-micaceous grit and schist
(94 E) Approximately 8.8 km east-northeast of the confluence of Fredrikson and Laforce creeks, Swannell Ranges, British Columbia, 57°02'48"N, 126°14'48"W. Toodoggone River map-area. Sample GAD-72-1 collected by T. Geer and interpreted by C.J. Dodds.

See GSC 76-79 for description and interpretation.

GSC 76-79 Muscovite, K-Ar age **120 ± 5 m.y.**

K = 6.16%, $^{40}Ar/^{40}K$ = 0.00721, radiogenic Ar = 80.3%.
Concentrate: Fresh, mainly clear muscovite with no visible contamination.

From banded meta-micaceous grit and schist
(94 E) Details as for GSC 76-78.

The rock is a coarse- to fine-grained, moderately banded meta-micaceous grit and mica schist (latter is minor and comprises thin foliae), and is composed of a prograde assemblage of quartz-plagioclase-biotite-muscovite-garnet. It consists of quartz (63%), sodic plagioclase (23%), muscovite (2%), biotite (10%), garnet (1%) with accessory chlorite, apatite, zoned tourmaline, epidote, zircon and opaques. Mild cataclastic deformation has affected the rock resulting in slight retrograde chloritization of biotite and garnet. Biotite is orange-brown and fairly fresh, and contains sparse inclusions of zircon with pleochroic haloes. Muscovite is unaltered and somewhat finer grained than biotite.

The sample was collected from the central, core area of a broad asymmetrical (steeper southwest limits) anclinorium composed predominantly of regionally metamorphosed Proterozoic clastic rocks. Regional metamorphism in the vicinity has reached at least lower amphibolite grade and appears to be conformable with the major structure. An elongated muscovite biotite quartz monzonite intrusion, with porphyritic and non-porphyritic phases and a lit-par-lit contact zone occurs close by to the north-northwest in the vicinity of Whudzi Mountain. This body is approximately coaxial with the main axis of the anticlinorium and its composition is remarkably similar to rocks of Pitman Batholith.

See GSC 76-83 for further discussion.

GSC 76-80 Biotite, K-Ar age **94.2 ± 3.5 m.y.**

K = 6.59%, $^{40}Ar/^{40}K$ = 0.0056, radiogenic Ar = 91.6%.
Concentrate: Reddish brown biotite with approximately 9-10% chlorite alteration.

From quartz monzonite
(94 E) On ridge about 3.6 km south of Whudzi Mountain, Swannell Ranges, British Columbia, 57°19'06"N, 126°28'30"W. Toodoggone River map-area. Sample GAD-73-112A-1 collected and interpreted by C.J. Dodds.

See GSC 76-81 for description and GSC 76-83 for interpretation.

GSC 76-81 Muscovite, K-Ar age **99.7 ± 3.7 m.y.**

K = 8.14%, $^{40}Ar/^{40}K$ = 0.0060, radiogenic Ar = 87.5%.
Concentrate: Fresh and unaltered, clear muscovite with no visible contamination.

From quartz monzonite
(94 E) Details as for GSC 76-80.

The rock is a light grey, medium grained, homogeneous, relatively equigranular, muscovite biotite quartz monzonite. It is composed of quartz (35%), plagioclase (38%), orthoclase (18%), biotite (5%), muscovite (4%), chlorite (1%) and accessory sphene, apatite, zircon, and opaques. Only mild cataclastic deformation has affected the rock resulting in slight deformation of felsic minerals and minor shredding and bending of micas. Alteration of feldspars is minimal. Biotite is orange-brown and sparingly interleafed with chlorite; muscovite is fresh.

See GSC 76-83 for interpretation.

GSC 76-82 Biotite, K-Ar age **90.9 ± 3.4 m.y.**

K = 7.64%, $^{40}Ar/^{40}K$ = 0.00545, radiogenic Ar = 91.0%.
Concentrate: Light brown biotite with approximately 2 to 3% chlorite alteration.

From porphyritic quartz monzonite
(94 E) On ridge approximately 1.6 km north-northwest of Whudzi Mountain, Swannell Ranges, British Columbia, 57°21'48"N, 126°29'12"W. Toodoggone River map-area. Sample GAD-73-107-1 collected and interpreted by C.J. Dodds.

See GSC 76-83 for description and interpretation.

GSC 76-83 Muscovite, K-Ar age **99.5 ± 3.7 m.y.**

K = 8.78%, $^{40}Ar/^{40}K$ = 0.00598, radiogenic Ar = 77.3%.
Concentrate: Fresh, clear muscovite with no visible contamination.

From porphyritic quartz monzonite
(94 E) Details as for GSC 76-82.

The rock is a light creamy white, well foliated, somewhat sheared, porphyritic biotite-muscovite quartz monzonite. It consists of quartz (33%), plagioclase (30%), microcline (26%), biotite (4%), muscovite (5%), myrmekite (1%), and accessory chlorite, apatite, zircon, and opaques. Some 16% of the microcline is present as megacrysts occurring up to 1.5 cm in size. The rock displays a marked foliation, conceivably the result of cataclastic deformation during the latter stages of intrusion. This deformation has given rise to peripheral granulation of felsic minerals and some shredding and bending of micas. Feldspars are mildly altered, muscovite is fresh, and biotite (orange-brown) is sporadically altered to chlorite.

Age determinations (GSC 76-80 to 83 inclusive) were obtained from the Whudzi Mountain leucocratic muscovite-biotite quartz monzonite. This body is elongated in shape and is approximately coaxial with the main axis of a broad anticlinorium occupying most of the Swannell Ranges and composed predominantly of regionally metamorphosed Proterozoic clastic rocks. The unfoliated, non-porphyritic, relatively equigranular phase of the Whudzi body (sample GAD-73-112A-1) intrudes the sheared porphyritic phase (sampleGAD-73-107-1) in a haphazard array of tensional fractures. These granitic rocks also are strikingly similar in composition to those of the eastern flank of Pitman Batholith.

The Whudzi Complex results, together with those from the metagrit (GSC 76-78 and 79), agree favourably with earlier reported ages from a schist sampled further to the SE within the same belt (Irvine, T.N., Geol. Surv. Can., Paper 71-2, p. 11-12). These ages also are all consistent with a K-Ar pair obtained from the granitic rocks occurring on the east flank of Pitman Batholith (Gabrielse, H., GSC 73-51, 52 in GSC Paper 74-2), and with those from similar granitic phases present in both the Cassiar and Hogem batholiths.

These results in general, however, contrast sharply with the predominantly early Tertiary ages obtained from the granitic and metamorphic rocks of the eastern flanks of the Omineca Crystalline Belt (e.g. GSC 76-85, 86, 87), and conceivably, infer either a thermal event(s) or uplift and unroofing during early- to mid-Cretaceous times involving at least the western portion of this belt. Further evidence favouring such a period of early to mid-Cretaceous uplift, is possibly revealed by similar K-Ar ages from both granitic cobbles from basal Sustut Formation conglomerates in the Fort Ware area (Gabrielse, H., GSC 73-53, 54 in Geol. Surv. Can., Paper 74-2) and from westerly derived detrial muscovite found in Sifton Formation sandstones outcropping in the lower part of the Omineca River (Eisbacher, G.H., in Geol. Surv. Can., Paper 73-2, p. 23).

GSC 76-84 Whole-rock, K-Ar age **41.6 ± 2.8 m.y.**

K = 2.95%, $^{40}Ar/^{40}K$ = 0.0025, radiogenic Ar = 70.1%.
Concentrate: Crushed whole-rock.

From andesite
(94 F) Approximately 5.6 km southeast of the south end of Stelkuz Lake, Ware map-area, British Columbia, 57°13'N, 125°26'24"W. Sample GA-73-30, collected by H. Gabrielse and interpreted by C.J. Dodds.

The rock is a vivid orange-ochre weathering, dark grey, massive, fine grained, porphyritic, basic-intermediate (andesite) dyke. It consists of an aphanitic matrix with sparsely scattered phenocrysts of plagioclase (5%) and clinopyroxene (2%). Plagioclase phenocrysts (andesine) are euhedral to subhedral and variably altered to saussurite and calcite. Clinopyroxene phenocrysts are subhedral and partially corroded. The matrix displays a trachytic texture and is composed of abundant minute fresh slender crystals of andesine, fine pyroxene, a ubiquitous dusting of opaques, and abundant finely disseminated calcite (secondary). Fine, haphazard, calcite-filled fractures are common.

The specimen was collected from a thick, massive, vaguely columnar-jointed dyke occurring in close proximity to the Rocky Mountain Trench. Close by are probably associated pyroclastic volcanics. The dyke probably cuts Sifton Formation continental clastic sediments, but relationships are uncertain.

This whole-rock Eocene age is consistent with the earlier reported biotite ages of 49 m.y. and 37 m.y. (GSC 73-55 and 56) obtained from two lamprophyre (minette) dykes which cut Sifton Formation sediments. Lamprophyre dykes of similar kindred commonly intrude joint planes and movement zones related to block faulting within this area, and almost certainly are comagmatic with the andesite dyke and quite possibly also with the sporadically distributed pyroclastic volcanics.

These results, therefore, offer further evidence of Eocene uplift and locally associated volcanism within the Omineca Crystalline Belt.

GSC 76-85 Biotite, K-Ar age **42 ± 4 m.y.**

K = 7.80%, $^{40}Ar/^{40}K$ = 0.0024, radiogenic Ar = 75%.
Concentrate: Greenish brown biotite with approximately 5% chlorite alteration.

From leucocratic biotite granite
(94 C) Near valley floor (east side of Rocky Mountain Trench) between Chowika and Police creeks, British Columbia, 56°47'N, 124°45'W. Fort Grahame map-area. Sample GACa-70-144-1 collected by K.V. Campbell and interpreted by C.J. Dodds.

The rock is a moderately well foliated (sheared), medium- to coarse-grained porphyritic leucocratic biotite granite, and was obtained from a relatively small, but narrow outcropping of granitic and granite-gneissic rocks, occurring within the Rocky Mountain Trench (east side). It consists of quartz (40%), orthoclase (30%), plagioclase (oligoclase) (25%), and biotite (5%). Biotite is fairly fresh, quartz strongly recrystallized, and megacrysts are predominantly of orthoclase. The rock is highly cataclastically deformed with biotite growth essentially parallel with shearing. These granitic and gneissic rocks, at present considered to be Precambrian in age, are enveloped by regionally metamorphosed amphibolites, schists,micaceous, quartzites and minor marbles of the Misinchinka Group.

See GSC 76-87 for interpretation.

GSC 76-86 Biotite, K-Ar age **47 ± 3 m.y.**

K = 7.17% $^{40}Ar/^{40}K$ = 0.0028, radiogenic Ar = 80%.
Concentrate: Clean, very light orange biotite with less than 1% chlorite.

From garnet-mica-quartz schist
(94 C) Ridge crest, Butler Range, British Columbia, 56°30'30"N, 124°40'W. Fort Grahame map-area. Sample GACa-70-143-1, collected by K.V. Campbell and interpreted by C.J. Dodds.

See GSC 76-87 for description and interpretation.

GSC 76-87 Muscovite, K-Ar age **47 ± 3 m.y.**

K = 7.99%, $^{40}Ar/^{40}K$ = 0.0028, radiogenic Ar = 51%.
Concentrate: Clear muscovite with no visible contamination, but with some yellow staining on split edges.

From garnet-mica-quartz schist
(94 C) Details as for GSC 76-86.

The rock is a medium grained garnet muscovite biotite quartz schist composed of quartz (50%), combined micas (20%), plagioclase (10%), and garnet (20%), and was collected from just north of the location of sample GSC 73-46, etc. from within the same regionally metamorphosed Precambrian terrane. Quartz crystals are highly sutured, and micas very fresh. Plagioclase (andesine) occurs as deeply embayed crystals (possibly detrital?) and garnet forms as euhedral poikiloblasts up to 1.5 mm in size. All K-Ar ages from Butler Range and Deserters Range samples are tabulated below.

Summary of K-Ar Ages

Butler Range (west of Rocky Mountain Trench)

Rock Type	Sample	Mineral	Age (m.y.)
Amphibolite	GSC 72-46	Hornblende	64.7 ± 2.4
	GSC 73-46(2)	Hornblende	64.9 ± 2.2
Schist	GSC 76-86	Biotite	47 ± 3
	GSC 76-87	Muscovite	47 ± 3
Amphibolite	GSC 73-47	Hornblende	53.9 ± 3.0
	GSC 73-47(2)	Hornblende	53.7 ± 2.4
	GSC 73-48	Biotite	40.5 ± 2.2

Deserters Range (east of Rocky Mountain Trench)

Rock Type	Sample	Mineral	Age (m.y.)
Leucogranite	GSC 76-85	Biotite	42 ± 4
Amphibolite / schist	GSC 73-49	Hornblende	45.4 ± 1.9
	GSC 73-49(2)	Hornblende	47.9 ± 2.0
	GSC 73-50	Biotite	40.8 ± 1.9

Immediately apparent from the above table, are the consistently slightly older hornblende ages (45-65 m.y. range) contrasted with biotite ages (40-47 m.y.), particularly where hornblende-biotite pairs have been run. This may simply be attributable to excess argon in hornblende. However, on the whole the ages from samples collected from either side of the Rocky Mountain Trench are in close agreement with earlier reported results obtained from the Wolverine Complex of the Omineca Mountains, both from within Butler and Wolverine ranges (Gabrielse, H., Geol. Surv. Can., Paper 73-2, p. 24), and from farther south (Muller, J.E., Geol. Surv. Can., Papers 71-2, p. 22-27; 63-17, p. 43-44; 62-17, p. 10-21; and 61-17, p. 14).

Conclusions drawn in earlier reports regarding these enigmatic, relatively young ages, are still favoured here. That is, although geological evidence from within the

Omineca Mountains favours a major period of deformation and regional metamorphism during late Middle or early Late Jurassic time, the early Tertiary ages in fact probably reflect a period of major block faulting with local emplacement of high-level intrusions and coeval volcanism.

It is also notable that the Eocene age (GSC 76-85) obtained for the leucocratic granite and granitic gneiss outcropping on the east side of the Rocky Mountain Trench is similar to the majority of K-Ar ages reported from the Malton Gneiss (Campbell, R.B., Geol. Surv. Can., Papers 71-2, p. 13-14; and 69-2A, p. 25-26). However, a more recent $^{207}Pb/^{206}Pb$ age on zircon of 707 m.y. (R.B. Campbell, and R.K. Wanless, pers. comm.) has revealed that the Malton Complex is indeed much older than at first indicated by the K-Ar ages. As a tentative corollary, this may suggest a much older age for the Deserters Range granite/gneiss.

GSC 76-88 Biotite, K-Ar age **71.5 ± 2.7 m.y.**

K = 6.95%, $^{40}Ar/^{40}K$ = 0.00426, radiogenic Ar = 83.6%.
Concentrate: Very light brown biotite with approximately 7% chlorite alteration.

From leucocratic porphyry
(93 M) Large, flat-topped ridge approximately 3.2 km west of French Peak, British Columbia, 55°22'30"N, 126°54'24"W. Sample FRENCH PK-72RW, collected and interpreted by T. Richards.

The rock is from a quartz-eye-biotite-orthoclase-plagioclase porphyry sill complex intrusive into Bowser Lake Group. The complex is part of the Bulkley Intrusions.

GSC 76-89 Biotite, K-Ar age **49.7 ± 2.3 m.y.**

K = 6.29%, $^{40}Ar/^{40}K$ = 0.00295, radiogenic Ar = 84.3%.
Concentrate: Light reddish orange biotite with approximately 5% chlorite alteration.

From tonalite
(93 M) Top of large rounded mountain between Babine and Nilkitkwa rivers, British Columbia, 55°38'36"N, 126°49'48"W. Sample HORETSKY-1-73RW, collected and interpreted by T. Richards.

See GSC 76-91 for description and interpretation.

GSC 76-90 Hornblende, K-Ar age **56.9 ± 2.9 m.y.**

K = 0.887%, $^{40}Ar/^{40}K$ = 0.00338, radiogenic Ar = 55.3%.
Concentrate: Fresh and unaltered, pleochroic, brown to dark green hornblende with no visible contamination.

From tonalite
(93 M) Details as for GSC 76-89.

See GSC 76-91 for description and interpretation.

GSC 76-91 Biotite, K-Ar age **50.1 ± 2.4 m.y.**

K = 7.03%, $^{40}Ar/^{40}K$ = 0.00297, radiogenic Ar = 81.9%.
Concentrate: Light brownish biotite with approximately 2% chlorite alteration.

From biotite-plagioclase porphyry
(93 M) Top of large rounded hill between the Babine and Nilkitkwa rivers, British Columbia, 55°38'36"N, 126°49'42"W. Sample HORETSKY-2-73RW, collected and interpreted by T. Richards.

The samples are from a large, high level granodiorite stock capped by hornfelsed Bowser Lake Group and biotite-feldspar porphyry that is mineralized and is part of the Babine porphyry copper suite.

GSC 76-92 Biotite, K-Ar age **44.0 ± 2.4 m.y.**

K = 5.54%, $^{40}Ar/^{40}K$ = 0.00260, radiogenic Ar = 79.3%.
Concentrate: Brownish orange biotite with approximately 6% chlorite alteration.

From quartz-plagioclase porphyry
(93 M) Low, prominent ridge north of Driftwood River, British Columbia, 55°59'30"N, 126°40'12"W. Sample 29A1-B73RW, collected and interpreted by T.A. Richards.

The rock is a thick (about 100 m) tabular dyke related to the Kastberg Intrusions.

GSC 76-93 Hornblende, K-Ar age **48.8 ± 3.1 m.y.**

K = 1.03%, $^{40}Ar/^{40}K$ = 0.00289, radiogenic Ar = 56.6%.
Concentrate: Slightly pleochroic, light green hornblende with approximately 5% attached chlorite contamination.

From porphyritic quartz monzonite
(94 D) Large, rounded mountain at head of Kastberg Creek, McConnell Creek map-area, British Columbia, 56°09'18"N, 126°35'42"W. Sample K-1-72RW, collected and interpreted by T. Richards.

The sample is part of a large, steep-walled, quartz monzonite-rhyolite plug intrusive into the lower members of the Sustut Group (Tango Creek Formation). The body is the largest unit of the Kastberg Intrusions, and correlative with the Ootsa Lake Group.

GSC 76-94 Biotite, K-Ar age **47.1 ± 2.2 m.y.**

K = 6.96%, $^{40}Ar/^{40}K$ = 0.00280, radiogenic Ar = 69.7%.
Concentrate: Fresh and unaltered, light brown biotite with no visible contamination.

From rhyolite porphyry
(93 M) Prominent knob on west side of lake, 16.1 km south of Fort Babine, British Columbia, 55°11'06"N, 126°35'30"W. Sample W73-16D-RW, collected by G. Woodsworth and interpreted by T. Richards.

The sample is from a quartz-eye feldspar rhyolite porphyry plug from west shore of Babine Lake. Dated rhyolite body is part of the acidic intrusive-extrusive Ootsa Lake Group, and in this region in part coeval with the 'granodioritic' Babine volcanics and the porphyry copper suite of intrusions.

GSC 76-95 Biotite, K-Ar age **110 ± 4 m.y.**

K = 7.60%, $^{40}Ar/^{40}K$ = 0.00664, radiogenic Ar = 89.3%.
Concentrate: Light green biotite with approximately 6% chlorite alteration.

From schistose metaconglomerate
(93 M) On ridge top immediately east of Ominicetla River valley, British Columbia, 55°58'N, 126°06'06"W. Sample 173-RW73, collected and interpreted by T.A. Richards.

The sample is from an epidote-amphibolite grade metaconglomerate that is probably part of the Sitlika Assemblage (Paterson, 1974). The rocks, along with the Cache Creek Group, are a metamorphosed uplifted block east of the Takla fault. The age likely reflects an uplift episode coincident with development of the Skeena and Sustut clastic basin.

Reference

Paterson, I.A.
1974: Geology of the Cache Creek Group and Mesozoic Rocks at the north end of the Stuart Lake Belt, central British Columbia; in Report of Activities, Part B, Geol. Surv. Can., Paper 74-1B, p. 31-42.

GSC 76-96 Muscovite, K-Ar age **147 ± 7 m.y.**

K = 8.51%, $^{40}Ar/^{40}K$ = 0.00895, radiogenic Ar = 89.3%.
Concentrate: Mostly clear muscovite with approximately 5% chlorite contamination.

From sandstone
(93 L) 0.4 km upstream from bridge, Canyon Creek, 6.4 km east of Smithers, British Columbia, 54°47'30"N, 127°05'42"W. Sample CANYON CREEK-72RW, collected and interpreted by T. Richards.

Detrital muscovite from sandstone of the Skeena Group. These rocks are dated paleontologically as Albian (Mid-Cretaceous), and represent the time of the first appearance of detrital muscovite in the stratigraphic column in this part of the Intermontane Belt. The presumed source for the white mica is to the east, some 145 to 160 km, off the Omenica Crystalline Belt.

GSC 76-97 Muscovite, K-Ar age **246 ± 8 m.y.**

K = 8.15%, $^{40}Ar/^{40}K$ = 0.0153, radiogenic Ar = 94.7%.
Concentrate: Clear, fresh and unaltered muscovite with no visible contamination.

From conglomerate-sandstone-siltstone
(94 C) Approximately 3.2 km east of divide at head of Polaris Creek, crest of Long Range, Fort Grahame, west-half, map area, British Columbia, 56°32'35"N, 125°46'40"W. Map-unit 5, Geol. Surv. Can., Mem. 274. Sample MV73-78g, collected and interpreted by J.W.H. Monger.

The muscovite was obtained from quartz-mica schist cobbles in conglomerate and detrital mica in interbedded sandstone and siltstone. This rock grades down into mixed schist and volcanic clast conglomerate and breccia and then breccia composed almost entirely of volcanic clasts. This in turn overlies cherty argillite and volcaniclastic sandstone and siltstone with interbedded Middle Pennsylvanian carbonate pods. It is possibly overlain by Upper Triassic rocks. Clasts in the conglomerate lithologically resemble some rocks in the Wolverine Complex, 32 km to the east, that have yielded young, "Shuswap-like" ages of about 50 m.y. The age of 246 ± 8 m.y. corresponds closely to the probable stratigraphic age of the conglomerate and can possibly be explained by uplift and more-or-less simultaneous erosion of and deposition from a Paleozoic metamorphic complex.

GSC 76-98 Biotite, K-Ar age **46.9 ± 2.8 m.y.**

K = 7.52%, $^{40}Ar/^{40}K$ = 0.00278, radiogenic Ar = 74.9%.
Concentrate: Dark olive-green biotite with approximately 7% chlorite alteration.

From quartz diorite
(92 J) 13 km north of junction of Salal Creek and Lillooet River, British Columbia, 50°47'50"N, 123°29'45"W. Map-unit 2 (Roddick and Woodsworth, 1975), and map-unit 1 (Stephens, 1972). Sample Rd71-40208-1, collected by G.C. Stephens and interpreted by G.J. Woodsworth.

The sample is a medium grained, slightly foliated quartz diorite consisting largely of plagioclase (An_{32}), biotite, and quartz, with minor epidote, sphene, apatite, and opaques. Biotite forms about 10% of the rock, and is partially altered to chlorite and magnetite.

See GSC 76-99 for interpretation and reference.

GSC 76-99 Biotite, K-Ar age **7.9 ± 0.2 m.y.**

K = 7.60%, $^{40}Ar/^{40}K$ = 0.00047, radiogenic Ar = 40.1%.
Concentrate: Light brownish biotite with approximately 7% chlorite alteration.

From quartz monzonite
(92 J) About 13 km northeast of the junction of Salal Creek and Lillooet River, British Columbia, 50°46'49"N, 123°08'05"W. Map-unit 4a (Roddick and Woodsworth, 1975), map-unit 2 (Stephens, 1972). Sample Rd71-40209-1, collected by G.C. Stephens and interpreted by G.J. Woodsworth.

The rock is a medium grained equigranular quartz monzonite composed of 27% quartz, 34% K-feldspar, 34% plagioclase (An_{25}), and 3% slightly chloritized biotite. Accessories and minor alteration products include sericite, epidote and magnetite.

GSC 76-99 is from the coarse grained marginal quartz monzonite of the Salal Creek pluton, a high-level stock which is intrusive into the Coast Plutonic Complex. GSC 76-98 is from quartz diorite of the Coast Plutonic Complex, about 0.5 km from its contact with the Salal Creek pluton.

The 47 m.y. date is about 9 m.y. younger than other ages obtained from the eastern part of the southern Coast Plutonic Complex (e.g., GSC 73-27 at 57.5 m.y.; GSC 73-22, 23 at 55 m.y.). It is not known whether this discrepancy indicates a distinct thermal event at 47 m.y. or is a result of partial resetting of 55 m.y. old rocks during the emplacement of the nearby Salal Creek pluton.

The 7.9 m.y. date for GSC 76-99 makes the Salal Creek pluton the youngest yet dated in the Canadian Cordillera. The stock appears to be part of a chain of high-level, Miocene plutons extending northwest from the Cascade Mountains of Washington State through the Coast Mountains to Bella Coola. Ages previously obtained from plutons in this chain range from 26 m.y. to 12 m.y. (Richards and White, 1970; Baer, 1973) which are significantly older than the Salal Creek pluton.

According to Stephens (1972) the Salal Creek pluton is composed of four intrusive facies, of which the K-Ar sample represents the oldest. Economically important porphyry molybdenite mineralization is associated with the younger phases. The K-Ar date of 7.9 m.y. represents a maximum age for the mineralization, and indicates that porphyry molybdenum deposits were produced in the Cordillera at least as recently as late Miocene.

References

Baer, A.J.
1973: Bella Coola – Laredo Sound map-areas, British Columbia; Geol. Surv. Can., Mem. 372.

Richards, T. and White, W.H.
1970: K-Ar ages of plutonic rocks between Hope, British Columbia, and the 49th parallel; Can. J. Earth Sci., v. 7, p. 1203-1207.

Roddick, J.A. and Woodsworth, G.J.
1975: Coast Mountains Project: Pemberton (92J West Half) map-area, British Columbia; in Report of Activities, Part A, Geol. Surv. Can., Paper 75-1A, p. 37-40.

Stephens, G.C.
1972: The geology of the Salal Creek pluton, southwestern British Columbia, Canada; unpubl. Ph.D. thesis, Lehigh Univ.

GSC 76-100 Biotite, K-Ar age **127 ± 5 m.y.**

K = 6.07%, $^{40}Ar/^{40}K$ = 0.00767, radiogenic Ar = 93.3%.
Concentrate: Light brown to green biotite with approximately 15-20% chlorite. Individual mica flakes vary from relatively fresh to almost completely chloritized.

From gneiss
(82 L) Trans-Canada Highway, 4 km northeast of Chase, British Columbia, 50°50'12"N, 119°38'18"W. Sample 110CAa74-1, collected and interpreted by A.V. Okulitch.

Granodioritic ortho(?) gneiss which is seen at the deepest stratigraphic levels of the Mount Ida Group may either constitute the basement to the group or intrude its lowermost formation. The age of this formation may be Paleozoic or late Proterozoic. Two U-Pb analyses of zircon from this gneiss unit (sample 38-CAc-72) indicate a minimum age of crystallization of 400 m.y. ago, perhaps as much as 600 m.y. ago. The thermal history of this unit is likely complex.

The K-Ar date of 127 m.y. is considered to be the minimum age of deformation and metamorphism of the Mount Ida Group. Previous K-Ar analyses from this locality (GSC 61-1, 2, 3; Lowdon et al., 1963) gave dates ranging from 135 to 140 m.y. but are considered to be slightly too great.

See GSC 76-103 for further discussion and reference.

GSC 76-101 Biotite, K-Ar age **45.8 ± 2.5 m.y.**

K = 7.04%, $^{40}Ar/^{40}K$ = 0.00271, radiogenic Ar = 69.4%.
Concentrate: Fresh and unaltered, very light brown biotite with no visible contamination.

From syenite
(82 L) Whitemans Creek Road, 7.2 km west of junction with Boulder Creek Road, British Columbia, 50°13'N, 119°38'W. Map-unit 19, Geol. Surv. Can., Map 1059A. Sample WN-9-74, collected and interpreted by R.K. Wanless and A.V. Okulitch.

The rock is a pink hornblende biotite syenite of Unit 19, assigned a Cretaceous or Tertiary age (Jones, 1959) and has a minimum age of crystallization of 46 m.y. This pluton may be associated with other Tertiary intrusive rocks that are possible causes of the regional resetting of the K-Ar system discussed in relation to GSC 76-113.

See GSC 76-103 and 113 for further discussion and reference.

GSC 76-102 Biotite, K-Ar age **75.6 ± 2.9 m.y.**

K = 6.75%, $^{40}Ar/^{40}K$ = 0.00451, radiogenic Ar = 85.3%.
Concentrate: Brownish orange biotite with approximately 9% chlorite alteration.

From granite
(82 L) On Highway 1 at west end of Salmon Arm, Shuswap Lake, British Columbia, 50°46'N, 119°20'W. Map-unit 18, Geol. Surv. Can., Map 1059A. Sample WN-10-74, collected and interpreted by R.K. Wanless and A.V. Okulitch.

See GSC 76-103 for description and interpretation.

GSC 76-103 Muscovite, K-Ar age **108 ± 4 m.y.**
106 ± 4 m.y.

$K = 8.68\%$, $^{40}Ar/^{40}K = \frac{0.00687}{0.00638}$, radiogenic
$Ar = \frac{85.3\%}{83.0\%}$.
Concentrate: Clean, fresh, clear muscovite with no visible contamination.

From granite
(82 L) Details as for GSC 76-102.

This massive granodiorite-quartz monzonite intruded the Mount Ida Group after deformation and metamorphism ceased. Partial resetting of the K-Ar system is indicated by the disparity in dates from biotite (75.6) and muscovite (106, 108), and 106 m.y. must be the minimum age of intrusion. This age is consistent with that obtained for the time of metamorphism of sample GSC 76-100. A previous K-Ar analysis (GSC 62-37; Leech et al., 1963) gave a date from biotite of 127 m.y. but this may be somewhat too old.

The following notes pertain to samples GSC 76-100 to 103. These are of plutonic rocks pre- and post-dating the late Proterozoic(?) to Late Triassic Mount Ida Group which lie west of the Shuswap Metamorphic Complex and which have largely escaped regional resetting of the K-Ar system 50 m.y. ago. This resetting is described in the interpretation of sample GSC 76-113. Partial resetting, as described by Medford (1975), may have affected these three western samples, hence the K-Ar dates obtained must be considered to be minimum ages of crystallization.

References

Jones, A.G.
1959: Vernon map-area, British Columbia; Geol. Surv. Can., Mem. 296.

Leech, G.B., Lowdon, J.A., Stockwell, C.H., and Wanless, R.K.
1963: Age determinations and geological studies, Rept. 4; Geol. Surv. Can., Paper 63-17.

Lowdon, J.A., Stockwell, C.H., Tipper, H.W., and Wanless, R.K.
1963: Age determinations and geological studies, Rept. 3; Geol. Surv. Can., Paper 62-17.

Medford, G.A.
1975: K-Ar and fission track geochronometry of an Eocene thermal event in the Kettle River (west half) map area, southern British Columbia; Can. J. Earth Sci., v. 12, p. 836-843.

GSC 76-104 Muscovite, K-Ar age **46.4 ± 2.4 m.y.**

K = 8.63%, $^{40}Ar/^{40}K$ = 0.00275, radiogenic Ar = 51.8%.
Concentrate: Clear, fresh and unaltered muscovite with no visible contamination.

From pegmatite
(82 M) West shore of Anstey Arm, Shuswap Lake, British Columbia, 51°04'N, 118°56'W. Sample WN-2-74, collected by R.K. Wanless and A. Okulitch and interpreted by A. Okulitch.

The concentrate was prepared from books of muscovite taken from a pegmatite associated with a foliated granodiorite. The Eocene (46.4 ± 2.4 m.y.) age of muscovite from pegmatite in the Shuswap Metamorphic Complex is in keeping with other K-Ar results from this area. Although possibly indicating very young injection of pegmatite late in the tectonic and metamorphic history of the complex, the apparent absence of such pegmatites from rocks younger than Late Triassic and the intimate relationship of pegmatites with Jura-Cretaceous orogenic events which ended about 125 m.y. ago, suggests that the analyzed sample is considerably older than the resulting figure and that the number represents uplift and cooling of the complex that was closely followed by emplacement of basaltic dykes and extrusion of associated flows in Eocene or Oligocene time.

See GSC 76-105 and 113 for further discussion.

GSC 76-105 Biotite, K-Ar age **45.8 ± 2.5 m.y.**

K = 6.79, $^{40}Ar/^{40}K$ = 0.00272, radiogenic Ar = 81.0%.

Concentrate: Dark brown biotite with approximately 7% chlorite alteration.

From foliated granodiorite
(82 M) West shore of Anstey Arm, Shuswap Lake, British Columbia, 51°04'N, 118°56'W. Sample WN-1-74, collected and interpreted by R.K. Wanless and A.V. Okulitch.

The sample is of granodioritic gneiss possibly of Devonian age (Okulitch and Wanless, 1975), whereas GSC 76-104 is of much younger pegmatite presumed to be related to high grade metamorphism during Jura-Cretaceous orogenic events. The K-Ar isotopic systems have been reset in both rocks during Eocene time.

See GSC 76-113 for further discussion and references.

GSC 76-106 Biotite, K-Ar age **63.4 ± 2.5 m.y.**

K = 7.24%, $^{40}Ar/^{40}K$ = 0.00378, radiogenic Ar = 71.9%.
Concentrate: Brownish orange biotite with approximately 4% chlorite alteration.

From mafic gneiss
(82 L) On Mabel Lake road, 16.9 km east of Enderby, British Columbia, 50°32'48"N, 118°55'36"W. Sample 86CAa73-1Z, collected and interpreted by A.V. Okulitch.

See GSC 76-107 fordescription and interpretation.

GSC 76-107 Hornblende, K-Ar age **52.3 ± 3.1 m.y.**

K = 0.555%, $^{40}Ar/^{40}K$ = 0.00310, radiogenic Ar = 38.3%.
Concentrate: Fresh and unaltered, pleochroic, brown to green hornblende with no visible contamination.

From mafic gneiss
(82 L) Details as for GSC 76-106.

The sample is of amphibolitic gneiss tentatively correlated with the Permo-Triassic Kaslo Group and Tsalkom Formation. Preliminary zircon analysis suggests a minimum age of crystallization of 207 m.y. ago (R.K. Wanless, pers. comm., 1975). Deformation and metamorphism took place in the Jura-Cretaceous.

See GSC 76-113 for further discussion.

GSC 76-108 Biotite, K-Ar age **43.0 ± 2.4 m.y.**

K = 7.01%, $^{40}Ar/^{40}K$ = 0.00255, radiogenic Ar = 64.2%.
Concentrate: Dark greenish brown biotite with approximately 4% chlorite alteration.

From granite/granodiorite
(82 M) Ridge about 1980 m east of Perry River, British Columbia, 51°09'36"N, 118°38'W. Map-unit B, Geol. Surv. Can., Paper 64-32 (Frenchman's Cap gneiss dome). Sample 355CAa74, collected and interpreted by A.V. Okulitch.

The rock is a foliated granitic intrusive rock and/or gneiss intruding and containing inclusions of swirled quartz-feldspar-garnet-biotite gneiss with leucocratic veins, all from the core zone of Frenchman's Cap gneiss dome (Wheeler, 1964). The age of the intruded gneiss is unknown but may be Proterozoic. The foliated granitic rock likely formed during melting and mobilization of the core of the dome towards the end of Jura-Cretaceous tectonism.

See GSC 76-113 for further discussion and references.

GSC 76-109 Biotite, K-Ar age **43.3 ± 2.4 m.y.**

K = 7.11%, $^{40}Ar/^{40}K$ = 0.00257, radiogenic Ar = 85.4%.
Concentrate: Clean, fresh and unaltered, dark brown biotite with a trace of hornblende contamination.

From garnetiferous gneiss
(82 M) Ridge between Jordan River and Frisby Creek, at altitude 2286 m, 10.5 km north of Mount Copland and 10.5 km southeast of Frenchman's Cap, British Columbia, 51°14'N, 118°26'W. Sample WN-5-74, collected and interpreted by R.K. Wanless and A.V. Okulitch.

The rock is a swirled, garnetiferous, granitoid gneiss (unit C, Wheeler, 1964), possibly paragneiss, within the highly mobilized core zone of Frenchman's Cap gneiss dome. The age is unknown. Mobilization is presumed to have taken place in the Jura-Cretaceous.

See GSC 76-113 for further discussion and reference.

GSC 76-110 Biotite, K-Ar age **45.9 ± 2.5 m.y.**

K = 7.82%, $^{40}Ar/^{40}K$ = 0.00272, radiogenic Ar = 70.2%.
Concentrate: Fresh and unaltered, dark brown biotite with less than 1% chlorite.

From granitoid gneiss
(82 L) At top of Burnham Glacier, 1.6 km east of summit of Mount Odin, British Columbia, 50°33'N, 118°07'W. Sample WN-3-74, collected and interpreted by R.K. Wanless and A.V. Okulitch.

See GSC 76-111 for description and GSC 76-113 for interpretation.

GSC 76-111 Muscovite, K-Ar age **46.0 ± 2.5 m.y.**

K = 8.45%, $^{40}Ar/^{40}K$ = 0.00273, radiogenic Ar = 71.7%.
Concentrate: Fresh and unaltered, clear muscovite with no visible contamination.

From granitoid gneiss
(82 L) Details as for GSC 76-110.

The rock is highly folded biotite granodiorite gneiss from the core of Thor-Odin gneiss dome. Zircons from this unit (C-1, Reesor and Moore, 1971) originally crystallized 1960 m.y. ago and were reset during mobilization 175 m.y. ago (Wanless and Reesor, 1975).

See GSC 76-113 for further discussion and reference.

GSC 76-112 Biotite, K-Ar age **50.5 ± 2.8 m.y.**

K = 7.85%, $^{40}Ar/^{40}K$ = 0.00299, radiogenic Ar = 82.0%.
Concentrate: Relatively clean, very light brown biotite with less than 1% chlorite alteration.

From gneiss
(82 M) North side of road-cut 1.8 km toward Revelstoke from Illecillewaet River, on Trans-Canada Hwy., British Columbia, 51°01'N, 118°05'W. Sample WN-6-74, collected and interpreted by R.K. Wanless and A.V. Okulitch.

The sample is from quartz diorite orthogneiss (Daly, 1913) intruding early Paleozoic and late Proterozoic sediments in the Revelstoke-Clachnacudainn area. It is of Devonian age (R.K. Wanless, pers. comm., 1975) based on zircon analysis.

See GSC 76-113 for further discussion and reference.

GSC 76-113 Biotite, K-Ar age **50.9 ± 2.4 m.y.**

K = 7.48%, $^{40}Ar/^{40}K$ = 0.00302, radiogenic Ar = 83.9%.
Concentrate: Fresh and unaltered, light brownish biotite with no visible contamination.

From granodiorite gneiss
(82 F) About 1.6 km east-northeast of Upper Little Slocan Lake, about 14.5 km southwest of Slocan, British Columbia, 49°41'18"N, 117°37'54"W. Sample VALHALLA-III, collected and interpreted by A.V. Okulitch.

This rock is a veined augen gneiss in the core of Valhalla gneiss dome (Reesor, 1965) of unknown age, possibly emplaced during Mesozoic orogenic events.

The following discussion pertains to samples GSC 76-104 to 113. These samples are from units ranging in age from mid-Proterozoic to Cretaceous, and represent a variety of igneous, sedimentary(?) and volcanic rock types lying within medium- to high-grade parts of the Shuswap Metamorphic Complex. They have all had the K-Ar system in their component minerals reset about 50 m.y. ago (range: 63 to 43 m.y.).

This resetting may have been caused by either a thermal event associated with igneous activity or by rapid uplift and cooling. During and after this resetting, these metamorphic rocks were eroded and buried by sediments and volcanic rocks of Eocene age. Evidence for plutonism, metasomatism and heating has been documented for parts of the Shuswap Complex in the southern Okanagan Valley (Medford, 1975) but no evidence for such a thermal event has been observed in the Shuswap Lake region (Mathews, 1976). Late orogenic uplift and cooling could have set the K-Ar system within the Shuswap Complex as it demonstrably has undergone considerable uplift to bring sillimanite grade rocks to the surface. Moreover, resetting of the K-Ar system dies away rapidly west of the Okanagan Valley and is essentially confined to the high grade terrane (Medford, 1975). However, large movements along faults within the valley and its northward extension to Shuswap Lake cannot have taken place everywhere as in some places (Ross and Christie, 1969; Okulitch, 1974) units can be traced across this lineament.

Although no definitive answers to this problem are presently available, it is probable that the following sequence of events may be responsible for the complex geochronological results. Waning regional metamorphism, bounded by narrow transition zones and initiated during the Jura-Cretaceous Columbian orogeny, was followed by local faulting that juxtaposed terranes of dissimilar metamorphic grade. This faulting was accompanied or closely followed by heating associated with local, early Tertiary plutonic and volcanic activity.

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GSC 76-114 Biotite, K-Ar age **85.2 ± 3.2 m.y.**

K = 7.26%, $^{40}Ar/^{40}K$ = 0.00510, radiogenic Ar = 84.5%.
Concentrate: Fresh, light brown biotite with approximately 2% chlorite alteration.

From granodiorite/quartz diorite
(115 J&K) At base of northern end of Horsecamp Hill, next to Alaska Highway 3.2 km south of Sampete Creek, Yukon, 62°03'40"N, 140°38'40"W. Sample TO72-457b, collected by T. Booth and interpreted by D. Tempelman-Kluit.

See GSC 76-115 for description and GSC 76-156 for discussion.

GSC 76-115 Hornblende, K-Ar age **91.7 ± 4.3 m.y.**

K = 0.697%, $^{40}Ar/^{40}K$ = 0.00550, radiogenic Ar = 58.6%.
Concentrate: Fresh and unaltered, pleochroic, olive-green to light brown hornblende with less than 1% biotite contamination.

From granodiorite/quartz diorite
(115 J&K) Details as for GSC 76-114.

The sample is from a well foliated, medium grained, biotite hornblende granodiorite to quartz diorite of the Nisling Range granodiorite suite consisting of quartz (10%), plagioclase (70%), potash feldspar (less than 5%), biotite (7%), hornblende (7%) and accessories.

See GSC 76-156 for discussion.

GSC 76-116 Biotite, K-Ar age **97.6 ± 3.7 m.y.**

K = 6.95%, $^{40}Ar/^{40}K$ = 0.00586, radiogenic Ar = 83.9%.
Concentrate: Clean, fresh and unaltered, dark greenish brown biotite with no visible contamination.

From quartz monzonite
(115 O&N) On ridge 4 km southwest of Fifty Mile Creek, 11.3 km upstream from its confluence with Sixty Mile River, Yukon, 63°47'30"N, 140°28'00"W. Sample TO72-376a, collected and interpreted by D. Tempelman-Kluit.

The rock is a phase of Pelly Gneiss. It is a well foliated biotite quartz monzonite consisting of quartz (10%), plagioclase (10-15%), potash feldspar (70%) and biotite (less than 10%).

See GSC 76-156 for discussion.

GSC 76-117 Biotite, K-Ar age **94.4 ± 3.5 m.y.**

K = 6.46%, $^{40}Ar/^{40}K$ = 0.00566, radiogenic Ar = 83.6%.
Concentrate: Fresh, reddish brown biotite with approximately 3% chlorite alteration.

From granodiorite
(115 J&K) On ridge 16.1 km east-southeast of confluence of Mackinnon Creek and Donjek River, Yukon, 62°01'15"N, 139°34'10"W. Sample TO72-370, collected and interpreted by D. Tempelman-Kluit.

See GSC 76-118 for description and GSC 76-156 for discussion.

GSC 76-118 Hornblende, K-Ar age **94.7 ± 4.4 m.y.**

K = 0.459%, $^{40}Ar/^{40}K$ = 0.00568, radiogenic Ar = 44.5%.
Concentrate: Altered, pleochroic, light brown to dark green hornblende.

From granodiorite
(115 J&K) Details as for GSC 76-117.

The rock is a medium grained, porphyritic biotite hornblende granodiorite of the Nisling Range granodiorite suite consisting mainly of quartz (25%), plagioclase (50%), potash feldspar (10%), pyroxene (3-5%), biotite (5%), hornblende (7-10%) and accessory opaques, chlorite and sericite.

See GSC 76-156 for discussion.

GSC 76-119 Biotite, K-Ar age **89.1 ± 3.3 m.y.**

K = 7.77%, $^{40}Ar/^{40}K$ = 0.00534, radiogenic Ar = 85.6%.
Concentrate: Clean, fresh and unaltered, light brown biotite with no visible contamination.

From granodiorite/quartz diorite
(115 J&K) On ridge in headwaters of Coffee Creek, about 27.4 km southwest from its confluence with the Yukon River, Yukon, 62°45'50"N, 139°30'W. Sample TO72-373, collected and interpreted by D. Tempelman-Kluit.

See GSC 76-120 for description and GSC 76-156 for discussion.

GSC 76-120 Hornblende, K-Ar age **174 ± 8 m.y.**

K = 0.696%, $^{40}Ar/^{40}K$ = 0.01070, radiogenic Ar = 70.5%.
Concentrate: Pleochroic, light brown to dark green hornblende with less than 1% biotite contamination which occurs as an intergrowth with the amphibole.

From granodiorite/quartz diorite
(115 J&K) Details as for GSC 76-119.

The rock of the Klotassin suite is a distinctly layered hornblende-biotite granodiorite to quartz diorite with some fine grained mafic inclusions. It is medium grained and generally equigranular, but has some larger euhedral hornblende crystals. The main constituents are quartz (25%), plagioclase (50-60%), potash feldspar (5%), hornblende (10%), biotite (5%) and accessory chlorite and sericite.

See GSC 76-156 for discussion.

GSC 76-121 Biotite, K-Ar age **117 ± 4 m.y.**

K = 7.46%, $^{40}Ar/^{40}K$ = 0.00703, radiogenic Ar = 78.5%.
Concentrate: Clean, fresh and unaltered, brownish biotite with no visible contamination.

From granodiorite to quartz diorite
(115 J&K) Along ridge 2.4 km south of Coffee Creek, 20.9 km above its confluence with the Yukon River, Yukon, 62°44'20"N, 139°17'20"W. Sample TO72-360, collected and interpreted by D. Tempelman-Kluit.

See GSC 76-122 for description and GSC 76-156 for discussion.

GSC 76-122 Hornblende, K-Ar age **92.0 ± 4.3 m.y.**

K = 0.537%, $^{40}Ar/^{40}K$ = 0.00551, radiogenic Ar = 62.3%.
Concentrate: Clean, fresh and unaltered, pleochroic, brown to dark green hornblende with no visible contamination.

From granodiorite to quartz diorite
(115 J&K) Details as for GSC 76-121.

The sample of the Klotassin suite is from a nonfoliated, medium grained, equigranular hornblende biotite granodiorite

to quartz diorite consisting of quartz (25%), plagioclase (45%), potash feldspar (10%), biotite (7%), hornblende (10%) and accessory chlorite and opaques.

See GSC 76-156 for discussion.

GSC 76-123 Whole-rock, K-Ar age **58.4 ± 3.0 m.y.**

K = 2.65%, $^{40}Ar/^{40}K$ = 0.00347, radiogenic Ar = 91.8%.
Concentrate: Crushed whole-rock.

From tuff
(115 J&K) On western end of high ridge between Klotassin and Nisling rivers approximately 32 km upstream from their confluence, Yukon, 62°25'00"N, 138°55'50"W. Sample TO72-361, collected and interpreted by D. Tempelman-Kluit.

The rock is a dark grey lithic tuff of the Nisling Range alaskite suite consisting of fine grained felsic material with dark angular fragments ranging in size from 0.2 to 1 cm.

See GSC 76-156 for discussion.

GSC 76-124 Biotite, K-Ar age **137 ± 5 m.y.**

K = 7.24%, $^{40}Ar/^{40}K$ = 0.00830, radiogenic Ar = 84.4%.
Concentrate: Light brown biotite with approximately 3% alteration to chlorite.

From granodiorite/quartz diorite
(115 J&K) On ridge 6.4 km northeast of confluence of Dip Creek with Casino Creek, Yukon, 62°43'50"N, 138°37'30"W. Sample TOB72-463, collected by Terry Booth and interpreted by D. Tempelman-Kluit.

See GSC 76-125 for description and GSC 76-156 for discussion.

GSC 76-125 Hornblende, K-Ar age **103 ± 5 m.y.**

K = 0.609%, $^{40}Ar/^{40}K$ = 0.00619, radiogenic Ar = 59.1%.
Concentrate: Somewhat impure, pleochroic, light brown to olive-green hornblende with 2% biotite and a trace of chlorite contamination.

From granodiorite/quartz diorite
(115 J&K) Details as for GSC 76-124.

The sample of the Klotassin suite is from a medium grained, equigranular, hornblende biotite granodiorite to quartz diorite. It is a nonfoliated, dark rock consisting of quartz (20%), plagioclase (45%), potash feldspar (10%), biotite (10%), hornblende (15%) and chlorite (1%), with accessory opaques and sericite.

See GSC 76-156 for discussion.

GSC 76-126 Biotite, K-Ar age **55.7 ± 2.6 m.y.**

K = 7.08%, $^{40}Ar/^{40}K$ = 0.00331, radiogenic Ar = 79.7%.
Concentrate: Clean, fresh and unaltered, brown biotite with no visible contamination.

From quartz monzonite
(115 J&K) 1.2 km south of Nisling River about 9.7 km downstream from its confluence with Klaza River, Yukon, 62°07'20"N, 138°36'00"W. Sample TO72-367a, collected and interpreted by D. Tempelman-Kluit.

The rock (Nisling Range alaskite suite) is a porphyritic biotite quartz monzonite with large phenocrysts of K-feldspar and lesser quartz. It consists mainly of quartz (25-30%), plagioclase (30%), potash feldspar (35%), biotite (5%), hornblende (1%) and accessory apatite, sericite and sphene.

See GSC 76-156 for discussion.

GSC 76-127 Biotite, K-Ar age **93.8 ± 3.5 m.y.**

K = 6.84%, $^{40}Ar/^{40}K$ = 0.00563, radiogenic Ar = 84.9%.
Concentrate: Slightly altered light brown biotite with approximately 4% chloritization.

From granodiorite/quartz diorite
(115 J&K) On ridge 4.8 km south of Klotassin River, about 14.5 km upstream from its confluence with Somme Creek, Yukon, 62°17'50"N, 138°32'50"W. Sample TO72-367, collected and interpreted by D. Tempelman-Kluit.

See GSC 76-128 for description and GSC 76-156 for discussion.

GSC 76-128 Hornblende, K-Ar age **93.0 ± 4.3 m.y.**

K = 0.527%, $^{40}Ar/^{40}K$ = 0.00558, radiogenic Ar = 56.5%.
Concentrate: Relatively clean, fresh and unaltered, pleochroic, light brown to dark green hornblende with a trace of biotite and chlorite contamination.

From granodiorite/quartz diorite
(115 J&K) Details as for GSC 76-127.

The rock (of the Klotassin suite) is a nonfoliated, equigranular biotite hornblende granodiorite to quartz diorite consisting of quartz (27%), plagioclase (45%), potash feldspar (10%), biotite (5%), hornblende (10%) and accessory epidote, opaques, chlorite, sericite and sphene.

See GSC 76-156 for discussion.

GSC 76-129 Biotite, K-Ar age **137 ± 5 m.y.**

K = 7.53%, $^{40}Ar/^{40}K$ = 0.00830, radiogenic Ar = 90.4%.
Concentrate: Dark greenish biotite with approximately 10% chlorite alteration.

From muscovite-biotite schist
(115 J&K) Ridge top 3.2 km southwest of divide between Scroggie Creek and Cripple Creek, Yukon, 62°55'30"N, 138°27'20"W. Sample TO72-359, collected and interpreted by D. Tempelman-Kluit.

See GSC 76-130 for description and GSC 76-156 for discussion.

GSC 76-130 Muscovite, K-Ar age **168 ± 6 m.y.**

K = 8.40%, $^{40}Ar/^{40}K$ = 0.01027, radiogenic Ar = 86.3%.
Concentrate: Clean, fresh and unaltered clear muscovite with no visible contamination.

From muscovite-biotite schist
(115 J&K) Details as for GSC 76-129.

The sample is from a strongly foliated and somewhat banded biotite muscovite schist composed of quartz (25%), plagioclase (45-50%), biotite (7%), muscovite (10%), sericite (7%), opaques (1-2%) and chlorite (2%).

See GSC 76-156 for discussion.

GSC 76-131 Biotite, K-Ar age **99.6 ± 3.7 m.y.**

K = 7.44%, $^{40}Ar/^{40}K$ = 0.00598, radiogenic Ar = 87.0%.
Concentrate: Light greenish brown biotite with approximately 3% chlorite alteration.

From quartz monzonite
(115 J&K) Ridge top 16.1 km northwest of confluence of Cripple Creek and Yukon River, Yukon, 62°52'45"N, 138°26'20"W. Sample TO72-359a, collected and interpreted by D. Tempelman-Kluit.

The sample (of the Coffee Creek quartz monzonite suite) is from a medium grained, equigranular, nonfoliated biotite quartz monzonite consisting primarily of quartz (20-25%), plagioclase (25%), potash feldspar (40-45%), biotite (3-5%) and accessory opaques, apatite, sericite, sphene and (?)epidote.

See GSC 76-156 for discussion.

GSC 76-132 Biotite, K-Ar age **93.7 ± 3.5 m.y.**

K = 6.76%, $^{40}Ar/^{40}K$ = 0.00562, radiogenic Ar = 82.7%.
Concentrate: Greenish brown biotite with approximately 5% chlorite alteration.

From granodiorite
(115 J&K) On ridge 1.6 km south of Battle Creek, about 4.8 km upstream from its confluence with the Selwyn River, Yukon, 62°42'00"N, 138°22'40"W. Sample TO72-363a, collected and interpreted by D. Tempelman-Kluit.

See GSC 76-133 for description and GSC 76-156 for discussion.

GSC 76-133 Hornblende, K-Ar age **92.0 ± 4.3 m.y.**

K = 0.850%, $^{40}Ar/^{40}K$ = 0.00552, radiogenic Ar = 68.1%.
Concentrate: Pleochroic, bluish green to light brown hornblende with a trace of chlorite and approximately 2% biotite contamination. Some of the mica is attached to the hornblende grains.

From granodiorite
(115 J&K) Details as for GSC 76-132.

A melanocratic, fine- to medium-grained, equigranular, weakly foliated hornblende biotite granodiorite consisting mainly of quartz (15%), plagioclase (60-65%), potash feldspar (15%), biotite (10%), hornblende (1%), chlorite, opaques, sericite, epidote and apatite (Klotassin suite).

See GSC 76-156 for discussion.

GSC 76-134 Biotite, K-Ar age **161 ± 6 m.y.**

K = 7.77%, $^{40}Ar/^{40}K$ = 0.00985, radiogenic Ar = 89.3%.
Concentrate: Light green biotite with approximately 3% chlorite alteration.

From quartz diorite
(115 J&K) Near southern bank of Yukon River, 3.2 km west of confluence with Selwyn River, Yukon, 62°46'45"N, 138°18'30"W. Sample TO72-381b, collected and interpreted by D. Tempelman-Kluit.

See GSC 76-135 for description and GSC 76-156 for discussion.

GSC 76-135 Muscovite, K-Ar age **159 ± 6 m.y.**

K = 6.32%, $^{40}Ar/^{40}K$ = 0.00974, radiogenic Ar = 76.7%.
Concentrate: Clean, fresh, clear muscovite with a slight trace of free chlorite contamination.

From quartz diorite
(115 J&K) Details as for GSC 76-134.

The rock is a strongly foliated muscovite biotite quartz diorite of equigranular, medium grain size. It consists of quartz (35%), plagioclase (35%), biotite (10-15%), muscovite (5-7%) and accessory spinel (1%). (Pelly Gneiss).

See GSC 76-156 for discussion.

GSC 76-136 Biotite, K-Ar age **91.5 ± 3.4 m.y.**

K = 7.60%, $^{40}Ar/^{40}K$ = 0.00549, radiogenic Ar = 86.1%.
Concentrate: Light greenish brown biotite with approximately 5% chlorite alteration.

From granodiorite
(115 J&K) Along east bank of Selwyn River 6.4 km upstream from confluence with Hayes Creek, Yukon, 62°40'10"N, 138°16'20"W. Sample TOM72-273A, collected by S. Gordey and interpreted by D. Tempelman-Kluit.

The sample (of the Coffee Creek quartz monzonite suite) is from a porphyritic granodiorite/quartz monzonite consisting of quartz (25%), plagioclase (45%), potash feldspar (25%), biotite (5%) and accessory chlorite, magnetite, sphene and apatite.

See GSC 76-156 for discussion.

GSC 76-137 Biotite, K-Ar age **164 ± 6 m.y.**

K = 8.05%, $^{40}Ar/^{40}K$ = 0.01000, radiogenic Ar = 90.6%.
Concentrate: Clean, fresh and unaltered, light greenish brown biotite with no visible contamination.

From biotite schist
(115 J&K) A few hundred feet west of Selwyn River about 3.2 km upstream from its confluence with Yukon River, Yukon, 62°47'30"N, 138°16'15"W. Sample TO72-459b, collected by T. Booth and interpreted by D. Tempelman-Kluit.

The rock is a biotite schist or strongly foliated gneiss of granodioritic composition. It consists of quartz (40-45%), plagioclase (30%), potash feldspar (less than 5%), biotite (15%) and epidote (10%).

See GSC 76-156 for discussion.

GSC 76-138 Biotite, K-Ar age **92.0 ± 3.4 m.y.**

K = 6.66%, $^{40}Ar/^{40}K$ = 0.00552, radiogenic Ar = 85.1%.
Concentrate: Greenish brown biotite with approximately 6% chlorite alteration.

From biotite quartz monzonite
(115 J&K) 1.6 km east of Selwyn River, about 19.3 km upstream from its confluence with the Yukon River, Yukon, 62°37'05"N, 138°13'40"W. Sample TO72-363, collected and interpreted by D. Tempelman-Kluit.

The sample (of the Coffee Creek quartz monzonite suite) is from a porphyritic biotite quartz monzonite consisting of quartz (15-20%), plagioclase (35-40%), potash feldspar (35-40%), biotite (less than 5%) and accessory chlorite, opaques, sericite, sphene and apatite. The medium to large phenocrysts are of pink or white feldspar.

See GSC 76-156 for discussion.

GSC 76-139 Biotite, K-Ar age **98.4 ± 3.6 m.y.**

K = 5.73%, $^{40}Ar/^{40}K$ = 0.00591, radiogenic Ar = 87.5%.
Concentrate: Light brownish biotite with approximately 2% chlorite alteration.

From granodiorite
(115 J&K) 4.0 km north of Klaza River, about 27.4 km upstream from its confluence with Nisling River, Yukon, 62°10'50"N, 138°01'10"W. Sample TO72-366b, collected and interpreted by D. Tempelman-Kluit.

See GSC 76-140 for description and GSC 76-156 for discussion.

GSC 76-140 Hornblende, K-Ar age **91.0 ± 4.2 m.y.**

K = 0.887%, $^{40}Ar/^{40}K$ = 0.00545, radiogenic Ar = 68.3%.

Concentrate: Pleochroic, light brown to dark green hornblende with approximately 3% biotite and a trace of chlorite contamination. The mica impurity occurs both as free flakes and attached to the amphibole.

From granodiorite
(115 J&K) Details as for GSC 76-139.

The rock (Klotassin suite) is a nonfoliated, medium grained, equigranular biotite hornblende granodiorite with occasional small mafic inclusions. It consists of quartz (10-15%), plagioclase (55%), potash feldspar (20%), biotite (2-3%), hornblende (7-10%) and accessory chlorite, apatite, magnetite and sericite.

See GSC 76-156 for discussion.

GSC 76-141 Biotite, K-Ar age **51.7 ± 3.0 m.y.**

K = 5.84%, $^{40}Ar/^{40}K$ = 0.00306, radiogenic Ar = 68.2%.
Concentrate: A heterogeneous concentrate consisting of approximately 75% brown and 25% green biotite. Both varieties of mica are fresh and have no visible impurities.

From alaskite
(115 H) Beneath cliff 0.8 km west of shoreline and 6.4 km south of northern end of Sekulmun Lake, Yukon, 61°29'50"N, 137°35'30"W. Sample TOB72-450, collected by T. Booth and interpreted by D. Tempelman-Kluit.

This is a miarolitic granite (Nisling Range alaskite) consisting mainly of quartz (10%), plagioclase (less than 5%), potash feldspar (80-85%), biotite (less than 1%) and accessory sphene, opaques and fluorite.

See GSC 76-156 for discussion.

GSC 76-142 Biotite, K-Ar age **164 ± 6 m.y.**

K = 7.30%, $^{40}Ar/^{40}K$ = 0.01000, radiogenic Ar = 91.4%.
Concentrate: Light greenish brown biotite with approximately 3% chlorite which occurs as an alteration product of the mica.

From foliated granodiorite to quartz diorite
(115 H) Beside small unnamed lake 16.1 km due east of centre of Stevens Lake, Yukon, 61°42'30"N, 137°12'05"W. Sample TO72-350a, collected and interpreted by D. Tempelman-Kluit.

See GSC 76-143 for description and GSC 76-156 for discussion.

GSC 76-143 Hornblende, K-Ar age **171 ± 7 m.y.**

K = 0.970%, $^{40}Ar/^{40}K$ = 0.01047, radiogenic Ar = 79.0%.
Concentrate: Clean, fresh and unaltered, pleochroic, brownish green to dark green hornblende with no visible contamination.

From granodiorite to quartz diorite
(115 H) Details as for GSC 76-142.

A strongly foliated, melanocratic, biotite hornblende granodiorite to quartz diorite of medium equigranular grain size (Klotassin suite). It consists mainly of quartz (20%), plagioclase (55%), potash feldspar (5-10%), biotite (10%), hornblende (10%) and accessory apatite, magnetite, epidote and sphene.

This is a revised age based on a reassessment of the potassium content of the hornblende concentrate. An earlier potassium determination of 0.868% yielded an age of 190 ± 8 m.y. as reported by Tempelman-Kluit and Wanless, 1975. However, the 171 ± 7 m.y. age indicated here is based on three additional K determinations averaging 0.970%, two by isotope dilution and one by X-ray fluorescene methods.

See GSC 76-156 for further discussion and reference.

GSC 76-144 Biotite, K-Ar age **48.9 ± 2.3 m.y.**

K = 7.61%, $^{40}Ar/^{40}K$ = 0.00290, radiogenic Ar = 68.4%.
Concentrate: Clean, fresh and unaltered, brownish green biotite with no visible contamination.

From weakly foliated granodiorite to quartz diorite
(115 H) Western shoreline, 4.8 km north of the southern end of Canyon Lake, Yukon, 61°06'30"N, 137°01'00"W. Sample TO72-343A, collected and interpreted by D. Tempelman-Kluit.

See GSC 76-145 for description and GSC 76-156 for discussion.

GSC 76-145 Hornblende, K-Ar age **55.4 ± 3.3 m.y.**

K = 0.853%, $^{40}Ar/^{40}K$ = 0.00329, radiogenic Ar = 56.4%.
Concentrate: Clean, fresh and unaltered, pleochroic brown to dark green hornblende with no visible contamination.

From granodiorite to quartz diorite
(115 H) Details as for GSC 76-144.

The rock (of the Ruby Range granodiorite suite) is a weakly foliated, medium grained, biotite hornblende granodiorite to quartz diorite containing occasional, dark, fine grained inclusions elongated with the foliation. It consists mainly of quartz (15-20%), plagioclase (60-65%), potash feldspar (10%), biotite (5%) and hornblende (5%) with accessory opaques, chlorite and sphene.

See GSC 76-156 for discussion.

GSC 76-146 Biotite, K-Ar age **51.6 ± 2.4 m.y.**

K = 7.60%, $^{40}Ar/^{40}K$ = 0.00306, radiogenic Ar = 65.0%.
Concentrate: Clean, fresh and unaltered, very light brown biotite with no visible contamination.

From granodiorite
(115 H) 5.6 km north of the south end of Canyon Lake on east shore by the Aishihik Road, Yukon, 61°06'15"N, 137°00'W. Sample TO72-344C, collected and interpreted by D. Tempelman-Kluit.

See GSC 76-147 for description and GSC 76-156 for discussion.

GSC 76-147 Hornblende, K-Ar age **53.8 ± 3.2 m.y.**

K = 0.852%, $^{40}Ar/^{40}K$ = 0.00320, radiogenic Ar = 59.1%.
Concentrate: Fresh and unaltered, pleochroic, light brown to dark green hornblende with less than 2% biotite contamination.

From granodiorite
(115 H) Details as for GSC 76-146.

The rock (of the Ruby Range granodiorite suite) is a nonfoliated, medium grained, biotite hornblende granodiorite consisting of quartz (30%), plagioclase (40-45%), potash feldspar (10%), biotite (5-10%), hornblende (3%) and accessory sphene (1%).

See GSC 76-156 for discussion.

GSC 76-148 Biotite, K-Ar age **67.6 ± 2.7 m.y.**

K = 7.31%, $^{40}Ar/^{40}K$ = 0.00403, radiogenic Ar = 75.8%.
Concentrate: Light brownish biotite with approximately 10% chlorite alteration.

From quartz diorite/granodiorite
(115 H) On western shore of Aishihik Lake, 5.6 km southwest of north end of Hopkins Lake, Yukon, 61°14'30"N, 137°00'50"W. Sample TO72-329, collected and interpreted by D. Tempelman-Kluit.

See GSC 76-149 for description and GSC 76-156 for discussion.

GSC 76-149 Hornblende, K-Ar age **68.3 ± 3.4 m.y.**

K = 0.500%, $^{40}Ar/^{40}K$ = 0.00407, radiogenic Ar = 51.8%.
Concentrate: Clean, fresh and unaltered, pleochroic, olive-brown to green hornblende with no visible contamination.

From quartz diorite/granodiorite
(115 H) Details as for GSC 76-148.

The rock (of the Ruby Range granodiorite suite) is a medium grained, nonfoliated hornblende biotite granodiorite containing quartz (25%), plagioclase (40%), potash feldspar (25%), biotite (5%), hornblende (5%) and accessory opaque, chlorite and sericite-carbonate.

See GSC 76-156 for discussion.

GSC 76-150 Biotite, K-Ar age **52.7 ± 2.4 m.y.**

K = 7.12%, $^{40}Ar/^{40}K$ = 0.00313, radiogenic Ar = 82.4%.
Concentrate: Clean, fresh and unaltered, brownish biotite with no visible contamination.

From quartz monzonite
(115 H) 11.3 km due east of confluence of West Aishihik River with the Aishihik River, Yukon, 61°01'40"N, 136°50'15"W. Sample TO72-339a, collected and interpreted by D. Tempelman-Kluit.

The sample (of the Nisling Range alaskite suite) is from a weakly foliated, medium- to coarse-grained biotite quartz monzonite consisting of quartz (20%), plagioclase (25%), potash feldspar (45%), biotite (5%) and accessory opaques.

See GSC 76-156 for discussion.

GSC 76-151 Biotite, K-Ar age **162 ± 6 m.y.**

K = 6.97%, $^{40}Ar/^{40}K$ = 0.00992, radiogenic Ar = 88.9%.
Concentrate: Light greenish brown biotite with approximately 10% chlorite contamination mainly as an alteration product of the mica.

From quartz diorite
(115 H) Along ridge 16.1 km northwest of Kirkland Creek and 35 km southwest of Nordenskiold River, Yukon, 61°45'N, 136°39'W. Sample TO72-346, collected and interpreted by D. Tempelman-Kluit.

See GSC 76-152 for description and GSC 76-156 for discussion.

GSC 76-152 Hornblende, K-Ar age **165 ± 7 m.y.**

K = 1.03%, $^{40}Ar/^{40}K$ = 0.01012, radiogenic Ar = 84.4%.
Concentrate: Clean, fresh and unaltered, pleochroic brown to dark green hornblende with no visible contamination.

From quartz diorite
(115 H) Details as for GSC 76-151.

The rock (of the Klotassin suite) is a strongly foliated, melanocratic biotite hornblende quartz diorite of equigranular, medium grain size. It consists primarily of quartz (15%), plagioclase (65-70%), potash feldspar (less than 1%), biotite (10%), hornblende (5%) and sphene (2%).

See GSC 76-156 for discussion.

GSC 76-153 Biotite, K-Ar age **166 ± 6 m.y.**

K = 7.82%, $^{40}Ar/^{40}K$ = 0.01016, radiogenic Ar = 91.7%.
Concentrate: Clean, fresh and unaltered, light brownish green biotite with no visible contamination.

From quartz monzonite/granodiorite
(115 H) 11.3 km west of Little Buffalo Lake, Yukon, 61°51'45"N, 136°39'W. Sample TO72-350, collected and interpreted by D. Tempelman-Kluit.

The rock (of the pink quartz monzonite suite) is a porphyritic biotite quartz monzonite composed primarily of quartz (20%), plagioclase (40-45%), perthite (35-40%) and biotite (2%) with minor clinozoisite and chlorite.

See GSC 76-156 for discussion.

GSC 76-154 Biotite, K-Ar age **160 ± 6 m.y.**

K = 7.46%, $^{40}Ar/^{40}K$ = 0.00979, radiogenic Ar = 87.1%.
Concentrate: Relatively clean, fresh, light brown biotite with a slight trace of chlorite alteration.

From porphyritic quartz monzonite
(115 H) On sharp bend in larger tributary of Nordenskiold River, 17.7 km north of Kirkland Creek and 27.4 km southwest of Nordenskiold River, Yukon, 61°47'30"N, 136°37'30"W. Sample TO72-348a, collected and interpreted by D. Tempelman-Kluit.

The sample (of the pink quartz monzonite suite) is from a porphyritic biotite quartz monzonite made up of quartz (20%), plagioclase (60%), potash feldspar (15-20%), biotite (2-3%) and accessory opaques, sericite, muscovite, chlorite and sphene.

See GSC 76-156 for discussion.

GSC 76-155 Biotite, K-Ar age **160 ± 7 m.y.**

K = 7.21%, $^{40}Ar/^{40}K$ = 0.00975, radiogenic Ar = 88.5%.
Concentrate: Very light green biotite with approximately 15% chlorite alteration.

From quartz monzonite
(115 H) 2.0 km south of Nordenskiold River, below Mount Cooper, 12.9 km downriver from Hutshi Lakes, Yukon, 61°13'20"N, 136°18'W. Sample TO72-342, collected and interpreted by D. Tempelman-Kluit.

The rock (of the pink quartz monzonite suite) is a medium grained, nearly equigranular, pink quartz monzonite with some foliation. It consists mainly of quartz (35%), plagioclase (30%), potash feldspar (30%), biotite (2-3%) with accessory opaques, apatite and zircon.

See GSC 76-156 for description.

GSC 76-156 Hornblende, K-Ar age **174 ± 8 m.y.**

K = 0.638%, $^{40}Ar/^{40}K$ = 0.01070, radiogenic Ar = 81.0%.
Concentrate: Clean, fresh and unaltered, pleochroic, light brown to olive-green hornblende with no visible contamination.

From granodiorite
(105 E) At baseof Conglomerate Mountain, beside highway along Kulsha Creek, Yukon, 61°37'30"N, 135°53'W. Sample TO72-399, collected and interpreted by D. Tempelman-Kluit.

The rock (of the Klotassin suite) is a fine- to medium-grained, equigranular hornblende granodiorite consisting of quartz (15%), plagioclase (55-60%), potash feldspar (20-25%), hornblende (5%) and accessories (3%). It formed a large boulder in Laberge conglomerate.

This study has served to define the timing of the three youngest thermal events in the Yukon Crystalline Terrane and to correlate these events with three plutonic and metamorphic episodes, which are recognizable not only in the Yukon Crystalline Terrane, but along much of the length of the Canadian Cordillera. The oldest event, 160-170 m.y. ago, produced widespread thermal resetting of ages of metamorphosed and igneous rocks in much of the Yukon Crystalline Terrane. It probably resulted in weak, retrograde metamorphism and accompanied the emplacement of small plutons of pink quartz monzonite in the central part of the region. The next oldest intrusive event was the emplacement of the 90-100 m.y. Coffee Creek quartz monzonite. Although this quartz monzonite affects the K-Ar ages of intruded rocks in its vicinity, no regional metamorphism is related to it as is the case with the older event. The youngest episode, 50-60 m.y. ago, can be related to the time when the Nisling Range alaskite was emplaced and when the K-Ar system of the Ruby Range batholith was thermally reset. This event is related to regional metamorphism in the southernmost part of the Yukon Crystalline Terrane, the continuation of the Coast Plutonic Complex. For a detailed treatment of these determinations and a tabulated listing of all samples involved the reader is directed to Tempelman-Kluit and Wanless, 1975.

Reference

Tempelman-Kluit, D.J. and Wanless, R.K.
1975: Potassium-Argon Age Determinations of Metamorphic and Plutonic rocks in the Yukon Crystalline Terrane; Can. J. Earth Sci., v. 12, no. 11, p. 1895-1909.

GSC 76-157 Muscovite,K-Ar age **255 ± 13 m.y.**

K = 3.65%, $^{40}Ar/^{40}K$ = 0.01601, radiogenic Ar = 86.5%.
Concentrate: A heterogeneous mixture of two types of white mica; a potassic muscovite and a sodic or calcic variety. The concentrate contains approximately 4% chlorite contamination.

From eclogite
(105 K) 8.8 km west-northwest of Faro, Yukon, 62°17'30"N, 133°27'W. Map-unit 1, Geol. Surv. Can., Map 1261A. Sample TO73-104, collected and interpreted by D. Tempelman-Kluit.

The rock dated is an amphibole eclogite (Tempelman-Kluit, 1970) which occurs interfoliated with micaceous quartzite (Proterozoic) immediately adjacent to the Vangorda fault in the Anvil district in central Yukon. The Vangorda fault is a steeply southwest dipping structure and one of a family of faults that control the Tintina Trench. Alpine ultramafic bodies are emplaced along this fault at many places. Movement on the fault was probably transcurrent although only vertical displacement can be proven by stratigraphic omission of 1524 m across the structure. Timing of the displacement on Vangorda fault is closely limited because mid-Permian basalt and limestone are cut by it and because fragments of serpentinite, emplaced along the fault, occur in fossiliferous Middle or Upper Triassic conglomerate that post-dates movement.

The age determined for muscovite from the eclogite reflects the time at which the eclogite was formed. This time coincides nicely with the displacement along Vangorda fault.

It is interesting that the Anvil Batholith, a pluton of granodiorite and quartz monzonite about 95 m.y. old, has affected the K-Ar age determined on muscovite in phyllite and schist around its periphery, but that it has not changed the age of muscovite in the eclogite. The phyllitic sample, dated as 99 ± 5 m.y. (GSC 67-47, See Geol. Surv. Can., Paper 69-2A), lies 3.2 km beyond the edge of the Anvil Batholith whereas the eclogite sample was taken 8.0 km from its margin.

Reference

Tempelman-Kluit, D.J.
1970: An occurrence of eclogite near Tintina Trench, Yukon; in Report of Activities, Part B, Geol. Surv. Can., Paper 70-1B, p. 19-22.

GSC 76-158 Chlorite-Biotite, K-Ar age **50.6 ± 3.6 m.y.**

K = 2.60%, $^{40}Ar/^{40}K$ = 0.00300, radiogenic Ar = 42.1%.
Concentrate: 75% chlorite as free flakes and as an alteration product of biotite which makes up the remaining 25%.

From lithic sandstone
(115 G) Gully cut by creek flowing from Wolverine Plateau into Donjek River, Yukon, 61°28'N, 139°50'W. Map-unit 20, Geol. Surv. Can., Map 1177A. Sample E74-5-1, collected and interpreted by G.H. Eisbacher.

This separation of chloritized biotite comes from the Amphitheatre Formation in the St. Elias Mountains. The Amphitheatre Formation is of Oligocene age (S. Hopkins, pers. comm., 1976). The age reflects very well the predominant K-Ar numbers in the suspected source area of the Amphitheatre Formation. The source lay to the east of the present-day Shakwak Trench and included the Kluane Schist which yields K-Ar numbers around 50 m.y. In spite of the chloritization of the biotite the date is meaningful in that it clearly predates deposition of the Amphitheatre Formation and in that it was derived from a metamorphic terrane which yields the same biotite cooling ages. Chloritization must have taken place within the metamorphic complex prior to sedimentary transport by westward flowing rivers.

Also see GSC 76-159 for further discussion.

GSC 76-159 Biotite, K-Ar age **106 ± 4 m.y.**

K = 7.37%, $^{40}Ar/^{40}K$ = 0.00636, radiogenic Ar = 89.4%.
Concentrate: Clean, fresh and unaltered, very light brown biotite with no visible contamination.

From basic intrusion
(115 A) Near head of Shorty Creek, approximately 4 km west of its confluence with Alder Creek, Dezadeash area, Yukon, 60°24'30"N, 137°14'W. Sample E74-51-2, collected and interpreted by G.H. Eisbacher.

This biotite age probably reflects the minimum age for the cooling of the Shorty Creek granodiorite which intrudes the Upper Jurassic-Lower Cretaceous Dezadeash Formation of the St. Elias Mountains. The Shorty Creek Stock post-dates an early phase of folding in the Dezadeash Formation and predates strike-slip faulting along the Denali Fault. An ultramafic intrusion within the Dezadeash Formation yielded a hornblende age of 118 m.y. and biotite 107 m.y. (R. Armstrong, UBC, 1976). It is interesting to note that Richter et al. (1975) have described compositionally similar plutons in the Nutzotin Mountains sequence of eastern Alaska which intruded into this Upper Jurassic-Lower Cretaceous succession of clastic and volcanic rocks between 105 and 111 m.y. Therefore the age of the Shorty Creek Stock is another point in favour of 300 km right-lateral shift along the Denali Fault (Eisbacher, 1976).

References

Eisbacher, G.H.
1976: Sedimentology of the Dezadeash flysh and its implications for strike-slip faulting along the Denali Fault, Yukon Territory and Alaska; Can. J. Earth Sci., v. 13, p. 1495-1513.

Richter, D.H., Lanphere, M.A., Matson, N.A. Jr.
1975: Granitic plutonism and metamorphism, Eastern Alaska Range, Alaska; Geol. Soc. Am. Bull., v. 86, p. 819-829.

GSC 76-160 Feldspar, K-Ar age **828 ± 66 m.y.**
832 ± 66 m.y.

$K = \frac{0.0550\%}{0.0547\%}$, $^{40}Ar/^{40}K = \frac{0.0608}{0.0612}$, radiogenic Ar = 58.3%.

Concentrate: Clean, pink andesine (Ab_7An_3) showing mild sericitization.

From phyllitic argillite

(106 L) Surface exposure in Richardson Anticlinorium at headwaters of Caribou River, Yukon, 66°12'N, 135°18'W. Map-unit 1, Geol. Surv. Can., Map 10-1963. Sample 90NC(C-27191) collected and interpreted by D.K. Norris.

The host rock is a dark greenish grey (5 GY 4/1) phyllitic argillite, strongly cleaved and kinked, so that primary bedding is largely obliterated. It is of lower greenschist facies and is overlain unconformably by paleontologically dated (GSC Locality C-27191), unmetamorphosed clastics and carbonates of Early Cambrian age. The rock occurs as a north-northwest trending horst, bounded on its east and west flanks by two major, nearly vertical faults of the Richardson Fault Array. The host rock is exposed over an area of approximately 11 km^2 in a structural culmination within the horst.

The feldspar (andesine) mineralization occurs as irregular as well as tabular masses in the argillite, commonly parallel and subparallel to foliation but also to fractures which cut across the foliation. The mineralization clearly post-dates the phyllitization and fracturing and pre-dates the deposition of the overlying Lower Cambrian strata.

The 832 and 828 m.y. ages do not conflict with the known structural and stratigraphic setting of the occurrence and would appear to set a minimum intrinsic age of the feldspathization. Because the andesine is slightly sericitized and because the potassium content was found to be very low, these ages should be used with caution. They are, however, the oldest numbers yet recorded for this part of the Cordilleran Orogenic System, and support the thesis that the Richardson Fault Array may have served as synkinematic avenues of mineral migration and concentration in late Precambrian time.

GSC 76-161 Whole-rock, K-Ar age **136 ± 14 m.y.**

K = 0.232%, $^{40}Ar/^{40}K$ = 0.00828, radiogenic Ar = 50.0%.
Concentrate: Crushed whole-rock.

From diabase
(560 D) South-facing slope 2.9 km northeast of southern extremity of Krueger Island, District of Franklin, 81°33'N, 91°36'W. Map-unit bc, Geol. Surv. Can., Map 1305A. Sample TM-73-317a-1, collected and interpreted by H.P. Trettin.

The sample is a microporphyritic diabase consisting of microphenocrysts of labradorite and clinopyroxene in a very fine grained groundmass of plagioclase, pyroxene, and "iron ore". There is little alteration. The sample represents the upper chilled margin of the same dyke or sill analyzed in GSC 76-164, about 300 m to the east. For interpretation, see GSC 76-164.

GSC 76-162 Whole-rock, K-Ar age **142 ± 6 m.y.**

K = 0.409%, $^{40}Ar/^{40}K$ = 0.00865, radiogenic Ar = 66.3%.
Concentrate: Crushed whole-rock.

From diabase
(560 D) Details as for GSC 76-161. Sample TM-73-317a-2, collected and interpreted by H.P. Trettin.

The sample is a fine grained diabase with a subophitic texture. It is composed of labradorite, clinopyroxene and lesser amounts of "iron ore", with trace amounts of K-feldspar and quartz forming myrmekitic or graphic intergrowths, and biotite. The plagioclase shows considerable sericite alteration, and the biotite is partly replaced by chlorite, but there is no evidence of regional metamorphism. The sample represents the interior of the same diabase analyzed in GSC 76-161, 163 and 164. For interpretation, see GSC 76-164.

GSC 76-163 Whole-rock, K-Ar age **201 ± 20 m.y.**

K = 0.088%, $^{40}Ar/^{40}K$ = 0.01241, radiogenic Ar = 30.0%.
Concentrate: Crushed whole-rock.

From diabase
(560D) Details as for GSC 76-161. Sample TM-73-317a-3, collected and interpreted by H.P. Trettin.

The sample is a microporphyritic diabase composed of microphenocrysts of plagioclase and clinopyroxene in a groundmass of plagioclase, pyroxene, and "iron ore". It is relatively fresh except for minor carbonate alteration. For interpretation see GSC 76-164.

GSC 76-164 Whole-rock, K-Ar age **230 ± 22 m.y.**

K = 0.158%, $^{40}Ar/^{40}K$ = 0.01430, radiogenic Ar = 52.6%.
Concentrate: Crushed whole-rock.

From diabase
(560 D) South-facing slope 2.7 km northeast of southern extremity of Krueger Island, Nansen Sound region, District of Franklin, 81°33'N, 91°37'W. Map-unit bc, Geol. Surv. Can., Map 1305A. Sample TM-73-316a-2 collected and interpreted by H.P. Trettin.

The rock is a microphorphyritic diabase composed of microphenocrysts of plagioclase and clinopyroxene in a very fine grained groundmass of plagioclase, pyroxene, and "iron ore". It shows some epidote and carbonate alteration but no regional metamorphism. The sample is from the upper chilled margin of a 8.5-m-thick diabase that intrudes a gabbro. The diabase and gabbro form part of the Bourne Complex (Trettin, 1969), a thick assemblage of basic dykes or sills, locally with intercalated green phyllite. The age of the intrusions is unknown; they may be related to any of the following formations which include basic volcanic rocks: Svartevaeg (Lower Devonian), Audhild (Pennsylvanian), Esayoo (Lower Permian), Isachsen (Lower Cretaceous), and Strand Fiord (Upper Cretaceous). The present age determinations, GSC 76-161, 162, 163 and 164, all from the same intrusion, are too scattered to permit a specific interpretation but seem to exclude a Cretaceous age and thus, indirectly, support a Paleozoic assignment.

Reference

Trettin, H.P.
1969: Pre-Mississippian geology of northern Axel Heiberg and northwestern Ellesmere Islands, Arctic Archipelago; Geol. Surv. Can., Bull. 171.

GSC 76-165 Whole-rock, K-Ar age **98.0 ± 4.5 m.y.**

K = 0.719%, $^{40}Ar/^{40}K$ = 0.00589, radiogenic Ar = 49.7%.
Concentrate: Crushed whole-rock.

From gabbro
(560 D) Location as for GSC 76-164. Sample TM-73-316a-3, collected and interpreted by H.P. Trettin.

The rock is a medium grained gabbro composed mainly of labradorite and clinopyroxene. The minerals show some sericite and chlorite alteration but there is no evidence of regional metamorphism. The specimen represents the gabbro that is intruded by the diabase analyzed in specimens GSC 76-161 to 164. The present K-Ar age of 98 m.y. appears too young in view of the fact that the ages of the diabase range from 230 to 136 m.y.

GSC 76-166 Hornblende, K-Ar age **73.6 ± 3.5 m.y.**

K = 0.341%, $^{40}Ar/^{40}K$ = 0.00439, radiogenic Ar = 54.5%.
Concentrate: Fresh and unaltered, nonpleochroic, light green hornblende with a trace of chlorite contamination.

From syenite
(560 D) South of GSC 76-167, 1.1 km south of small lake, northeast side of Kleybolte Peninsula, Ellesmere Island, District of Franklin, 81°36'N, 90°57'30"W. Map-unit Dgd, Geol. Surv. Can., Map 1305A and Geol. Surv. Can., Bull. 171. Sample TM-73-324a-2, collected and interpreted by H.P. Trettin.

This sample is from the same source as GSC 76-167 and differs only in containing very small amounts of biotite. For sample description and interpretation, see GSC 76-167.

GSC 76-167 Hornblende, K-Ar age **84.2 ± 3.9 m.y.**

K = 0.526%, $^{40}Ar/^{40}K$ = 0.00504, radiogenic Ar = 69.2%.
Concentrate: Clean, fresh and unaltered, nonpleochroic, light green hornblende with no visible contamination.

From syenite
(560 D) Northeast side of Kleybolte Peninsula, 1.1 km south of small lake, northeasternmost Ellesmere Island, District of Franklin, 81°36'N, 90°57'30"W. Map-unit Dgd, Geol. Surv. Can., Map 1305A and Geol. Surv. Can., Bull. 171. Sample TM-73-324a-1, collected and interpreted by H.P. Trettin.

The sample is a medium grained, quartz-bearing hornblende syenite composed mainly of microcline with lesser amounts of hornblende and less than 10 per cent quartz; the

hornblende appears unaltered in thin section. The rock comes from a small, high-level pluton that intrudes early Paleozoic or older clastic and carbonate sediments metamorphosed to hornfels and marble (Trettin, 1969). It forms part of a group of similar plutons in northern Axel Heiberg and northwestern Ellesmere islands that intrude Silurian and older strata and have yielded a significant K-Ar determination of 360 m.y. The present pluton almost certainly is devonian or older and the Late Cretaceous K-Ar age must be due to argon loss at later times, for example during the Tertiary Eurekan Orogeny.

Reference

Trettin, H.P.
1969: Pre-Mississippian geology of northern Axel Heiberg and northwestern Ellesmere Island, Arctic Archipelago; Geol. Surv. Can., Bull. 171.

GSC 76-168 Biotite, K-Ar age **1693 ± 50 m.y.**

K = 7.11%, $^{40}Ar/^{40}K$ = 0.1605, radiogenic Ar = 99.2%.
Concentrate: Olive-green biotite with approximately 6% chlorite alteration.

From amphibolite
(47 B) 1 km east-northeast of river delta at northeast end of Folster Lake, Melville Peninsula, District of Franklin, 68°05'30"N, 85°39'W. Sample FS-73-20, collected and interpreted by T. Frisch.

See GSC 76-169 for description and interpretation.

GSC 76-169 Hornblende, K-Ar age **1715 ± 112 m.y.**

K = 0.284% $^{40}Ar/^{40}K$ = 0.1636, radiogenic Ar = 97.2%.
Concentrate: Clean, fresh and unaltered, pleochroic, light brown to green hornblende with no visible contamination.

From amphibolite
(47 B) Details as for GSC 76-168.

The sample dated was a biotite amphibolite from an amphibolite-facies metadiabase dyke cutting gneissic tonalite of probable Archean age. The dyke is part of a large swarm which was affected by an apparent remobilization of the tonalite and whose intrusion pre-dates Proterozoic greenschist-grade metasediments (K-Ar age approximately 1450 m.y., GSC 76-170 and 171).

The hornblende and biotite ages agree within error limits and are typical K-Ar values for this region, reflecting the effects of a pervasive Hudsonian thermal event (Heywood, 1967). If the K-Ar ages are valid, this Hudsonian event is separate and distinct from that in which the metasediments were metamorphosed.

Reference

Heywood, W.W.
1967: Geological notes, northeastern District of Keewatin and southern Melville Peninsula, District of Franklin, Northwest Territories (parts of 46, 47, 56, 57); Geol. Surv. Can., Paper 66-40.

GSC 76-170 Whole-rock, K-Ar age **1416 ± 44 m.y.**

K = 4.45%, $^{40}Ar/^{40}K$ = 0.1234, radiogenic Ar = 99.9%.
Concentrate: Crushed whole-rock.

From schist
(47 B) 4.8 km south of Folster Lake and 7.2 km due east of east coast of Committee Bay, District of Franklin, 68°02'N, 85°45'W. Map-unit 16, Geol. Surv. Can., Paper 66-40 (W.W. Heywood). Sample FS-74-55 collected and interpreted by T. Frisch.

See GSC 76-171 for description and interpretation.

GSC 76-171 Mica mixture, K-Ar age **1477 ± 37 m.y.**

K = 7.11%, $^{40}Ar/^{40}K$ = 0.1311, radiogenic Ar = 99.7%.
Concentrate: A mixture of light brown biotite intergrown with clean muscovite. Both micas are unaltered, but there is some attached quartz and many flakes contain opaque inclusions (possibly hematite).

From schist
(47 B) Details as for GSC 76-170.

The sample dated was a fine grained, biotite-muscovite-feldspar-quartz schist from the basal part of a greenschist-grade metasedimentary sequence (Unit 16 of Heywood, 1967) that overlies with marked angular unconformity gneissic granitoid rocks and the Prince Albert Group (Frisch, 1974).

The ages obtained, which agree within error limits, are interpreted as approximating the age of metamorphism for the following reasons: (a) petrographic study shows that the muscovite and biotite clearly grew during metamorphism and are not detrital minerals; (b) the metamorphic grade was that of the Barrovian biotite zone at a probable temperature around 500°C and shallow depth; (c) there is no evidence of a younger metamorphism in the area; (d) subsequent deformation was moderate to slight (Frisch, 1974).

If the above interpretation is correct, the age obtained is the first indication of an Elsonian thermal event on Melville Peninsula. It is of interest that, on the basis of whole-rock Rb-Sr isochron work on sediments of the Aphebian Dubawnt Group near Baker Lake, 600 km to the southwest of Folster Lake, Bell and Blenkinsop (1974) have obtained evidence of a possible thermal event at 1460 ± 60 m.y.

References

Bell, K. and Blenkinsop, J.
1974: Summary of results, Research Agreement 1135 D-13-4-135/73. In: Progress Summary 1974, Research Agreements Program in the Natural, Physical and Social Sciences and Engineering. Can. Dept. Energy, Mines and Resources, Ottawa.

Frisch, T.
1974: Geological studies in the Prince Albert Hills, western Melville Peninsula, District of Franklin; in Report of Activities, Part A, Geol. Surv. Can., Paper 74-1A, p. 163-164.

Heywood, W.W.
1967: Geological notes, northeastern District of Keewatin and southern Melville Peninsula, District of Franklin, Northwest Territories (parts of 46, 47, 56, 57); Geol. Surv. Can., Paper 66-40.

GSC 76-172 Biotite, K-Ar age **1603 ± 40 m.y.**

K = 7.12%, $^{40}Ar/^{40}K$ = 0.1478, radiogenic Ar = 99.7%.
Concentrate: Clean, fresh, unaltered, greenish brown biotite with no visible contamination.

From granite
(26 F) 48.3 km west of Nettilling Fiord, Baffin Island, District of Franklin, 65°58'N, 69°21'W. Map-unit 13, Geol. Surv. Can., Map 17-1966. Sample BE-65-179, collected by R.G. Blackadar and interpreted by C.H. Stockwell.

See GSC 76-173 for description and interpretation.

GSC 76-173 Hornblende, K-Ar age **1678 ± 49 m.y.**

K = 1.40%, $^{40}Ar/^{40}K$ = 0.1583, radiogenic Ar = 99.6%.

Concentrate: Clean, unaltered, pleochroic, olive-green to dark green hornblende with no visible contamination.

From granite

(26 F) Details as for GSC 76-172.

This sample is from a very large batholith. The sample is a massive granite with phenocrysts of pink feldspar up to 3.8 cm long lying in a medium grained groundmass of feldspar, quartz, and mafic minerals. As seen in thin section the rock consists of plagioclase, microcline, quartz and, in the groundmass, abundant fresh biotite and fairly plentiful fresh hornblende. Apatite and zircon are accessory constituents.

The hornblende and biotite are primary and both undoubtedly crystallized at virtually the same time. Their K-Ar ages are interpreted as post-crystallization cooling ages. They reflect the long cooling history of the rock; the hornblende passed its relatively high argon blocking temperature at 1678 ± 49 m.y. ago while, on further cooling, the biotite passed its relatively low argon blocking temperature at 1603 ± 40 m.y. ago. This is the normal relationship for a slow cooling rock and the age obtained on the hornblende approaches more closely the time of primary crystallization of the granite.

GSC 76-174 Biotite, K-Ar age **1604 ± 40 m.y.**

K = 7.93%, $^{40}Ar/^{40}K$ = 0.1479, radiogenic Ar = 99.9%.
Concentrate: Clean, fresh and unaltered, brown biotite with no visible contamination.

From biotite gneiss

(15 M) Drillhole site 48.7 km east-southeast of Cape Murchison, Brevoort Island, and 42.2 km northeast of Lady Franklin Island, Baffin Island shelf, District of Franklin, 63°11'06"N, 63°06'12"W. Sample HN75-009V-9A, collected by B. MacLean and S.P. Srivastava, interpreted by B. MacLean, L.F. Jansa and G.D. Jackson.

See GSC 76-175 for description and interpretation.

GSC 76-175 Biotite, K-Ar age **1611 ± 39 m.y.**

K = 7.90%, $^{40}Ar/^{40}K$ = 0.1489, radiogenic Ar = 99.7%.
Concentrate: Clean, fresh and unaltered, brown biotite with no visible contamination.

From biotite gneiss

(15 M) Details as for GSC 76-174.

The sample is from the lower 94 cm of a shallow drill core 158 cm in length recovered by underwater drill from CSS Hudson at station HN75-009V-9A (Cruise 75-009, Phase V) (MacLean and Srivastava, 1976).

The locality where samples GSC 76-174 and 175 were collected forms a basement high that extends in a generally northeasterly direction from Loks Land through Monumental and Lady Franklin islands and terminates a few kilometres northeast of the sample locality (MacLean et al., in prep.).

Both samples are light grey, fine- to barely medium grained, xenoblastic, and massive, granulose to faintly foliated and gneissose. Sample GSC 76-175 is mineralogically similar to GSC 76-174, but is slightly coarser and more massive. The mineral composition of GSC 76-174 is: quartz 40 per cent, plagioclase (An_{17-26}) 40 per cent, biotite 10 per cent, muscovite 8 per cent, carbonate 1 per cent, chlorite 1 per cent; traces of apatite, garnet, epidote, metamict allanite, sphene, zircon, amphibole, microcline, tourmaline and magnetite.

The ages are consistent with K-Ar ages determined for other metamorphosed Precambrian rocks on southern Baffin Island.

The K-Ar age of the samples is considered to relate to deformation and recrystallization of older rocks during the Hudsonian orogeny and their subsequent cooling (Jackson and Taylor, 1972; Wanless et al., 1972, p. 40).

The rocks lie within the Churchill structural province.

References

Jackson, G.D. and Taylor, F.C.
1972: Correlation of major Aphebian rock units in the northeastern Canadian Shield; Can. J. Earth Sci., v. 12, p. 1650-1669.

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1976: Shallow corehole drilling on the Baffin Island Shelf; in Report of Activities, Part A, Geol. Surv. Can., Paper 76-1A, p. 141-143.

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Wanless, R.K., Stevens, R.D., Lachance, G.R., and Delabio, R.N.
1972: Age determinations and geological studies K-Ar isotopic ages, Report 10, Geol. Surv. Can., Paper 71-2, p. 40.

GSC 76-176 Whole-rock, K-Ar age **3120 ± 69 m.y.** / **3175 ± 69 m.y.**

K = 0.777%, $^{40}Ar/^{40}K = \frac{0.4667}{0.4838}$, radiogenic Ar = $\frac{99.7\%}{99.7\%}$.
Concentrate: Crushed whole-rock.

From muscovite schist
(86 B) Island in Indin Lake, District of Mackenzie, 64°15'N, 115°20'W. Map-unit 5, Geol. Surv. Can., Map 1022A. Sample FYT1540, collected and interpreted by R.A. Frith.

See GSC 76-177 for interpretation.

GSC 76-177 Muscovite, K-Ar age **2007 ± 46 m.y.**

K = 6.59%, $^{40}Ar/^{40}K$ = 0.2096, radiogenic Ar = 99.7%.
Concentrate: Clean, fresh and unaltered, clear muscovite with a very slight trace of chlorite contamination.

From schist
(86 B) Island in Indin Lake, District of Mackenzie, 64°15'N, 115°20'W. Map-unit 5, Geol. Surv. Can., Map 1022A. Sample FYT1540, collected and interpreted by R.A. Frith.

Muscovite-bearing schists at this locality have yielded the following results:

1. Two whole-rock K-Ar determinations indicated ages of 3120 ± 69 m.y. and 3175 ± 69 m.y., but when plotted together on a $^{40}Ar/^{36}Ar$ vs. $^{40}K/^{36}Ar$ diagram yielded a slope corresponding to approximately 2510 m.y. The slope intercept is 31 250 (= $(^{40}Ar/^{36}Ar)_{Initial}$) which suggests the presence of excess ^{40}Ar.

2. Muscovite gave a K-Ar age of 2007 ± 46 m.y. that approximates an age of regional metamorphism (Frith et al., 1977).

3. The Rb-Sr age of the muscovite is 2442 + 110, -106 m.y. ($^{87}Rb\ \lambda = 1.47 \times 10^{-11} y^{-1}$) in agreement with the K-Ar isochron (1.). The age corresponds to the time of metamorphism and muscovite generation.

Reference

Frith, Rosaline, Frith, R.A., and Doig, R.
1977: The geochronology of the granitic rocks along the Bear-Slave structural province boundary, northwest Canadian Shield; Can. J. Earth Sci., v. 14, p. 1356-1373.

GSC 76-178 Hornblende, K-Ar age **2833 ± 148 m.y.**

K = 0.052%, $^{40}Ar/^{40}K$ = 0.3853, radiogenic Ar = 87.2%.
Concentrate: Clean, fresh and unaltered, non-pleochroic, clear to very light green amphibole with no visible contamination.

From diabase
(86 B) Ranji Lake, District of Mackenzie, 64°13'30"N, 115°24'W. Map-unit 8, Geol. Surv. Can., Map 1022A. Sample FY7307, collected and interpreted by R.A. Frith.

The hornblende used in this age determination was separated from a dyke belonging to a northwest diabase dyke set that forms part of a conjugate set with north-south dykes in the same area. The dyke cuts 1928 ± 179 m.y. rocks (Frith et al., 1977) and it is unlikely that the rock is this old. The low K content of the hornblende increases the uncertainty and the presence of excess argon in the host schists has been reported (GSC 76-176). The age value is excessive.

Reference

Frith, Rosaline, Frith, R.A., and Doig, R.
1977: The geochronology of the granitic rocks along the Bear-Slave structural province boundary, northwest Canadian Shield; Can. J. Earth Sci., v. 14, no. 6, p. 1356-1373.

GSC 76-179 Whole-rock, K-Ar age **1854 ± 52 m.y.**

K = 0.418%, $^{40}Ar/^{40}K$ = 0.1845, radiogenic Ar = 97.8%.
Concentrate: Crushed whole-rock.

From diabase
(86 B) Indin Lake, District of Mackenzie, 64°20'N, 114°58'W. Sample FY7303, collected and interpreted by R.A. Frith.

The rock is a fresh and undeformed north-south trending diabase dyke which is representative of a suite of dykes that intrude the Indin Lake greenstone belt referred to by McGlynn and Irving (1975) as the Indin Dykes. Leech's (1966) "preferred" age for this suite was 2000 m.y. The dyke suite cuts granodiorites dated by Rb-Sr whole rock techniques at 1928 ± 179 m.y. (Frith et al., 1977; $^{87}Rb\ \lambda = 1.39 \times 10^{-11} y^{-1}$). ^{40}Ar loss is suspected, resulting in a value that is too low.

References

Frith, Rosaline, Frith, R.A., and Doig, R.
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McGlynn, J.C. and Irving, E.
1975: Paleomagnetism of early Aphebian Diabase Dykes from the Slave Structural Province, Canada; Tectonophysics, v. 26, p. 23-38.

GSC 76-180 Hornblende, K-Ar age **1925 ± 120 m.y.**

K = 0.290%, $^{40}Ar/^{40}K$ = 0.1958, radiogenic Ar = 95.3%.
Concentrate: Pleochroic, light brown to green hornblende with a trace of biotite and chlorite contamination. Most of the hornblende grains have a mottled appearance which may indicate incipient alteration.

From diabase
(86 B) Indin Lake, District of Mackenzie, 64°16'N, 114°42'W. Map-unit 6, Geol. Surv. Can., Map 49-10A. Sample R366, collected and interpreted by R.A. Frith.

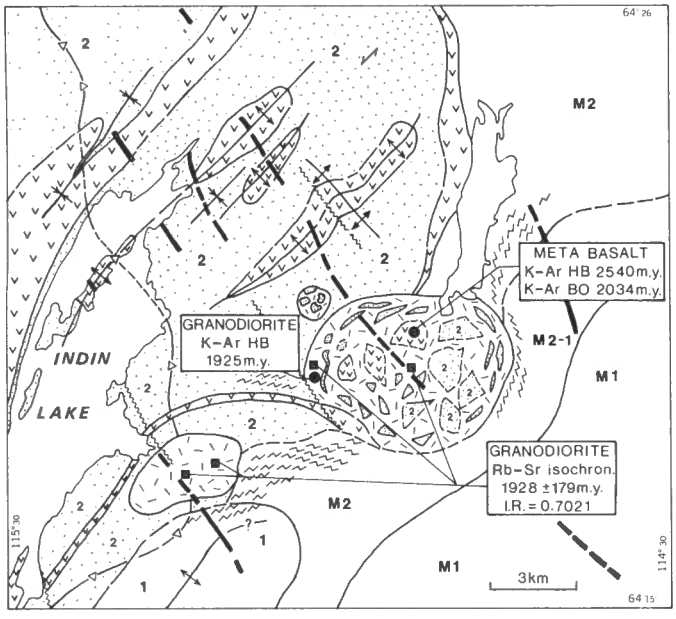
See GSC 76-182 for interpretation.

GSC 76-181 Biotite, K-Ar age **2034 ± 46 m.y.**

K = 7.60%, $^{40}Ar/^{40}K$ = 0.2140, radiogenic Ar = 99.7%.
Concentrate: Clean, fresh and unaltered, very light green biotite with no visible contamination.

From mafic gneiss
(86 B) Indin Lake, District of Mackenzie, 64°16'N, 114°42'W. Map-unit 4, Geol. Surv. Can., Map 49-10A. Sample T298, collected and interpreted by R.A. Frith.

See GSC 76-182 for interpretation.



ISOGRAD, ANDALUSITE — EARLY FOLDING, LATE FOLDING

STOCKS OF GRANODIORITE WITH ABUNDANT INCLUSIONS OF COUNTRY ROCK, PRIMARILY UNITS 1 AND 2.

2 YELLOWKNIFE SUPERGROUP META-SEDIMENTARY GREYWACKES, ARGILLITES.

YELLOWKNIFE SUPERGROUP META-VOLCANIC BASALTS, ANDESITES AND RHYOLITES.

1 META-TONALITE, GRANODIORITE, WITH MINOR ALASKITE.

M MIGMATITE DERIVED FROM THE ABOVE UNITS.

Figure 4. Generalized geology near Indin Lake, Northwest Territories.

GSC 76-182 Hornblende, K-Ar age **2540 ± 62 m.y.**

K = 0.662%, $^{40}Ar/^{40}K$ = 0.3140, radiogenic Ar = 99.1%.
Concentrate: Clean, fresh and unaltered, pleochroic, brown to dark green hornblende with no visible contamination.

From mafic gneiss
(86 B) Details as for GSC 76-181.

The hornblende and biotite were separated from a mafic gneiss believed to be a recrystallized roof pendant of Yellowknife Supergroup volcanic rock incorporated in a younger granodiorite stock (Fig. 4). The stock was dated by Frith et al. (1976) by Rb-Sr whole rock techniques at 1928 ± 179 m.y. (using $^{87}Rb\ \lambda = 1.39 \times 10^{-11} yr^{-1}$), and by K-Ar hornblende at 1925 ± 120 m.y. (GSC 76-180). The body intrudes between older tonalitic basement to the southeast and the Yellowknife volcanic and sedimentary rocks of the Indin Lake greenstone belt. The stock itself is intruded by a northwest diabase dyke set considered to be about 2000 m.y. (Leech, 1966).

The hornblende 2540 ± 62 m.y. age determination is similar to a late Kenoran time of metamorphism and deformation as reported by Frith et al (1977). The 2034 ± 46 m.y. age of the biotite is similar to Aphebian low grade regional metamorphism common to rocks along the Slave Province boundary with the Bear Province. However, the time of regional metamorphism is geochronologically close to the age of crystallization of the granodiorite pluton and could have been reset by either the regional metamorphism or the pluton. In any case, the hornblende was not reset, testifying to the fact that the roof pendant was relatively cool by 2034 m.y., at least below the blocking temperature of hornblende.

The hornblende separated from the granodiorite host rock gave a K-Ar age of 1925 ± 120 m.y. (GSC 76-180) which corresponds well with the 1928 ± 179 m.y. Rb-Sr whole rock isochron age and probably dates the age of crystallization of the rocks which were probably cooled rapidly.

References

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Leech, A.P.
1966: Potassium-argon dates of basic intrusive rocks of the District of Mackenzie, N.W.T.; Can. J. Earth Sci., v. 3, p. 389-412.

GSC 76-183 Biotite, K-Ar age **2456 ± 52 m.y.**

K = 6.65%, $^{40}Ar/^{40}K$ = 0.2955, radiogenic Ar = 99.8%.
Concentrate: Light brown biotite with approximately 9 to 10% chlorite alteration.

From porphyroblastic meta-argillite
(85 I) Upper Ross Lake, District of Mackenzie, 62°43'N, 113°10'W. Map-unit 2, Geol. Surv. Can., Map 47-16A. Sample Y216-73, collected and interpreted by W.K. Fyson.

The metagreywackes of the Yellowknife Supergroup in the Upper Ross Lake area, Slave Province, are deformed by three phases of folds (Fyson, 1975). The F_1 folds are large linear open structures, roughly conformable to granite margins. No accompanying metamorphic fabrics are recognized. F_2 folds vary in trend, but are commonly upright with, in places, a schistosity defined by quartz and muscovite aligned along the axial planes (S_2). A third fold phase is accompanied by a penetrative schistosity and biotite has locally grown along the axial planar direction. Biotite also overgrows the earlier S_2 fabric, which is preserved as quartz inclusion trails. The biotite age of 2456 ± 56 m.y. represents the approximate age of this third deformation (F_3) and its associated metamorphism. All structures may have developed during progressive regional metamorphism, which culminated with the emplacement of late granite plutons that were intruded about this time.

Reference

Fyson, W.K.
1975: Fabrics and deformation of Archean metasedimentary rocks, Ross Lake-Gordon Lake area, Slave Province, Northwest Territories; Can. J. Earth Sci., v. 12, p. 765-776.

GSC 76-184 Whole-rock, K-Ar age **2487 ± 64 m.y.**

K = 1.22%, $^{40}Ar/^{40}K$ = 0.3021, radiogenic Ar = 99.7%.
Concentrate: Crushed whole-rock.

From diabase
(85 I) 3.2 km south of mouth of Beaulieu River, District of Mackenzie, 62°00'N, 113°11'W. Sample HBA-72-06, collected and interpreted by J.B. Henderson.

See GSC 76-187 for description and interpretation.

GSC 76-185 Whole-rock, K-Ar age **2222 ± 58 m.y.**

K = 1.04%, $^{40}Ar/^{40}K$ = 0.2482, radiogenic Ar = 99.3%.
Concentrate: Crushed whole-rock.

From diabase
(85 I) Very small lake just east of Detour Lake, District of Mackenzie, 62°40'N, 112°49'W. Sample HBA-72-03, collected and interpreted by J.B. Henderson.

See GSC 76-187 for description and interpretation.

GSC 76-186 Whole-rock, K-Ar age **2212 ± 58 m.y.**

K = 0.771%, $^{40}Ar/^{40}K$ = 0.2461, radiogenic Ar = 99.1%.
Concentrate: Crushed whole-rock.

From diabase
(85 I) 4 km north of Detour Lake, District of Mackenzie, 62°42'N, 112°52'W. Sample HBA-72-04, collected and interpreted by J.B. Henderson.

See GSC 76-187 for description and interpretation.

GSC 76-187 Whole-rock, K-Ar age **2482 ± 61 m.y.**

K = 0.642%, $^{40}Ar/^{40}K$ = 0.3011, radiogenic Ar = 99.3%.
Concentrate: Crushed whole-rock.

From diabase
(85 I) Near small lake 3.2 km north of Languish Lake, District of Mackenzie, 62°47'N, 112°50'W. Sample HBA-72-05, collected and interpreted by J.B. Henderson.

The four samples are from gently dipping to horizontal diabase sheets found 80 km east of Yellowknife, N.W.T. The material was collected in the course of paleomagnetic sampling of the sills which occur at least 80 km east and 80 km west of Yellowknife.

Sample GSC 76-185 is a fresh diabase consisting of long laths of plagioclase and blocky subhedral grains of pyroxene with very few alteration products. Sample GSC 76-184 is a more altered fine grained diabase made up of fine corroded laths of plagioclase and interstitial mafic minerals, now altered to amphibole, chlorite, epidote and biotite. Sample GSC 76-186 is a very fresh diabase with elongate laths of plagioclase and subhedral elongate crystals of pyroxene. Scattered equant olivine crystals are also present. Sample GSC 76-187 is a highly altered vesicular diabase in which the subhedral pyroxene laths in many cases are altered to amphibole or chlorite and occur in a matrix of sheaf-like aggregates of fine subparallel plagioclase. The vesicles are filled with carbonate and/or chlorite.

The results from the four samples fall into two groups with apparent ages of about 2215 m.y. for samples GSC 76-185 and 186, and 2485 m.y. for samples GSC 76-184 and 187. The more altered materials in both cases have the oldest ages. The time of intrusion of the sheets is interpreted as similar to the "set I" dykes in the Yellowknife-Prosperous Lake area (Leech, 1966). These dykes have an east-northeasterly trend and were intruded 2200 to 2400 million years ago.

Reference

Leech, A.P.
1966: Potassium-argon dates of basic intrusive rocks of the District of Mackenzie, N.W.T.; Can. J. Earth Sci., v. 3, p. 389-412.

GSC 76-188 Riebeckite, K-Ar age **2057 ± 56 m.y.**

K = 1.23%, $^{40}Ar/^{40}K$ = 0.2180, radiogenic Ar = 99.6%.
Concentrate: Clean, unaltered, strongly pleochroic, dark blue to greenish brown amphibole (riebeckite) with no visible contamination.

From granite
(85 I) West side of a small hill 1500 m southeast of the shore of Blachford Lake, District of Mackenzie, 62°08'06"N, 112°35'54"W. See Geol. Surv. Can. Map 581A. Sample 71DM1Δ7, collected and interpreted by A. Davidson.

The riebeckite was extracted from a particularly fresh sample of alkali-feldspar granite in which it forms poikilitic crystals up to 3 cm across. The riebeckite encloses 5 mm feldspar euhedra and quartz anhedra and minor amounts of smaller, drop-like grains of fluorite. The sample is from unit 8a, the youngest unit of the Blachford Lake complex of alkalic granites and syenites (Davidson, 1972). This complex intrudes both metasedimentary rocks of the Yellowknife Supergroup and biotite granodiorite that intrudes the metasediments. The complex is itself cut by two sets of diabase dykes, the older set trending N65°E and the younger set N30°W. Four km south of the southernmost exposures of the complex along the north shore of the East Arm of Great Slave Lake, Aphebian sediments of the Great Slave Supergroup, Blanchet Formation, are exposed on Blanchet Island.

The age reported here is an unusual one for the southern part of the Slave Province, where almost all ages obtained from the plutonic rocks are between 2300 and 2700 m.y. The pluton of biotite granodiorite intruded by the Blachford Lake alkali-feldspar granite has not been dated, but there is no reason to suspect that it is of different age than other similar plutonic rocks in the region; it is petrologically like, and probably belongs to the same plutonic suite as, the Southeast Granodiorite, 50 km to the northwest, for which an age in excess of 2600 m.y. has been established (Green and Baadsgaard, 1971).

Sediments of the Great Slave Supergroup may lie unconformably upon the southern part of the Blachford Lake complex beneath the East Arm of Great Slave Lake north of Blanchet Island, although it seems more likely that the two are separated by an east-northeasterly dislocation zone (Hoffman, 1973). In any event, the Blanchet Formation is not older than 1744 ± 17 m.y., the recently determined Rb-Sr isochron age of the volcanic rocks of the slightly older Seton Formation (Hoffman, 1969; R.K. Wanless, pers. comm.).

The N30°W trending diabase dykes that cut the Blachford Lake complex are probably members of the Mackenzie swarm, considered to be about 1300 m.y. old (Fahrig et al., 1965). The age of the N65°E diabase dyke set is not known. Ages determined for diabase dikes of similar trend some 80 km to the northwest vary between 2300 and 1800 m.y. (Wanless et al., 1965; Wanless et al., 1972; Leech, 1966), but it is possible that these two swarms are unrelated. 32 km west-southwest of Blachford Lake, a thin, subhorizontal diabase sheet within biotite granodiorite has been dated at 2487 ± 64 m.y. (this report, GSC 76-184). However, no flat diabase sheets are known within any part of the Blachford Lake complex.

The unusual age of 2057 m.y. reported here, therefore, is not in conflict with other ages determined in the region, nor with interpretation of the geological succession. It suggests that some plutonism in the southern Slave Province occurred considerably later than the accepted time of the end of Kenoran Orogeny (about 2400 m.y.); the nature of the Blachford Lake complex itself indicates high level emplacement under stable (post-tectonic) crustal conditions.

References

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1972: Granite studies in the Slave Province, in Report of Activities, Part A, Geol. Surv. Can., Paper 72-1A, p. 109-115.

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1965: Age determinations and geological studies, part 1: Isotopic ages, report 5; Geol. Surv. Can., Paper 64-17, pt. 1, p. 47.

Wanless, R.K., Stevens, R.D., Lachance, G.R., and Delabio, R.N.
1972: Age determinations and geological studies; K-Ar isotopic ages, report 10; Geol. Surv. Can., Paper 71-2, p. 42.

District of Keewatin
(GSC 76-189 to GSC 76-197)

GSC 76-189 Hornblende, K-Ar age **1742 ± 75 m.y.**

K = 0.287%, $^{40}Ar/^{40}K$ = 0.1676, radiogenic Ar = 96.0%.
Concentrate: Clean, fresh and unaltered, pleochroic, green to brown hornblende with no visible contamination.

From lamprophyre
(55 M) 6.4 km north of the north end of MacQuoid Lake, District of Keewatin, 63°33'44"N, 94°43'41"W. Sample RM-383B-72, collected and described by E.W. Reinhardt.

The sample rock is a massive, medium grained lamprophyre with biotite, hornblende and potash feldspar phenocrysts. The specimen is from a 15-m-wide dyke, which strikes at 130°, dips almost vertically and cuts Kenoran(?) quartz monzonite. The dyke is one of the largest of a set of southeast to east-southeast trending lamprophyre dykes in the Gibson-MacQuoid Lakes map-area.

GSC 76-190 Whole-rock, K-Ar age **1458 ± 45 m.y.**

K = 2.13%, $^{40}Ar/^{40}K$ = 0.1287, radiogenic Ar = 99.2%.
Concentrate: Crushed whole-rock.

From diabase
(56 D) On Bowell Islands, north side of Chesterfield Inlet, District of Keewatin, 64°00'11"N, 94°08'33"W. Sample RM-301A-72, collected and described by E.W. Reinhardt.

The rock is from a dyke of dark grey, medium grained diabase with subophitic texture. It appears to be unaltered and contains visible iron sulphide and magnetite. It cuts an older, deformed diabase dyke striking at 240°. Both dykes are about 12 m wide. This is the youngest diabase recognized in the map-area and provides a minimum age for the east-west dyke swarm.

GSC 76-191 Biotite, K-Ar age **1773 ± 42 m.y.**

K = 7.84%, $^{40}Ar/^{40}K$ = 0.1721, radiogenic Ar = 99.6%.
Concentrate: Clean, fresh and unaltered, light greenish brown biotite with no visible contamination.

From gneiss
(55 M) 19.3 km south of Chesterfield Inlet, District of Keewatin, 63°49'06"N, 94°06'10"W. Map unit 12, Geol. Surv. Can., Map 1216A. Sample RMS-408-72, collected and described by G.B. Skippen and E.W. Reinhardt.

See GSC 76-192 for description.

GSC 76-192 Hornblende, K-Ar age **1883 ± 52 m.y.**

K = 0.732%, $^{40}Ar/^{40}K$ = 0.1891, radiogenic Ar = 98.4%.
Concentrate: Clean, fresh and unaltered, pleochroic, olive-green to bluish green hornblende with no visible contamination.

From gneiss
(55 M) Details as for GSC 76-191.

The rock is a gneiss, foliated with biotite and hornblende, and showing some minor evidence of recrystallization during shear deformation. It consists mainly of medium grained quartz, plagioclase, biotite and hornblende. The unit forms part of a sequence of metamorphosed and migmatized sediments and volcanics that are thought to be Archean. The ages, however, indicate the effect of Hudsonian metamorphic events.

GSC 76-193 Hornblende, K-Ar age **1729 ± 50 m.y.**

K = 0.515%, $^{40}Ar/^{40}K$ = 0.1657, radiogenic Ar = 98.7%.
Concentrate: Pleochroic, olive-green to dark green hornblende with less than 2% alteration to chlorite.

From diabase
(55 N) South end of Gibson Lake, District of Keewatin, 63°23'32"N, 93°04'34"W. Sample RMC-066A-72, collected and described by F.W. Chandler and E.W. Reinhardt.

The sample is from a massive, medium grained diabase. It is 30 m wide, trends 245°, dips vertically and cuts supposed Archean lithologies.

GSC 76-194 Biotite, K-Ar age **1654 ± 50 m.y.**

K = 7.73%, $^{40}Ar/^{40}K$ = 0.1549, radiogenic Ar = 99.2%.
Concentrate: Greenish brown biotite with approximately 7% chlorite alteration.

From granodiorite
(55 N) Primrose Island, District of Keewatin, 63°52'56"N, 93°00'07"W. Map-unit 13, Geol. Surv. Can., Map 1216A. Sample RMS-080-72, collected and described by G.B. Skippen and E.W. Reinhardt.

See GSC 76-195 for description.

GSC 76-195 Hornblende, K-Ar age **1726 ± 50 m.y.**

K = 0.972%, $^{40}Ar/^{40}K$ = 0.1652, radiogenic Ar = 99.1%.
Concentrate: Clean, fresh and unaltered, pleochroic, olive-green to dark bluish green hornblende with a slight trace of chlorite contamination.

From granodiorite
(55 N) Details as for GSC 76-194.

The rock is a grey, slightly foliated, medium grained granodiorite. The granodiorite body is one of a suite of late intrusives (granodiorite-granite) that cuts Kenoran(?) migmatites.

GSC 76-196 Biotite, K-Ar age **1700 ± 41 m.y.**

K = 7.27%, $^{40}Ar/^{40}K$ = 0.1615, radiogenic Ar = 99.3%.
Concentrate: Clean, fresh and unaltered, reddish orange biotite with no visible contamination.

From quartzite
(56 P) 37 km S28°W of Cape Weynton, Ellice Hills, west of Committee Bay, District of Keewatin, 67°27'N, 88°30'W. Map-unit 3, Map 14-1966 (W.W. Heywood). Sample FS-72-11, collected and interpreted by T. Frisch.

See GSC 76-197 for description and interpretation.

GSC 76-197 Muscovite, K-Ar age **1615 ± 49 m.y.**

K = 6.01%, $^{40}Ar/^{40}K$ = 0.1495, radiogenic Ar = 98.8%.
Concentrate: Clean, clear, fresh muscovite with no visible contamination.

From quartzite
(56 P) Details as for GSC 76-196.

The micas dated come from a foliated garnet-sillimanite (fibrolite)-muscovite-biotite quartzite, part of a major metaquartzite unit in the southwestern part of the Prince Albert sedimentary-volcanic belt.

A number of K-Ar determinations are available from the more or less gneissic granitoid rocks in the general area of the Prince Albert belt but none from rocks of the belt itself. The granitoid rocks commonly intrude the Prince Albert Group, probably as a result of remobilization. It was hoped that the sample submitted might give an age greater than the 1600-1700 m.y. K-Ar date yielded by the granitoid rocks. Unfortunately, it is evident that the metaquartzite has also been strongly affected by the Hudsonian thermal event so pervasive in this area.

GSC 76-198 Whole-rock, K-Ar age **2368 ± 270 m.y.** / **2393 ± 270 m.y.**

$K = \frac{0.089}{0.088}\%$, $^{40}Ar/^{40}K = \frac{0.2769}{0.2821}$, radiogenic Ar = 92.1%.
Concentrate: Crushed whole-rock.

From diabase
(63 H) Northwest channel, Playgreen Lake, Manitoba, 53°56'35"N, 98°02'20"W. Map-unit 10, Geol. Surv. Can., Paper 72-29. Sample EE720704, collected and interpreted by I.F. Ermanovics.

The rock is a differentiated, aphanitic to medium grained, basaltic diabase dyke.

See GSC 76-201 for interpretation.

GSC 76-199 Whole-rock, K-Ar age **1337 ± 96 m.y.**

K = 0.178%, $^{40}Ar/^{40}K$ = 0.1139, radiogenic Ar = 94.2%.
Concentrate: Crushed whole-rock.

From diabase
(63 H) Washahigan Lake, Manitoba, 53°55'30"N, 96°56'00"W. Map-unit 10, Geol. Surv. Can., Paper 72-29. Sample EE721001, collected and interpreted by I.F. Ermanovics.

The rock is an aphanitic, massive, basaltic diabase dyke.

See GSC 76-201 for interpretation.

GSC 76-200 Whole-rock, K-Ar age **1646 ± 111 m.y.**

K = 0.168%, $^{40}Ar/^{40}K$ = 0.1537, radiogenic Ar = 89.0%.
Concentrate: Crushed whole-rock.

From diabase
(63 H) Estuary of Bélanger River on Lake Winnipeg, Manitoba, 53°28'06"N, 97°38'40"W. Map-unit 10, Geol. Surv. Can., Paper 72-29. Sample EE720102, collected and interpreted by I.F. Ermanovics.

The sample is from a massive, aphanitic, basaltic diabase dyke.

See GSC 76-201 for interpretation.

GSC 76-201 Whole-rock, K-Ar age **2997 ± 67 m.y.** / **2974 ± 68 m.y.**

K = 0.701%, $^{40}Ar/^{40}K = \frac{0.4301}{0.4237}$, radiogenic Ar = $\frac{99.5\%}{99.3\%}$.
Concentrate: Crushed whole-rock.

From diabase
(63 H) Shoal in southern part of Playgreen Lake, Manitoba, 53°48'45"N, 98°02'30"W. Map-unit 10, Geol. Surv. Can., Paper 72-29. Sample EE720202, collected and interpreted by I.F. Ermanovics.

The sample is of aphanitic, massive, basaltic diabase from a narrow (2.5 cm to 28 cm) dyke.

The purpose of these four age determinations was to give an estimate of the age of emplacement of the Molson dykes. The samples should be compared with those collected by W.H. Fahrig at Molson Lake (GSC 64-77 at 1445 ± 180 m.y. and GSC 64-79 at 1280 ± 180 m.y.). The petrography, chemistry and paleomagnetic data for these dykes is discussed by Ermanovics and Fahrig (1975).

Samples GSC 76-198 and 201, yielding ages of 2400 and 3000 m.y., contain 0.09 and 0.70% K respectively. Very small quantities of excess argon in these samples could account for their anomalously great age. The age of the Molson dykes is considered to vary from 1300 to 1700 m.y. and the range probably reflects variation in the loss of argon during late stage deuteric and hydrothermal alteration of the dykes.

Attempts at Rb-Sr age determinations failed due to low Rb and Sr content of the dykes. Rubidium for all dykes ranged from 6 to 41 ppm and Sr ranged from 65 to 110 ppm.

Reference

Ermanovics, I. and Fahrig, W.
1975: The petrochemistry and paleomagnetism of the Molson dykes, Manitoba; Can. J. Earth Sci., v. 12, p. 1564-1575.

GSC 76-202 Biotite, K-Ar age **2065 ± 48 m.y.**

K = 7.70%, $^{40}Ar/^{40}K$ = 0.2195, radiogenic Ar = 99.6%.
Concentrate: Clean, fresh, light green biotite with no visible contamination or alteration.

From gneiss
(63 H) 9.7 km south of Norway House on the Gunisao River, Manitoba, 53°53'45"N, 97°49'W. See Norway House and Grand Rapids maps (in prep.). Sample EE71-1205, collected and interpreted by I.F. Ermanovics.

See GSC 76-203 for description and GSC 76-207 for interpretation.

GSC 76-203 Hornblende, K-Ar age **2684 ± 63 m.y.**

K = 0.825%, $^{40}Ar/^{40}K$ = 0.3475, radiogenic Ar = 98.8%.
Concentrate: Relatively clean, fresh, unaltered, pleochroic yellowish brown to dark green hornblende with a trace of biotite contamination.

From gneiss
(63 H) Details as for GSC 76-202.

The rock is a fine- to medium-grained, dark grey to black hornblende-quartz-biotite-oligoclase gneiss with rare 3 to 4 mm porphyroblasts of grey plagioclase and pink microcline. The main constituents are oligoclase (38%), quartz (21%), hornblende (12.6%), biotite (27.4%) and microcline (less than 1%).

See GSC 76-207 for interpretation.

GSC 76-204 Biotite, K-Ar age **2469 ± 53 m.y.**

K = 7.64%, $^{40}Ar/^{40}K$ = 0.2983, radiogenic Ar = 98.9%.
Concentrate: Clean, fresh, light green biotite with no visible alteration or contamination.

From granodiorite
(63 H) At rapids on Belanger River, Manitoba, 53°26'40"N, 96°43'40"W. See Norway House and Grand Rapids maps (in prep.). Sample EE71-1420, collected and interpreted by I.F. Ermanovics.

See GSC 76-205 for description and GSC 76-207 for interpretation.

GSC 76-205 Hornblende, K-Ar age **2602 ± 63 m.y.**

K = 0.768%, $^{40}Ar/^{40}K$ = 0.3281, radiogenic Ar = 99.5%.
Concentrate: Clean, unaltered, pleochroic, yellow-brown to bluish green hornblende with less than 2% free biotite contamination.

From granodiorite
(63 H) Details as for GSC 76-204.

The specimen is a grey, medium grained, equigranular, weakly foliated hornblende-biotite granodiorite consisting mainly of oligoclase (49%), quartz (18%), biotite (11%), hornblende (6%), microcline (5%) and minor epidote.

See GSC 76-207 for interpretation.

GSC 76-206 Hornblende, K-Ar age **2569 ± 61 m.y.**

K = 0.614%, $^{40}Ar/^{40}K$ = 0.3204, radiogenic Ar = 99.3%.
Concentrate: Clean, unaltered, pleochroic, yellowish brown to dark bluish green hornblende with no visible contamination.

From diorite
(63 H) West shore of Gunisao Lake, Manitoba, 53°31' 25"N, 96°23'00"W. See Norway House and Grand Rapids map-sheet (in prep.). Sample EED71-56, collected and interpreted by I.F. Ermanovics.

The rock is a coarse grained, massive diorite with epidote streaks. It consists primarily of andesine (59%), hornblende (35%), biotite (2%), quartz (1.2%) and microcline (0.2%).

See GSC 76-207 for interpretation.

GSC 76-207 Biotite, K-Ar age **2503 ± 55 m.y.**

K = 7.88%, $^{40}Ar/^{40}K$ = 0.3057, radiogenic Ar = 99.8%.
Concentrate: Relatively clean, light greenish biotite with less than 2% chlorite.

From granodiorite
(63 H) Southeastern shore of Gunisao Lake, Manitoba, 53°32'00"N, 96°11'45"W. See Norway House and Grand Rapids map (in prep.). Sample EE71-1010, collected and interpreted by I.F. Ermanovics.

The rock is a foliated medium- to coarse-grained, pale pink granodiorite with phenocrysts of plagioclase. Main constituents are oligoclase (65%), quartz (25%), microcline (5%) and biotite (4%).

Biotite-hornblende pairs GSC 76-202 and 203, 204 and 205, and samples 206 and 207 were undertaken to illustrate the relative greater argon retentivity of hornblende to biotite. At least one of the hornblende results (GSC 76-203 at 2684 ± 63 m.y.) appears a little too high. There is some indication that excessively high $^{40}Ar/^{36}Ar$ ratios exist in rocks of this area. Further hornblende analyses on various rock types are warranted to resolve the significance of this higher age.

Sample GSC 76-202 (biotite at 2065 ± 48 m.y.) corroborates a biotite age of 2190 ± 125 m.y. (GSC 60-85, Lowdon, 1961) from the same area, whereas the associated hornblende has retained argon yielding an age of 2684 ± 63 m.y. The biotite ages represent the southernmost extent of reset Kenoran ages (2500 m.y.); at this latitude hornblende ages are not reset. A program of K-Ar age determinations should continue in northwestern Superior Province to define the biotite and hornblende "chrontour" (Armstrong, 1966, p. 128).

Hornblende ages GSC 76-206 (2569 ± 61 m.y.) and GSC 76-205 (2602 ± 63 m.y.) come from post-kinematic (massive) granodiorite and quartz diorite, considered to be cogenetic with quartz monzonite in the Berens River-Deer Lake map-area. Here, whole-rock Rb-Sr ages on quartz monzonites (pers. comm., Wanless, 1976) at Horseshoe Lake (where they intrude metamorphosed volcanic rocks) and at Apisko Lake (where they intrude gneissic granodiorite) yield ages of 2470 ± 43, and 2586 ± 160 m.y. respectively. Thus, K-Ar ages of hornblende easily attain and surpass the range of ages produced by the Rb-Sr method. There is also excellent concordance of K-Ar biotite ages from these hornblende-biotite pairs with respect to the Rb-Sr ages (sample GSC 76-207 biotite at 2503 ± 55 m.y., and sample GSC 76-204 biotite at 2469 ± 53 m.y.).

It is concluded that massive, K-rich rocks can yield comparable ages by either the Rb-Sr or K-Ar method.

References

Armstrong, R.L.
1966: K/Ar dating of plutonic and volcanic rocks in orogenic belts; in Potassium Argon Dating, Springer-Verlag, New York Inc., p. 117.

Lowdon, J.A.
1961: Age determinations by the Geological Survey of Canada; Geol. Surv. Can., Paper 61-17, p. 51.

GSC 76-208 Biotite, K-Ar age **2153 ± 48 m.y.**

K = 7.69%, $^{40}Ar/^{40}K$ = 0.2353, radiogenic Ar = 99.6%.
Concentrate: Clean, fresh and unaltered, light brown biotite with no visible contamination.

From foliated quartz diorite
(63 H) Northeastern shore of Ponask Lake, Manitoba, 53°52'15"N, 96°20'01"W. Map-unit 5a, Geol. Surv. Can., Map 72-29. Sample EE72-A1, collected and interpreted by I.F. Ermanovics.

See GSC 76-209 for description and interpretation.

GSC 76-209 Hornblende, K-Ar age **2668 ± 64 m.y.**

K = 0.870%, $^{40}Ar/^{40}K$ = 0.3437, radiogenic Ar = 98.7%.
Concentrate: Clean, fresh and unaltered, pleochroic, olive-green to dark green hornblende with no visible contamination.

From foliated quartz diorite
(63 H) Details as for GSC 76-208.

The rock is a foliated quartz diorite with phenocrysts of plagioclase. The principal constituents are epidotized andesine, strained quartz, hornblende and biotite showing some alteration to chlorite, epidote, sphene and zircon. The biotite and hornblende are of metamorphic origin.

These results from Ponask Lake represent the southernmost occurrence of reset Ar in biotite from a mean age value of ca. 2500 m.y. A $^{206}Pb/^{207}Pb$ zircon age from the same sample yielded 2703 m.y. (pers. comm., R.K. Wanless, 1975). Whole-rock Rb-Sr analysis was unsuccessful due to the small range of Sr present. Age determinations 32 and 48 km south of the Ponask Lake lineament show normal K-Ar values (e.g. GSC 76-204, 205, 206 and 207). The 'chrontour' defining the southern limit of reset K-Ar biotite ages thus lies either along the Ponask Lake lineament or just south of it east of Lake Winnipeg.

The hornblende age of 2668 ± 64 m.y. may be slightly high, as is the case in other biotite-hornblende pairs where biotite yields a reset age (e.g. GSC 76-202 and 203).

GSC 76-210 Hornblende, K-Ar age $\begin{matrix}\textbf{4760 ± 195 m.y.}\\ \textbf{4590 ± 190 m.y.}\end{matrix}$

$K = 0.237\%$, $^{40}Ar/^{40}K = \frac{1.2657}{1.1473}$, radiogenic
$Ar = \frac{97.8\%}{98.4\%}$.
Concentrate: Clean, pleochroic bright green to bluish green, fine grained hornblende with no visible contamination.

From slate
(42 E) Highway 625, 13 km south of intersection with Highway 11, Seagram-Pagwachuan area, Ontario, 49°41'00"N, 86°17'50"W. Sample SH-31-60, collected and interpreted by C.H. Stockwell.

This is a dark grey, fine grained schist containing chlorite, biotite, and hornblende. The minerals are oriented more or less parallel with one another and the hornblende forms the larger crystals. The schist is crossed by a few stringers of quartz.

The hornblende was expected to give an age only slightly younger than its time of crystallization but the age obtained, being older than the age of the earth, is obviously highly anomalous due to its content of excess argon.

GSC 76-211 Whole-rock, K-Ar age **1563 ± 47 m.y.**

$K = 1.12\%$, $^{40}Ar/^{40}K = 0.1424$, radiogenic
$Ar = 99.1\%$.
Concentrate: Crushed whole-rock.

From crystal tuff
(41 J) On hill with relay station, Hwy. 108, north of Elliot Lake, Ontario, 46°26'N, 82°40'W. Sample CS-EL-10, collected and interpreted by C. Schluchter (Zurich).

A volcanic tuff was discovered during field work in 1974 within the coarse diamictic sediments of the Gowganda Formation north of Elliot Lake. This tuff deposit has a lense-like occurrence within the clastic sequence and seems to be related to an unconformity. The field evidence is not fully conclusive but the possibility exists that the tuff "layer" rests on top of a weathered surface and, perhaps, is itself weathered.

The rock is a crystalline tuff of sand grain size and consisting of plagioclase (75%), chlorite (25%) with accessory minerals pyrite and quartz.

The age of 1563 ± 47 m.y. is, compared to Rb-Sr isochron age of 2160 m.y. for the post-Gowganda Nipissing Diabase, clearly too young for the age of the Gowganda Formation.

Considering both the K-Ar age obtained and the field evidence it seems possible that the tuff horizon before being covered by an upper tillite was subject to weathering.

GSC 76-212 Biotite, K-Ar age **2315 ± 65 m.y.**

K = 7.82%, $^{40}Ar/^{40}K$ = 0.2666, radiogenic Ar = 99%.
Concentrate: Clean, straw-brown to olive-green biotite with no detected chlorite.

From granite
(32 C) East of Megiscane River crossing on Senneterre to Forsythe road, 21.5 km east of Senneterre, Quebec, 48°21'48"N, 77°02'30"W. Map-unit 11b, Geol. Surv. Can., Map 997A. Sample WN-13-67, collected by R.K. Wanless and R.D. Stevens.

See GSC 76-213 for description.

GSC 76-213 Hornblende, K-Ar age **2670 ± 75 m.y.**

K = 0.765%, $^{40}Ar/^{40}K$ = 0.3445, radiogenic Ar = 96%.
Concentrate: Fresh, pleochroic, straw-yellow to dark green hornblende with a slight trace of chlorite and quartz, and approximately 5% biotite contamination.

From granite
(32 C) Details as for GSC 76-212.

The rock is a grey, hornblende-biotite granite consisting of somewhat kaolinized feldspars, strained quartz, hornblende, biotite, epidote, and accessory sphene, apatite and rounded zircon.

These ages are reconnaissance determinations in an area where no previous geochronological information was available.

GSC 76-214 Hornblende, K-Ar age **2495 ± 75 m.y.**

K = 0.997%, $^{40}Ar/^{40}K$ = 0.3076, radiogenic Ar = 99.7%.
Concentrate: Fresh, pleochroic, pale yellow-green to green hornblende with a trace of quartz and chlorite contamination.

From gabbroic gneiss
(32 C) About 5 km north of Paradis on road to Forsythe, Quebec, 48°15'30"N, 76°35'24"W. Map-unit 4c, Q.M.R.N. Geol. Rep. 169, 1976. Sample WN-18-67, collected by R.K. Wanless and R.D. Stevens.

The rock consists of hornblende, biotite, plagioclase and minor epidote. The age is a reconnaissance determination in an area where no previous geochronological information was available.

GSC 76-215 Biotite, K-Ar age **1825 ± 60 m.y.**

K = 7.14%, $^{40}Ar/^{40}K$ = 0.1798, radiogenic Ar = 99%.
Concentrate: Impure, straw-brown biotite with approximately 17% chlorite contamination.

From gneiss
(32 C) Approximately 3.4 km north-northeast of the Senneterre to Forsythe road, approximately 14.2 km east-southeast of the south end of lac Faillon, Quebec, 48°17'18"N, 76°31'30"W. Map-unit 4c, Q.M.R.N. Geol. Rep. 169, 1976. Sample WN-15-67, collected by R.K. Wanless and R.D. Stevens.

See GSC 76-216 for description.

GSC 76-216 Hornblende, K-Ar age **2465 ± 75 m.y.**

K = 0.91%, $^{40}Ar/^{40}K$ = 0.2977, radiogenic Ar = 98%.
Concentrate: Fresh, pleochroic, straw-yellow to dark green hornblende with trace contaminants of chlorite, biotite and quartz.

From gneiss
(32 C) Details as for GSC 76-215.

The rock is a hornblende-biotite gneiss in which both plagioclase and potash feldspar are somewhat sericitized and the quartz is strained and fractured. The abundant hornblende and biotite are fresh and are accompanied by epidote and sphene, with accessory apatite and rare zircon.

These ages are reconnaissance determinations in an area where no previous geochronological information was available.

GSC 76-217 Hornblende, K-Ar age **2439 ± 60 m.y.**

K = 0.484%, $^{40}Ar/^{40}K$ = 0.2919, radiogenic Ar = 81.6%.
Concentrate: Slightly altered, pleochroic, light green to dark green hornblende with a trace of chlorite contamination.

From mafic gneiss
(32 C) 16.7 km north of Senneterre on Chibougamau road near lac Bernadette, Quebec, 48°34'N, 77°07'W. Sample WN-20-70, collected by R.K. Wanless and R.D. Stevens.

The sample is from a medium grained, strongly gneissic rock consisting of highly sericitized plagioclase, altered hornblende, chlorite, quartz and powdery opaque clots. Accessory minerals include apatite, sphene and iron oxides. The date obtained represents the age of metamorphism in an area where no previous geochronological information was available.

GSC 76-218 Biotite, K-Ar age **2552 ± 53 m.y.**

K = 7.34%, $^{40}Ar/^{40}K$ = 0.3167, radiogenic Ar = 99.9%.
Concentrate: Light brown biotite with approximately 6% chlorite alteration.

From granite
(32 C) Chibougamau road, 70.8 km north of Senneterre, 5.8 km north of Beatyville Station, Quebec, 48°56'48"N, 77°06'30"W. Sample WN-23-70, collected by R.K. Wanless and R.D. Stevens.

See GSC 76-219 for description.

GSC 76-219 Hornblende, K-Ar age **2621 ± 63 m.y.**

K = 0.680, $^{40}Ar/^{40}K$ = 0.3324, radiogenic Ar = 99.4%.
Concentrate: Clean, fresh and unaltered, pleochroic, brown to green hornblende with no visible contamination.

From granite
(32 C) Details as for GSC 76-218.

The rock is a hornblende biotite granite consisting mainly of altered potash feldspar (microcline and microperthite), strained quartz, minor plagioclase, relatively abundant green hornblende and brown biotite, and accessory epidote, sphene, apatite, dusty opaques and occasional zircon. These ages are reconnaissance determinations in an area where no previous geochronological information was available.

GSC 76-220 Hornblende, K-Ar age **2630 ± 63 m.y.**

K = 0.622, $^{40}Ar/^{40}K$ = 0.3347, radiogenic Ar = 99.3%.
Concentrate: Clean, fresh and unaltered, pleochroic, brownish green to dark green hornblende with no visible contamination.

From adamellite
(32 F) 115.8 km from Senneterre on Chibougamau road, Quebec, 49°16'N, 76°53'W. Sample WN-25-70, collected by R.K. Wanless and R.D. Stevens.

The sample is from a coarse grained hornblende adamellite consisting primarily of altered zoned plagioclase, potash feldspar (microcline and microperthite), strongly strained quartz, green hornblende, chlorite pseudomorphs after original biotite, and accessory epidote, sphene, apatite and opaques. This age is a reconnaissance determination in an area where no previous geochronological information was available.

GSC 76-221 Hornblende, K-Ar age **2659 ± 63 m.y.**

K = 0.510%, $^{40}Ar/^{40}K$ = 0.3416, radiogenic Ar = 98.6%.
Concentrate: Slightly pleochroic, light green to dark green hornblende with traces of both chlorite and biotite contamination.

From adamellite
(32 G) 220.4 km from Senneterre on Chibougamau road, in road-cut southwest of creek running into lac Renault, Quebec, 49°46'N, 75°53'W. Sample WN-30-70, collected by R.K. Wanless and R.D. Stevens.

The rock is a medium- to coarse-grained hornblende adamellite consisting of strained and recrystallized quartz, sericitized plagioclase and potash feldspar (including microcline and microperthite), green hornblende and accessory epidote and sphene. This age is a reconnaissance determination in an area where no previous geochronological information was available.

GSC 76-222 Biotite, K-Ar age **2415 ± 52 m.y.**

K = 7.15%, $^{40}Ar/^{40}K$ = 0.2868, radiogenic Ar = 99.8%.
Concentrate: Light greenish biotite with approximately 8% chlorite alteration.

From adamellite gneiss
(32 G) Chibougamau road, 226.1 km northeast of Senneterre, Quebec, 49°51'N, 75°52'W. Sample WN-32-70, collected by R.K. Wanless and R.D. Stevens.

The rock is a pink, strongly foliated, recrystallized, medium grained biotite adamellite gneiss composed of heavily fractured and recrystallized quartz, potash feldspar (including microperthite), plagioclase, green biotite and epidote. Accessory minerals include sphene, pyrite and apatite. This age is a reconnaissance determination in an area where no previous geochronological information was available.

GSC 76-223 Biotite, K-Ar age **2514 ± 53 m.y.**

K = 6.96%, $^{40}Ar/^{40}K$ = 0.3081, radiogenic Ar = 99.9%.
Concentrate: Light greenish brown biotite with approximately 4% chlorite alteration.

From metagabbro(?)
(32 G) Chibougamau road, 226.1 km northeast of Senneterre, Quebec, 49°52'N, 75°52'W. Sample WN-34-70, collected by R.K. Wanless and R.D. Stevens.

See GSC 76-224 for description.

GSC 76-224 Hornblende, K-Ar age **2593 ± 62 m.y.**

K = 0.328%, $^{40}Ar/^{40}K$ = 0.3261, radiogenic Ar = 98.8%.
Concentrate: Clean, fresh and unaltered, pleochroic, light green to dark green hornblende with no visible contamination.

From metagabbro(?)
(32 G) Details as for GSC 76-233.

These samples are from a strongly "spotted" rock about 60 m north of the contact with adamellite of sample GSC 76-222. The rock consists of coarse clots of green hornblende, brown biotite and magnetite embedded in a finer, calcite-bearing matrix. These ages are reconnaissance determinations in an area where no previous geochronological information was available.

GSC 76-225 Biotite, K-Ar age **2539 ± 53 m.y.**

K = 7.05%, $^{40}Ar/^{40}K$ = 0.3137, radiogenic Ar = 99.9%.
Concentrate: Light greenish brown biotite with approximately 4% chlorite alteration.

From knotted schist
(32 G) Chibougamau road, 226.1 km northeast of Senneterre, Quebec, 49°51'N, 75°52'W. Sample WN-33-70, collected by R.K. Wanless and R.D. Stevens.

See GSC 76-226 for description.

GSC 76-226 Hornblende, K-Ar age **2538 ± 62 m.y.**

K = 0.638%, $^{40}Ar/^{40}K$ = 0.3135, radiogenic Ar = 99.3%.
Concentrate: Pleochroic, light green to dark green hornblende with approximately 3% attached biotite contamination.

From knotted schist.
(32 G) Details as for GSC 76-225.

The two minerals are from a knotted schist consisting primarily of hornblende with lesser biotite and epidote. The hornblende knots are surrounded by fine quartz. The ages are reconnaissance determinations in an area where no previous geochronological information was available.

GSC 76-227 Hornblende, K-Ar age **1928 ± 53 m.y.**

K = 0.607%, $^{40}Ar/^{40}K$ = 0.1964, radiogenic Ar = 97.6%.
Concentrate: Clean fresh, and unaltered, pleochroic, light brown to green hornblende with no visible contamination.

From amphibolite
(23 P) 5 km east of headwaters of the George River, Quebec, 55°02'N, 64°17'W. Sample BT-71, collected by A.J. Baer and interpreted by F.C. Taylor.

See GSC 76-229 for description and interpretation.

GSC 76-228 Hornblende, K-Ar Isochron age **2770 m.y.**

K = 0.903%, $^{40}Ar/^{40}K$ = 0.3682, radiogenic Ar = N.A.
Concentrate: Clean, unaltered pleochroic, brown to green hornblende with no visible contamination.

From amphibolite
(23 P) 10 km south of southern end of lac Raude, Quebec, 55°07'N, 64°12'W. Map-unit 12, Geol. Surv. Can., Paper 71-48. Sample TA-598, collected and interpreted by F.C. Taylor.

This is an "Isochron age" derived from two determinations giving individual ages of 2814 ± 65 and 2953 ± 67 m.y.

See GSC 76-229 for description and interpretation.

GSC 76-229 Hornblende, K-Ar age **1629 ± 49 m.y.**

K = 1.07%, $^{40}Ar/^{40}K$ = 0.1514, radiogenic Ar = 98.4%.
Concentrate: Relatively clean, fresh and unaltered, pleochroic, light green to dark green hornblende with a trace of free biotite impurity.

From amphibolite

(23 P) South of Whitegull Lake, Quebec, 55°10'N, 64° 05'W. Map-unit 12, Geol. Surv. Can., Map 9-1971. Sample TA-584, collected and interpreted by F.C. Taylor.

These three samples are all from amphibolite bodies lying within areas of granitic gneiss of Aphebian age. All the samples are equigranular, foliated, dark grey-green or dark green rocks. GSC 76-228 contains biotite and GSC 76-227 garnet, otherwise all three are similar. Outcrop at GSC 76-229 is cut by a few granite veinlets and at GSC 76-228 a few granite sills are present.

The ages for two of the samples (GSC 76-229 and 229) 1928 ± 53 and 1629 ± 49 are similar to other ages for this gneissic terrane east of the Labrador Trough. The result for sample GSC 76-228 is far in excess of any others for this region. At present no geological basis for this age is forthcoming, unless it is assumed this garnet amphibolite is much older than the other two and is an Archean relict. However, an "isochron" plot constructed from two analyses of that sample indicate an initial $^{40}Ar/^{40}Ar$ ratio of approximately 4000, a value much greater than the normal atmospheric ratio of 296. Consequently, the presence of excess radiogenic argon is indicated.

GSC 76-230 Hornblende, K-Ar age **1715 ± 50 m.y.**

K = 0.999%, $^{40}Ar/^{40}K$ = 0.1637, radiogenic Ar = 99.1%.
Concentrate: Relatively clean, unaltered, pleochroic, olive-brown to dark green hornblende with less than 1% biotite contamination.

From amphibolite

(24 H) George River area, Quebec, 57°25'N, 64°10'W. Sample RM69-176C, collected by E.W. Reinhardt and interpreted by F.C. Taylor.

This sample is from an amphibolite band in a granulite terrane. The amphibolite is a medium grained, equigranular, massive to weakly foliated, dark green rock containing small amounts of biotite and clinopyroxene, as well as the essential constituents.

The age of 1715 ± 50 m.y. is considered to be a metamorphic age, a product of the Hudsonian orogeny. This figure is significantly older than biotite ages from the same general region (GSC 62-138, 1220 m.y. and GSC 64-164, 1340 m.y.) that are from paragneiss (in granulite terrain) and granulite, respectively. This age, however, probably reflects more accurately the time of the metamorphism as it is similar to many other ages in the metamorphic terrain east of the Labrador Trough. Uplift and re-heating by intrusion of large plutons of anorthosite and adamellite are believed to have brought about the younger biotite ages in the region.

GSC 76-231 Biotite, K-Ar age **367 ± 12 m.y.**

K = 7.79%, $^{40}Ar/^{40}K$ = 0.02373, radiogenic Ar = 91.9%.
Concentrate: Clean, fresh and unaltered, light reddish brown biotite with no visible contamination.

From porphyritic granite boulder
(11 L) Glacial erratic, Nicholas Point road, Prince Edward Island, 45°59'35"N, 62°51'20"W. Sample PC99/72, collected and interpreted by V.K. Prest.

See GSC 76-239 for discussion.

GSC 76-232 Biotite, K-Ar age **379 ± 12 m.y.**

K = 7.35%, $^{40}Ar/^{40}K$ = 0.02456, radiogenic Ar = 96.7%.
Concentrate: Brown, slightly altered biotite with approximately 3% chloritization.

From porphyritic granite boulder
(11 L) Poplar Grove marine gravels, Malpeque map-area, Prince Edward Island, 46°38'50"N, 63°54'W. Sample PC100/72, collected and interpreted by V.K. Prest.

See GSC 76-239 for discussion.

GSC 76-233 Biotite, K-Ar age **357 ± 12 m.y.**

K = 7.29%, $^{40}Ar/^{40}K$ = 0.02298, radiogenic Ar = 95.1%.
Concentrate: Light brownish biotite with approximately 4% chlorite contamination as an alteration product of the mica.

From porphyritic granite boulder
(11 L) Exposed by road grading operations 4.8 km east of Uigg, Prince Edward Island, 46°10'N, 62°45'W. Sample PC23/72, collected and interpreted by V.K. Prest.

See GSC 76-239 for discussion.

GSC 76-234 Biotite, K-Ar age **376 ± 12 m.y.**

K = 7.07%, $^{40}Ar/^{40}K$ = 0.02435, radiogenic Ar = 96.1%.
Concentrate: Clean, fresh and unaltered brownish orange biotite with no visible contamination. Some of the mica flakes contain evidence of pleochroic haloes.

From granite gneiss boulder
(11 L) North side of highway 2.7 km northwest of New Glasgow, Prince Edward Island, 46°25'30"N, 63°22'35"W. Sample PC40/72, collected and interpreted by V.K. Prest.

See GSC 76-239 for discussion.

GSC 76-235 Biotite, K-Ar age **1043 ± 29 m.y.**

K = 7.18%, $^{40}Ar/^{40}K$ = 0.08153, radiogenic Ar = 98.3%.
Concentrate: Relatively clean, fresh and unaltered, yellowish brown biotite with a trace of hornblende contamination.

From granite boulder
(11 L) 250 m northeast on side road (west side of road) from point on highway 3.1 km northwest of New Glasgow, Prince Edward Island, 46°25'50"N, 63°22'50"W. Sample PC4/74, collected and interpreted by V.K. Prest.

See GSC 76-236 for associated hornblende and GSC 76-239 for discussion.

GSC 76-236 Hornblende, K-Ar age **1092 ± 36 m.y.**

K = 0.763%, $^{40}Ar/^{40}K$ = 0.08653, radiogenic Ar = 95.7%.
Concentrate: Clean, fresh and unaltered, pleochroic, brown to dark green hornblende with no visible contamination.

From granite boulder
(11 L) Details as for GSC 76-235.

See GSC 76-239 for discussion.

GSC 76-237 Biotite, K-Ar age **893 ± 31 m.y.**

K = 4.16%, $^{40}Ar/^{40}K$ = 0.06686, radiogenic Ar = 97.2%.
Concentrate: Somewhat altered brown biotite with approximately 8% chloritization.

From granite boulder
(11 L) South of Hurry Road south-southwest of Winsloe (north of Charlottetown), Prince Edward Island, 46°16'25"N, 63°10'50"W. Sample PC1/74, collected and interpreted by V.K. Prest.

See GSC 76-239 for discussion.

GSC 76-238 Biotite, K-Ar age **1585 ± 39 m.y.**

K = 6.76%, $^{40}Ar/^{40}K$ = 0.1454, radiogenic Ar = 99.4%.
Concentrate: Olive-green biotite with approximately 7% chlorite alteration.

From monzonite gneiss boulder
(11 L) At fence line near intersection on road north from St. Peters road towards Cable Head, Prince Edward Island, 46°26'10"N, 62°37'W. Sample PC5/74, collected and interpreted by V.K. Prest.

See GSC 76-239 for discussion.

GSC 76-239 Biotite, K-Ar age **372 ± 12 m.y.**

K = 5.88%, $^{40}Ar/^{40}K$ = 0.02409, radiogenic Ar = 97.0%.
Concentrate: Brown biotite with approximately 9% chlorite alteration.

From granite boulder
(11 L) 300 m south of Harmony Junction (north of Souris), Prince Edward Island, 46°24'10"N, 62°15'05"W. Sample PC6/74, collected and interpreted by V.K. Prest.

Potassium-Argon dating of glacial erratics, Prince Edward Island

V.K. Prest

Introduction

Commencing in 1964 a number of glacial erratic boulders and cobbles of granitoid and gneissic rocks were collected for Potassium-Argon analyses. They were collected from the surface of the Pleistocene drift mantle where they had been uncovered by either farm, urban or road development; only one was from within the till. The erratics are clearly foreign to the island as the bedrock is almost entirely comprised of Permo-Carboniferous, continental 'red beds'. The only non-sedimentary rock is a small outcrop at the northeast tip of George (Hogg) Island, Malpeque Bay[1]. This is a sill of basaltic rock and associated breccia approximately 3 m thick. It is also reported to outcrop on the bottom of the bay off the southwestern end of the island. Two diabasic dykes reported by Abraham Gesner (1946) from the north shore of eastern Prince Edward Island have not been seen on the present-day shoreline. In western Prince Edward Island,

[1] See following Table for age-determinations.

K-Ar dates from glacial erratics, Prince Edward Island

Sample No.	Material	Age (m.y.)	Remarks	Latitude (N)	Longitude (W)
GSC 65-133	Biotite	387 ± 12	Porphyritic granite; southwest of Montague	46°08'40"	62°37'30"
GSC 65-134	Biotite	500 ± 20	Biotite granite gneiss; south of Irish Town	46°29'	63°36'12"
GSC 65-135	Biotite	1125 ± 40	Porphyritic granite; north-northwest of New Glasgow or west of Mayfield	46°27'06"	63°23'15"
GSC 66-163	Whole-rock	668 ± 81	Anorthosite; near Parks Corner	46°30'35"	63°34'25"
GSC 70-127	Biotite	381 ± 16	Biotite paragneiss; northeast of O'Leary	46°43'35"	64°07'45"
GSC 70-128	Biotite	376 ± 16	Biotite gneiss; Baltic-Spring Valley road	46°30'40"	63°39'
GSC 70-129	Biotite	387 ± 16	Biotite gneiss; French River-Cape Tryon area	46°31'35"	63°30'35"
GSC 70-130	Biotite	383 ± 16	Porphyritic biotite granite; north-northwest of St. Peters	46°26'	62°35'40"
GSC 72-124	Biotite	341 ± 15	Porphyritic biotite granite; Poplar Grove-Rocky Point road	46°39'	63°54'25"
GSC 76-231	Biotite	367 ± 12	Porphyritic biotite granite; Nicholas Pt. road	45°59'35"	62°51'20"
GSC 76-232	Biotite	379 ± 12	Porphyritic biotite granite; Poplar Grove-Rocky Point road	46°38'50"	63°54'
GSC 76-233	Biotite	357 ± 12	Porphyritic biotite granite; East of Uigg	46°10'	62°45'
GSC 76-234	Biotite	376 ± 12	Biotite granite gneiss; northwest of New Glasgow	46°25'30"	63°22'35"
GSC 76-235	Biotite	1043 ± 29	Fine granite; northwest of New Glasgow	46°25'50"	63°22'50"
GSC 76-236	Hornblende	1092 ± 36	Same sample	46°25'50"	63°22'35"
GSC 76-237	Biotite	893 ± 31	Siliceous granite; Winsloe-Charlottetown	46°16'25"	63°10'50"
GSC 76-238	Biotite	1585 ± 39	Monzonite gneiss; northwest of St. Peters	46°26'10"	62°37'
GSC 76-239	Biotite	372 ± 12	White granite; Souris-Harmony Jct. road	46°24'10"	62°15'05"

K-Ar dates from George (Hogg) Island sill, P.E.I.

Sample No.	Material	Age (m.y.)	Remarks	Latitude (N)	Longitude (W)
GSC 72-125	Whole-rock	210 ± 30	Basalt (dolerite)	46°36'	63°46'05"
GSC 72-126	Whole-rock	211 ± 29	Same sill	46°36'	63°46'05"
WK207h	Whole-rock	207 ± 8	Basalt; analysis by N.J. Snelling, British Overseas Geological Survey	46°36'	63°46'05"

except for two boulders, only those from above the marine limit (M.L.) were submitted for analyses, and in the case of both these erratics they were deposited by a late-phase ice lobe that flowed southward from Gulf of St. Lawrence onto Prince Edward Island, at the time of maximum marine overlap.

Preamble

There has long been controversy as to the source areas of the ice sheet(s) responsible for scouring the Maritime Provinces. A general east-southeast ice-flow pattern on the main Scotian Peninsula and in southwestern New Brunswick was assumed to reflect the regional flow of the Laurentide Ice Sheet; marked diversions form this trend on Cape Breton Island and in the Cobequid Mountains of Nova Scotia, on Prince Edward Island, and in eastern New Brunswick were regarded as late-glacial variations. Yet some geologists had long recognized that the distribution of erratics did not readily 'fit' this concept. In the case of Prince Edward Island the regional ice-flow trend was about N115°E and the erratics were reported to be from New Brunswick (Chalmers, 1896, p. 52M). New Brunswick acidic intrusive rocks are mainly Devonian, though there are also extensive granitoid and gneissic rocks of Ordovician-age. K-Ar dating of glacial erratics on Prince Edward Island would serve therefore to differentiate between erratics from New Brunswick (mainly Devonian in age) and those from the Canadian or Laurentian Shield (Precambrian in age). It should be noted here that a large boulder (GSC 66-163) of black anorthosite northeast of Irishtown, in Malpeque map-area at an elevation of 76 m, is identical mineralogically and petrographically with some anorthosites north of St. Lawrence River; no similar rock has been reported from New Brunswick though they may be present in the Gaspé. Thus a possible Laurentide component among the erratics was recognized prior to the start of the dating program.

The general distribution of glacial erratics on Prince Edward Island is in harmony with the concept of ice from northern New Brunswick flowing east-southeast over the island, i.e. the erratics are very common in the northwest and very rare to absent in the southeast. There is, however, a seeming secondary concentration around Malpeque Bay, and eastward along the entire north coast, and also east of Hillsborough Bay. The dearth of erratics in the east-central and southeastern end of the island may be a 'shadow-effect' in the lee of the high, central part of the island, with sparse erratics merely distributed in the fringe zone around the lee area. Alternatively the erratics were distributed by a later ice flow that tended to wrap around the highlands and thus deposited the erratics in the fringe areas. The concentration of erratics around Malpeque Bay, however, is assuredly related to a late-phase ice flow from Gulf of St. Lawrence. In any case the K-Ar dating of the island's glacial erratics will serve to establish whether the source areas were in the Appalachians (New Brunswick highland and Gaspésia) or in the Laurentian Shield.

Results of the K-Ar boulder-dating Program

Three granitoid erratics have yielded K-Ar ages clearly indicative of a Laurentian Shield source area. Two of these (GSC 65-135 and GSC 76-235, 236) collected on the highlands northwest of New Glasgow in north-central Prince Edward Island, were only 2.4 km apart. They also lie only 16 km east of the earlier mentioned Laurentide? anorthosite (GSC 66-163). The third granite boulder having a Precambrian age (GSC 76-238) was collected 3.2 km west-northwest of St. Peters in the northeastern part of the island. The K-Ar ages of these granite erratics are 1125 ± 40, 1043 ± 29 and 1585 ± 39 m.y. respectively, all based on biotite. A check on the second date utilizing hornblende gave 1092 ± 36 m.y. A fourth date, which may indicate a Laurentide source area, was from a very siliceous granite boulder (GSC 76-237) only 1.6 km northwest of Charlottetown. The date of 893 ± 31 m.y. was based on a limited quantity of altered biotite hence the derived age may be a minimum value.

K-Ar analyses of all other boulders of granitic and gneissic erratics from diverse parts of the island have given ages indicative of source areas in the Appalachians. One analysis (GSC 65-135) is suggestive of an Ordovician intrusive but all the others gave Devonian ages. Both Ordovician and Devonian granites and gneisses outcrop in the New Brunswick highlands and hence it is clear that the last main Wisconsinan ice flow was from New Brunswick rather than from the Laurentian Shield. The minor component of Shield rocks amongst the island's erratics may have first entered the Appalachian highlands via the St. John and/or the Matapedia valleys and then been redistributed by Appalachian ice as it flowed generally eastward from the New Brunswick highlands.

Conclusions

The K-Ar dates provide confirmation of the source areas of carefully selected glacial erratics from Prince Edward Island. (The great bulk of the granitoid erratics on the island are of a porphyritic granite that is both visually and petrographically similar to that which outcrops in New Brunswick; such erratics were not submitted for analyses.) Three of the erratics gave dates that substantiate a Laurentide component in the drift, as was earlier indicated by an anorthosite boulder. The ages of most of the selected erratics, however, indicate that the main contribution was from New Brunswick, a concept which is in harmony with the trend of the main ice-flow features in north-central and all of eastern Prince Edward Island.

References

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Gesner, A.
1846: Report of the geological survey of Prince Edward Island; report to the Lieut. Governor, Prince Edward Island; Charlottetown. Typescript of Report available at library of Geol. Surv. Can.

GSC 76-240 Hornblende, K-Ar age **1242 ± 40 m.y.**

K = 0.476%, $^{40}Ar/^{40}K$ = 0.1028, radiogenic Ar = 95.9%.
Concentrate: Clean, fresh and unaltered, non-pleochroic, dark brown hornblende with no visible contamination.

From metatuff
(13 L) Eastern end of Contact Lake, Labrador, Newfoundland, 54°14'N, 63°47'W. Map-unit 2, Geol. Surv. Can., Map 19-1968. Sample EC63-342A, collected and interpreted by R.F. Emslie.

The sample is a metatuff from the Petscapiskau Group that outcrops around the periphery of, and is intruded by, the Michikamau intrusion. The rock is dark grey-green and thinly layered with very fine grained granoblastic texture. The hornblende is free of inclusions and secondary alteration and is accompanied by plagioclase, quartz, epidote and clinopyroxene. The sample was collected well away from the observed contact aureole of the intrusion and was expected to provide an estimate of the age of regional metamorphism of the Petscapiskau Group. Previously reported ages on minerals of the Michikamau intrusion include hornblende from marginal gabbro that yielded 1479 ± 101 m.y. (GSC 73-164) and biotite from olivine-bearing anorthosite that yielded 1400 ± 50 m.y. (GSC 63-164). In addition, Krogh and Davis (1973) have reported a U-Pb zircon age of about 1460 m.y. from a sample of the adamellite group that forms the youngest member of the intrusive suite. The age of 1242 ± 40 m.y. for the hornblende from the Petscapiskau Group must therefore be related to post-Michikamau intrusion, uplift and cooling or else has been affected by some younger thermal disturbance.

Reference

Krogh, T.E. and Davis, G.L.
1973: The significance of inherited zircons on the age and origin of igneous rocks — an investigation of the Labrador adamellites; Carnegie Inst. Wash., Yearb., v. 72, p. 610-613.

GSC 76-241 Hornblende, K-Ar age **1449 ± 44 m.y.**

K = 0.738%, $^{40}Ar/^{40}K$ = 0.1276, radiogenic Ar = 97.4%.
Concentrate: Clean, fresh and unaltered, pleochroic, light green to dark green hornblende with no visible contamination.

From amphibolite
(13 K) West shore of Shapio Lake, Labrador, Newfoundland, 54°56'N, 61°19'W. Sample EC73-108A, collected and interpreted by R.F. Emslie.

See GSC 76-246 for description and interpretation.

GSC 76-242 Hornblende, K-Ar age **1482 ± 45 m.y.**

K = 0.782%, $^{40}Ar/^{40}K$ = 0.1318, radiogenic Ar = 98.1%.
Concentrate: Clean, fresh and unaltered, non-pleochroic, light brownish green hornblende with no visible contamination.

From gabbro
(13 K) 1.6 km west of shore of Shapio Lake, Labrador, Newfoundland, 54°59'N, 61°21'W. Sample EC73-129E, collected and interpreted by R.F. Emslie.

See GSC 76-246 for description and interpretation.

GSC 76-243 Biotite, K-Ar age **1193 ± 32 m.y.**

K= 7.48%, $^{40}Ar/^{40}K$ = 0.09737, radiogenic Ar = 99.3%.
Concentrate: Clean, fresh, reddish orange biotite with no visible alteration or contamination.

From adamellite
(13 M) North shore of unnamed river, Labrador, Newfoundland, 55°25'N, 62°07'W. Sample EC71-14, collected and interpreted by R.F. Emslie.

See GSC 76-246 for description and interpretation.

GSC 76-244 Hornblende, K-Ar age **1351 ± 42 m.y.**

K = 0.647%, $^{40}Ar/^{40}K$ = 0.1155, radiogenic Ar = 96.8%.
Concentrate: Pleochroic, dark brown to very dark green hornblende with approximately 2% chlorite contamination.

From granite
(13 K) Rock point on north shore of Snegamook Lake, Labrador, Newfoundland, 54°36'N, 61°20'W. Sample EC73-84, collected and interpreted by R.F. Emslie.

See GSC 76-246 for description and interpretation.

GSC 76-245 Whole-rock, K-Ar age **1311 ± 94 m.y.** **1322 ± 94 m.y.**

K = 0.226% / 0.221%, $^{40}Ar/^{40}K$ = 0.1107 / 0.1132, radiogenic Ar = 90.5%.
Concentrate: Crushed whole-rock.

From diabase
(13 L) Labrador, Newfoundland, 54°52'N, 62°26'W. Sample EC71-42, collected and interpreted by R.F. Emslie.

See GSC 76-246 for description and interpretation.

GSC 76-246 Whole-rock, K-Ar age **1080 ± 82 m.y.**

K = 0.147%, $^{40}Ar/^{40}K$ = 0.08529, radiogenic Ar = 80.7%.
Concentrate: Crushed whole-rock.

From olivine diabase
(13 N) 1.6 km northeast of long, narrow lake, central Labrador, Newfoundland, 55°04'N, 61°33'W. Sample EC73-135, collected and interpreted by R.F. Emslie.

This group of samples was submitted as part of an overall study of the Harp Lake Complex. The samples relate to three groups which are described separately as follows: basic (including anorthositic) rocks of the Harp Lake Complex, adamellite and granite which are the younger intrusions of the Harp Lake Complex, and the Harp dykes of olivine diabase that postdate crystallization of the Harp Lake Complex.

Basic rocks of the Harp Lake Complex

Sample GSC 76-241 is hornblende from a pyroxene amphibolite pod within the contact metamorphic aureole of the complex collected about 0.4 km from the contact with marginal gabbros. The rock is medium-grained, massive, and contains about 40% olive-green to brown hornblende, about 30% clinopyroxene plus orthopyroxene, together with plagioclase, quartz and opaque oxides. The envelope rocks on this, the eastern side of the complex, are Archean in age and it was expected that recrystallized hornblende well within the contact aureole should yield an estimate of the time of intrusion of the basic (and anorthositic) rocks of the complex.

Sample GSC 76-242 is hornblende from marginal basic rocks of the Harp Lake Complex collected about 6 m from the contact. The rock sample is a medium grained, layered

olivine plagioclase rock with discontinuous hornblende-rich streaks subparallel to the layering. It contains about 30% fresh brown hornblende, 25% olivine that is partly serpentinized and the remainder is plagioclase and minor opaque oxides. The igneous hornblende was expected to give an estimate of the time of crystallization of the basic rocks of the complex.

These two hornblende samples, with ages 1449 ± 44 m.y. and 1482 ± 45 m.y. for metamorphic hornblende of the contact aureole and igneous hornblende from the intrusion respectively, are identical in age within experimental uncertainty. Because there is no younger metamorphic overprint in the region these ages are believed to approximate the time of intrusion of the basic (and anorthositic) rocks of the complex.

Adamellite and granite of the Harp Lake Complex

Sample GSC 76-243 is biotite from a sample of the large adamellite intrusion on the northeast side of the complex. The rock is coarse grained and massive with large microperthite crystals together with lesser amounts of plagioclase, quartz, olivine, clinopyroxene, hornblende, red-brown biotite, apatite and zircon. Insufficient hornblende was obtained for analysis and biotite was dated as an alternative to estimate the minimum age of crystallization of the adamellite and the time of final cooling. A U-Pb zircon age of about 1450 m.y. was obtained by Krogh and Davis (1973) from a sample of adamellite from this same intrusion and is believed to closely approximate the crystallization age of the adamellite. The age of 1193 ± 32 m.y. for biotite of GSC 76-243 is very young, younger than most other biotites from Elsonian adamellites in the region and may reflect a local thermal disturbance that considerably postdates the magmatic history of the Harp Lake Complex.

Sample GSC 76-244 is hornblende separated from a sample of granite from the intrusion on the southeast flank of the complex. Petrographically and chemically it is closely similar to the adamellites and intrudes anorthosites and adamellites of the complex. The granite is deep pink to red, massive, and medium- to coarse-grained. It contains about 29% quartz, 48% microperthite, 14% plagioclase, 6% hornblende with accessory biotite, apatite, zircon and opaque oxides. Hornblende was dated in an attempt to establish the crystallization age of the granite and yielded 1351 ± 42 m.y. Sufficient zircon was obtained for dating from the same sample and yielded slightly discordant ages with a $^{207}Pb/^{206}Pb$ minimum age of 1426 m.y. (R.K. Wanless, pers. comm., 1974). The age of 1426 m.y. is regarded as the best estimate of the age of crystallization of the granite and the hornblende age of 1351 m.y. presumably relates to cooling and uplift of the complex.

Harp dykes

The Harp dykes are a major swarm of large olivine diabase dykes that strike west-southwest across the Harp Lake Complex and are subvertical. The dykes are fine grained to aphanitic on the margins and have medium grained interiors. They are known to cut all rock types of the Harp Lake Complex except the late granite described above. Two fine grained specimens were selected for whole-rock K-Ar age determination in an attempt to define the age of intrusion of the dykes. Specimen GSC 76-245 yielded an average K-Ar age of 1316 ± 94 m.y. and GSC 76-246 yielded a K-Ar age of 1080 ± 82 m.y. Because of the acknowledged susceptibility of whole-rock systems to argon loss, the older age of 1316 m.y. is believed to be a more reliable indication of the true age of intrusion and even it may be a minimum. Chemically and petrographically, the Harp dykes are similar to the basic volcanics and diabase sills of the Seal Lake Group (Meyers, 1974) which have yielded a Rb-Sr whole-rock isochron age of 1278 ± 92 m.y. ($\lambda = 1.47 \times 10^{-11} yr^{-1}$) or 1350 ± 92 m.y. ($\lambda = 1.39 \times 10^{-11} yr^{-1}$) according to Baragar in Wanless and Loveridge (1977). The whole-rock K-Ar age of 1316 ± 94 m.y. is consistent with correlation of the Harp dykes with the basic magmatic activity of the Seal Lake Group.

Summary

The two hornblende ages of 1449 and 1482 m.y. are important in establishing that the basic (and anorthositic) rocks of the Harp Lake Complex are only very slightly older than the adamellites and granites which are known from geological evidence to be younger. Mineral ages from the various rock types support an interpretation that intrusion and crystallization of the entire Harp Lake Complex took place in the interval 1450 ± 25 m.y. Younger ages of biotite from adamellite and hornblende from granite are probably due to subsequent uplift and cooling and possibly one or more local thermal disturbances. K-Ar hornblende ages previously reported by Stockwell of 1430 m.y. (GSC 62-177), 1401 ± 43 (GSC 73-167) and 1350 m.y. (GSC 63-177) from gneisses south of the Harp Lake Complex are in accord with this interpretation.

The Harp dyke swarm was emplaced about 1316 ± 94 m.y. ago and is probably related to the basic magmatic activity in the Seal Lake basin to the south.

References

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Wanless, R.K. and Loveridge, W.D.
1977: Rubidium-strontium isochron age studies, Report 2 (Canadian Shield); Geol. Surv. Can., Paper 77-14.

GSC 76-247 Biotite, K-Ar age **1600 ± 50 m.y.**

K = 6.68%, $^{40}Ar/^{40}K = 0.1471$, radiogenic Ar = 99%.
Concentrate: Olive-green biotite with about 15% free chlorite and less than 5% hornblende contamination.

From quartz monzonite
(13 K) Beside falls on Bruce River, Labrador, Newfoundland, 54°37'N, 60°32'W. Sample WM-708B-67, collected by F.M.G. Williams.

The rock is a light grey, foliated, biotite-quartz monzonite intrusive into an older plutonic-metamorphic complex near the border of the Grenville province. It is intrusive into rocks overlain unconformably by the Croteau Group for which a Rb-Sr isochron age of 1474 ± 42 m.y. has been determined (Wanless and Loveridge, 1972).

Reference

Wanless, R.K. and Loveridge, W.D.
1972: Rubidium-strontium isochron age studies, Report 1; Geol. Surv. Can., Paper 72-23, p. 57-59.

GSC 76-248 Biotite, K-Ar age **1685 ± 55 m.y.**

K = 7.54%, $^{40}Ar/^{40}K = 0.1594$, radiogenic Ar = 99%.
Concentrate: Relatively pure, greenish biotite with a trace of chlorite. Some of the mica flakes have split edges.

From granite

(13 K) Near mouth of unidentified creek, Labrador Newfoundland, 54°57'N, 60°17'W. Sample WM-462-66, collected by F.M.G. Williams.

The biotite was obtained from a medium grained, slightly foliated, biotite granite taken from near the core of a major, elongate gneiss dome which lies between an area of older (Archean?) gneisses, and gneisses to the south which have been involved in later (Grenville) deformation.

APPENDIX

The numbers listed below refer to the individual sample determination numbers, e.g. (GSC) 62-189, published in the G.S.C. Age Reports listed below:

GSC 60-17, Report No. 1 – determination 59-1 to 59-98
GSC 61-17, Report No. 2 – determinations 60-1 to 60-152
GSC 62-17, Report No. 3 – determinations 61-1 to 61-204
GSC 63-17, Report No. 4 – determinations 62-1 to 62-190
GSC 64-17, Report No. 5 – determinations 63-1 to 63-184
GSC 65-17, Report No. 6 – determinations 64-1 to 64-165
GSC 66-17, Report No. 7 – determinations 65-1 to 65-153
GSC 67-2A, Report No. 8 – determinations 66-1 to 66-176
GSC 69-2A, Report No. 9 – determinations 67-1 to 67-146
GSC 71-2, Report No. 10 – determinations 70-1 to 70-156
GSC 73-2, Report No. 11 – determinations 72-1 to 72-163
GSC 74-2, Report No. 12 – determinations 73-1 to 73-198
GSC 77-2, Report No. 13 – determinations 76-1 to 76-248

GSC Age Determinations Listed by N.T.S. Co-ordinates

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