

GEOLOGICAL
SURVEY
OF
CANADA

DEPARTMENT OF ENERGY,
MINES AND RESOURCES

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PAPER 67-2
Part A

AGE DETERMINATIONS AND GEOLOGICAL STUDIES
K-Ar Isotopic Ages, Report 8

(Report, 4 tables and 1 figure)

R. K. Wanless, R. D. Stevens, G. R. Lachance and C. M. Edmonds



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ABSTRACT

One hundred and seventy-six new 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 the mineral concentrate used. Brief interpretive comments regarding the geological significance of each age is also provided. The experimental procedures developed for the isotope dilution determination of the potassium concentration are described as is a method of correcting isotopic abundances for mass spectrometer instrumental discrimination. Two recent geological time-scales are published in tabular form for ready reference. The age determinations are displayed on an accompanying map of Canada.

The age-determination program is a coordinated effort involving the field geologists acknowledged in the accompanying text, and the chemists, geologists, mineralogists, and physicists of the research laboratories of the Geological Survey listed below:

R.D. Stevens) - Argon extraction, mass spectrometry, age calculation,
R.K. Wanless) and potassium determination using isotope dilution
techniques.

G.R. Lachance - Potassium determination using X-ray fluorescence
techniques.

C.M. Edmonds - X-ray diffractometry and mineralogy of the
concentrates.

AGE DETERMINATIONS AND GEOLOGICAL STUDIES BY THE GEOLOGICAL SURVEY OF CANADA

INTRODUCTION

By R.K. Wanless

This, the eighth report of potassium-argon age measurements completed in the Geochronology Laboratories of the Geological Survey of Canada, presents one hundred and seventy-six new determinations, the majority of which were carried out during 1966. The eight publications contain a total of 1,322 age determinations.

The experimental procedures employed have been discussed in preceding reports to which the reader is referred for specific details. New methods developed for the determination of the potassium content using isotope dilution techniques, and a method used to compensate for variable solid source instrumental discrimination are described below.

Determination of Potassium Content

The concentration of potassium in minerals and whole rock samples is routinely determined by X-ray fluorescence methods (see Lachance in Wanless et al. 1965, pp. 4-7). The reliability of the method has been verified through the comparison of the results obtained using flame photometric and isotope dilution techniques (Wanless et al. 1966, Table I, p. 2). Additional confirmation has been obtained through the comparison of ages determined for mineral pairs separated from the same rock, and in the particular case of coeval biotite and muscovite, the age correspondence has generally been excellent. However, more recently, variations in age have been observed for biotite-hornblende mineral pairs, with the hornblende age consistently lower than the age determined for the biotite.

This age discordance has been traced to an overestimation of the potassium content of the hornblendes, presumably caused by differences in absorption of the $K\alpha$ X-ray intensity, attributed to the presence of iron in the crystal lattice. A comparison of the X-ray fluorescence and isotope dilution results (Table I) has shown that the discrepancy, although variable in degree, is always in the same direction. Table II illustrates the age concordance obtained for coeval biotites and hornblendes when calculations are based on potassium concentrations determined using isotope dilution techniques.

Experimental Procedures

Considerable difficulty was experienced in obtaining reproducible mass spectrometric potassium analyses as a consequence of sample contamination and variable isotopic discrimination in the mass spectrometer source.

Table I

Hornblende Potassium Determinations

<u>Sample No.</u>	<u>Per cent potassium</u>	
	<u>X-ray fluorescence</u>	<u>Isotope dilution</u>
GSC 66-36	0.74	0.59
GSC 66-7	1.33	1.07
GSC 66-11	1.04	0.98
GSC 66-5	1.24	1.05
GSC 66-59	2.12	1.77
GSC 66-8	1.79	1.41
GSC 66-17	1.12	0.94
GSC 66-16	0.82	0.70
GSC 66-123	1.30	1.15
GSC 66-25	0.89	0.81
GSC 66-40	0.55	0.51
GSC 66-38	0.51	0.46

Table II

Comparison of Hornblende and Biotite Age Determinations

<u>Sample No.</u>	<u>Age (m. y.)</u>	
	<u>Biotite</u>	<u>Hornblende</u>
GSC 66-35, 36	194 $\pm$ 10	198 $\pm$ 12
GSC 66-6, 7	50 $\pm$ 5	48 $\pm$ 9
GSC 66-10, 11	139 $\pm$ 7	133 $\pm$ 22
GSC 66-4, 5	96 $\pm$ 5	101 $\pm$ 15
GSC 66-58, 59	91 $\pm$ 5	80 $\pm$ 13
GSC 66-9, 8	44 $\pm$ 5	49 $\pm$ 7
GSC 66-13, 12	70 $\pm$ 4	87 $\pm$ 15
GSC 66-17, 16	88 $\pm$ 5	87 $\pm$ 11
GSC 66-124, 123	1860 $\pm$ 55	1825 $\pm$ 55
GSC 66-19, 18	164 $\pm$ 9	152 $\pm$ 15
GSC 64-24, 25 (revised)	187 $\pm$ 10	181 $\pm$ 28
GSC 66-39, 40	197 $\pm$ 10	187 $\pm$ 27
GSC 66-37, 38	184 $\pm$ 8	189 $\pm$ 20

The former was kept within practical limits by exercising meticulous care while processing the samples and by pre-treating the mass spectrometer source assembly before making the isotopic analysis. The problem of variable instrumental discrimination was overcome by using a 'double' tracer and by carrying out the calculations described below.

Sample Preparation

Whole rock samples and pure hornblende concentrates, crushed to pass -250 mesh, were weighed in platinum dishes. Generally from 10 to 20 mg were used per analysis. A 'double' potassium tracer solution, enriched in both K^{40} and K^{41} , and containing $5.84 \mu\text{g/g}$, was added to the sample and weighed as quickly as possible. The lid was kept on the platinum dish while weighing to reduce the effects of possible evaporation of the tracer solution. Approximately 4 ml of purified HF and 0.5 ml of HClO_4 were added and the sample was taken into solution while being heated on a steam bath. This operation usually required from one to two hours. All excess HClO_4 was driven off by slowly evaporating the solution to dryness on a hot plate. The residue was taken up in a few ml of demineralized water and purified dilute HCl, and was transferred to a quartz dish where it was again evaporated almost to dryness. Under these conditions a small precipitate formed and the excess solution was decanted and discarded. Following the addition of a few drops of H_2SO_4 the solution was taken to dryness, cooled and covered with parafilm to await mass spectrometric analysis.

In order to maintain a rough equivalence between the ion currents arising from the sample and from the potassium of the tracer a slight modification to the procedure was required when micaceous minerals were processed. In this case a 60 mg sample was weighed in a platinum dish and taken into solution with HF and HClO_4 , but without the addition of the tracer solution. Following expulsion of the excess HClO_4 , the residue was taken up as above, and transferred quantitatively to a pre-weighed 250 ml quartz volumetric flask which was filled to the mark with demineralized water and weighed. Approximately 4 g of this solution was placed in a covered quartz dish and weighed. Approximately 2 g of the potassium tracer solution was then added. After accurately weighing to determine the quantity of tracer, the solution was evaporated almost to dryness and treated as outlined above.

Mass Spectrometric Analysis

A 6-inch radius, 90 degree, Nier type mass spectrometer equipped with a three filament source (Inghram and Chupka, 1953) and an electron multiplier was used in this study. Ion currents were measured with a Dymec model 2401C Integrating Digital Voltmeter and were recorded on paper tape by a Hewlett-Packard 562A Digital Recorder. Peak switching was realized through cyclic variation of the magnet current while maintaining a constant ion accelerating voltage.

For each analysis a clean, three-filament unit comprising a rehenium centre filament and tantalum side filaments, was assembled. The filaments were pre-baked overnight in a high vacuum oven ($p < 10^{-5} \text{mm Hg}$) at a filament current in excess of 4 amperes. In addition, the central portion of the source plate immediately in front of the filaments was removed and replaced with a clean plate, in order to minimize the possibility of cross contamination between samples.

The source assembly, with the centre filament removed, was placed in a small bench holder to facilitate sample loading. A few drops of demineralized water were added to the sample residue in the quartz dish and

the slurry formed was placed on the side filaments with fresh, cleaned, quartz or teflon micro-pipettes. Excess moisture was driven off by passing a small current through the filament, or under the direct heat of an infrared lamp. The central filament was replaced prior to attaching the assembly to the mass spectrometer source.

As noted above, triple filament assemblies were used when determining the potassium isotopic concentration. During preliminary work undertaken with single filament assemblies, analyses of solutions containing the enriched potassium tracer were not reproducible, due to variable contamination with potassium having a normal isotopic composition but reproducible analyses were eventually obtained using the following procedure. With the loaded filament assembly in place and the mass spectrometer at operating pressure, the centre rehenium filament current was slowly increased to at least 4 amperes, a value well above the current required for normal ion production. Under these conditions large ion currents of normal potassium were produced, presumably arising from the surface of the filaments and the source plate assembly. After a minute or two at this temperature the ion current dropped to negligible levels, and no ion currents were produced from the sample material on the side filaments. The centre filament current was then reduced to zero and the side filament current was increased to approximately 1 ampere. The centre filament current was slowly increased and the side filament current was adjusted until the desired ion current intensity was attained. Stable ion currents of 10^{-13} to 10^{-14} amperes were generally realized with a centre filament current of 0.9 amperes and the side filament current set in the 1.2 to 1.5 ampere range.

Instrumental Discrimination

Isotopic abundances were first adjusted for mass discrimination by applying a correction directly proportional to the mass of the ion being measured. However, in addition to this adjustment another correction must often be applied in order to obtain acceptable abundance ratios. It is believed that this latter aberration is a function of the position of the sample on the filaments, the condition of the filament surface, the sample-filament interface, the position of the filaments with respect to one another and to the initial source slit, or other features of the source geometry. It was observed that this discrimination remained relatively constant throughout an analysis but varied, in either a positive or negative sense, from sample to sample. The use of a tracer solution having a known mass 41 to mass 40 ratio provided a means for adjusting the isotopic abundances to compensate for the observed discrimination.

Potassium salts enriched in mass 40 and mass 41 were obtained from the U.S. Atomic Energy Commission, and were mixed in the proportions required to produce a tracer solution having the following isotopic abundances: K^{39} , 19.247%; K^{40} , 8.740% and K^{41} , 72.014%. The K^{40} abundance in natural potassium is extremely low (0.0119%) therefore the major contribution to the ion current at mass 40 will arise from the tracer solution. Similarly, the tracer solution will contribute about 90 per cent of the ion current at mass 41, for a one to one sample to tracer mixture. By applying the equations derived below it was possible to determine the relative contributions of the sample and tracer components to the ion currents at masses 40

and 41, and to solve for the K^{41}/K^{40} ratio of the tracer component. If this was found to be at variance with the established value of 8.240, a correction was applied to the observed abundances. This operation was repeated until the correct ratio was calculated for the tracer component.

The following equations may be written for the three potassium masses:

$$N_m^{39} = N_s^{39} + N_t^{39} \dots\dots\dots(1)$$

$$N_m^{40} = N_s^{40} + N_t^{40} \dots\dots\dots(2)$$

$$N_m^{41} = N_s^{41} + N_t^{41} \dots\dots\dots(3)$$

Where N = the number of atoms of the mass indicated and the subscripts m, s and t identify the mixture, sample and tracer components.

$$\text{From (1)} \quad N_m^{41} (39/41)_m = N_s^{41} (39/41)_s + N_t^{41} (39/41)_t$$

Substituting for N_s^{41} from (3) and rearranging

$$N_m^{41} \{ (39/41)_m - (39/41)_s \} = N_t^{41} \{ (39/41)_t - (39/41)_s \}$$

$$\frac{N_t^{41}}{N_m^{41}} = \frac{(39/41)_s - (39/41)_m}{(39/41)_s - (39/41)_t} = A \dots\dots\dots(4)$$

$$\begin{aligned} \text{From (3)} \quad \frac{N_s^{40}}{N_m^{41}} &= \left\{ 1 - \frac{N_t^{41}}{N_m^{41}} \right\} (40/41)_s \\ &= \left\{ 1 - A \right\} (40/41)_s = B \dots\dots\dots(5) \end{aligned}$$

$$\begin{aligned} \text{And} \quad \frac{N_t^{40}}{N_m^{41}} &= (40/41)_m - \left\{ 1 - A \right\} (40/41)_s \\ \text{from (2)} \quad &= (40/41)_m - B = C \dots\dots\dots(6) \end{aligned}$$

$$\begin{array}{l} \text{Dividing} \\ (4) \text{ by } (6) \end{array} \quad \frac{N_t^{41}}{N_t^{40}} = \frac{A}{C} \dots\dots\dots(7)$$

By introducing the appropriate ratios derived from the isotopic abundance values for sample and tracer potassium the equations for A and B become;

$$A = \frac{13.461 - (39/41) m}{13.1937}$$

$$B = \{ 1 - A \} \quad (0.00172)$$

To test for the existence of discrimination, solve the equation for A/C. If the value determined is 8.240 the discrimination may be considered to be normal and to have been completely compensated for by the application of the direct mass correction. If, on the other hand, A/C does not yield 8.240 a correction proportional to the degree of divergence must be applied to the mixture ratios. The procedure must be repeated until the corrected mixture abundances yield the desired value for the K^{41}/K^{40} ratio of the tracer component.

Argon Analyses - M.S. 10 Mass Spectrometer

To further the general objective of obtaining reliable age measurements for young rocks, a small gas source mass spectrometer (Associated Electrical Industries, model M.S. 10) was procured. This unit has been extensively modified to permit rapid operation in the static mode and has been thoroughly tested. Modification details will be the subject of a separate publication and will not be considered here.

An increase in sensitivity of 50 over the sensitivity of our conventional mass spectrometer has been realized, and the age of 1 m.y. old rocks has been successfully determined. Preliminary tests with a critically damped vibrating reed amplifier have yielded encouraging results which indicate that the sensitivity may be increased by an additional factor of 100. Although our experience with this instrument has admittedly been meagre it has been encouraging.

Constants Employed in Age Calculations

Age calculations are based on the following:

$$\lambda_{\beta} = 4.72 \times 10^{-10} \text{ yr}^{-1}$$

$$\lambda_e = 0.585 \times 10^{-10} \text{ yr}^{-1}$$

$$K^{40} \text{ atomic abundance} = 1.19 \times 10^{-4}$$

Geological Time Scale

The Phanerozoic time scales of the Geological Society of London (1964), and Holmes (1959) are summarized in tabular form in Table III. A time scale and subdivisions for the Precambrian Canadian Shield were presented and discussed by Stockwell (1964; his Table II). For reference it is reproduced in essence as Table IV of this paper.

References

Geological Society of London

- 1964: Geological Society Phanerozoic time scale; Quart. J. Geol. Soc. London, vol. 120 S, pp. 206-262.

Holmes, A.

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

Inghram, M.G., and Chupka, W.A.

- 1953: Surface ionization source using multiple filaments; Rev. Sci. Inst., vol. 24, pp. 518-520.

Stockwell, C.H.

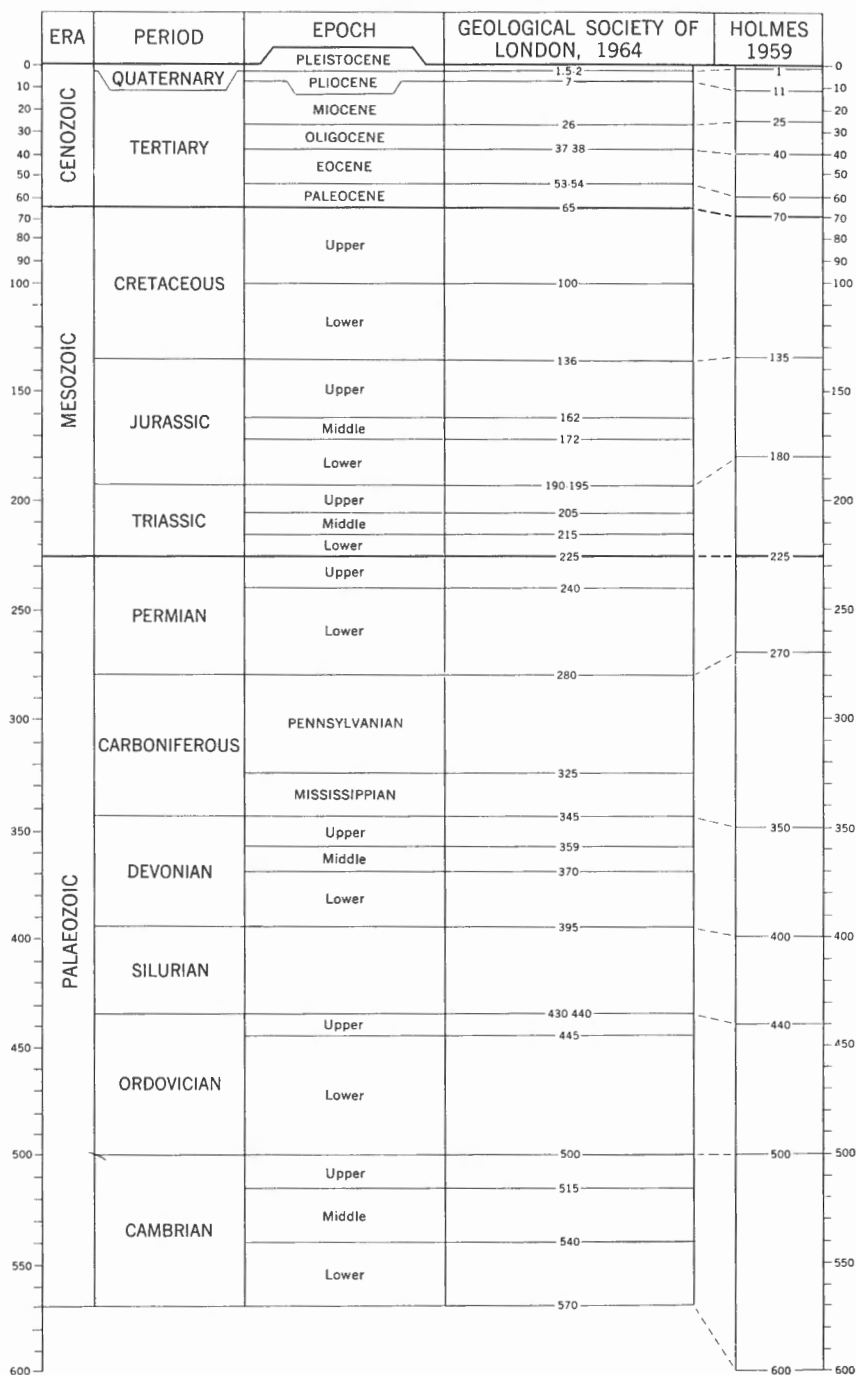
- 1964: Fourth report on structural provinces, orogenies, and time-classification of the Canadian Precambrian Shield; In Age determinations and geological studies, Geol. Surv. Can., Paper 64-17, Pt. II, pp. 1-21.

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- 1965: Age determinations and geological studies, Part I. - Isotopic ages, Report 5; Geol. Surv. Can., Paper 64-17, pp. 1-126.

Wanless, R.K., Stevens, R.D., Lachance, G.R., and Rimsaite, J.Y.H.

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



GSC

Table III. Phanerozoic time-scale.

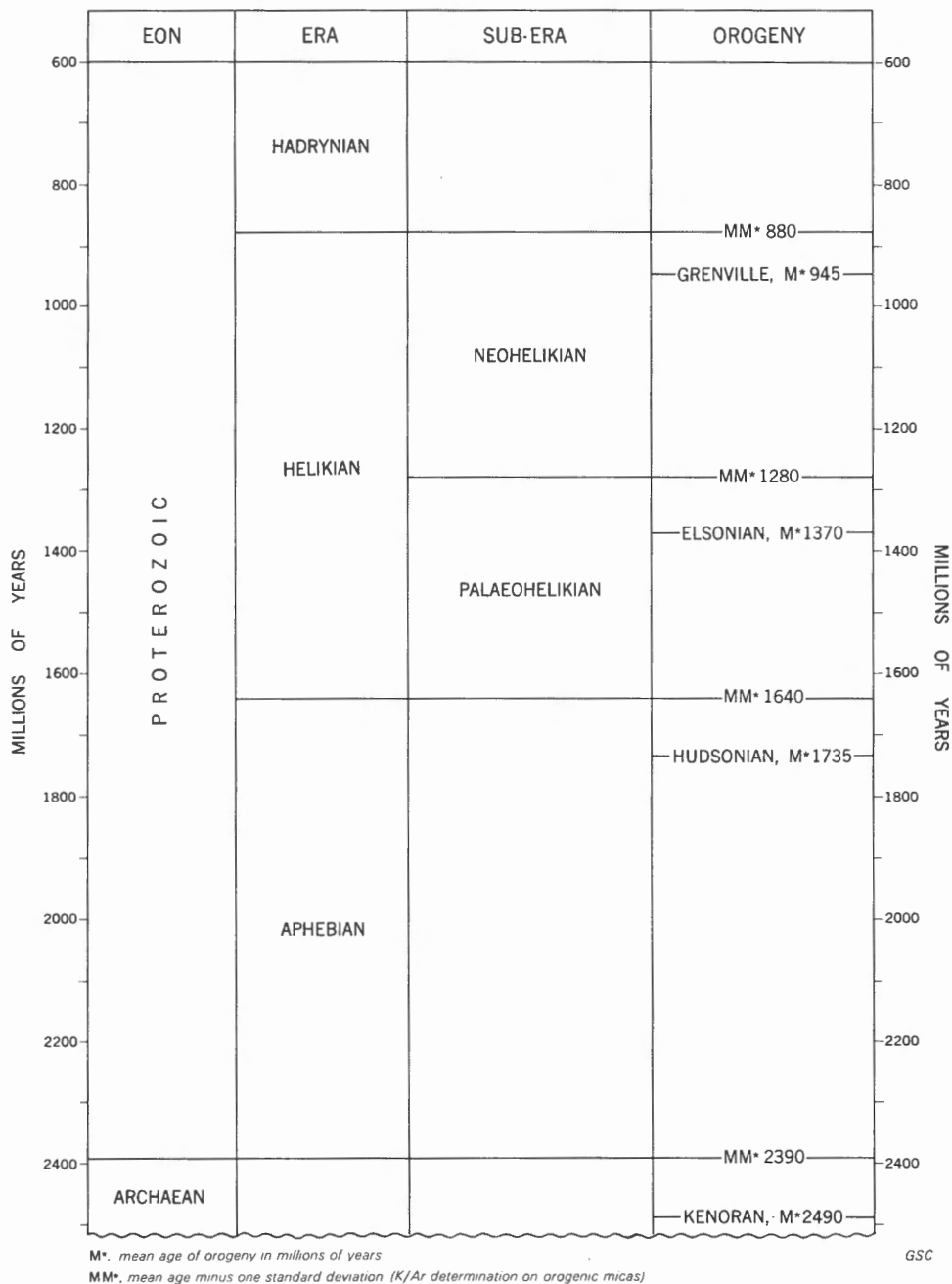


Table IV. Precambrian time-scale for the Canadian Shield (after Stockwell, 1964).

Errata

GSC Paper 64-17 (Part I)

Determination GSC 63-28, p. 33, line 15:
'East' shore should read 'West' shore.

Determination GSC 63-43:
Coordinates should read 63°08'N, 110°41'W.

GSC Paper 66-17

Determination GSC 65-83:
Map-unit 13 should read map-unit 2.
Sample JD-107A-59 should read JD-207A-59.

Determination GSC 65-87:
Map-unit 13 should read map-unit 2.
Seventh line from bottom p. 71, 1963 m.y.
should read 1693 m.y.

K-Ar — Isotopic Ages
Report 8

Compiled by R. D. Stevens

BRITISH COLUMBIA

GSC 66-1 HORNBLLENDE, K-AR AGE 79 + OR - 11 M.Y.

K=0.90 PERCENT, AR40/K40=0.0047, RADIOGENIC AR=71 PERCENT.

CONCENTRATE- CLEAN, UNALTERED DARK GREEN HORNBLLENDE WITH TRACES OF BIOTITE AND CHLORITE IMPURITIES. LESS THAN 5 PERCENT OF THE GRAINS CONTAIN A VERY FEW OPAQUE BLEBS.

FROM GRANITE

(104 0) CIRQUE WEST OF BLACKFLY LAKE, BRITISH COLUMBIA, 59-14 N, 130-49 W. MAP-UNIT 11, TUYA-TESLIN MAP SHEET (WATSON AND MATHEWS). SAMPLE Y-10RA-1, COLLECTED AND INTERPRETED BY J.E. REESOR.

THE ROCK IS A COARSE-GRAINED, LIGHT COLOURED, HORNBLLENDE PERTHITE GRANITE, CHARACTERIZED BY SMALL MIAROLYTIC CAVITIES, AND SMOKEY QUARTZ. IT BELONGS TO A GROUP OF SIMILAR EARLY TERTIARY INTRUSIONS FOUND THROUGHOUT NORTHERN BRITISH COLUMBIA-SOUTHERN YUKON.

THE AGE OF 79 M.Y. INDICATES THE TIME OF EMPLACEMENT OF THE MASS. THIS AGE AS WELL AS CURRENT FIELD WORK BY H. GABRIELSE (PERSONAL COMMUNICATION- 1966), SHOWS THE MIAROLYTIC GRANITES TO BE MUCH MORE EXTENSIVE THAN SHOWN BY WATSON AND MATHEWS IN THE TUYA-TESLIN AREA. (WATSON K DE P., AND MATHEWS W.H., BRIT. COL. DEPT. OF MINES BULL 19, 1944).

GSC 66-2 HORNBLLENDE, K-AR AGE 146 + OR - 17 M.Y.

K=0.98 PERCENT, AR40/K40=0.0089, RADIOGENIC AR=82 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, DARK GREEN HORNBLLENDE WITH TRACES OF QUARTZ, MICA AND CHLORITE AS IMPURITIES. LESS THAN 5 PERCENT OF THE GRAINS CONTAIN COLOURLESS INCLUSIONS.

FROM QUARTZ DIORITE

(104 0) 2 MILES EAST OF KEDAHDA LAKE, BRITISH COLUMBIA, 59-16 N, 131-29 W. MAP-UNIT 10B, TUYA-TESLIN MAP-SHEET (WATSON AND MATHEWS). SAMPLE Y-6RA-1, COLLECTED AND INTERPRETED BY J.E. REESOR.

BRITISH COLUMBIA

SEE GSC 66-3 FOR DESCRIPTION AND INTERPRETATION.

GSC 66-3 BIOTITE, K-AR AGE 73 + OR - 5 M.Y.

K=6.24 PERCENT, AR40/K40=0.0043, RADIOGENIC AR=85 PERCENT.

CONCENTRATE- IMPURE SAMPLE OF ALTERED OLIVE-GREEN BIOTITE WITH ABOUT 5 PERCENT HORNBLende AND 3 PERCENT FREE CHLORITE. MOST FLAKES ARE ALTERED TO CHLORITE ON THE EDGES AND ALONG CLEAVAGE PLANES. TOTAL CHLORITE CONTENT IS 8-10 PERCENT.

FROM QUARTZ DIORITE

(104 O) 2 MILES EAST OF KEDAHDA LAKE, BRITISH COLUMBIA, 59-16 N, 131-29 W. MAP-UNIT 10B, TUYA-TESLIN MAP SHEET (WATSON AND MATHEWS). SAMPLE Y-6RA-1, COLLECTED AND INTERPRETED BY J.E. REESOR.

THE ROCK IS A MEDIUM-GRAINED, DARK GREY, HORNBLende-BIOTITE QUARTZ DIORITE WITH COARSE GRAINS OF HORNBLende UP TO 5 MM. OR MORE.

THE YOUNGER AGE SHOWN BY THE BIOTITE REFLECTS THE INFLUENCE OF THE NEARBY EMPLACEMENT OF TERTIARY GRANITIC-ROCKS ON THE OLDER, MAFIC-RICH, QUARTZ DIORITE. THE HORNBLende AGE OF 146 M.Y. MAY REPRESENT THE AGE OF CONSOLIDATION AND EMPLACEMENT OF THE QUARTZ DIORITE. HOWEVER, IF THE HORNBLende AGE HAS BEEN AFFECTED BY THE EMPLACEMENT OF THE LATER GRANITES IT THEN REPRESENTS A MINIMUM AGE OF CONSOLIDATION OF THE GRANODIORITE AND ITS TRUE AGE OF EMPLACEMENT MUST BE STILL OLDER.

GSC 66-4 BIOTITE, K-AR AGE 96 + OR - 5 M.Y.

K=7.61 PERCENT, AR40/K40=0.0058, RADIOGENIC AR=86 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED OLIVE-GREEN BIOTITE WITH ABOUT 3 PERCENT HORNBLende AND 1 PERCENT CHLORITE IMPURITY.

FROM GRANODIORITE

(103 J) ON SOUTHERN SHORE OF DUNDAS ISLAND, TWO MILES NORTH-NORTHEAST OF PRINCE LEBOO ISLAND, BRITISH COLUMBIA, 54-29-00 N, 130-57-30 W. MAP-UNIT 11, GSC PAPER 66-33. SAMPLE BT-50-15-63, COLLECTED BY A.J. BAER, INTERPRETED BY W.W. HUTCHISON.

SEE GSC 66-5 FOR DESCRIPTION AND INTERPRETATION.

BRITISH COLUMBIA

GSC 66-5 HORNBLLENDE, K-AR AGE 101 + OR - 15 M.Y.

K=1.05 PERCENT, AR40/K40=0.0060, RADIOGENIC AR=72 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF PLEOCHROIC GREEN TO LIGHT GREEN HORNBLLENDE. IMPURITIES CONSIST OF TRACES OF CHLORITE, MICA AND QUARTZ.

FROM GRANODIORITE
(103 J) ON SOUTHERN SHORE OF DUNDAS ISLAND, TWO MILES NORTH-NORTHEAST OF PRINCE LEBOO ISLAND, BRITISH COLUMBIA, 54-29-00 N, 130-57-30 W. MAP-UNIT 11, GSC PAPER 66-33. SAMPLE BT-50-15-63, COLLECTED BY A.J. BAER, INTERPRETED BY W.W. HUTCHISON.

THE SAMPLE IS A COARSE-GRAINED, MASSIVE GRANODIORITE COMPOSED OF COARSE, SHATTERED-LOOKING QUARTZ, CREAM COLOURED PLAGIOCLASE, POIKILOBLASTIC K-FELDSPAR AND SLIGHTLY RAGGED CRYSTALS OF HORNBLLENDE AND BIOTITE. BOTH MAFIC MINERALS ARE COMMONLY ASSOCIATED WITH SMALL CLOTS OF GRANULAR EPIDOTE. SPHENE IS ALSO PRESENT AS AN ACCESSORY MINERAL. THE PLAGIOCLASE CRYSTALS (AVERAGE AN31) DISPLAY OSCILLATORY ZONING SUPERIMPOSED ON A GENERAL NORMAL ZONING. THESE CRYSTALS ARE COMMONLY BENT SUGGESTING POST CRYSTALLIZATION DEFORMATION.

THERE IS NO STRATIGRAPHIC CONTROL ON THE POSSIBLE AGE OF THIS ROCK. THE TWO DATES FROM THIS ROCK ARE THE SAME WITHIN THE LIMITS OF EXERIMENTAL ERROR. THE AGES ARE OLDER THAN THOSE TO THE EAST IN THE PRINCE RUPERT-SKEENA AREA (HUTCHISON, 1966) AND ARE CONSISTENT WITH THE PATTERN EVOLVING FOR THE NORTHERN COAST MOUNTAINS OF BRITISH COLUMBIA WITH OLDER AGES, RANGING FROM 60 TO 135 M.Y., OCCURRING IN THE WESTERN REGION AND WITH YOUNGER AGES, CHIEFLY CLOSE TO 45 M.Y., OCCURRING IN THE EASTERN REGION.

REFERENCE-

HUTCHISON W.W.

1966 PRINCE RUPERT-SKEENA MAP-AREA, GEOL, SURV, CAN., PAPER 66-33.

GSC 66-6 BIOTITE, K-AR AGE 50 + OR - 5 M.Y.

K=6.73 PERCENT, AR40/K40=0.0030, RADIOGENIC AR=77

BRITISH COLUMBIA

PERCENT.

CONCENTRATE- SLIGHTLY IMPURE, UNALTERED KHAKI BIOTITE WITH ABOUT 10 PERCENT HORNBLLENDE CONTAMINATION. CHLORITE CONTENT IS 1 PERCENT.

- (103 I) FROM QUARTZ DIORITE
ON PEAK 1 MILE EAST OF NORTH TIP OF LAKE 2 MILES EAST OF LEVERSON LAKE, BRITISH COLUMBIA, 54-20-56 N, 129-52-07 W. MAP-UNIT 10, GSC PAPER 66-33. SAMPLE HS-19-10-64, COLLECTED AND INTERPRETED BY W.W. HUTCHISON.

SEE GSC 66-7 FOR A DESCRIPTION OF THE ROCK, AND GSC 66-9 FOR AN INTERPRETATION OF THE AGE.

GSC 66-7 HORNBLLENDE, K-AR AGE 48 + OR - 9 M.Y.

K=1.07 PERCENT, AR40/K40=0.0028, RADIOGENIC AR=57 PERCENT.

CONCENTRATE- CLEAN, PLEOCHROIC DARK GREEN TO YELLOW HORNBLLENDE WITH A TRACE OF QUARTZ AND FELDSPAR.

- (103 I) FROM QUARTZ DIORITE
ON PEAK 1 MILE EAST OF NORTH TIP OF LAKE 2 MILES EAST OF LEVERSON LAKE, BRITISH COLUMBIA, 54-20-56 N, 129-52-07 W. MAP-UNIT 10, GSC PAPER 66-33. SAMPLE HS-19-10-64, COLLECTED AND INTERPRETED BY W.W. HUTCHISON.

THE SAMPLE FROM WHICH GSC 66-6 AND 7 WERE OBTAINED IS A COARSE GRAINED, ALMOST MASSIVE QUARTZ DIORITE COMPOSED OF DULL CREAM COLOURED ANHEDRAL PLAGIOCLASE, MINOR QUARTZ, ISOLATED STUMPY PRISMS OF HORNBLLENDE, A FEW CLOTS OF BIOTITE AND ACCESSORY SPHENE. THE SUB-HEDRAL PLAGIOCLASE CRYSTALS (AVERAGE AN38) HAVE A POORLY DEFINED OSCILLATORY ZONING THAT IS SUPERIMPOSED ON NORMAL ZONING. THE MAFIC MINERALS COMPRISE CHIEFLY HORNBLLENDE AND BIOTITE ALONG WITH MINOR AMOUNTS OF SPHENE AND EPIDOTE AND VERY MINOR MAGNETITE.

FOR INTERPRETATION SEE GSC 66-9.

BRITISH COLUMBIA

GSC 66-8 HORNBLLENDE, K-AR AGE 49 + OR - 7 M.Y.

K=1.41 PERCENT, AR40/K40=0.0029, RADIOGENIC AR=60 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED, PLEO-CHROIC DARK GREEN TO BROWNISH YELLOW HORNBLLENDE WITH LESS THAN 5 PERCENT BIOTITE IMPURITY.

FROM QUARTZ DIORITE
(103 J) 1 1/2 MILE EAST OF MT. MCNEIL, 4 1/2 MILES EAST OF WORK CHANNEL, BRITISH COLUMBIA, 54-34-40 N, 130-11-00 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE RD 65-10385, COLLECTED BY J.A. RODDICK, INTERPRETED BY W.W. HUTCHISON.

SEE GSC 66-9 FOR DESCRIPTION AND INTERPRETATION.

GSC 66-9 BIOTITE, K-AR AGE 44 + OR - 5 M.Y.

K=7.26 PERCENT, AR40/K40=0.0026, RADIOGENIC AR=59 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED, LIGHT BROWN BIOTITE WITH 1 PERCENT FREE CHLORITE AND 5 PERCENT HORNBLLENDE AS IMPURITIES.

FROM FOLIATED QUARTZ DIORITE
(103 J) 1 1/2 MILE EAST MT. MCNEIL, 4 1/2 MILES EAST OF WORK CHANNEL, BRITISH COLUMBIA, 54-34-40 N, 130-11-00 W. MAP-UNIT 10, GSC PAPER 66-33. SAMPLE RD 65-10385, COLLECTED BY J.A. RODDICK, INTERPRETED BY W.W. HUTCHISON.

THIS MATERIAL IS FROM A COARSE-GRAINED, POORLY FOLIATED QUARTZ DIORITE COMPOSED OF SUB-HEDRAL PRISMATIC HORNBLLENDE, FINER GRAINED ANHEDRAL BIOTITE AND AN INTERGROWTH OF TABULAR PLAGIOCLASE AND ANHEDRAL QUARTZ. RESINOUS LOZENGE SHAPED CRYSTALS OF SPHENE ARE PROMINENT. THE PLAGIOCLASE CRYSTALS (AVERAGE AN32) ARE NORMALLY ZONED WITH POORLY DEFINED SUPER-IMPOSED OSCILLATORY ZONING. HORNBLLENDE CONTAINS MINOR AMOUNTS OF BIOTITE, QUARTZ, SPHENE, EPIDOTE AND MAGNETITE. BIOTITE CONTAINS UP TO 10 PERCENT INTERLEAVED CHLORITE.

THE BIOTITE-HORNBLLENDE PAIRS (GSC 66-8, 9 AND GSC 66-6, 7) WERE COLLECTED APPROXIMATELY 20 MILES APART ROUGHLY ALONG THE MAIN AXIS OF QUOTTOON PLUTON. THIS BODY EXTENDS FOR OVER

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90 MILES IN A NORTHWESTERLY DIRECTION AND IS RARELY MORE THAN 5 MILES WIDE. TO THE SOUTHEAST THE ROCK IS COMMONLY GNEISSIC AND EVEN MIGMATITIC WHEREAS TO THE NORTHWEST THE ROCK IS COMMONLY HOMOGENEOUS AND MASSIVE OR POORLY FOLIATED, (SEE HUTCHISON, 1966). IT IS POSSIBLE THAT THE MORE HOMOGENEOUS PARTS OF THIS BODY REPRESENT DIAPYRIC MOVEMENTS UP AND AWAY FROM A DEEPER SEATED MIGMATITE ZONE. THESE MOVEMENTS WERE PROBABLY CONTEMPORANEOUS WITH THOSE INVOLVING EMPLACEMENT OF THE BODY FROM WHICH BIOTITE OF GSC 65-29 GAVE AN AGE OF 43 M.Y.

THERE IS NO SIGNIFICANT DIFFERENCE BETWEEN THESE AGES OBTAINED FROM QUOTTOON PLUTON. THE AVERAGE AGE (48 M.Y.) IS SIMILAR TO AGES 45 ± 5 M.Y. OBTAINED FROM PLUTONIC ROCKS ALONG THE EASTERN FLANK OF THE COAST MOUNTAINS (RODDICK, BAER AND HUTCHISON, 1966). THE SIGNIFICANCE OF THE CONSISTENCY OF THESE EARLY TERTIARY DATES IS NOT YET CLEAR. PRESUMABLY THEY ARE RELATED TO FALL IN TEMPERATURE WHICH MAY HAVE CLOSELY FOLLOWED EMPLACEMENT OR REGIONAL UPLIFT. STRATIGRAPHIC CONTROL TELLS US ONLY THAT ONE OF THESE EARLY TERTIARY PLUTONS (PONDER PLUTON, HUTCHISON 1966) CUTS STRATA OF PROBABLE LATE JURASSIC-EARLY CRETACEOUS AGE.

REFERENCE-

HUTCHISON, W.W.

1967

PRINCE RUPERT-SKEENA MAP-AREA, B.C. GSC PAPER 66-33.

GSC 66-10 BIOTITE, K-AR AGE 139 ± 7 M.Y.

K=7.88 PERCENT, $AR_{40}/K_{40}=0.0085$, RADIOGENIC AR=89 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, LIGHT BROWN BIOTITE. MOST FLAKES CONTAIN PATCHES OF ORIENTED ACICULAR INCLUSIONS. HORNBLENDE IMPURITY AMOUNTS TO ABOUT 2 PERCENT.

FROM QUARTZ DIORITE

(103 H) WEST SHORE OF GILL ISLAND, 3.5 MILES SOUTH OF BLACKROCK POINT, BRITISH COLUMBIA, 53-09-16 N, 129-35-30 W. MAP-UNIT 2, GSC PAPER 66-1, PP. 80-85. SAMPLE HS-23-12-63, COLLECTED BY W.W. HUTCHISON AND INTERPRETED BY J.A. RODDICK.

FOR DESCRIPTION AND INTERPRETATION SEE GSC 66-11.

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GSC 66-11 HORNBLLENDE, K-AR AGE 133 + OR 22 M.Y.

K=0.98 PERCENT, AR40/K40=0.0080, RADIOGENIC AR=70 PERCENT.

CONCENTRATE- CLEAN, PLEOCHROIC, DARK GREEN TO YELLOW HORNBLLENDE WITH TRACE CONTAMINATION OF CHLORITE, BIOTITE AND QUARTZ.

FROM QUARTZ DIORITE
(103 H) WEST SHORE OF GILL ISLAND, 3.5 MILES SOUTH OF BLACKROCK POINT, BRITISH COLUMBIA, 53-09-16 N, 129-35-30 W. MAP-UNIT 2, GSC PAPER 66-1, PP. 80-85. SAMPLE HS-23-12-63, COLLECTED BY W.W. HUTCHISON AND INTERPRETED BY J.A. RODDICK.

THE ROCK IS A MEDIUM- TO COARSE-GRAINED, HORNBLLENDE/BIOTITE QUARTZ DIORITE CONSISTING OF ABOUT 65 PERCENT PLAGIOCLASE, 10 PERCENT QUARTZ, 18 PERCENT HORNBLLENDE, 7 PERCENT BIOTITE, AND MINOR PYROXENE AND APATITE. THE QUARTZ IS INTERSTITIAL, AND THE MAFIC MINERALS ARE MARKEDLY POIKILOBLASTIC. MOST OF THE PLAGIOCLASE IS TWINNED AND SHOWS SMOOTHLY GRADATIONAL, NON-OSCILLATORY ZONING.

WITHIN THE LIMITS OF ANALYTICAL ERROR, NO SIGNIFICANT DIFFERENCE IN AGE WAS OBTAINED FROM THE HORNBLLENDE AND BIOTITE. THE JURA-CRETACEOUS AGE IS THE OLDEST DETERMINATION YET MADE FROM THE NORTHERN COAST MOUNTAIN PLUTONIC ROCKS. IT IS DISTINCTLY OLDER THAN THE 103-111 M.Y. AGES FROM GRANODIORITE ON ANGE ISLAND, 35 MILES TO THE NORTHWEST ALONG THE REGIONAL TREND (SEE GSC PAPER 65-17, P. 10). THE JURA-CRETACEOUS AGE OF THE QUARTZ DIORITE ON GILL ISLAND SUPPORTS EARLIER INDICATIONS THAT THE ISOTOPIC AGES OF THE PLUTONIC ROCKS GENERALLY DECREASE FROM WEST TO EAST WITHIN THE COAST MOUNTAIN BELT.

GSC 66-12 HORNBLLENDE, K-AR AGE 87 + OR - 15 M.Y.

K=0.94 PERCENT, AR40/K40=0.0052, RADIOGENIC AR=59 PERCENT.

CONCENTRATE- CLEAN, PLEOCHROIC DARK GREEN TO HONEY-YELLOW HORNBLLENDE WITH A TRACE OF QUARTZ IMPURITY.

FROM COARSE-GRAINED GRANODIORITE
(103 H) SOUTH SHORE OF GRAVEL LAKE, BRITISH COLUMBIA, 53-40-45 N, 129-29-45 W. ONLY PUBLISHED GEOLOGICAL MAP IS SMALL SCALE SKETCH MAP IN GSC PAPER 66-1,

BRITISH COLUMBIA

P. 83. SAMPLE IS FROM MAP-UNIT 4. SAMPLE SEN-60-08-63, COLLECTED BY S. NELSON, AND INTERPRETED BY J.A. RODDICK.

FOR INTERPRETATION SEE DETERMINATION GSC 66-13.

GSC 66-13 BIOTITE, K-AR AGE 70 + OR - 4 M.Y.

K=7.07 PERCENT, AR40/K40=0.0042, RADIOGENIC AR=70 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED, LIGHT OLIVE-GREEN BIOTITE WITH LESS THAN 5 PERCENT HORN-
BLLENDE CONTAMINATION.

(103H) FROM COARSE-GRAINED GRANODIORITE
SOUTH SHORE OF GRAVEL LAKE, BRITISH COLUMBIA; 53-40-45 N, 129-29-45 W. ONLY PUBLISHED GEOLOGICAL MAP IS SMALL SCALE SKETCH MAP IN GSC PAPER 66-1, P. 83. SAMPLE IS FROM MAP-UNIT 4. SAMPLE SEN 60-08-63 COLLECTED S. NELSON, AND INTERPRETED BY J.A. RODDICK.

THIS SAMPLE WAS COLLECTED FROM GRANODIORITE JUST WEST OF THE CENTRAL METASEDIMENTARY BELT IN THE COAST CRYSTALLINE BELT. A DATE OF AROUND 65 M.Y. WAS EXPECTED AND THE BIOTITE DATE OBTAINED OF 70 + OR - 4 M.Y. IS IN THE RIGHT NEIGHBOURHOOD. HORNBLENDE YIELDED 87 + OR - 15 M.Y. WHICH IN VIEW OF THE RATHER LARGE POSSIBLE ERROR, MAY NOT BE SIGNIFICANTLY DIFFERENT FROM THE BIOTITE AGE. THE RESULT FURTHER SUBSTANTIATES THE EMERGING CONCEPT OF A CENTRAL ZONE IN THE COAST CRYSTALLINE BELT THAT HAS AN AGE INTERMEDIATE BETWEEN THE 45 M.Y. ZONE TO THE EAST AND 100 M.Y. ZONE TO THE WEST.

THE GRANODIORITE WAS TAKEN FROM WHAT MAY BE CONSIDERED THE SOUTHERN EXTENSION OF THE ECSTALL PLUTON. FROM THE NORTHERN END OF THIS PLUTON (40 MILES NORTH OF WHERE SAMPLE SEN 60-08-63 WAS TAKEN) A SPECIMEN OF QUARTZ DIORITE SUBMITTED BY W.W. HUTCHISON YIELDED A BIOTITE AGE OF 64 + OR - 8 M.Y. THE NORTHERN END OF THE PLUTON MAY BE SLIGHTLY YOUNGER THAN THE SOUTHERN PART BUT THIS CONCLUSION REQUIRES FURTHER SUBSTANTIATION. AT BEST INTERPRETATION OF ISOTOPIC AGES FROM COAST MOUNTAIN ROCKS WILL REMAIN DIFFICULT UNTIL IT IS KNOWN WHETHER AGES OBTAINED REPRESENT THAT OF PLUTON EMPLACEMENT OR ARE RELATED TO GENERAL UNROOFING OF LARGE SEGMENTS OF THE COAST CRYSTALLINE BELTS.

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GSC 66-14 HORNBLLENDE, K-AR AGE 142 + OR - 37 M.Y.

K=0.41 PERCENT, AR40/K40=0.0086, RADIOGENIC AR=49 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED GREEN HORNBLLENDE. MOST GRAINS CONTAIN FINE OPAQUE INCLUSIONS. IMPURITIES CONSIST OF ABOUT 5 PERCENT BIOTITE AND TRACES OF QUARTZ AND CHLORITE.

FROM GRANODIORITE
(103 B) POOLE POINT, BURNABY ISLAND (QUEEN CHARLOTTE ISLANDS), BRITISH COLUMBIA, 52-22 N, 131-15 W. NO PUBLISHED GEOLOGICAL MAP. SAMPLE 65-AB4, COLLECTED AND INTERPRETED BY A. SUTHERLAND BROWN (B.C. DEPT. OF MINES AND PETROLEUM RESOURCES).

THE ROCK IS A GREY, MEDIUM-GRAINED HORNBLLENDE-BIOTITE GRANODIORITE CONSISTING MAINLY OF STRONGLY ZONED LATH-SHAPED PLAGIOCLASES (40 PERCENT) WITH LESSER QUARTZ (30 PERCENT) AND K-FELDSPAR (10 PERCENT). BIOTITE (8 PERCENT) OCCURS AS FRESH ORANGE-BROWN FLAKES AND HORNBLLENDE (12 PERCENT) AS FRESH PALE GREEN, SLIGHTLY CORRODED GRAINS WITH INCLUDED OPAQUES.

THE AGE OF 142 + OR - 37 M.Y. IS RATHER OLDER THAN EXPECTED IN THAT THE BURNABY ISLAND PLUTON IS ASSUMED TO BE POST-LONG-ARM (HAUTERIVIAN-BARREMIAN - ABOUT 125 M.Y.). MOST OF THE POST TECTONIC INTRUSIONS ARE DEFINITELY TERTIARY, BUT IT APPEARS THAT THE SOUTHERN PLUTONS MUST BE LATE CRETACEOUS.

GSC 66-15 BIOTITE, K-AR AGE 47 + OR - 4 M.Y.

K=7.72 PERCENT, AR40/K40=0.0028, RADIOGENIC AR=77 PERCENT.

CONCENTRATE- CLEAN, VERY SLIGHTLY ALTERED OLIVE-GREEN BIOTITE WITH 2 PERCENT HORNBLLENDE CONTAMINATION. THE MICA FLAKES ARE SLIGHTLY ALTERED ON THE EDGES AND THE TOTAL CHLORITE CONTENT IS 1 PERCENT.

FROM GRANODIORITE
(103 I) APPROXIMATELY 3 MILES WEST OF MT. VOSHELL, BRITISH COLUMBIA, 54-53-40 N, 129-25-00 W. ONLY PUBLISHED GEOLOGICAL MAP IS IN GSC PAPER 66-33, SAMPLE COLLECTED FROM MAP-UNIT 11. SAMPLE RD 65-10386 COLLECTED BY J.A. RODDICK AND INTERPRETED BY

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W.W. HUTCHISON.

THE ROCK IS A MEDIUM-GRAINED GRANODIORITE WHOSE TEXTURE IS DEFINED BY COARSE, SLIGHTLY RAGGED BIOTITE, STUMPY SUB-EUHEDRAL COMMONLY BENT PLAGIOCLASE (AN32 APPROX.), AND IRREGULARLY INTERGROWN AGGREGATES OF QUARTZ, MICROCLINE PERTHITE AND MYRMEKITE. ACCESSORY MINERALS ARE HORNBLende, MAGNETITE AND SPHENE. BIOTITE CONSTITUTES APPROXIMATELY 10 PERCENT OF THE ROCK AND IS SLIGHTLY ALTERED TO CHLORITE.

THE SAMPLE WAS COLLECTED FROM A CENTRAL ZONE OF PONDER PLUTON, WHICH INTRUDES BOWSER GROUP STRATA (UPPER JURASSIC - LOWER CRETACEOUS) TO THE EAST AND GRADES INTO AND IN PART OVER RIDES THE GNEISS COMPLEX TO THE WEST. A PREVIOUS K/AR DATE ON BIOTITE FROM GRANODIORITE NEAR THE EAST CONTACT OF THIS PLUTON, YIELDED 46 M.Y. WHICH IS NOT SIGNIFICANTLY DIFFERENT FROM THE AGE UNDER DISCUSSION. THIS 47 M.Y. DATE IS CONSISTENT WITH THE 46 ± 4 M.Y. K-AR DATES OBTAINED FROM 9 OTHER DETERMINATIONS MADE ON PLUTONIC AND METAMORPHIC ROCKS IN THE COAST MOUNTAIN PROJECT AREA. THIS DATE MAY REFLECT TIME OF EMPLACEMENT OR THE TIME OF THE LAST REGIONAL THERMAL EVENT WHICH WAS BROUGHT TO A CLOSE BY UPLIFT AND ACCOMPANYING UN-ROOFING.

GSC 66-16 HORNBLende, K-AR AGE 87 ± 11 M.Y.

$K=0.70$ PERCENT, $AR_{40}/K_{40}=0.0052$, RADIOGENIC $AR=55$ PERCENT.

CONCENTRATE- RELATIVELY CLEAN, PLEOCHROIC DARK GREEN TO HONEY YELLOW HORNBLende WITH QUARTZ, CHLORITE AND MICA IMPURITIES.

FROM GRANODIORITE
(103 A) TWO MILES NORTHEAST OF KITASU BAY, SWINDLE ISLAND, BRITISH COLUMBIA, 52-34-30 N, 128-41-30 W. MAP-UNIT C, GSC PAPER 66-25. SAMPLE RD-65-30069, COLLECTED BY W.W. HUTCHISON, INTERPRETED BY A.J. EAER.

THE SAMPLE IS FROM A MEDIUM GRAINED, GREY HORNBLende-BIOTITE GRANODIORITIC PLUTON. HORNBLende IS IN PRISMS 1-2 MM LONG, AND BIOTITE FORMS EUHEDRAL BOOKS UP TO 6 MM IN DIAMETER.

FOR INTERPRETATION, SEE GSC 66-17

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GSC 66-17 BIOTITE, K-AR AGE 88 + OR - 5 M.Y.

K=6.33 PERCENT, AR40/K40=0.0053, RADIOGENIC AR=83 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED, LIGHT BROWN BIOTITE WITH LESS THAN 10 PERCENT HORNBLLENDE CONTAMINATION.

FROM GRANODIORITE
(103A) FOR DETAILS AND DESCRIPTION SEE GSC 66-16.

FIELD EVIDENCE, PARTICULARLY THE PRESENCE OF A NORTH-WESTERLY STRUCTURAL TREND DEFORMED BY A NORTHEASTERLY TREND INDICATE THAT THE PLUTON HAS HAD A COMPLEX HISTORY. IN SOME PLACES, TWO GENERATIONS OF PLAGIOCLASE CRYSTALS CAN BE RECOGNIZED, THE OLDER BEING COMMONLY MORE CALCIC.

AS THE AGE INDICATED BY BIOTITE AND HORNBLLENDE IS THE SAME, IT APPEARS TO DATE A MAJOR EVENT IN THE HISTORY OF THE PLUTON. THIS MIGHT NOT BE THE TIME OF ITS INTRUSION, BUT OF SOME LATER RECRYSTALLIZATION.

GSC 66-18 HORNBLLENDE, K-AR AGE 152 + OR - 15 M.Y.

K=1.04 PERCENT, AR40/K40=0.0093, RADIOGENIC AR=73 PERCENT.

CONCENTRATE- CLEAN, SLIGHTLY SCHILLERIZED OLIVE-GREEN HORNBLLENDE WITH A TRACE OF OLIVINE AND MICA (BIOTITE).

FROM BIOTITE-HORNBLLENDE PERIDOTITE
(94 C) AIKEN LAKE AREA, BRITISH COLUMBIA, 56-26 N, 125-35 W. MAP-UNIT 9, GSC MAP 1030A (AIKEN LAKE, E.F. ROOTS). SAMPLE IB65-127B, COLLECTED AND INTERPRETED BY T.N. IRVINE.

SEE GSC 66-19 FOR A DESCRIPTION OF THE ROCK AND DISCUSSION OF THE AGE OBTAINED.

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GSC 66-19 BIOTITE, K-AR AGE 164 + OR - 9 M.Y.

K=7.59 PERCENT, AR40/K40=0.0100, RADIOGENIC AR=87 PERCENT.

CONCENTRATE- CLEAN, UNALTERED, VERY PALE REDDISH BROWN BIOTITE WITH ONLY A TRACE OF CHLORITE.

FROM BIOTITE-HORNBLENDE PERIDOTITE
(94 C) AIKEN LAKE AREA, BRITISH COLUMBIA, 56-26 N, 125-35 W. MAP-UNIT 9, GSC MAP 1030A (AIKEN LAKE, E.F. ROOTS). SAMPLE IB65-127B, COLLECTED AND INTERPRETED BY T.N. IRVINE.

THE ROCK IS MEDIUM GRAINED, MASSIVE AND UNSHEARED, WITH 20 PERCENT BIOTITE AND 15 PERCENT HORNBLENDE POIKILITICALLY ENCLOSING ROUNDED OLIVINE GRAINS. IT CONTAINS ABOUT 1 PERCENT OF TINY OPAQUE CHROMITE GRAINS. THE OLIVINE IS VEINED WITH A LITTLE SERPENTINE AND SECONDARY MAGNETITE. THE OTHER MINERALS APPEAR VIRTUALLY UNALTERED.

THE SAMPLE IS FROM THE POLARIS ULTRAMAFIC COMPLEX IN THE AIKEN LAKE MAP-AREA IN NORTH-CENTRAL BRITISH COLUMBIA. IN THE COMPLEX, HORNBLENDE IS A MAJOR PRIMARY MINERAL, AND PRIMARY BIOTITE IS WIDELY DISPERSED IN TRACE AMOUNTS THROUGH LARGE AREAS OF PERIDOTITE. THE BIOTITE AND HORNBLENDE IN SAMPLE IB 65-127B ARE ALSO INDICATED TO BE PRIMARY BY THEIR TEXTURAL CHARACTERISTICS. ON THIS BASIS, THE MIDDLE JURASSIC AGE OF 164 M.Y. OBTAINED FOR THE BIOTITE, SUPPORTED BY A 152 M.Y. AGE FOR THE HORNBLENDE (SEE GSC 66-18), SHOULD INDICATE THE TIME AT WHICH THE INTRUSION SOLIDIFIED. THERE IS A POSSIBILITY OF SLIGHT ARGON LOSS DUE, FOR EXAMPLE, TO POST-CONSOLIDATION SERPENTINIZATION, AND THIS IS BEING FURTHER TESTED.

GSC 66-20 MUSCOVITE, K-AR AGE 51 + OR - 6 M.Y.

K=8.69 PERCENT, AR40/K40=0.0030, RADIOGENIC AR=57 PERCENT.

CONCENTRATE- CLEAN MUSCOVITE WITH PROMINENT (001) PARTING. A FEW FLAKES HAVE ATTACHED SPECKS OF BIOTITE AND CHLORITE. TOTAL CHLORITE CONTENT IS LESS THAN 1 PERCENT.

FROM GRANODIORITE
(93 D) OVESEN PINT, LABOUCHERE CHANNEL, BRITISH COLUMBIA, 52-25 N, 127-14 W. MAP-UNIT 11B, GSC PAPER 66-25.

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SAMPLE BT 89-A-63, COLLECTED AND INTERPRETED BY
A.J. BAER.

THE SPECIMEN IS FROM A MASSIVE, HOMOGENEOUS GRANODIORITE-QUARTZ MONZONITE PLUTON, SHARPLY INTRUSIVE INTO DIORITE, GREENSTONE, QUARTZ DIORITE AND GNEISS OF UNKNOWN AGE. A GROSSLY CONCENTRIC FOLIATION IS VISIBLE IN THE MARGINAL ZONES.

THIS IS THE SAME SPECIMEN FROM WHICH BIOTITE INDICATED 57 + OR - 6 M.Y. (GSC 64-10, GSC PAPER 65-17). AGES GIVEN BY MUSCOVITE AND BIOTITE MAY BE CONSIDERED IDENTICAL WITHIN THE LIMITS OF EXPERIMENTAL ERROR. THESE AGES ARE NOT CONTRADICTED BY FIELD EVIDENCE, AND MAY INDICATE THE APPROXIMATE AGE OF INTRUSION.

GSC 66-21 BIOTITE, K-AR AGE 105 + OR - 6 M.Y.

K=7.37 PERCENT, $AR_{40}/K_{40}=0.0063$, RADIOGENIC AR=89 PERCENT.

CONCENTRATE- CLEAN, OLIVE-GREEN BIOTITE. MOST FLAKES CONTAIN A FEW ROD-LIKE, COLOURLESS INCLUSIONS OF APATITE, AND A FEW FLAKES ARE SLIGHTLY BLISTERED. HORNBLLENDE (1 PERCENT) IS THE ONLY IMPURITY.

FROM **GRANITE** BOULDER
(93 G) MOUTH OF REDROCK CREEK, BRITISH COLUMBIA, 53-42 N,
122-41 W. MAP-UNIT 6A, GSC MAP 49-1960. SAMPLE
502B-8TD, COLLECTED AND INTERPRETED BY H.W. TIPPER.

THE SAMPLE IS FROM SEVERAL BOULDERS OF IDENTICAL LITHOLOGY IN A LOWER JURASSIC CONGLOMERATE. THE MATERIAL IS DEEPLY WEATHERED. THE ROCK IS A COARSE-GRAINED QUARTZ MONZONITE, EQUIGRANULAR FOR THE MOST PART.

FOR INTERPRETATION SEE GSC 66-25.

GSC 66-22 BIOTITE, K-AR AGE 98 + OR - 5 M.Y.

K=7.42 PERCENT, $AR_{40}/K_{40}=0.0059$, RADIOGENIC AR=82 PERCENT.

CONCENTRATE- CLEAN, UNALTERED, LIGHT BROWN BIOTITE WITH A TRACE OF HORNBLLENDE AND 1 PERCENT CHLORITE IMPURITY.

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FROM QUARTZ MONZONITE
 (93 G) MOUTH OF RED ROCK CREEK, BRITISH COLUMBIA, 53-41 N,
 122-41 W. MAP-UNIT 6A, GSC MAP 49-1960. SAMPLE
 502A-8TD, COLLECTED AND INTERPRETED BY H.W. TIPPER.

THE SAMPLE WAS OBTAINED FROM A BOULDER IN A LOWER JURASSIC CONGLOMERATE. THE ROCK IS DEEPLY WEATHERED AND FRIABLE. IT IS A LIGHT GREY, COARSE-GRAINED, PORPHYRITIC QUARTZ MONZONITE. SCATTERED PALE PINK SUBHEDRAL CRYSTALS OF POTASH FELDSPAR ARE PRESENT.

FOR INTERPRETATION SEE GSC 66-25.

GSC 66-23 BIOTITE, K-AR AGE 104 + OR - 5 M.Y.

K=7.60 PERCENT, AR40/K40=0.0063, RADIOGENIC AR=93 PERCENT.

CONCENTRATE- CLEAN, OLIVE-GREEN BIOTITE. MOST FLAKES CONTAIN A FEW ROD-LIKE, COLOURLESS INCLUSIONS OF APATITE. THERE ARE OCCASIONAL PLEOCHROIC HALOS, AND A FEW FLAKES ARE ALTERED TO CHLORITE ON THE EDGES. ABOUT 1 PERCENT HORNBLENDE IS PRESENT AS AN IMPURITY.

FROM QUARTZ MONZONITE
 (93 G) 7 MILES FROM HIGHWAY 97 ALONG NAVER FORESTRY ROAD,
 BRITISH COLUMBIA, 53-18 N, 122-22 W. MAP-UNIT 7B,
 GSC MAP 49-1960. SAMPLE 506-24TD, COLLECTED AND
 INTERPRETED BY H.W. TIPPER.

THE SAMPLE IS A FRESH, GREY, COARSE-GRAINED QUARTZ MONZONITE WITH SCATTERED ANHEDRAL TO SUBHEDRAL PHENOCRYSTS OF PALE PINK POTASH FELDSPAR UP TO 2/3 INCH LONG, FRESH BLACK SUBHEDRAL CRYSTALS OF BIOTITE ARE ABUNDANT THROUGHOUT THE GROUNDMASS.

FOR INTERPRETATION SEE GSC 66-25.

GSC 66-24 BIOTITE, K-AR AGE 107 + OR - 6 M.Y.

K=7.68 PERCENT, AR40/K40=0.0064, RADIOGENIC AR=86 PERCENT.

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CONCENTRATE- RELATIVELY CLEAN, UNALTERED OLIVE-GREEN BIOTITE WITH ABOUT 2 PERCENT HORNBLLENDE IMPURITY. A FEW OF THE FLAKES CONTAIN COLOURLESS APATITE INCLUSIONS AND OCCASIONAL WEAK PLEOCHROIC HALOS. MOST FLAKES ARE SLIGHTLY BLISTERED.

- FROM QUARTZ MONZONITE
(93 G) 8 MILES WEST-SOUTHWEST OF TEAPOT LAKE, BRITISH COLUMBIA, 53-25 N, 122-14 W. MAP-UNIT 7B, GSC MAP 49-1960. SAMPLE 506-25TD, COLLECTED AND INTERPRETED BY W.H. TIPPER.

THIS IS A COARSE-GRAINED PORPHYRITIC QUARTZ MONZONITE WITH PHENOCRYSTS OF VERY PALE PINK POTASH FELDSPAR AS ANHEDRAL TO SUBHEDRAL CRYSTALS UP TO 1/2 INCH LONG. BIOTITE IS FRESH AND UNALTERED.

FOR INTERPRETATION SEE GSC 66-25.

GSC 66-25 HORNBLLENDE, K-AR AGE 176 + OR - 20 M.Y.

K=1.15 PERCENT, AR40/K40=0.0108, RADIOGENIC AR=85 PERCENT.

CONCENTRATE- CLEAN, PLEOCHROIC DARK GREEN TO YELLOW BROWN HORNBLLENDE WITH TRACE IMPURITIES OF MICA, CHLORITE, QUARTZ AND FELDSPAR.

- FROM GRANITE
(93 G) ON WILLOW RIVER FORESTRY ROAD AT ST. MARYS LAKE, BRITISH COLUMBIA, 53-44 N, 122-20 W. MAP-UNIT 7B, GSC MAP 49-1960. SAMPLE 505-21TD, COLLECTED AND INTERPRETED BY H.W. TIPPER.

THIS ROCK IS A GREY, COARSE-GRAINED, PORPHYRITIC HORNBLLENDE GRANITE WITH PHENOCRYSTS OF POTASH FELDSPAR UP TO 3/4 INCH LONG. THE MAFIC MINERAL IS ALMOST EXCLUSIVELY A DARK GREEN HORNBLLENDE IN EUHEDRAL TO SUBHEDRAL GRAINS.

A GROUP OF AGE DETERMINATIONS (GSC 66-21, 22, 23, 24, AND 25) WAS OBTAINED FROM SAMPLES OF GRANITIC ROCK IN THE PRINCE GEORGE- QUESNEL AREA. FOUR OF THE AGE DETERMINATIONS WERE MADE ON BIOTITE (GSC 66-21, 22, 23, AND 24) AND OF THESE, TWO (GSC 66-21 AND 22) WERE ON SAMPLES FROM BOULDERS IN A CONGLOMERATE THAT IS BELIEVED TO BE OF LOWER JURASSIC AGE. THE FIFTH AGE DETERMINATION (GSC 66-25) IS ON HORNBLLENDE OBTAINED FROM AN INTRUSIVE BODY. THE AGE DETERMINATION OF THIS HORNBLLENDE (176 + OR - 20 MILLION YEARS) IS ABOUT 75 MILLION YEARS OLDER THAN THE AGE DETERMINATIONS ON THE BIOTITE

BRITISH COLUMBIA

OF THE OTHER FOUR SAMPLES.

THE THREE INTRUSIVE BODIES SAMPLED (GSC 66-23, 24, AND 25) ALL INTRUDE UPPER TRIASSIC (KARNIAN) STRATA AND THESE BODIES WERE APPARENTLY THE SOURCE OF THE BOULDERS IN THE LOWER JURASSIC CONGLOMERATE FROM WHICH THE OTHER TWO SAMPLES WERE OBTAINED (GSC 66-22 AND 21). IF THE FIELD INTERPRETATIONS ARE CORRECT, THE AGE OF THE INTRUSIONS SHOULD BE LATE UPPER TRIASSIC OR EARLY LOWER JURASSIC AND AN AGE DETERMINATION OF 190 TO 200 MILLION YEARS WOULD BE EXPECTED.

IT WOULD APPEAR THAT THERE HAS BEEN A LOSS OF ARGON, MUCH GREATER IN THE BIOTITE THAN IN THE HORNBLENDE, THAT MAY HAVE BEEN CAUSED BY SOME OROGENIC EVENT AT THE CLOSE OF LOWER CRETACEOUS TIME.

GSC 66-26 BIOTITE, K-AR AGE 106 + OR - 6 M.Y.

K=7.19 PERCENT, AR40/K40=0.0064, RADIOGENIC AR=88 PERCENT.

CONCENTRATE- CLEAN, OLIVE-GREEN BIOTITE WITH LESS THAN 2 PERCENT HORNBLENDE IMPURITY.

FROM GRANODIORITE
(93 B) 2 MILES NORTH OF WEST END OF DRUMMOND LAKE, BRITISH COLUMBIA, 52-04 N, 122-35 W. MAP-UNIT A, GSC MAP 12-1959. SAMPLE 611-43TD, COLLECTED AND INTERPRETED BY H.W. TIPPER.

THIS IS A GREY, COARSE-GRAINED, EQUIGRANULAR GRANODIORITE. THE BIOTITE IS BLACK AND IN EUHEDRAL CRYSTALS COMPRISING AS MUCH AS 20 PERCENT OF THE ROCK.

THE PLUTONIC BODY FROM WHICH THE SAMPLE WAS OBTAINED IS INTRUSIVE INTO ROCKS THAT ARE BELIEVED TO BE OF LOWER JURASSIC AGE. LITHOLOGICALLY THIS ROCK RESEMBLES BOULDERS FOUND IN A LATE LOWER CRETACEOUS (APTIAN) CONGLOMERATE TO THE SOUTH AND HENCE IS BELIEVED TO BE THE SOURCE AREA. GRANITIC PEBBLES IN CONGLOMERATES OF EARLY UPPER JURASSIC AGE (OXFORDIAN) MAY ALSO HAVE BEEN DERIVED FROM THIS INTRUSIVE MASS. FROM STRATIGRAPHIC EVIDENCE THE GRANODIORITE IS BELIEVED TO BE MIDDLE JURASSIC (BATHONIAN) IN AGE.

THE AGE DETERMINATION DATE OF 106 + OR - 6 MILLION YEARS IS ABOUT SIXTY MILLION YEARS YOUNGER THAN THE MIDDLE JURASSIC DATE PROPOSED FROM FIELD EVIDENCE.

K=6.01 PERCENT, AR40/K40=0.0092, RADIOGENIC AR=85 PERCENT.
K=6.01 PERCENT, AR40/K40=0.0092, RADIOGENIC AR=86 PERCENT.

CONCENTRATE- ALTERED, LIGHT BROWN BIOTITE. ALTERATION CONSISTS MAINLY OF CHLORITIZATION ON FLAKE EDGES, AND THE TOTAL CHLORITE CONTENT IS ABOUT 20 PERCENT.

(92 L) FROM QUARTZ MONZONITE
NORTHEAST SHORE OF BONANZA LAKE, VANCOUVER ISLAND,
BRITISH COLUMBIA, 50-22-15 N, 126-45-40 W. SEE
GSC MAP 1029A. SAMPLE CTKA-64-1, COLLECTED AND
INTERPRETED BY D.J.I. CARSON.

THE ROCK IS MEDIUM GRAINED PALE PINKISH-GRAY FRESH HPYDIO-
MORPHIC-GRANULAR BIOTITE GRANODIORITE. IT CONTAINS 49.7 PER-
CENT SUBHEDRAL OSCILLATORY ZONED CLOUDY OLIGOCLASE-ANDESINE,
11.3 PERCENT CLOUDY ANHEDRAL POTASH FELDSPAR, 31.6 PERCENT
ANHEDRAL STRAINED QUARTZ, 5.3 PERCENT SUBHEDRAL PLEOCHROIC
BROWN TO PALE YELLOW BIOTITE, 0.5 PERCENT POIKILITIC SUBHEDRAL
PLEOCHROIC DEEP GREENISH BROWN TO PALE YELLOW HORNBLende, 0.8
PERCENT CHLORITE AFTER BIOTITE, 0.4 PERCENT IRON OXIDE,
AND 0.4 PERCENT APATITE AND SPHENE.

MOST BIOTITE GRAINS ARE UNALTERED. EUHEDRAL UNALTERED HORNBLLENDE AND APATITE CRYSTALS ARE INCLUDED IN MANY BIOTITE GRAINS AND POIKILITIC HORNBLLENDE INCLUDES UNALTERED BIOTITE CRYSTALS.

THE INTRUSION AT BONANZA LAKE IS A RELATIVELY HOMOGENEOUS BODY APPROXIMATELY 8 MILES LONG BY 2 MILES WIDE. IT IS PETROGRAPHICALLY SIMILAR TO A MAJOR PHASE OF THE NIMPKISH BATHOLITH (GSC 65-14, 151 M.Y.) SOUTH OF BONANZA LAKE. THE YOUNGEST ROCKS IT INTRUDES ARE THOSE OF THE BONANZA FORMATION THE LOWER PART OF WHICH IS OF LATE NORIAN (MID LATE TRIASSIC) AGE.

THE K-AR AGES OF 150 M.Y. AND 152 M.Y. ARE IN CLOSE AGREEMENT WITH SEVERAL OTHER K-AR DETERMINATIONS FROM VANCOUVER ISLAND, WHICH RANGE FROM 143 TO 167 M.Y. AND APPEAR TO DATE THE **COAST RANGE OROGENY** IN THAT AREA.

REFERENCES-

HOADLEY, J.W.
1954 GEOLOGY AND MINERAL DEPOSITS OF THE ZEBALLOS-

BRITISH COLUMBIA

GSC 66-28 NIMPKISH AREA, VANCOUVER ISLAND, B.C. GSC MEM. 272.
PHLOGOPITE, K-AR AGE 148 + OR - 8 M.Y.

K=5.47 PERCENT, AR40/K40=0.0090, RADIOGENIC AR=84 PERCENT.

CONCENTRATE- VERY PALE GREEN, CLEAN PHLOGOPITE.
THERE IS NO FREE CHLORITE IN THE CONCENTRATE, YET
X-RAY DIFFRACTION STUDY INDICATES ABOUT 35 PERCENT
CHLORITE. IT IS SUGGESTED, THEREFORE, THAT THE
GREEN COLOUR OF THE MICA IS DUE TO THE PRESENCE OF
CHLORITE WITHIN THE STRUCTURE OF THE MICA.

(92 L) FROM SKARN
ZEBALLOS IRON MINE, FL OREBODY, VANCOUVER ISLAND,
BRITISH COLUMBIA, 50-02-58 N, 126-49-56 W. MAP AS
FIG. 2 IN B.C. DEPT. OF MINES BULLETIN 27. SAMPLE
CT-A-24/8/65, COLLECTED AND INTERPRETED BY D.J.T.
CARSON.

THE COARSE FRESH DARK GREENISH-BROWN PHLOGOPITE OF SAMPLE
CT-A-24/8/64 IS FROM THE SKARN ZONE ENCLOSING THE FL CONTACT
METASOMATIC MAGNETITE OREBODY. CHLORITE CONTAINED WITHIN THE
CRYSTAL STRUCTURE GIVES IT A GREENISH COLOUR BUT IS BELIEVED TO
BE PRIMARY.

THE DETERMINATION OF 148 + OR - 8 M.Y. SHOULD INDICATE THE
AGE OF THE SKARN, AND APPROXIMATELY, THE AGE OF THE MAGNETITE
ORE WHICH HAS A CLOSE GENETIC RELATIONSHIP TO THE SKARN. THIS
DETERMINATION IS IN CLOSE AGREEMENT WITH DATING DONE ON THE
INTRUSIONS RELATED TO THE CONTACT METASOMATIC MAGNETITE DEPOSITS
AT KENNEDY LAKE (GSC 64-2, -3) AND NIMPKISH LAKE (GSC 65-14,-15)

REFERENCES-

- STEVENSON, J.S.
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MINING CAMP, BRITISH COLUMBIA, B.C. DEPT. OF
MINES BULL. NO. 27.
- WANLESS ET AL
1966 AGE DETERMINATIONS AND GEOLOGICAL STUDIES K-AR
ISOTOPIC AGES, REPORT 6, GSC PAPER 65-17.
1967 AGE DETERMINATIONS AND GEOLOGICAL STUDIES K-AR
ISOTOPIC AGES, REPORT 7, GSC PAPER 66-17.

BRITISH COLUMBIA

GSC 66-29 BIOTITE, K-AR AGE 39 + OR - 7 M.Y.

K=4.73 PERCENT, AR40/K40=0.0023, RADIOGENIC AR=71 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, SLIGHTLY ALTERED BROWN BIOTITE WITH 2 PERCENT HORNBLLENDE AND 2 PERCENT FREE CHLORITE IMPURITIES. ABOUT 10 PERCENT OF THE FLAKES ARE ALTERED TO CHLORITE ON THEIR EDGES, AND APPROXIMATELY 1 PERCENT CONTAIN COLOURLESS INCLUSIONS. TOTAL CHLORITE CONTENT IS 8 PERCENT.

FROM QUARTZ DIORITE
(92 F) IN CREEK 500 FT WEST OF FAITH LAKE, FORBIDDEN PLATEAU, VANCOUVER ISLAND, BRITISH COLUMBIA, 49-39-12 N, 125-24-41 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE CT-K-17/9/65. COLLECTED AND INTERPRETED BY D.J.T. CARSON.

THE ROCK IS FINE TO MEDIUM GRAINED HYPIDIOMORPHIC-GRANULAR GREY FRESH HORNBLLENDE BIOTITE QUARTZ DIORITE. IT CONTAINS 68.6 PERCENT SUBHEDRAL OSCILLATORY ZONED PLAGIOCLASE (AN16-66), 21.2 PERCENT ANHEDRAL QUARTZ, 5.3 PERCENT POIKILITIC HORNBLLENDE WITH PLAGIOCLASE AND BIOTITE INCLUSIONS, 3.4 PERCENT POIKILITIC BIOTITE WITH PLAGIOCLASE INCLUSIONS AND PLEOCHROIC FROM DEEP ORANGE-BROWN TO PALE YELLOW, 1.1 PERCENT CHLORITE AFTER BIOTITE, AND MINOR ACCESSORY EPIDOTE, SPHENE, AND MAGNETITE.

SAMPLE CT-K-17/9/65 IS FROM THE CENTER OF A SMALL PLUG COMPOSED OF QUARTZ DIORITE OR DACITE PORPHYRY, IN THE FORBIDDEN PLATEAU. IT INTRUDES TRIASSIC VOLCANIC ROCKS. A PETROGRAPHICALLY SIMILAR INTRUSION AT MT. WASHINGTON ABOUT 8 MILES TO THE NORTHEAST YIELDS A SIMILAR AGE (GSC 66-30, 35 + OR - 6 M.Y.) AND INTRUDES TRIASSIC AND LATE CRETACEOUS ROCKS. COPPER-GOLD DEPOSITS AND BRECCIA ZONES ARE GENETICALLY RELATED TO BOTH INTRUSIONS.

REFERENCE-

MULLER, J.E.
1965 COMOX LAKE AREA, GSC MAP 2-1965.

GSC 66-30 BIOTITE, K-AR AGE 35 + OR - 6 M.Y.

K=7.33 PERCENT, AR40/K40=0.0021, RADIOGENIC AR=78 PERCENT.

BRITISH COLUMBIA

CONCENTRATE- CLEAN, UNALTERD KHAKI BIOTITE WITH LESS THAN 1 PERCENT CHLORITE IMPURITY.

FROM QUARTZ DIORITE
(92 F) IN ROADCUT ON MT. WASHINGTON MINE ROAD, 50 FT. EAST OF MCKAY CREEK AT 3600 FT. ELEVATION, VANCOUVER ISLAND, BRITISH COLUMBIA, 49-46-04 N, 125-17-24 W. MAP-UNIT 12, GSC MAP 2-1965. SAMPLE CT-A-6/9/65, COLLECTED AND INTERPRETED BY D.J.T. CARSON.

THE ROCK IS FINE TO MEDIUM GRAINED HYPIDIOMORPHIC-GRANULAR GREY FRESH HORNBLLENDE BIOTITE QUARTZ DIORITE. IT CONTAINS 60.0 PERCENT SUBHEDRAL OSCILLATORY ZONED PLAGIOCLASE (AN18-52), 26.3 PERCENT ANHEDRAL QUARTZ, 7.1 PERCENT POIKILITIC HORNBLLENDE, 4.6 PERCENT BIOTITE PLEOCHROIC FROM DEEP BROWN TO PALE YELLOW WHICH IS INTERGROWN WITH AND REPLACING HORNBLLENDE, 1 PERCENT CHLORITE AFTER HORNBLLENDE AND BIOTITE, AND ACCESSORY APATITE AND MAGNETITE.

SAMPLE CT-A-6/9/65 IS FROM THE CENTRAL PART OF THE MT. WASHINGTON STOCK WHICH INTRUDES ROCKS OF TRIASSIC AND LATE CRETACEOUS AGES. ASSOICATED WITH THE RELATIVELY EQUIGRANULAR STOCK ARE INTRUSIONS OF QUARTZ DIORITE PORPHYRY OR DACITE PORPHYRY WHICH OCCUR AS GENERALLY CONCORDANT BODIES IN THE LATE CRETACEOUS SEDIMENTS OF THE COMOX AND TRENT RIVER FORMATIONS SURROUNDING THE STOCK. THE CU-AU DEPOSITS AND BRECCIAS AT MT. WASHINGTON ARE ASSOCIATED WITH THESE INTRUSIVE ROCKS.

THE K-AR AGE OF 35 + - OR 6 M.Y. IS THE YOUNGEST YET OBTAINED FROM VANCOUVER ISLAND, BUT COMPARABLE DATES WERE OBTAINED FROM BODIES OF SIMILAR QUARTZ DIORITE WITH ASSOCIATED PORPHYRITES AND MINERAL DEPOSITS AT FAITH LAKE (GSC 66-29 AT 39 OR - 7 M.Y.), CATFACE PENINSULA (GSC 65-11 AT 48 + OR - 12 M.Y.), AND ZEBALLOS (GSC 65-12 AT 38 + OR - 14 M.Y.).

REFERENCES-

CARSON, D.J.T.
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MULLER, J.E.
1965 COMOX LAKE AREA GSC MAP 2-1965.

GSC 66-31 BIOTITE, K-AR AGE 50 + OR - 5 M.Y.

K=6.87 PERCENT, AR40/K40=0.0030, RADIOGENIC AR=71 PERCENT.

BRITISH COLUMBIA

CONCENTRATE- RELATIVELY CLEAN, BLEACHED, REDDISH BROWN BIOTITE. ABOUT ONE THIRD OF THE FLAKES CONTAIN STRONGLY PLEOCHROIC HALOS SURROUNDING BLEB-LIKE COLOURLESS INCLUSIONS. OTHER FLAKES CONTAIN COLOURLESS ACICULAR INCLUSIONS. CHLORITE ALTERATION IS PRESENT ON FLAKE EDGES AND TOTAL CHLORITE CONTENT IS 10 PERCENT. HORNBLENDE CONTAMINATION AMOUNTS TO ABOUT 3 PERCENT.

FROM BIOTITE LEUCOGRANODIORITE

- (92 F) STUBBS ISLAND, NEAR TOFINO, SOUTH OF WHARF, BRITISH COLUMBIA, 49-09-25 N, 125-55-30 W. NO PUBLISHED GEOLOGICAL MAP. SAMPLE MEKA 65-1, COLLECTED AND INTERPRETED BY J.E. MULLER.

THE SAMPLE IS FROM A SMALL STOCK OF LEUCOCRATIC BIOTITE QUARTZ MONZONITE, VARYING IN TEXTURE FROM MEDIUM GRAINED EQUIGRANULAR TO PORPHYRITIC. IT OCCUPIES PARTS OF STUBBS AND FELICE ISLANDS AND A SMALL COASTAL AREA SOUTH OF TOFINO. THE ROCK IS READILY DISTINGUISHED FROM DARKER, COMMONLY HORNBLENDE-BEARING, MESOZOIC GRANITIC ROCKS OF THE REGION. IT INTRUDES A GREYWACKE-ARGILLITE-CONGLOMERATE SEQUENCE THAT MAY BE EQUIVALENT TO SIMILAR ROCKS OF LOWER JURASSIC AGE, DESCRIBED BY JELETZKY (GSC PAPER 53-17) FROM FARTHER NORTH ON THE VANCOUVER ISLAND WEST COAST.

THE EARLY TERTIARY AGE OF THE STOCK IS NEARLY IDENTICAL TO THAT OF THE YOUNGEST PART OF THE GRANITIC COMPLEX OF CATFACE MOUNTAIN, 7 MILES TO THE NORTH-NORTHWEST.

GSC 66-32 BIOTITE, K-AR AGE 59 + OR - 3 M.Y.

K=7.14 PERCENT, AR40/K40=0.0035, RADIOGENIC AR=79 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, SLIGHTLY ALTERED KHAKI BIOTITE. A FEW FLAKES CONTAIN TINY PRISMATIC APATITE INCLUSIONS, AND A FEW CONTAIN COLOURLESS, BLEB-LIKE INCLUSIONS SURROUNDED BY WEAK PLEOCHROIC HALOS. SOME FLAKES ALSO CONTAIN OPAQUE INCLUSIONS. TOTAL CHLORITE CONTENT AMOUNTS TO LESS THAN 2 PERCENT AND HORNBLENDE CONTAMINATION IS ABOUT 3 PERCENT.

FROM QUARTZ MONZONITE

- (92 F) LOGGING ROAD WEST OF PARADISE CREEK, BRITISH COLUMBIA (VANCOUVER ISLAND), 49-01-25 N, 125-29-10 W. NO PUBLISHED GEOLOGICAL MAP. SAMPLE MEKA 65-2,

BRITISH COLUMBIA

COLLECTED AND INTERPRETED BY J.E. MULLER.

THE SAMPLE IS A PORPHYRITIC BIOTITE QUARTZ MONZONITE WITH QUARTZ, ORTHOCLASE AND BIOTITE IN A SLIGHTLY FINER MATRIX OF THE SAME MINERALS AND PLAGIOCLASE. CORROSION OF BIOTITE AND QUARTZ, ZONING OF PLAGIOCLASE, AND INCLUSION OF REMNANTS OF QUARTZ, PLAGIOCLASE AND BIOTITE IN PERTHITIC ORTHOCLASE INDICATE SEVERAL STAGES IN THE CRYSTALLIZATION HISTORY.

THE ROCK FORMS PART OF A GRANITIC COMPLEX, INTRUDING TRIASSIC AND JURASSIC VOLCANIC ROCKS AND CALCAREOUS SEDIMENTS EAST OF KENNEDY LAKE. THE METASOMATIC BRYNNOR MINES MAGNETITE DEPOSIT OCCURS IN THE SAME COMPLEX, 3 MILES TO THE NORTHEAST. FROM THERE TWO OTHER K-AR AGES HAVE ALREADY BEEN OBTAINED FROM SAMPLES, SUBMITTED BY G.E.P. EASTWOOD. ONE OF THESE, FROM GRANODIORITE IN CONTACT WITH LIMESTONE AND MAGNETITE, 3/4 MILE NORTHEAST OF THE MINE, YIELDED AN AGE OF 167 ± 10 M.Y. NEARLY EQUAL TO SEVERAL OTHER MIDDLE TO UPPER JURASSIC K-AR AGES OBTAINED ON OTHER PARTS OF THE VANCOUVER ISLAND GRANITIC COMPLEX. THE PRESENT SAMPLE SHOWS THAT THE KENNEDY LAKE GRANITIC ROCKS ALSO CONTAIN AN EARLY TERTIARY COMPONENT. THE AGE IS THE HIGHEST OF SEVEN EARLY TERTIARY DATES OBTAINED SO FAR FROM THE ISLAND. WITH THE DATES FROM NEARBY CATFACE MOUNTAIN AND STUBBS ISLAND IT FORMS A SMALL GROUP BETWEEN 48 AND 59 M.Y., POSSIBLY REPRESENTING AN OLDER PHASE OF TERTIARY INTRUSIONS, DISTINCT FROM ANOTHER GROUP OF DATES BETWEEN 35 AND 39 M.Y. THE DATE OF 121 ± 35 M.Y., OBTAINED FROM COMPOSITE SAMPLE OF TWO DYKES CUTTING MAGNETITE IN THE BRYNNOR MINES PIT HAS SO FAR NOT BEEN MATCHED BY SIMILAR DATES ELSEWHERE ON THE ISLAND, BUT MAY WITHIN THE ERROR LIMIT REPRESENT ANOTHER UPPER JURASSIC AGE.

GSC 66-33 BIOTITE, K-AR AGE 160 ± 8 M.Y.

K=6.32 PERCENT, $AR_{40}/K_{40}=0.0098$, RADIOGENIC $AR=92$ PERCENT.

CONCENTRATE- CLEAN, RELATIVELY UNALTERED, KHAKI BIOTITE. THERE IS SLIGHT CHLORITE ALTERATION AROUND FLAKE EDGES AND THE TOTAL CHLORITE CONTENT IS ABOUT 2 PERCENT. HORNBLENDE IMPURITY ALSO AMOUNTS TO ABOUT 2 PERCENT.

FROM GRANODIORITE
(92 F) NANIAMO LAKES ROAD, NEAR DASH CREEK, 0.2 MILE WEST OF LOGGING SPUR C12, BRITISH COLUMBIA (VANCOUVER ISLAND), 49-05-15 N, 124-16-15 W. MAP-UNIT 7, GSC MAP 49-1963. SAMPLE MEKA 64-8, COLLECTED AND INTERPRETED BY J.E. MULLER.

BRITISH COLUMBIA

THE SAMPLE IS A DARK COLOURED BIOTITE-HORNBLENDE GRANO-DIORITE WITH OVER 25 PERCENT MAFIC MINERALS. IT IS THE FIRST DETERMINATION FROM THE EASTERNMOST GRANITIC BELT OF VANCOUVER ISLAND. THIS BELT INTRUDES TRIASSIC KARMUTSEN VOLCANIC ROCKS AND IS OVERLAIN UNCONFORMABLY BY THE UPPER CRETACEOUS NANAIMO GROUP. THE MIDDLE TO LATE JURASSIC K-AR AGE IS IN GOOD AGREEMENT WITH THE FIELD DATA AND SHOWS THAT THIS PLUTONIC BELT IS DIRECTLY CORRELATIVE TO THE CENTRAL AND WESTERN CRYSTALLINE BELTS OF VANCOUVER ISLAND, ALREADY REPRESENTED BY A SMALL GROUP OF AGES, RANGING FROM 143 TO 167 M.Y.

GSC 66-34 WHOLE ROCK, K-AR AGE 163 + OR - 20 M.Y.

K=3.98 PERCENT, AR40/K40=0.0100, RADIOGENIC AR=74 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM SCHIST

(92 B) PORTAL OF TWIN J MINE, DUNCAN, VANCOUVER ISLAND, BRITISH COLUMBIA, 48-52-00 N, 123-47-30 W. NO GEOLOGICAL MAP. SAMPLE CT-A-18/8/65, COLLECTED AND INTERPRETED BY D.J. CARSON.

SAMPLE CT-A-18/8/65 IS FINE GRAINED SERICITE SCHIST DERIVED FROM CHERTY TUFFS OF THE LATE PALEOZOIC SICKER GROUP (EQUIVALENT TO THE CACHE CREEK GROUP). THESE TUFFS ARE THE HOST ROCKS FOR THE PB-ZN-CU-AG DEPOSITS OF THE TWIN **J** MINE NEAR DUNCAN, AND THE SAMPLE WAS TAKEN TO DETERMINE THE TIME OF THEIR DEFORMATION.

STEVENSON (1945) BELIEVES THAT THE TWIN **J** ORES OCCUR AS REPLACEMENT BODIES INTRODUCED AFTER THE FOLDING AND METAMORPHISM WHICH AFFECTED THE HOST ROCKS, AND NEWHOUSE AND FLAHERTY (1930) BELIEVE THAT THE ORE IS LITTLE DEFORMED.

THE PRESENT WRITER BELIEVES THAT THE ORE MAY HAVE BEEN DEFORMED AND REMOBILIZED DURING THE PERIOD OF FOLDING AND METAMORPHISM WHICH BY GSC 66-34 OCCURRED APPROXIMATELY 163 M.Y. AGO. THIS AGE COINCIDES WITH SEVERAL DATES FROM GRANITIC ROCKS ON VANCOUVER ISLAND AND APPEARS TO PLACE THE **COAST RANGE OROGENY** ON VANCOUVER ISLAND IN THE MIDDLE TO LATE JURASSIC INTERVAL.

IF THE TWIN **J** ORE WAS DEFORMED ALONG WITH ITS HOST ROCKS DURING THE **COAST RANGE OROGENY** IT IS OLDER THAN 163 OR - 20 M.Y.

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NEWHOUSE, W.H., AND FLAHERTY, C.F.

1930 TEXTURE AND ORIGIN OF SOME BANDED OR SCHISTOSE
SULPHIDE ORES, ECON. GEOL. VOL. 25, PP. 602-603.

STEVENSON, J.S.

1945 GEOLOGY OF THE TWIN **J** MINE, WESTERN MINER,
MARCH 1945, PP. 38-44.

GSC 66-35 BIOTITE, K-AR AGE 194 + OR - 10 M.Y.

K=7.49 PERCENT, AR40/K40=0.0120, RADIOGENIC AR=96
PERCENT.CONCENTRATE- RELATIVELY CLEAN, SLIGHTLY ALTERED
KHAKI BIOTITE. A FEW FLAKES HAVE CHLORITIC ALTERA-
TION ON THE EDGES. IMPURITIES ARE HORNBLLENDE (3
PERCENT) AND CHLORITE (2-3 PERCENT).

FROM GRANODIORITE

(92 P) 1.7 MILES NORTHEAST OF NORTH END OF CAVERHILL LAKE,
BRITISH COLUMBIA, 51-20-40 N, 120-24-00 W. MAP
UNIT 8C IN GSC PAPAER 64-1, P. 67, 1964. SAMPLE
35-CACB-1, COLLECTED AND INTERPRETED BY R.B. CAMP-
BELL.

SEE GSC 66-36 FOR DESCRIPTION AND INTERPRETATION.

GSC 66-36 HORNBLLENDE, K-AR AGE 198 + OR - 12 M.Y.

K=0.59 PERCENT, AR40/K40=0.0122, RADIOGENIC AR=89
PERCENT.CONCENTRATE- CLEAN, UNALTERED, DARK GREEN HORN-
BLLENDE. ABOUT 50 PERCENT OF THE GRAINS CONTAIN A
VERY FEW FINE, OPAQUE INCLUSIONS.

FROM GRANODIORITE

(92 P) 1.7 MILES NORTHEAST OF NORTH END OF CAVERHILL LAKE,
BRITISH COLUMBIA, 51-20-40 N, 120-24-00 W. MAP
UNIT 8C IN GSC PAPER 64-1, P. 67, 1964. SAMPLE 35-

BRITISH COLUMBIA

CACB-1, COLLECTED AND INTERPRETED BY R.B. CAMPBELL. THE ROCK IS MEDIUM-GRAINED, WEAKLY FOLIATED, ROUGHLY EQUI-GRANULAR, SPECKLED, MEDIUM-GREY HORNBLende-BIOTITE GRANODIORITE. IT CONSISTS OF ABOUT 50 PERCENT PARTIALLY SERICITIZED AND ARGILLIZED PLAGIOCLASE (AN30-AN35), 15 PERCENT POTASH FELDSPAR, 20 PERCENT QUARTZ, 10 PERCENT HORNBLende, AND 5 PERCENT BIOTITE. HORNBLende IS NOT ALTERED AND ALTERATION OF BIOTITE IS VARIABLE, SOME IS HEAVILY CHLORITIZED, SOME IS UNALTERED.

THE SAMPLE WAS TAKEN FROM A BATHOLITH THAT UNDERLIES MUCH OF THE EAST-CENTRAL PART OF THE BONAPARTE RIVER (92P) MAP-AREA (MAP-UNIT 14, GSC MAP 3-1966). THE BATHOLITH INTRUDES PERMIAN AND LATE TRIASSIC ROCKS. IT IS THOUGHT TO HAVE BEEN INTRUDED AND UNROOFED PRIOR TO THE DEPOSITION OF EARLY JURASSIC VOLCANIC AND SEDIMENTARY ROCKS. CLASTS IN EARLY JURASSIC CONGLOMERATE ARE LITHOLOGICALLY SIMILAR TO ROCKS OF THE BATHOLITH BUT THE EARLY JURASSIC STRATA HAVE NOT BEEN FOUND IN DIRECT CONTACT WITH THE GRANITIC ROCKS, AND THUS THE AGE RELATIONS ARE INFERRED ONLY.

THE K-AR AGES FOR BIOTITE AND HORNBLende (GSC 66-35 AND 36) OF 194 ± 10 M.Y. AND 198 ± 12 M.Y. ARE CONSISTENT WITH THE INFERRED AGE (ASSUMING THE TRIASSIC - JURASSIC BOUNDARY AT 190 TO 195 M.Y.). AN AGE OF 166 ± 11 M.Y. (GSC 65-25, GSC PAPER 66-17) OBTAINED ON BIOTITE FROM THE WESTERN, MORE POTASSIC AND LESS MAFIC PART OF THE BATHOLITH (MAP-UNIT 17) MAY REPRESENT THE TRUE AGE OF A YOUNGER PHASE OR IT MAY BE ANOMALOUSLY YOUNG.

THE BIOTITE AGE COMPARES WELL WITH THAT OBTAINED FOR BIOTITE FROM THE BATHOLITH NORTHWEST OF CANIM LAKE (187 M.Y., GSC 62-64, GSC PAPER 63-17, P. 42). IT IS ALSO REASONABLY CONSISTENT WITH THE AGE OF APPROXIMATELY 200 M.Y. OBTAINED FOR VARIOUS PHASES OF THE GUICHON BATHOLITH AS QUOTED BY WHITE (1966, P. 352). AGES FOR THE LATTER OBTAINED BY THE GEOLOGICAL SURVEY OF CANADA (GSC PAPER 63-17, PP. 39-42 AND GSC PAPER 64-17, PP. 12-15) SEEM TO BE ANOMALOUSLY OLD, REASONS FOR THIS ARE CURRENTLY UNDER INVESTIGATION (SEE GSC 66-38 AND -40).

REFERENCE-

WHITE, W.H.
1966 IN TECTONIC HISTORY AND MINERAL DEPOSITS OF THE
WESTERN CORDILLERA, C.I.M.M. SPECIAL VOL. NO. 8.

GSC 66-37 BIOTITE, K-AR AGE 184 ± 8 M.Y.
REVISED AGE

K=5.23 PERCENT, $AR_{40}/K_{40}=0.0113$, RADIOGENIC $AR=87$
PERCENT.

BRITISH COLUMBIA

CONCENTRATE- CONSISTS OF PARTLY ALTERED BROWN BIOTITE, ABOUT 40 PERCENT OF THE BIOTITE FLAKES ARE IN PART ALTERED TO CHLORITE AND SOME ARE INTERGROWN WITH AMPHIBOLE. ALTERED FLAKES CONTAIN NUMEROUS INCLUSIONS OF EPIDOTE. IMPURITIES CONSIST OF HORNBLLENDE, CHLORITE, EPIDOTE, MINOR FELDSPAR AND APATITE. TOTAL CHLORITE CONTENT IS 25 PERCENT. HORNBLLENDE CONTENT IS 15 PERCENT.

FROM QUARTZ DIORITE
(92 I) DETAILS AS FOR GSC 66-38.
SAMPLE 108-CAC-1, COLLECTED BY R.B. CAMPBELL.

SEE GSC 66-38 FOR DESCRIPTION AND INTERPRETATION.

GSC 66-38 HORNBLLENDE, K-AR AGE 189 + OR - 20 M.Y.

$K=0.46$ PERCENT, $AR_{40}/K_{40}=0.0117$, RADIOGENIC AR=67 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF DARK GREEN HORNBLLENDE WITH TRACE IMPURITIES OF QUARTZ.

FROM QUARTZ DIORITE
(92 I) NORTH SIDE OF ROAD, 0.9 MILES WEST OF WITCHES BROOK BRIDGE, 2 MILES WEST OF THE JUNCTION OF HIGHLAND VALLEY AND GUICHON CREEK ROADS, BRITISH COLUMBIA, 50-29-20 N, 120-51-55 W. MAP-UNIT 4, GSC MAP 886A. SAMPLE 108-CAC-1, COLLECTED AND DESCRIBED BY R.B. CAMPBELL. COMMENTS BY R.K. WANLESS.

THE ROCK IS A MEDIUM-GRAINED, GREY, UNDEFORMED HORNBLLENDE-BIOTITE QUARTZ DIORITE CONSISTING OF 30 PERCENT PLAGIOCLASE NEAR AN₄₀ (MODERATELY TO HIGHLY ALTERED LATHS WITH PREFERRED ORIENTATION), MINOR K-FELDSPAR, 25 PERCENT QUARTZ, 15 PERCENT HORNBLLENDE WITH REMNANTS OF AUGITE, 10 PERCENT BIOTITE, AND MINOR AUGITE. COLLECTED FROM THE EAST SIDE OF THE GUICHON BATHOLITH.

THE BIOTITE DETERMINATION (GSC 66-37) WAS CARRIED OUT ON ANOTHER PORTION OF THE CONCENTRATE ORIGINALLY DATED AT 240 + OR - 12 M.Y., AND REPORTED AS GSC 63-4 IN GSC PAPER 64-17, PART 1. THE HORNBLLENDE CONCENTRATE (GSC 66-38) WAS PREPARED FROM THE ORIGINAL ROCK SAMPLE. THE NEW AGE MEASUREMENTS ARE IN EXCELLENT AGREEMENT WITH ONE ANOTHER AND THEY SUPPORT THE GEOLOGICAL ASSIGNMENT OF THE BATHOLITHIC ROCKS WHICH ARE

BRITISH COLUMBIA

BELIEVED TO INTRUDE UPPER TRIASSIC ROCKS OF THE NICOLA GROUP AND TO BE overlain BY MIDDLE AND LATE JURASSIC STRATA. IN AN ATTEMPT TO RESOLVE THE ANALYTICAL DISCREPANCY FOR THE BIOTITE SAMPLE, THE MASS SPECTROMETER RECORDER CHARTS PRODUCED AT THE TIME GSC 63-4 AND OTHER BIOTITE SAMPLES (SEE GSC PAPERS 63-17 AND 64-17) FROM THE GUICHON BATHOLITH WERE PROCESSED, HAVE BEEN RE-EXAMINED. NO ERRORS IN CALCULATION OR MEASUREMENT HAVE BEEN FOUND AND IT HAS BEEN OBSERVED THAT ION CURRENTS AT MASS 36 WERE COMPLETELY ACCOUNTABLE AS REPRESENTING THE SMALL MASS 36 RESIDUAL PRESENT IN THE MASS SPECTROMETER. HOWEVER, A SMALL UNCERTAINTY IN THE MASS 36 ASSIGNMENT CAN PRODUCE LARGE VARIATIONS IN THE DETERMINED RADIOGENIC ARGON 40 CONTENT. THE SENSITIVITY OF THE MASS SPECTROMETER HAS NOW BEEN INCREASED THROUGH THE ADDITION OF AN ELECTRON MULTIPLIER AND AS A CONSEQUENCE THE OBSERVED ION CURRENTS HAVE BEEN INCREASED BY A FACTOR OF 14 FOR THIS PARTICULAR BIOTITE SAMPLE. THIS HAS PERMITTED A MORE PRECISE DETERMINATION OF THE MASS 36 ION CURRENT AND CONSEQUENTLY THE ATMOSPHERIC ARGON 40 CONTRIBUTION TO THE MASS 40 ION CURRENT. ADDITIONAL CONFIRMATION OF THIS AGE IS TO BE FOUND IN THE FOLLOWING BIOTITE AND HORNBLENDE DETERMINATIONS CARRIED OUT ON CONCENTRATES PREPARED FROM A LARGE SAMPLE PROVIDED FOR THIS STUDY THROUGH THE COURTESY OF R.B. CAMPBELL. (SEE GSC 66-39 AND 40).

GSC 66-39 BIOTITE, K-AR AGE 197 ± 10 M.Y.

$K=4.95$ PERCENT, $AR_{40}/K_{40}=0.0122$, RADIOGENIC AR=82 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF ALTERED BROWN BIOTITE. MOST FLAKES ARE ALTERED TO CHLORITE ON THE EDGES AND IN CRACKS. 5 TO 10 PERCENT OF THE FLAKES ARE BLEACHED. TOTAL CHLORITE CONTENT 20 TO 25 PERCENT. HORNBLENDE CONTENT IS ABOUT 2 PERCENT.

FROM QUARTZ DIORITE
(92 I) DETAILS AS FOR GSC 66-40 SAMPLE
GUICHON-2, COLLECTED BY R.B. CAMPBELL.

SEE GSC 66-40 FOR DESCRIPTION AND INTERPRETATION.

GSC 66-40 HORNBLENDE, K-AR AGE 187 ± 27 M.Y.

$K=0.51$ PERCENT, $AR_{40}/K_{40}=0.0115$, RADIOGENIC AR=52

BRITISH COLUMBIA

PERCENT.

CONCENTRATE- A RELATIVELY CLEAN CONCENTRATE OF UNALTERED PLEOCHROIC BROWNISH YELLOW TO GREEN HORNBLLENDE. MOST GRAINS CONTAIN TINY OPAQUE INCLUSIONS. CONTAMINANTS COMPRISE TRACES OF BIOTITE AND QUARTZ.

FROM QUARTZ DIORITE

- (92 I) FROM ROAD CUT ON EAST SIDE OF HIGHLAND VALLEY ROAD APPROXIMATELY 13 MILES FROM ASHCROFT, BRITISH COLUMBIA, 50-34-45 N, 121-13-25 W. MAP-UNIT 1, GSC MAP 1010A. SAMPLE GUICHON - 2, COLLECTED BY R.B. CAMPBELL AND DESCRIBED BY R.D. STEVENS. COMMENTS BY R.W. WANLESS.

THE ROCK CONSISTS OF RATHER HEAVILY ALTERED, CRUDELY SUB-PARALLEL, LATH-SHAPED PLAGIOCLASE (55 PERCENT), ANHEDRAL QUARTZ (20 PERCENT), SLIGHTLY ALTERED GREEN HORNBLLENDE (15 PERCENT), DARK BROWN BIOTITE (5 PERCENT), ORTHOCLASE (3 PERCENT) AND MINOR OPAQUES, APATITE, AND CHLORITE.

THE SAMPLE WAS SPECIFICALLY COLLECTED BY R.B. CAMPBELL TO PROVIDE AMPLE MATERIAL FOR THE DETERMINATION OF BOTH BIOTITE AND HORNBLLENDE AGES, AND TO PROVIDE DATA REQUIRED TO RESOLVE THE DISCORDANT AGE RESULTS REFERRED TO ABOVE. THE SAMPLE IS FROM ESSENTIALLY THE SAME LOCALITY AS SAMPLE GSC 63-3 (107-CAC-1, SEE GSC PAPER 64-17 PART 1). ANOTHER SAMPLE WAS SELECTED FROM THIS SITE BY K.E. NORTHCOTE OF THE UNIVERSITY OF BRITISH COLUMBIA (PERSONAL COMMUNICATION FROM R.B. CAMPBELL). TWO BIOTITE DETERMINATIONS HAVE BEEN REPORTED FOR THIS SAMPLE (NUMBER K-63-13) BY THE U.B.C. GROUP. THEIR RESULTS ARE 198 ± 8 M.Y. AND 206 ± 8 M.Y. IN EXCELLENT AGREEMENT WITH THE NEW BIOTITE DETERMINATION REPORTED HERE, ALTHOUGH SOMEWHAT HIGHER THAN THE VALUE OBTAINED FOR THE ASSOCIATED HORNBLLENDE. ALL OF THE DETERMINATIONS FALL WITHIN THE ERROR LIMITS ASSIGNED, AND AVERAGE 197 ± 5 M.Y. THE RESULTS OF 24 MEASUREMENTS CARRIED OUT AT THE UNIVERSITY OF BRITISH COLUMBIA ON SAMPLES REPRESENTING ALL PHASES OF THE BATHOLITH YIELD AN ARITHMETIC AVERAGE OF 200 M.Y. WITH A STANDARD ERROR OF ± 5 M.Y. FIELD RELATIONSHIPS INDICATE THAT THE BATHOLITH INTRUDES UPPER TRIASSIC NICOLA GROUP ROCKS AND IS OVERLAIN BY MIDDLE AND UPPER JURASSIC STRATA. THE NEW AGE MEASUREMENTS CONFIRM THIS INTERPRETATION.

ON THE BASIS OF THESE RECENT DETERMINATIONS AND OF THE RESULTS OBTAINED BY THE U.B.C. GROUP IT SEEMS PROBABLE THAT THE EARLIER AGE MEASUREMENTS FOR THE GUICHON BATHOLITH (SAMPLES GSC 62-58, -59, -60, -61, -62, -63, AND GSC 63-2, -3, 4, -5) WERE GENERALLY TOO HIGH FOR THE REASONS CITED IN THE DISCUSSION FOLLOWING GSC 66-38.

REFERENCE-

BRITISH COLUMBIA

WHITE, WM. H., ERICKSON, G.P., NORTHCOTE, K.E., DIROM, G.E.,
AND HAKAKAL, J.E.

1967 ISOTOPIC DATING OF THE GUICHON BATHOLITH, B.C.,
CAN J. EARTH SCIENCES, VOL. 4, PP 677-690.

GSC 66-41 BIOTITE, K-AR AGE 176 + OR - 8 M.Y.

K=7.90 PERCENT, AR40/K40=0.0108, RADIOGENIC AR=90
PERCENT.

CONCENTRATE- CLEAN, VERY PALE GREEN BIOTITE WITH
TRACE IMPURITIES OF HORNBLLENDE.

FROM PEGMATITE
(92 I) 1/2 MILE NORTH OF EDITH LAKE, 8 MILES SOUTH OF
KAMLOOPS, BRITISH COLUMBIA, 50-35 N, 120-21 W.
MAP-UNIT 4A (IRON MASK BATHOLITH), GSC MAP 886A.
SAMPLE KB-4-65, COLLECTED AND INTERPRETED BY E.D.
KINDLE.

THE BIOTITE WAS OBTAINED FROM A PEGMATITE VEIN CUTTING
SHEARED GRANODIORITE. BOOKS OF MICA MEASURE 1 TO 1 1/2 INCHES
ACROSS AND ARE ACCOMPANIED BY MINOR QUARTZ.

THE SAMPLE REPRESENTS A VERY LIMITED PEGMATITIC PHASE OF
THE MINERALIZATION THAT IS ASSOCIATED WITH A SHEARED ZONE ON
THE FARGO MINERAL CLAIM, 7 MILES SOUTH OF KAMLOOPS, BRITISH
COLUMBIA. (SEE GEOLOGICAL SURVEY OF CANADA, MAP 886 A). THE
COUNTRY ROCK IS COARSE MONZONITE OF THE IRON MASK BATHOLITH
(A SOUTHEASTERLY TRENDING BODY 12 MILES LONG AND 3 MILES WIDE).
AS THE PEGMATITE OCCURS AS A LATE DEVELOPMENT IN THE CONSOLID-
ATION OF THE BATHOLITH, THE AGE OF THE BATHOLITH MUST BE
ASSIGNED TO THE LOWER JURASSIC, AND THE AGE OF THE COPPER
MINERALIZATION TO LATER LOWER JURASSIC.

GSC 66-42 BIOTITE, K-AR AGE 46 + OR - 4 M.Y.

K=7.66 PERCENT, AR40/K40=0.0027, RADIOGENIC AR=69
PERCENT.

CONCENTRATE- RELATIVELY CLEAN, VERY SLIGHTLY
ALTERED OLIVE-GREEN BIOTITE WITH 1 PERCENT CHLORITE
AND 3-5 PERCENT HORNBLLENDE CONTAMINATION.

FROM QUARTZ DIORITE

BRITISH COLUMBIA

- (92 H) ONE MILE DUE SOUTH OF MONUMENT 77 ON INTERNATIONAL BOUNDARY, ON CREST OF DIVIDE A FEW HUNDRED FEET NORTH OF, AND 1600 FEET BELOW THE SUMMIT OF CASTLE PEAK, BRITISH COLUMBIA, 48-59-10 N, 120-51-35 W. MAP-UNIT 15, GSC MAP 888A. SAMPLE CU-65-205, COLLECTED AND INTERPRETED BY J.A. COATES.

THE SAMPLE IS A MEDIUM-GRAINED LIGHT GREY QUARTZ-DIORITE WITH A UNIFORM GRANITIC TEXTURE, CONSISTING MAINLY OF ANDESINE, QUARTZ, ORTHOCLSE, BIOTITE AND HORNBLLENDE. BIOTITE IS VERY SLIGHTLY ALTERED TO CHLORITE. PRESENT IN TRACE AMOUNTS ARE APATITE, MAGNETITE, SPHENE, ZIRCON, CALCITE AND SERICITE.

THE CASTLE PEAK STOCK IS INTRUDED INTO SEDIMENTARY ROCKS OF THE DEWDNEY CREEK GROUP. THE AGE OF THE INTRUDED ROCKS IS NOT CERTAINLY KNOWN BUT IS PROBABLY EARLY CRETACEOUS AND DEFINITELY EITHER JURASSIC OR CRETACEOUS. THE RADIO-METRIC AGE OF 46 M.Y. (LATE-MIDDLE-EOCENE) FALLS WITHIN THE SAME NARROW RANGE AS K-AR DATES OBTAINED ON ERUPTIVE ROCKS IN THE PRINCETON GROUP AND SEVERAL OTHER TERTIARY ASSEMBLAGES OF SOUTHERN AND CENTRAL BRITISH COLUMBIA (W.H. MATHEWS, G.S.A. BULL. V.75, P. 465-468). H.M.A. RICE (GSC MEM. 243, P. 46) CONSIDERED THE CASTLE PEAK STOCK CORRELATIVE WITH THE LIGHTNING CREEK INTRUSIONS WHICH HE BELIEVED TO BE UNCONFORMABLY OVERLAIN BY THE PRINCETON GROUP. THESE RELATIONS NOW NEED RE-EXAMINATION.

THE 46 M.Y. DATE ALSO SUPPORTS THE VIEW, BASED ON LITHOLOGY, THAT THE CASTLE PEAK STOCK IS NOT CORRELATIVE WITH THE PLUTONS THAT CUT THE DEWDNEY CREEK GROUP IN THE ADJACENT HOPE MAP-AREA. OF THESE PLUTONS, ONE CORRELATED WITH UNIT 25 OF THE HOPE MAP-AREA IS YOUNGER (39 M.Y.), AND ONE CORRELATED WITH UNIT 26 IS OLDER (84 M.Y.), (GSC 65-8 AND 65-10, GSC PAPER 66-17).

GSC 66-43 HORNBLLENDE, K-AR AGE 61 + OR - 6 M.Y.

$K=1.36$ PERCENT, $AR_{40}/K_{40}=0.0036$, RADIOGENIC $AR=65$ PERCENT.

CONCENTRATE- CLEAN, DARK GREEN HORNBLLENDE CONTAMINATED WITH JUST A TRACE OF QUARTZ.

- (82 L) FROM AUGEN GNEISS
ELEVATION 7150 FT, AT LOWER END OF ODIN GLACIER, BRITISH COLUMBIA, 50-34 N, 118-09 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE 197RA-4-63, COLLECTED AND INTERPRETED BY J.E. REESOR.

THE ROCK IS A HORNBLLENDE-BIOTITE GRANODIORITE AUGEN GNEISS WITH STRONG FOLIATION AND LINEATION. IT CONSISTS OF PLAGIO-

BRITISH COLUMBIA

CLASE (59.1 PERCENT), QUARTZ (19.4 PERCENT), POTASH FELDSPAR (4.6 PERCENT), HORNBLende (5.8 PERCENT), AND BIOTITE (10.3 PERCENT) WITH 0.8 PERCENT ACCESSORY MINERALS. IT IS PART OF SHUSWAP METAMORPHIC COMPLEX. SEE GSC 66-44 FOR INTERPRETATION.

GSC 66-44 HORNBLende, K-AR AGE 79 + OR - 8 M.Y.

K=1.46 PERCENT, AR40/K40=0.0047, RADIOGENIC AR=75 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED, DARK GREEN HORNBLende WITH LESS THAN 1 PERCENT BIOTITE IMPURITY.

FROM GRANODIORITE AUGEN GNEISS
(82 L) EAST END OF GLACIER (ELEVATION 7100 FT) TO EAST OF MT. ODIN, BRITISH COLUMBIA, 50-33-12 N, 118-04-54 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE 155RA-4-63, COLLECTED AND INTERPRETED BY J.E. REESOR.

THIS IS A HORNBLende-BIOTITE GRANODIORITE AUGEN GNEISS FORMING PART OF THE SHUSWAP METAMORPHIC COMPLEX. IT CONSISTS OF PLAGIOCLASE (43.2), QUARTZ (30.5), POTASH FELDSPAR (13.1), BIOTITE (10.7), HORNBLende (1.7), AND ACCESSORIES (0.8 PERCENT).

THESE SAMPLES (GSC 66-43, 44) ARE HORNBLende MINERAL SEPARATES MADE FROM COARSE VEINED HORNBLende-BIOTITE AUGEN GRANODIORITE GNEISS FROM THE SHUSWAP METAMORPHIC COMPLEX. A PREVIOUS DETERMINATION ON BIOTITE FROM THE SAME ROCK AS 155RA-4 GAVE AN AGE OF 64 M.Y. (GSC 62-35). THE TWO HORNBLende AGES GIVEN HERE ARE SIMILAR, AND AS WITH THE BIOTITE AGES CAN ONLY BE CONSIDERED TO INDICATE THE APPROXIMATE TIME OF COOLING OF A PART OF THIS METAMORPHIC COMPLEX. THEY GIVE NO INDICATION OF THE TIME OF THE BEGINNING OF DEFORMATION AND METAMORPHISM.

GSC 66-45 BIOTITE, K-AR AGE 39 + OR - 5 M.Y.

K=7.55 PERCENT, AR40/K40=0.0023, RADIOGENIC AR=68 PERCENT.

CONCENTRATE- CLEAN, BUT ALTERED OLIVE-GREEN BIOTITE WITH ABOUT 15 PERCENT CHLORITE ALTERATION ON FLAKE-EDGES AND ABOUT 1 PERCENT HORNBLende

BRITISH COLUMBIA

IMPURITY. MOST FLAKES CONTAIN SMALL, COLOURLESS INCLUSIONS (APATITE) AND PATCHES OF TINY OPAQUES.

(82 E) FROM QUARTZ MONZONITE
6,700 FT N 14 DEGREES E OF INTERSECTION OF DAN
O REA CK. AND HWY. 3, BRITISH COLUMBIA, 49-02-49.3
N, 118-21-43 W. SEE GSC MAP 6-1957. SAMPLE 65-P-
36A, COLLECTED AND INTERPRETED BY V.A. PRETO (B.C.
DEPT. OF MINES AND PETROLEUM RESOURCES).

THIS SAMPLE IS FROM A MASSIVE, MEDIUM-GRAINED HYPIDIO-
MORPHIC, SLIGHTLY PORPHYRITIC ROCK. THE LARGEST GRAINS ARE
ANHEDRAL QUARTZ AND ANHEDRAL TO SUBHEDRAL POTASH FELDSPAR.
PLAGIOCLASE CRYSTALS VARY GREATLY IN SIZE AND ARE ZONED FROM
ABOUT AN30 AT THE CORE TO ABOUT AN23 AT THE RIM.

POTASH FELDSPAR IS CLOUDY AND KAOLINIZED, PLAGIOCLASE IS
INCIPIENTLY SERICITIZED AT THE CORE. BIOTITE OCCURS IN SUB-
HEDRAL TO ANHEDRAL FLAKES, SLIGHTLY CHLORITIZED. THERE IS NO
SUGGESTION OF POST-CRYSTALLIZATION DEFORMATION NOR OF TWO
GENERATIONS OF BIOTITE. THE MODE IS AS FOLLOWS- QUARTZ 30.8
PERCENT, K-FELDSPAR 42.4 PERCENT, PLAGIOCLASE 21.6 PERCENT,
BIOTITE 4.3 PERCENT, OPAQUES 0.8 PERCENT, APATITE TR. THIS
ROCK IS FROM A NORTHERLY-TRENDING DYKE, PART OF A SWARM WHICH
CUTS THROUGH GNEISS OF THE SHUSWAP METAMORPHIC COMPLEX.

SEE GSC 66-46 FOR INTERPRETATION OF THIS AGE DETERMINA-
TION.

67 66-46 BIOTITE, K-AR AGE 46 + OR - 3 M.Y.

K=7.38 PERCENT, AR40/K40=0.0028, RADIOGENIC AR=68
PERCENT.

CONCENTRATE- CLEAN, RELATIVELY UNALTERED REDDISH
BROWN BIOTITE WITH ABOUT 1 PERCENT HORNBLende AND
LESS THAN 1 PERCENT CHLORITE. MOST FLAKES CONTAIN
SMALL, COLOURLESS INCLUSIONS SURROUNDED BY STRONG
PLEOCHROIC HALOS.

(82 E) FROM QUARTZ MONZONITE
14,300 FT. S 86 DEGREES 30 MINUTES E OF JUNCTION
OF FRAE CK. AND GRANBY RIVER, BRITISH COLUMBIA,
49-07-24.4 N, 118-23-14.0 W. SEE GSC MAP 6-1957.
SAMPLE 65-P-459, COLLECTED AND INTERPRETED BY V.A.
PRETO (B.C. DEPT. OF MINES AND PETROLEUM
RESOURCES).

THIS SAMPLE IS FROM A MEDIUM-GRAINED HYPIDIOMORPHIC INEQUI-

BRITISH COLUMBIA

GRANULAR ROCK. THE LARGER GRAINS ARE SUBHEDRAL TO ANHEDRAL PLAGIOCLASE, ZONED FROM ABOUT AN40 AT THE CORE TO ABOUT AN30 AT THE RIM. QUARTZ OCCURS IN SMALLER GRAINS INTERSTITIAL TO THE FELDSPARS. K-FELDSPAR IS TYPICALLY CLOUDY AND PLAGIOCLASE IS INCIPIENTLY SERICITIZED AT THE CORE. BIOTITE OCCURS IN SUBHEDRAL TO ANHEDRAL FLAKES OF VARIABLE SIZE, COMMONLY FORMING CLUSTERS. THE ROCK HAS A MARKED FOLIATION DUE TO PREFERRED ORIENTATION OF FELDSPAR, BIOTITE, AND QUARTZ GRAINS. INCIPIENT DEVELOPMENT OF A MORTAR STRUCTURE SUGGESTS A SLIGHT AMOUNT OF POST-CRYSTALLIZATION MOVEMENT. THE ESTIMATED MODE IS- QUARTZ 15 PERCENT, K-FELDSPAR 45 PERCENT, PLAGIOCLASE 30 PERCENT, BIOTITE 10 PERCENT, APATITE TR, OPAQUES TR. THIS ROCKS IS FROM A SMALL STOCK, ELONGATED IN A NORTHERLY DIRECTION AND CUTTING THROUGH GNEISS OF THE SHUSWAP METAMORPHIC COMPLEX.

SAMPLES 65-P-36A AND 65-P-459 (GSC 66-45 AND -46) ARE FROM A SUITE OF UNMETAMORPHOSED AND UNDEFORMED INTRUSIVE ROCKS WHICH OCCUR AS STOCKS AND DYKES IN THE SHUSWAP METAMORPHIC COMPLEX. THEY ARE THE OLDEST CLEARLY POST-TECTONIC INTRUSIVES FOUND IN THE MAP-AREA.

THIS INTRUSIVE SUITE IS CORRELATIVE WITH MAP-UNIT TQM FROM THE CURLEW MAP-AREA, WASHINGTON, FOR WHICH FIELD RELATIONS INDICATE A LATE EOCENE OR EARLY OLIGOCENE AGE (PARKER, R.L. AND CALKINS, J.A., 1964, P. 59). THE K-AR DATES OF 39 ± 5 AND 46 ± 3 M.Y. ARE THUS IN AGREEMENT WITH FIELD RELATIONS AND APPROXIMATELY SET AN UPPER AGE LIMIT TO THE LATEST METAMORPHIC EVENTS WHICH AFFECTED SHUSWAP ROCKS IN THE AREA.

THESE TWO DATES SHOULD BE COMPARED WITH A K-AR AGE 36 M.Y. OBTAINED ON BIOTITE FROM SHUSWAP GRANODIORITE GNEISS FOUND IN THE SOUTHEASTERN CORNER OF THE MAP-AREA (BAADSGAARD H., ET AL., 1961)

REFERENCES-

- BAADSGAARD, H., ET AL.
1961 POTASSIUM-ARGON DATES OF BIOTITES FROM CORDILLERAN GRANITES. GEOL. SOC. AMER., BULL., VOL. 72, PP. 689-701.
- PARKER, R.L. AND CALKINS, J.A.
1964 GEOLOGY OF THE CURLEW QUADRANGLE, FERRY COUNTY, WASHINGTON. U.S. GEOL. SURV., BULL. 1169.

GSC 66-47 BIOTITE, K-AR AGE 111 ± 5 M.Y.

K=6.96 PERCENT, AR40/K40=0.0067, RADIOGENIC AR=93 PERCENT.

BRITISH COLUMBIA

CONCENTRATE- RELATIVELY CLEAN, SLIGHTLY BLEACHED LIGHT BROWN BIOTITE. MOST FLAKES CONTAIN OPAQUE BLEBS AND PLEOCHROIC HALOS SURROUNDING COLOURLESS BLEBS. HORNBLende CONTAMINATION AMOUNTS TO ABOUT 3 PERCENT AND CHLORITE CONTENT IS 1 PERCENT.

FROM QUARTZOSE PHYLLITE

(82 D) BETWEEN PTARMIGAN AND BLACKMAN CREEKS, SELWYN RANGE, BRITISH COLUMBIA, 52-32-34 N, 118-41-56 W. MIETTE GROUP OF (AS YET) UNPUBLISHED PTARMIGAN CREEK GEOLOGICAL MAP. SAMPLE 65-PF284, COLLECTED AND INTERPRETED BY R.A. PRICE.

THE SPECIMEN IS FROM A LIGHT GREY AND GREENISH GREY GARNET-BIOTITE PHYLLITE IN THE LATE PRECAMBRIAN MIETTE GROUP. IT CONTAINS PORPHYROBLASTS OF BIOTITE FROM 3.0 TO 9.0 MM IN DIAMETER THAT ARE YOUNGER THAN THE PENETRATIVE DEFORMATION IN THE AREA, AND SHOW NO OBVIOUS PREFERRED ORIENTATION RELATIVE TO AN EARLY SLATY CLEAVAGE OR SCHISTOSITY, OR TO LATER PENETRATIVE STRAIN-SLIP OR CRENULATION CLEAVAGES. OTHER BIOTITE CRYSTALS LESS THAN 0.2 MM IN DIAMETER APPEAR TO BE ALIGNED IN THE EARLY CLEAVAGE AND MAY BE YOUNGER THAN SOME OF THE PENETRATIVE DEFORMATION.

THE BIOTITE AGE OF 111 M.Y. IS A MINIMUM AGE FOR REGIONAL METAMORPHISM THAT HAS BEEN SUPERPOSED DISCORDANTLY ACROSS THE LARGE-SCALE GEOLOGIC STRUCTURES IN THE WESTERN ROCKY MOUNTAINS BETWEEN KINBASKET LAKE AND YELLOWHEAD PASS (PRICE, 1967). ACCORDINGLY, IT REPRESENTS A MINIMUM AGE FOR THE LARGE-SCALE STRUCTURES AND MOST OR ALL OF THE PENETRATIVE DEFORMATION IN THIS REGION.

REFERENCE-

PRICE, R.A.
1967

OPERATION BOW-ATHABASCA, ALBERTA AND BRITISH COLUMBIA, IN REPORT OF ACTIVITIES, PART A, MAY TO OCTOBER, 1966, GEOL. SURV. CAN., PAPER 67-1, PP. 106-112.

GSC 66-48 MUSCOVITE, K-AR AGE 137 ± OR - 7 M.Y.

K=8.58 PERCENT, AR40/K40=0.0083, RADIOGENIC AR=86 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, CLEAR MUSCOVITE. ABOUT 10 PERCENT OF THE FLAKES HAVE SOME ATTACHED BIOTITE AND IRON STAINS. OTHER IMPURITIES CONSIST

BRITISH COLUMBIA

OF TRACES OF QUARTZ AND FELDSPAR.
FROM FELDSPAR PORPHYRY

- (82 K) 2/3 MILE SOUTHEAST OF TENDERFOOT LAKE, BRITISH COLUMBIA, 50-25-15 N, 117-20-50 W. NO PUBLISHED GEOLOGICAL MAP. SAMPLE K-40-RA-1, COLLECTED AND INTERPRETED BY J.E. REESOR.

THE ROCK IS A LIGHT GREY, WHITE-WEATHERING MONZONITE WITH A FINE-GRAINED GRANULAR MATRIX AND PHENOCRYSTS OF POTASH FELDSPAR, SODIC PLAGIOCLASE, AND MUSCOVITE. THE SPECIMEN WAS COLLECTED FROM A POINT 2/3 OF A MILE SOUTHEAST OF TENDERFOOT LAKE IN A STOCK EAST OF THE MAIN KUSKANAX BATHOLITH.

AN EARLIER SPECIMEN OF HORNBLLENDE MONZONITE (178 M.Y.) FROM THE NORTH-CENTRAL PART OF THE MAIN KUSKANAX BATHOLITH MAY REPRESENT THE TIME OF INTRUSION OF THE MAIN MASS. THE PRESENT DATE OF 137 M.Y. MAY REPRESENT THE TIME OF INTRUSION OF THIS KUSKANAX-LIKE STOCK. ACCORDING TO P.B. READ (POPLAR CREEK AREA, PH.D. THESIS, UNIV. OF CALIF. BERKELEY, 1966) THE KUSKANAX BATHOLITH, FROM FIELD STUDY, HAS BEEN INVOLVED IN THE REGIONAL DEFORMATION OF ITS ENCLOSING ROCKS, BUT THE STOCK HAS NOT BEEN SO INVOLVED. ALSO ACCORDING TO READ (PERSONAL COMMUNICATION, 1966) THE PERIOD BETWEEN 137 M.Y. AND 178 M.Y. REPRESENTS THE TIME OF DEVELOPMENT OF THE SECOND, THIRD, AND FOURTH GENERATIONS OF DEFORMATION AND THE PERIOD OF REGIONAL METAMORPHISM. READ COMMENTS, **.....THE FIRST-GENERATION OF DEFORMATION AND METAMORPHISM, WHICH CLEARLY AFFECTS ROCKS OF THE LARDEAU GROUP, MAY HAVE OCCURRED WITHIN THIS INTERVAL.....** AS WELL.

GSC 66-49 HORNBLLENDE, K-AR AGE 162 + OR 8 M.Y.

K=1.62 PERCENT, AR40/K40=0.0099, RADIOGENIC AR= 87 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, DARK GREEN HORNBLLENDE WITH LESS THAN 5 PERCENT BIOTITE, A TRACE OF QUARTZ AND A TRACE OF FELDSPAR AS IMPURITIES.

- FROM GNEISSIC GRANODIORITE
(82 K) AT ELEVATION 8500 FT. ON SHOULDER DUE WEST OF MT. TOBY, BRITISH COLUMBIA, 50-13 N, 116-34 W. SEE GSC MAP 1956-12. SAMPLE T-2RA-1, COLLECTED AND INTERPRETED BY J.E. REESOR.

THIS IS A RUDELY GNEISSIC, MAFIC-RICH HORNBLLENDE-BIOTITE GRANODIORITE FORMING PART OF THE TOBY STOCK. IT CONSISTS MAINLY OF PLAGIOCLASE (38.1 PERCENT), QUARTZ (18.3 PERCENT), BIOTITE (16.9 PERCENT), MICROCLINE (15.2 PERCENT), AND HORN-

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BLENDE (2.4 PERCENT).

THE TOBY STOCK IS A TADPOLE SHAPED PLUTON AT THE HEAD OF TOBY GLACIER (REESOR, 1957). IT CONSISTS OF HORNBLENDE AND/OR BIOTITE GRANODIORITE AND HYPERSTHENE MONZONITE AND IS SIMILAR LITHOLOGICALLY TO THE ADAMANT BATHOLITH IN THE NORTHERN SELKIRK RANGE (FOX, 1966). IN BOTH PLUTONS BIOTITES FROM BIOTITE GRANODIORITE YIELD APPARENTLY EXCESSIVE AGES, FOR EXAMPLE 281 M.Y. (GSC 61-21) IN ADAMANT BATHOLITH, AND 232 M.Y. (T-3RA-1, GSC 62-14) IN TOBY BATHOLITH. THE DETERMINATION ON HORNBLENDE GIVEN HERE, FROM THE MAIN MASS OF THE TOBY STOCK AT 162 M.Y. INDICATES A CONSIDERABLY YOUNGER, MID-JURASSIC, AGE. THIS IS NOT INCONSISTENT WITH AVAILABLE GEOLOGICAL KNOWLEDGE FOR THE SOUTHERN TAIL OF THE TOBY STOCK HAS BEEN STRONGLY DEFORMED BY THE LATEST DEFORMATION OF THE SURROUNDING STRATA (GABRIELSE AND REESOR OP. CIT.), AND THE MASS IS CONSIDERED TO BE SYNKINE-MATIC, SINCE IT LIES WITH ITS LONG AXIS PARALLEL WITH THE TREND OF THE MAJOR STRUCTURES OF THE PURCELL MOUNTAINS AND HAS BEEN DEFORMED ALONG WITH THE ENCLOSING STRATA.

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1966

PETROLOGY OF THE ADAMANT BATHOLITH, UNPUBLISHED PH.D. THESIS, CARLETON UNIVERSITY.

REESOR, J.E.

1957

LARDEAU MAP-AREA, BRITISH COLUMBIA, GEOL. SURV. CAN. MAP 12-1956.

GSC 66-50

HORNBLENDE, K-AR AGE 141 ± 16 M.Y.

K=1.10 PERCENT, AR40/K40=0.0086, RADIOGENIC AR=62 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, DARK GREEN HORN-BLENDE WITH MINOR IMPURITIES OF QUARTZ (1 PERCENT), CHLORITE (TRACE) AND BIOTITE (TRACE).

FROM QUARTZ DIORITE

(82 K)

3/4 MILE EAST OF SADDLE AT HEAD OF BLUE GROUSE CREEK, BRITISH COLUMBIA, 50-04-57.5 N, 117-43-59 W. NO PUBLISHED GEOLOGICAL MAP. SAMPLE HQ-119-8, COLLECTED BY D. W. HYNDMAN, INTERPRETED BY J.E. REESOR.

A MODERATELY FINE-GRAINED BIOTITE-HORNBLENDE-QUARTZ DIO-RITE CONSISTING OF PLAGIOCLASE (55 PERCENT), FRESH HORNBLENDE (15 PERCENT), POTASH FELDSPAR (10 PERCENT), SOMEWHAT CHLORITZ-ED BIOTITE (9.5 PERCENT), QUARTZ (7 PERCENT), AND EPIDOTE (3

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PERCENT), THIS IS AN ELONGATE SYNTECTONIC PLUTON (RUBY STOCK) INTRUDING **SLOCAN** SEDIMENTARY AND VOLCANIC ROCKS. SEE GSC 66-54 FOR INTERPRETATION.

GSC 66-51 HORNBLLENDE, K-AR AGE 136 + OR - 14 M.Y.

K=1.04 PERCENT, AR40/K40=0.0082, RADIOGENIC AR=71 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, PLEOCHROIC DARK GREEN TO BROWNISH YELLOW HORNBLLENDE WITH LESS THAN 1 PERCENT OF BIOTITE AND CHLORITE, AND A TRACE OF QUARTZ.

(82 F) FROM GRANODIORITE
IN SPRINGER CK. CANYON AT ELEVATION 4,700 FT. ON UPSTREAM SIDE OF SECOND BRIDGE ON ROAD FROM SLOCAN, BRITISH COLUMBIA, 49-47.0 N, 117-22.4 W. MAP-UNIT 19, GSC MAP 1090A. SAMPLE N-9RA-1, COLLECTED AND INTERPRETED BY J.E. REESOR.

GREY, MEDIUM-GRAINED PORPHYRITIC GRANODIORITE WITH LARGE (UP TO 3/4 INCH BY 1 1/4 INCHES) PHENOCRYSTS OF POTASH FELDSPAR IN A GROUNDMASS OF WEAKLY ZONED (AN22-28) PLAGIOCLASE (52.8 PERCENT), ANHEDRAL QUARTZ (25.5 PERCENT), RAGGED FLAKES OF BIOTITE (8.7 PERCENT), LATHS OF HORNBLLENDE (7.7 PERCENT) INTERSTITIAL TO THE FELSICS, INTERSTITIAL FINE MICROCLINE (2.4 PERCENT), AND 1.8 PERCENT ACCESSORY MINERALS.

THE GRANODIORITE IS PART OF THE NELSON BATHOLITH. SEE GSC 66-54 FOR GEOLOGICAL INTERPRETATION.

GSC 66-52 HORNBLLENDE, K-AR AGE 146 + OR - 10 M.Y.

K=1.02 PERCENT, AR40/K40=0.0089, RADIOGENIC AR=75 PERCENT.

CONCENTRATE- CLEAN, DARK GREEN HORNBLLENDE WITH TRACE CONTAMINATION BY CHLORITE, BROWN BIOTITE AND QUARTZ.

(82 F) FROM PORPHYRITIC GRANODIORITE
WEST OF KOKANEE GLACIER AT ELEVATION 7700 FT, BRITISH COLUMBIA, 49-49 N, 117-12 W. MAP-UNIT 19, GSC MAP 1090A. SAMPLE N-14RA-1, COLLECTED AND

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INTERPRETED BY J.E. REESOR.

THE ROCK IS A PORPHYRITIC HORNBLENDE-BIOTITE GRANODIORITE WITH COARSE PHENOCRYSTS OF POTASH FELDSPAR (25 PERCENT) IN A MEDIUM- TO COARSE-GRAINED MATRIX OF EUHEDRAL TO SUBHEDRAL PLAGIOCLASE (50 PERCENT), ANHEDRAL QUARTZ (15.1 PERCENT), HORNBLLENDE LATHS (14.2 PERCENT), BIOTITE (11.6 PERCENT), AND K-FELDSPAR (7.1 PERCENT).

THE GRANODIORITE IS PART OF THE NELSON BATHOLITH. SEE GSC 66-54 FOR GEOLOGICAL INTERPRETATION.

GSC 66-53 HORNBLLENDE, K-AR AGE 141 + OR - 24 M.Y.

K=1.24 PERCENT, AR40/K40=0.0085, RADIOGENIC AR= 65 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, PLEOCHROIC, DARK GREEN TO BROWNISH YELLOW HORNBLLENDE WITH LESS THAN 5 PERCENT BIOTITE AND A TRACE OF CHLORITE.

FROM PORPHYRITIC GRANODIORITE
(82 F) PONTIAC PEAK, BRITISH COLUMBIA, 49-46.4 N, 117-04.5 W. MAP UNIT 19, GSC MAP 1090A. SAMPLE N-2RA-1, COLLECTED AND INTERPRETED BY J.E. REESOR.

THE ROCK IS A MEDIUM-GRAINED PORPHYRITIC HORNBLLENDE GRANODIORITE CONSISTING OF LARGE (7 MM) PHENOCRYSTS OF FAINTLY PERTHITIC MICROCLINE (23 PERCENT) IN A GROUNDMASS OF SUBHEDRAL PLAGIOCLASE (45 PERCENT), ANHEDRAL QUARTZ (16 PERCENT), BIOTITE (9.5 PERCENT), YELLOW-GREEN TO BLUE-GREEN AMPHIBOLE (2.3 PERCENT), MINOR ACCESSORIES (2.1 PERCENT).

THE GRANODIORITE IS PART OF THE NELSON BATHOLITH. SEE GSC 66-54 FOR GEOLOGICAL INTERPRETATION.

GSC 66-54 HORNBLLENDE, K-AR AGE 152 + OR - 10 M.Y.

K=1.37 PERCENT, AR40/K40=0.0093, RADIOGENIC AR=78 PERCENT.

CONCENTRATE- CLEAN, UNALTERED, PLEOCHROIC GREEN TO GREENISH BROWN HORNBLLENDE WITH TRACE QUARTZ AND MICA CONTAMINATION.

FROM GRANODIORITE

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(82 F) PORCUPINE CREEK, BRITISH COLUMBIA, 49-15 N, 117-5 W. MAP-UNIT 19A, GSC MAP 1090A. SAMPLE P-1RA-1, COLLECTED AND INTERPRETED BY J.E. REESOR.

THIS IS A HORNBLÉNDE-BIOTITE GRANODIORITE WITH 1/4 INCH PHENOCRYSTS OF POTASH FELDSPAR IN A MATRIX OF PLAGIOCLASE ZONED FROM AN20 TO AN37 (33.7 PERCENT), QUARTZ (15.4 PERCENT), HORNBLÉNDE (14.6 PERCENT), BIOTITE (6.8 PERCENT), MICROCLINE (TOTAL K-FELDSPAR 24.2 PERCENT), AND 5.3 PERCENT ACCESSORIES. THE ROCK IS FROM THE PORCUPINE STOCK.

THE NELSON BATHOLITH, ALTHOUGH INTRUSIVE INTO MID-JURASSIC (LITTLE, 1960, P. 85-86), SHOWS SOME INVOLVEMENT IN AT LEAST ONE PHASE OF THE STRUCTURAL DEFORMATION OF THE ENCLOSING STRATA. IT THUS APPEARS TO BE SYN- TO LATE KINEMATIC. SIMILARLY, THE PORCUPINE STOCK SHOWS STRONG PERIPHERAL FOLIATION CONFORMABLE WITH THE TRENDS OF THE SURROUNDING ORDOVICIAN STRATA (LITTLE, OP. CIT.). THE RUBY STOCK IS AN ELONGATE, NARROW MASS, SITUATED ALONG AN EAST-WEST STRUCTURE WITH ITS POSITION AND SHAPE CONTROLLED BY THE STRUCTURE OF THE ENCLOSING STRATA (HYNDMAN, 1964). THE COMPOSITION OF THE PHASES SAMPLED FOR AGE DETERMINATION IN EACH OF THESE MASSES IS SIMILAR, AND CONSISTS OF BIOTITE-HORNBLÉNDE GRANODIORITE WITH OR WITHOUT MEGACRYSTS OF POTASH FELDSPAR.

IN SPITE OF THESE STRUCTURAL AND COMPOSITIONAL SIMILARITIES AGE DETERMINATIONS BY K-AR ON BIOTITE ALONE SHOW A CONSIDERABLE RANGE OF AGES FROM 123 M.Y. TO 171 M.Y. THE TABLE BELOW SUMMARIZES THE BIOTITE AND HORNBLÉNDE AGES NOW AVAILABLE-

SAMPLE NO.	AGE NO.	LOCATION	BIOTITE AGE	HORNBLÉNDE AGE
N 2RA-1	GSC 62-27 GSC 66-53	PONTIAC PEAK, NELSON BATHOLITH	159 M.Y.	141 M.Y.
N 9RA-1	GSC 62-28 GSC 66-51	BRIDGE ON SPRINGER CREEK, NELSON BATHOLITH	171 M.Y.	136 M.Y.
N-14RA-1	GSC 66-52	WEST OF KOKANNE GLACIER, NELSON BATHOLITH		146 M.Y.
P 1RA-1	GSC 62-5 GSC 66-54	PORCUPINE STOCK	128 M.Y.	152 M.Y.
H Q119-8	GSC 63-10 GSC 66-50	RUBY STOCK	123 M.Y.	141 M.Y.

(SEE GSC PAPERS 63-17, 64-17, 67-17.)

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A NUMBER OF OTHER DETERMINATIONS ON BIOTITE FROM THE NELSON BATHOLITH ARE AVAILABLE (GSC PAPER 63-17 AND GABRIELSE AND REESOR, 1964) THAT RANGE FROM 105 M.Y. TO 171 M.Y. IT WAS CLEAR PREVIOUSLY THAT THE OLDER OF THESE DETERMINATIONS WERE INCONSISTENT WITH THE GEOLOGICAL RELATIONS AS PRESENTED BY LITTLE (OP. CIT.) IN WHICH THE NELSON BATHOLITH IS FOUND TO CUT ROCKS OF MIDDLE JURASSIC AGE. REESOR (IN GABRIELSE AND REESOR 1964) ATTEMPTED TO EXPLAIN SOME OF THESE DISCREPANCIES BY SUGGESTING EARLIER SOLIDIFICATION OF THE GRANODIORITE OF NELSON BATHOLITH AND RE-EMPLACEMENT IN POST MID-JURASSIC TIME. CLEARLY THE HORNBLENDE AGES ABOVE, AND THEIR CONSISTENCY WITHIN THE NELSON BATHOLITH AS WELL AS SIMILAR DETERMINATIONS FROM OTHER PLUTONS RENDERS SUCH A COMPLEX EXPLANATION QUITE UNNECESSARY. THE HORNBLENDE-BIOTITE GRANODIORITES OF THESE THREE PLUTONS HAVE BEEN EMPLACED IN THE UPPER JURASSIC, AT ABOUT 140 M.Y.

CONSIDERATION OF THE STRUCTURAL RELATIONS OF THESE PLUTONS SUGGESTS THAT THE LAST IMPORTANT PHASE OF MOVEMENT IN THIS DEFORMATION CYCLE EXTENDED TO ABOUT 140 M.Y. THUS THE SHAPE AND POSITION OF THE RUBY STOCK WAS CONTROLLED BY THE MAJOR FOLD PATTERN. THE SOUTHERN PART OF THE NELSON BATHOLITH HAS BEEN INVOLVED IN THE LATEST PHASE OF MOVEMENT IN THE SURROUNDING STRATA. A STRONG LINEATION WITHIN THE PLUTONIC ROCKS IS HERE PARALLEL WITH FOLD AXES AND CLEAVAGE-BEDDING INTERSECTION IN THE SURROUNDING METASEDIMENTS.

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GSC 66-55 HORNBLLENDE, K-AR AGE 87 + OR - 15 M.Y.

K=0.67 PERCENT, AR40/K40=0.0040, RADIOGENIC AR=43 PERCENT.

CONCENTRATE- FRESH, CLEAN HORNBLLENDE.

(82 F) FROM GRANODIORITE
 1/4 MILE NORTHWEST OF A SMALL LAKE AT ORIGIN OF
 BUHL CREEK, KOOTENAY DISTRICT, BRITISH COLUMBIA,
 49-50-30 N, 116-12-45 W. MAP-UNIT 10, GSC MAP
 1053A (DEWAR CREEK). SAMPLE W-103-RA-1, COLLECTED
 BY J.E. REESOR AND G. MURSKY, INTERPRETED BY
 G. MURSKY.

THE ROCK IS MEDIUM GRAINED, SLIGHTLY PORPHYRITIC HORN-
 BLENDE - BIOTITE GRANODIORITE. PHENOCRYSTS OF K-FELDSPAR,
 PLAGIOCLASE AND HORNBLLENDE MEASURE UP TO 1/4 INCH IN SIZE AND
 ARE IMBEDDED IN FINER GRAINED MATRIX CONSISTING OF QUARTZ AND
 BIOTITE. PLAGIOCLASE (AVERAGE AN/27) IS ZONED AND IS SLIGHTLY
 ALTERED INTO SERICITE AND EPIDOTE. BIOTITE AND HORNBLLENDE ARE
 FRESH, THE LATTER BEING OFTEN TWINNED. X-RAY WORK SHOWS THAT
 K-FELDSPAR HAS HIGH OBLIQUITY VALUES OF .93 AND TRICLINIC
 SYMMETRY. THE DISTRIBUTION OF SODA BETWEEN K-FELDSPAR AND
 PLAGIOCLASE INDICATES A TEMPERATURE OF **CRYSTALLIZATION** OF
 410 DEGREES C FOR THE TWO FELDSPARS WHEREAS THE STRUCTURAL
 STATE OF PLAGIOCLASE SUGGESTS A TEMPERATURE OF 480 DEGREES C.

MODAL ANALYSIS OF THE THIN-SECTION REVEALS THE FOLLOWING
 PERCENTAGE OF MINERALS IN THE ROCK-

PLAGIOCLASE	37
K-FELDSPAR	23
QUARTZ	18
BIOTITE	13
HORNBLLENDE	5
MYRMEKITE	2

THE REMAINING MINERALS IN DECREASING ORDER OF ABUNDANCE,
 CONSIST OF APATITE, EPIDOTE, SPHENE, MUSCOVITE, OPAQUES,
 GARNET, ZIRCON AND CHLORITE.

THE AGE OF 87 + OR - 15 M.Y. IS THE HIGHEST OBTAINED BY
 THE K-AR METHOD ON THE WHITE CREEK BODY. SLIGHTLY LOWER VALUES
 OF 80 AND 82 M.Y. WERE OBTAINED FOR A MUSCOVITE - BIOTITE PAIR
 FROM THE LEUCOCRATIC QUARTZ MONZONITE CORE (UNIT 12) OF THE
 INTRUSIVE, AND 79, 73 M.Y. FOR THE BIOTITES FROM THE BIOTITE
 GRANODIORITE WHICH FORMS THE BOUNDARY (UNIT 9) OF THE INTRU-
 SIVE. RB/SR WHOLE ROCK ISOCHRON INDICATES THAT CORE ROCKS
 (UNIT 12) WERE CONSOLIDATED AT 111 + OR - 5 M.Y. THE AGE OF
 87 M.Y. FOR HORNBLLENDE SUBSTANTIATES THE OTHER K/AR AGES CITED
 ABOVE AND INDICATES A THERMAL EPISODE WHICH AFFECTED ALL ROCK

BRITISH COLUMBIA

UNITS AT ABOUT 85 M.Y.
REFERENCE-

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GSC 66-56 MUSCOVITE, K-AR AGE 1310 + OR - 40 M.Y.

K=8.36 PERCENT, AR40/K40=0.1107, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF UN-
ALTERED MUSCOVITE. IMPURITIES CONSIST OF BIOTITE
(1-2 PERCENT) AND QUARTZ-FELDSPAR (5 PERCENT).

(82 G) FROM ARGILLACEOUS QUARTZITE
1 3/4 MILES NORTHEASTERLY FROM ROSEN LAKE, BRITISH
COLUMBIA, 49-25-20 N, 115-14-28 W. MAP-UNIT 2,
GSC MAP 11-1960. SAMPLE LD-ML-20, COLLECTED AND
INTERPRETED BY G.B. LEECH.

SEE GSC 66-57 FOR DESCRIPTION AND INTERPRETATION.

GSC 66-57 FINE MUSCOVITE, K-AR AGE 890 + OR - 72 M.Y.

K=3.22 PERCENT, AR40/K40=0.0666, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- IMPURE MUSCOVITE, BEING A MIXTURE OF
MUSCOVITE (50 PERCENT), QUARTZ (40 PERCENT), POTASH
FELDSPAR (LESS THAN 5 PERCENT), OPAQUES, CHLORITE,
AND BIOTITE (5 PERCENT).

(82 G) FROM ARGILLACEOUS QUARTZITE
1 3/4 MILES NORTHEASTERLY OF ROSEN LAKE, BRITISH
COLUMBIA, 49-25-20 N, 115-14-28 W. MAP-UNIT 2,
GSC MAP 11-1960. SAMPLE LD-ML-20, COLLECTED AND
INTERPRETED BY G.B. LEECH.

THIS SAMPLE IS FROM A QUARTZITIC PART OF THE PRECAMBRIAN
ALDRIDGE FORMATION WITHIN A MAJOR THRUST SHEET UNDERLAIN BY
PALAEOZOIC STRATA IN THE WEST FACE OF THE ROCKY MOUNTAINS. IN
THIS PART OF THE FORMATION GREY QUARTZITE FORMS BEDS UP TO 7

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FEET THICK WHICH ARE MOSTLY MASSIVE BUT WHICH COMMONLY HAVE A THIN GRADATIONAL ZONE OF ARGILLACEOUS SILTSTONE OR SILTY ARGILLITE IN THEIR TOPS. THE MASSIVE QUARTZITE SAMPLED LACKS PERVASIVE MEGASCOPIC CLEAVAGE.

QUARTZ AND MUSCOVITE ARE THE CHIEF CONSTITUENTS OF THE SAMPLE AND ARE ACCOMPANIED BY MUCH SMALLER AMOUNTS OF FELDSPARS, BIOTITE, AND **CHLORITE**. TOURMALINE IS THE MOST ABUNDANT ACCESSORY MINERAL. THE QUARTZ GRAINS ARE COMMONLY 0.05 - 0.10 MM ACROSS AND HAVE UNEVEN OUTLINES. THERE ARE TWO MAIN SIZES OF MUSCOVITE- LARGE FLAKES, PARTLY CORRODED, THAT ARE COMMONLY 0.1 - 0.3 MM IN DIAMETER BUT WHICH RANGE UP TO ABOUT 1 MM AND SMALL ONES, COMMONLY IN THE 0.04 - 0.08 MM RANGE. THE LARGE MUSCOVITE FLAKES HAVE VARIOUS ORIENTATIONS AND MANY ARE BENT. THE SMALL ONES, INTERSTITIAL TO THE LARGER MINERAL GRAINS, LACK AN OBVIOUS PREFERRED ORIENTATION IN THIS MASSIVE QUARTZITE, THOUGH IN THE ACCOMPANYING ARGILLACEOUS STRATA THEY HAVE A STRONG PREFERRED ORIENTATION PARALLEL TO BEDDING. (EFFORTS TO MAKE A CLEAN CONCENTRATE OF FINE-GRAINED MUSCOVITE FROM THE LATTER WERE UNSUCCESSFUL). THE QUARTZITE DIFFERS FROM EQUIVALENT ALDRIDGE-QUARTZITE IN THE PURCELL MOUNTAINS FARTHER WEST BY ITS PAUCITY OF BIOTITE AND ITS RELATIVELY GREATER AMOUNT OF TWINNED FELDSPAR.

THE K-AR AGE OF THE COARSER MUSCOVITE (DIAMETERS GREATER THAN 0.15 MM AND THICKNESSES OF ABOUT 0.03 - 0.035 MM) IS 1310 ± 40 M.Y. (GSC 66-56) WHEREAS THE K-AR AGE OF THE FINER MUSCOVITE (DIAMETERS MOSTLY MUCH LESS THAN 0.05 MM) IS 890 ± 72 M.Y. (GSC 66-57). NEITHER NUMBER IS THE DATE OF AN EVENT AFFECTING THE STRATA. THE 1310 NUMBER PRESENTS CHIEFLY OLDER DETRITAL MUSCOVITE PARTIALLY UPDATED BY YOUNGER METAMORPHISM. THE OTHER NUMBER IS SMALLER BECAUSE IT REPRESENTS PROBABLY A MIXTURE OF UPDATED DETRITAL MUSCOVITE AND METAMORPHIC MUSCOVITE DEVELOPED FROM THE ARGILLACEOUS FRACTION OF THE SEDIMENT, AND BECAUSE OF ADDITIONAL FACTORS, NAMELY THAT SMALL MICA FLAKES ARE LIKELY TO BE MORE SUSCEPTIBLE TO UPDATING THAN LARGE ONES ARE, AND THAT THE CONCENTRATE WAS LESS PURE (THOUGH THE MAIN IMPURITY, QUARTZ, WOULD BE MERELY A DILUENT).

BOTH THESE K-AR AGES ARE MUCH GREATER THAN THOSE OF MUSCOVITES FROM COMPARABLE ALDRIDGE QUARTZITE IN THE PURCELL MOUNTAINS, E.G. 687 ± 28 M.Y. (GSC 65-6) FOR MUSCOVITE IN THE 0.1 - 0.15 MM SIZE RANGE AND 615 ± 55 M.Y. (GSC 65-2) FOR A LESS PURE MIXTURE OF SIZES 0.1 - 0.15 MM AND 0.03 MM. THE GREATER K-AR AGE OF MUSCOVITE IN THE ROCKIES IS TAKEN TO REFLECT AN ORIGINALLY GREATER AMOUNT OF DETRITAL MUSCOVITE AND LESSER METAMORPHISM OF STRATA THRUST INTO POSITION THERE. THE PAUCITY OF BIOTITE IN THE ROCKIES SAMPLE RELATIVE TO THE PURCELL ONES, IN WHICH MUCH BIOTITE IS DISTINCTLY METAMORPHIC, LEADS TO THE SAME INFERENCES.

YUKON TERRITORY

GSC 66-58 BIOTITE, K-AR AGE 91 + OR - 5 M.Y.

K=7.12 PERCENT, AR40/K40=0.0054, RADIOGENIC AR=88 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED DARK GREEN BIOTITE WITH 3 PERCENT HORNBLENDE AND 1 PERCENT CHLORITE IMPURITIES.

FROM QUARTZ MONZONITE
(116 B) 1.5 MILE NORTHWEST OF DIVIDE LAKE, YUKON TERRITORY, 64-27-13 N, 138-33-00 W. MAP-UNIT 21B, GSC MAP 13-1962 IN PAPER 62-7 (GREEN + RODDICK). SAMPLE TO 65-435, COLLECTED AND INTERPRETED BY D. TEMPLEMAN-KLUIT.

SEE GSC 66-59 FOR DESCRIPTION AND INTERPRETATION.

GSC 66-59 HORNBLENDE, K-AR AGE 80 + OR - 13 M.Y.

K=1.77 PERCENT, AR40/K40=0.0048, RADIOGENIC AR=76 PERCENT.

CONCENTRATE- CLEAN, DARK GREEN HORNBLENDE.

FROM QUARTZ MONZONITE
(116 B) 1.5 MILE NORTHWEST OF DIVIDE LAKE, YUKON TERRITORY, 64-27-13 N, 138-33 W. MAP-UNIT 21B, GSC MAP 13-1962, IN PAPER 62-7 (GREEN AND RODDICK). SAMPLE TO 65-435, COLLECTED AND INTERPRETED BY D. TEMPLEMAN-KLUIT.

THE SAMPLE IS OF A MEDIUM TO COARSE GRAINED, EQUIGRANULAR, MESOCRATIC HORNBLENDE BIOTITE QUARTZ MONZONITE FROM TOMBSTONE STOCK. IT WAS SELECTED TO PROVIDE A MINIMUM AGE FOR THE **KENO HILL QUARTZITE** (MAP-UNIT 17) AND OVERLYING STRATA, WHICH ARE INTRUDED BY THE QUARTZ MONZONITE. THE AGES OBTAINED AGREE FAIRLY CLOSELY WITH THOSE REPORTED FOR SIMILAR ROCKS THAT OCCUR IN A BELT ALONG THE NORTH SIDE OF TINTINA TRENCH BETWEEN MAYO AND DAWSON. THE FOLLOWING AGES HAVE BEEN OBTAINED FROM LITHOLOGICALLY SIMILAR ROCKS BETWEEN MAYO AND DAWSON.

AGE	LITHOLOGY	REFERENCE
102 M.Y.	QUARTZ MONZONITE	GSC PAPER 63-17, P. 51
134 M.Y.	BIOTITE-FELDSPAR PORPHYRY	GSC PAPER 63-17, P. 51

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106 M.Y.	GRANODIORITE	GSC PAPER 63-17, P. 52
81 M.Y.	PORPHYRITIC QUARTZ DIORITE	GSC PAPER 63-17, P. 52

THE 91 AND 80 M.Y. AGES DO NOT CONFLICT WITH THE SUGGESTED EARLY CRETACEOUS AGE FOR THE **KENO HILL QUARTZITE** AND OVERLYING STRATA. THESE AGES ALSO PROVIDE AN UPPER LIMIT FOR THE TIME OF FOLDING AND THRUSTING IN THIS REGION AND IMPLY A MID-CRETACEOUS PERIOD OF DEFORMATION.

REFERENCES-

GREEN, L.H. AND RODDICK, J.A.
1962 DAWSON, LARSEN CREEK, AND NASH CREEK MAP-AREAS,
YUKON TERRITORY, GEOL. SURV. CAN., PAPER 62-7.

GSC 66-60 HORNBLLENDE, K-AR AGE 199 + OR - 34 M.Y.

$K=0.51$ PERCENT, $AR_{40}/K_{40}=0.0122$, RADIOGENIC AR= 25 PERCENT.

CONCENTRATE- SLIGHTLY ALTERED GREEN TO OLIVE-GREEN HORNBLLENDE. ABOUT 15 PERCENT OF THE GRAINS ARE FINELY CRACKED, AND THE CRACKS CONTAIN BROWN ALTERATION PRODUCTS. MOST GRAINS CONTAIN FINE OPAQUE INCLUSIONS. IMPURITIES CONSIST OF ABOUT 5 PERCENT QUARTZ AND A TRACE OF BIOTITE.

(105E) FROM GRANITIC COBBLE IN CONGLOMERATE WHITEHORSE-DAWSON ROAD AT BASE OF CONGLOMERATE MOUNTAIN, ABOUT 28 MILES NORTHWEST OF NORTH END OF LAKE LABERGE, YUKON TERRITORY, 61-37 N, 135-53 W. MAP-UNIT 6, GSC MAP 372A. SAMPLE PB-4-64, COLLECTED AND INTERPRETED BY W.H. POOLE.

THE GRANODIORITE IS AN UNDEFORMED, MASSIVE, EQUIGRANULAR, MEDIUM-GRAINED ROCK WITH A PINKISH GREY OVERALL COLOUR. IN THIN SECTION, POTASH AND CALCIC FELDSPARS ARE SLIGHTLY CLOUDED. PLAGIOCLASE EUHEDRA AND SUBHEDRA ARE PARTLY ENCLOSED BY LARGER POTASH FELDSPAR ANHEDRA. QUARTZ IS ONLY SLIGHTLY STRAINED AND FORMS LARGE POIKILITIC ANHEDRA WHICH ENCLOSE AND REPLACE BOTH FELDSPARS. HORNBLLENDE IS UNALTERED AND PLEOCHROIC FROM YELLOW-GREEN TO GREEN. IT IS ASSOCIATED WITH ACCESSORY, UNALTERED BLACK IRON ORE MINERALS AND APATITE.

THE GRANODIORITE COBBLE WAS COLLECTED FROM A LARGE TALUS BLOCK WHICH SLID FROM THE LOWER AND EARLY MIDDLE JURASSIC

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LABERGE GROUP MAKING UP CONGLOMERATE MOUNTAIN (BOSTOCK AND LEES, 1938, WHEELER, 1961). THE HORNBLENDE WAS DATED IN ORDER TO DETERMINE THE AGE OF THE GRANITIC SOURCE, BELIEVED BY WHEELER (1961) THERE TO LIE TO THE WEST.

THE HORNBLENDE DATE OF 199 ± 34 M.Y. INDICATES AN EARLY MESOZOIC, POSSIBLY LATE TRIASSIC, AGE FOR THE GRANITIC TERRANE FROM WHICH THE COBBLE WAS DERIVED. SIMILAR DATES HAVE BEEN DETERMINED FROM GRANITIC AND METAMORPHIC ROCKS LYING WEST OF THE LABERGE GROUP ROCKS (GABRIELSE, 1967, FIG. 15).

REFERENCES-

BOSTOCK, H.S., AND LEES, E.J.

1938 LABERGE MAP-AREA, YUKON, GEOL. SURV. CAN., MEM. 217.

WHEELER, J.O.

1961 WHITEHORSE MAP-AREA, YUKON TERRITORY, GEOL. SURV. CAN., MEM. 312.

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GSC 66-61 BIOTITE, K-AR AGE 445 + OR - 18 M.Y.

K=7.23 PERCENT, AR40/K40=0.0294, RADIOGENIC AR=97 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, SLIGHTLY ALTERED REDDISH BROWN BIOTITE, SOME OF THE FLAKES BEING ALTERED TO CHLORITE ON THEIR EDGES. 30 PERCENT OF THE FLAKES CONTAIN NEEDLE-LIKE ORIENTED INCLUSIONS, AND 5 PERCENT CONTAIN PLEOCHROIC HALOS SURROUNDING COLOURLESS BLEBS. IMPURITIES CONSIST OF 5 PERCENT HORNBLLENDE AND 2-3 PERCENT CHLORITE.

FROM AUGEN GNEISS
(120 G) ABOUT 3 MILES WEST OF CAPE ALDRICH, ELLESMERE ISLAND, DISTRICT OF FRANKLIN, 83-07-40 N, 70-05 W. MAP-UNIT 1, GSC MAP 16-1956. SAMPLE CBF-65-317 COLLECTED AND INTERPRETED BY T. FRISCH.

THE BIOTITE COMES FROM A HIGHLY DEFORMED GARNET-BIOTITE-MUSCOVITE-PLAGIOCLASE-QUARTZ AUGEN GNEISS. THE AUGEN ARE 3-4 CM LONG FLATTENED PORPHYROCLASTS OF PLAGIOCLASE, CONTAINING SECONDARY MUSCOVITE ALONG CLEAVAGE PLANES. GARNET FORMS PORPHYROBLASTS UP TO 1 CM IN SIZE, WITH GRANULATED BORDERS. A WAVY FOLIATION IS DEFINED BY ALTERNATING LAYERS AND LENSES OF (1) BIOTITE, WHICH IS COMMONLY KINKED, (2) FINELY GRANULAR PLAGIOCLASE WITH MUSCOVITE FLAKES AND A LITTLE QUARTZ, AND (3) COARSER-GRAINED, STRAINED QUARTZ. AT LEAST SOME OF THE BIOTITE APPEARS TO BE AN ALTERATION PRODUCT OF THE GARNET.

SEE GSC 66-63 FOR AN INTERPRETATION OF THE AGE DETERMINATION ON THIS ROCK.

GSC 66-62 MUSCOVITE, K-AR AGE 403 + OR - 17 M.Y.

K=8.65 PERCENT, AR40/K40=0.0263, RADIOGENIC AR=95 PERCENT.

CONCENTRATE- CLEAN, CLEAR, UNALTERED MUSCOVITE.

FROM PEGMATITE
(120 G) ABOUT 1 MILE SOUTHEAST OF CAPE ALDRICH, ELLESMERE ISLAND, DISTRICT OF FRANKLIN, 83-07-30 N, 69-48 W. MAP-UNIT 1, GSC MAP 16-1956. SAMPLE CBF-65-91, COLLECTED AND INTERPRETED BY T. FRISCH.

THE MUSCOVITE IS FROM A COARSE-GRAINED WHITE PEGMATITE, CONSISTING OF MAINLY ALKALI FELDSPAR, QUARTZ AND MUSCOVITE IN

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COARSE **BOOKS** AND FINER PATCHES.

SEE GSC 66-63 FOR INTERPRETATION OF THIS AGE DETERMINATION.

GSC 66-63 HORNBLLENDE, K-AR AGE 389 + OR - 21 M.Y.

K=0.72 PERCENT, AR40/K40=0.0253, RADIOGENIC AR=88 PERCENT.

CONCENTRATE- CLEAN, PLEOCHROIC, DARK GREEN TO GREENISH YELLOW HORNBLLENDE WITH ABOUT 2 PERCENT QUARTZ AND TRACES OF MICA AND CHLORITE IMPURITIES.

FROM GNEISS
(120 N) ABOUT 1.5 MILES WEST OF CAPE COLUMBIA, DISTRICT OF FRANKLIN, 83-06-50 N, 70-45 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE CBF-65-306, COLLECTED AND INTERPRETED BY T. FRISCH.

THE HORNBLLENDE FORMS 35 PERCENT BY VOLUME OF A GARNET-QUARTZ-PLAGIOCLASE-HORNBLLENDE GNEISS THAT HAS BEEN STRONGLY DEFORMED. HORNBLLENDE IS IN RAGGED GRAINS (1-2 MM), IS PLEOCHROIC WITH X=GREENISH YELLOW, Y=GREEN AND Z=GRASS GREEN, AND LIES PARALLEL TO FOLIATION. MANY OF THE LARGER GRAINS HAVE BEEN HEAVILY REPLACED BY FINE-GRAINED PLAGIOCLASE AND QUARTZ. PINK GARNET FORMS EMBAYED PORPHYROBLASTS (2 MM), SIEVED WITH INCLUSIONS. COMPOSITION OF PLAGIOCLASE IS AN35. EPIDOTE (4 PERCENT) IS COMMONLY ASSOCIATED WITH HORNBLLENDE BUT MAY BE PRIMARY. SCAPOLITE (2 PERCENT) TENDS TO OCCUR WITHIN DISCRETE HORNBLLENDE-PLAGIOCLASE LAYERS.

ALL THREE ROCKS (GSC 66-61, 62, 63) WERE COLLECTED IN THE TYPE AREA OF THE CAPE COLUMBIA COMPLEX AND WERE SEPARATED BY A MAXIMUM DISTANCE OF NINE MILES. METAMORPHIC GRADE OF THE AREA IS OF THE AMPHIBOLITE FACIES (FYFE AND TURNER, 1966), ON WHICH HAS BEEN IMPOSED RETROGRESSIVE METAMORPHISM CAUSED BY CATACLASIS. THE AUGEN GNEISS (GSC 66-61) CAME FROM A LAYER IN MIXED GNEISSES AND HORNBLLENDE-BEARING ROCKS. SOME OF THESE ROCKS SHOW AT LEAST TWO PERIODS OF FELDSPAR PORPHYROBLASTESIS-ONE BEFORE AND ONE DURING OR AFTER DEFORMATION. THE PEGMATITE (GSC 66-62) IS FROM A SMALL DYKE SLIGHTLY DISCORDANT TO THE ENCLOSING GNEISSES AND, ALTHOUGH INTRUSIVE, WAS INTERPRETED IN THE FIELD TO BE ESSENTIALLY CONTEMPORANEOUS WITH THE METAMORPHISM THAT PRODUCED THE COUNTRY ROCKS. THE HORNBLLENDE GNEISS (GSC 66-63) FORMS PART OF A METAMAFIC SEQUENCE, WHICH HAS BEEN METAMORPHICALLY DIFFERENTIATED INTO FELSIC AND MAFIC LAYERS.

THESE RELATIVELY YOUNG, **CALEDONIAN** DATES ARE UNLIKELY

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TO BE AN INDICATION OF THE AGE OF THE MAIN METAMORPHISM OF THE CAPE COLUMBIA COMPLEX, WHICH, ON THE BASIS OF AMPLE STRATIGRAPHIC EVIDENCE, IS LOWER PALAEOZOIC OR PRECAMBRIAN. EVEN THE K-AR AGE OF 545 M.Y. PREVIOUSLY DETERMINED ON BIOTITE GNEISS FROM THIS AREA (BLACKADAR, 1960) IS CONSIDERED TO BE ONLY A MINIMUM AGE. THREE POSSIBLE EXPLANATIONS OF THE LOW VALUES ARE OFFERED- (1) THE AGE DETERMINATIONS MAY GIVE THE TIMES OF UPLIFT AND COOLING, FOLLOWING METAMORPHISM, OF THE CAPE COLUMBIA COMPLEX, (2) RETROGRESSIVE METAMORPHISM AND CATACLASIS, PERHAPS RELATED TO PALAEOZOIC FOLDING OF THE FRANKLINIAN GEOSYNCLINE (THORSTEINSSON AND TOZER, 1960), MAY HAVE CAUSED ARGON LOSS, (3) THE COMPLEX, WHICH FORMS THE BASEMENT OF THE GEOSYNCLINE, MAY HAVE BEEN RE-HEATED BY WIDE-SPREAD IGNEOUS ACTIVITY THAT, ACCORDING TO ISOTOPIC EVIDENCE, OCCURRED IN **CALEDONIAN** TIME IN NORTHERN ELLESMERE ISLAND.

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- FYFE, W.S. AND TURNER, F.J.
1966 REAPPRAISAL OF THE METAMORPHIC FACIES CONCEPT. CONTR. MINERAL. AND PETROL., VOL. 12, PP. 354-364.
- THORSTEINSSON, R. AND TOZER, E.T.
1960 SUMMARY ACCOUNT OF STRUCTURAL HISTORY OF THE CANADIAN ARCTIC ARCHIPELAGO SINCE PRECAMBRIAN TIME. GEOL. SURV. CAN., PAPER 60-7, 25 PP.
- GSC 66-64 BIOTITE, K-AR AGE 376 ± OR - 16 M.Y.
- K=7.74 PERCENT, AR40/K40=0.0244, RADIOGENIC AR=95 PERCENT.
- CONCENTRATE- CLEAN, RELATIVELY UNALTERED, PALE REDDISH BROWN BIOTITE WITH LESS THAN 1 PERCENT HORNBLÉNDE CONTAMINATION AND ABOUT 1 PERCENT CHLORITE.
- FROM GABBRO
(560 N) ABOUT 1.5 MILE SOUTHEAST OF CAPE FANSHAWE MARTIN, DISTRICT OF FRANKLIN, 82-55 N, 79-55 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE CBF-65-285, COLLECTED AND INTERPRETED BY T. FRISCH.
- THE ROCK IS A MEDIUM-GRAINED GABBRO CONSISTING OF HYPERSTHENE, AUGITE, BIOTITE, ZONED PLAGIOCLASE (AN40-61), AND

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FINELY DISSEMINATED MAGNETITE. URALITIZATION IS MODERATE TO HEAVY BUT PATCHY IN DISTRIBUTION.

THE SPECIMEN WAS TAKEN FROM THE OUTER ZONE OF A PERIDOTITE-GABBRO INTRUSION CUTTING ROCKS OF THE METAMORPHIC COMPLEX OF NORTHERN ELLESMERE ISLAND (CHRISTIE, R.L., 1957, GEOL. SURV. CAN., PAPER 56-9, P. 24). ALTHOUGH PROBABLY TILTED, THE INTRUSION HAS APPARENTLY NOT BEEN METAMORPHOSED, AS THERE IS GOOD EVIDENCE THAT THE URALITIZATION IS MERELY A DEUTERIC EFFECT. THE BIOTITE IS A LATE PYROGENIC MINERAL AND IS UNDEFORMED. IF VALID, THE AGE DETERMINATION SIGNIFIES BASALTIC MAGMATIC ACTIVITY IN **CALEDONIAN** TIME IN THE FRANKLINIAN GEOSYNCLINE. SMALLER MAFIC TO ULTRAMAFIC INTRUSIONS ON BROMLEY ISLAND, 18 MILES TO THE EAST, ARE PRE-MIDDLE ORDOVICIAN IN AGE, ACCORDING TO FIELD EVIDENCE (TRETTIN, H.P., 1967, GEOL. SURV. CAN. PAPER 67-1, PART A, P. 13). IF THESE REPRESENT THE SAME PERIOD OF IGNEOUS ACTIVITY, THE ISOTOPIC AGE GIVEN HERE MAY BE NO MORE THAN A MINIMUM ONE.

GSC 66-65 HORNBLLENDE, K-AR AGE 390 + OR - 20 M.Y.

K=0.57 PERCENT, AR40/K40=0.0254, RADIOGENIC AR=90 PERCENT.

CONCENTRATE- CLEAN, UNALTERED DARK GREEN HORNBLLENDE WITH A TRACE OF QUARTZ CONTAMINATION.

FROM SYENODIORITE

(120 E) 4000 FT. NORTH OF EAST-WEST TRENDING TONGUE OF ICE 3.4 MILES WEST OF M*CLINTOCK INLET, ELLESMERE ISLAND, DISTRICT OF FRANKLIN, 82-41 N, 76-48 W. MAPPED AS CHALLENGER GROUP, GSC MAP 1148A (CHRISTIE). SAMPLE TM-65-206A, COLLECTED AND INTERPRETED BY H.P. TRETTIN.

THE SPECIMEN ANALYZED IS FROM A SMALL, TABULAR SYENODIORITE PLUTON. A REPRESENTATIVE THIN-SECTION HAS APPROXIMATELY THE FOLLOWING COMPOSITION, FELDSPAR, 80 PERCENT (MAINLY SODIC OLIGOCLASE, LESS THAN ONE THIRD IS K-FELDSPAR), ACTINOLITE 8.5 PERCENT, HORNBLLENDE 7 PERCENT, QUARTZ 4 PERCENT, BIOTITE 0.5 PERCENT (ABOUT 300 POINTS COUNTED). THE HORNBLLENDE IS MOSTLY UNALTERED, BUT REPLACED AT THE MARGINS BY ACTINOLITE. THE STATE OF THE PLAGIOCLASE INDICATES THAT THE ROCK HAS NOT BEEN SUBJECTED TO REGIONAL METAMORPHISM.

THE SYENODIORITE INTRUDES A LARGE ULTRAMAFIC PLUTON, WHICH IS IN FAULT CONTACT WITH UPPER ORDOVICIAN AND OLDER ROCKS, AND IS UNCONFORMABLY overlain BY MIDDLE PENNSYLVANIAN STRATA. THIS ULTRAMAFIC PLUTON IS PROBABLY EITHER GENETICALLY

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RELATED TO THE SYENODIORITE, AND HENCE ONLY SLIGHTLY OLDER (FRISCH), OR TO ALTERED BASIC AND ULTRABASIC INTRUSIONS OF PRE-WILDERNESSIAN AGE ON NEARBY BROMLEY ISLAND.

ALTHOUGH DIRECT FIELD EVIDENCE BEARING ON THE AGE OF THE SYENODIORITE IS NOT AVAILABLE, THERE ARE TWO REASONS TO SUPPOSE THAT THE DETERMINATION GIVES THE APPROXIMATE AGE OF INTRUSION. (1) THE SPECIMEN CAME FROM A SMALL, HIGH-LEVEL BODY THAT PROBABLY COOLED FAIRLY RAPIDLY. (2) THE AGE OBTAINED COINCIDES, WITHIN THE CONFIDENCE LIMITS STATED, WITH SEVERAL RECENT DETERMINATIONS ON PLUTONIC AND METAMORPHIC ROCKS FROM NORTHERN ELLESMERE ISLAND.

THE DETERMINATION ALSO COINCIDES APPROXIMATELY WITH APPARENT AGES FROM EAST GREENLAND THAT ARE RELATED TO THE LATE SILURIAN - EARLY DEVONIAN CALEDONIAN OROGENY. BECAUSE DEVONIAN STRATA ARE NOT PRESERVED IN NORTHEASTERN ELLESMERE ISLAND, IT IS UNKNOWN WHETHER THIS REGION WAS AFFECTED BY THE CALEDONIAN OROGENY. IF THE SYENODIORITE IS GENETICALLY RELATED TO THE ULTRAMAFIC PLUTON, IT IS INDICATIVE OF CRUSTAL EXTENSION RATHER THAN COMPRESSION. THEREFORE, THE PRESENT DETERMINATION SHOULD NOT BE USED AS UNEQUIVOCAL EVIDENCE FOR A CALEDONIAN OROGENY IN NORTHEASTERN ELLESMERE ISLAND.

REFERENCE-

FRISCH, T.O.

METAMORPHISM AND PLUTONISM IN NORTHERNMOST ELLESMERE ISLAND, CANADIAN ARCTIC ARCHIPELAGO, PH.D. THESIS, UN. CAL. SANTA BARBARA (IN PREP.)

GSC 66-66 WHOLE ROCK, K-AR AGE 475 + OR - 81 M.Y.

K=0.30 PERCENT, AR40-K40=0.0316, RADIOGENIC AR=50 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM DIABASE

(47 F) CAPE APPEL, DISTRICT OF FRANKLIN, 70-07 N, 86-15 W. MAP UNIT 4, GSC MAP 3-1958 (BLACKADAR). SAMPLE BE 63-43-5, COLLECTED AND INTERPRETED BY R.G. BLACKADAR.

THIS DETERMINATION WAS MADE ON A SPECIMEN OF CRUSHED WHOLE ROCK DIABASE (RELATIVELY UNALTERED) COLLECTED SEVERAL HUNDREDS OF FEET ABOVE THE LOWER CONTACT OF A SILL THAT INTRUDES THE AUTRIDGE FORMATION OF PRESUMED LATE PROTEROZOIC AGE. A PREVIOUSLY MADE DETERMINATION (CARRIED OUT ON CONTACT MATERIAL

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FROM THE SAME SILL) GAVE AN AGE OF 639 M.Y. (GSC 64-33).

BOTH AGES, 475 AND 639 M.Y. ARE MUCH YOUNGER THAN WAS EXPECTED. NEAR ARCTIC BAY, SOME 200 MILES TO THE NORTH, DIABASE DYKE SWARMS HAVE BEEN DATED AT 915 AND 1140 M.Y. THESE ROCKS INTRUDE A LITHOLOGY COMPARABLE TO THAT INTRUDED BY THIS DYKE. NEAR ARCTIC BAY THE DYKES DO NOT INTRUDE THE OVERLYING ORDOVICIAN STRATA.

IT WOULD APPEAR POSSIBLE THAT THERE MAY HAVE BEEN MORE THAN ONE PERIOD OF EMPLACEMENT OF BASIC ROCK IN NORTHERN BAFFIN ISLAND BUT THIS CAN ONLY BE A SURMISE UNTIL MORE DATA ARE AVAILABLE.

GSC 66-67 BIOTITE, K-AR AGE 1540 + OR - 50 M.Y.

K=7.73 PERCENT, AR40/K40=0.1391, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED REDDISH BROWN BIOTITE WITH ABOUT 2 PERCENT HORNBLENDE IMPURITY AND A TRACE OF QUARTZ.

(36 H) FROM AUGEN GNEISS
SOUTHWESTERN BAFFIN ISLAND, DISTRICT OF FRANKLIN,
65-34 N, 73-37 W. MAP-UNIT 13, GSC PRELIM. SERIES
MAP 16-1966 (FOXEN PENINSULA). SAMPLE SR 65-160,
COLLECTED BY P.H. SMITH, INTERPRETED BY R.G.
BLACKADAR.

THE ROCK IS A MEDIUM GREY-PINK AND GREENISH BIOTITE AUGEN GRANITE GNEISS WITH CATACLASTIC TEXTURES. AUGEN OF K-FELDSPAR, QUARTZ AND PLAGIOCLASE MEASURE UP TO 2 CM. LONG BY 1 CM. WIDE AND ARE IN A FINE-GRAINED MATRIX OF THE SAME MINERALS PLUS BIOTITE AND ORTHOPYROXENE. BIOTITE FLAKES ARE ALIGNED IN THE FOLIATION AND ARE VIRTUALLY UNCHLORITIZED. THE SPECIMEN ON WHICH THE DETERMINATION WAS CARRIED OUT HAD THE FOLLOWING MINERALOGICAL COMPOSITION- QUARTZ 52 PERCENT, PLAGIOCLASE 24 PERCENT, K-FELDSPAR 10 PERCENT, BIOTITE 7 PERCENT, HYPERSTHENE 6 PERCENT, OPAQUES 1 PERCENT, AND TRACE AMOUNTS OF APATITE AND ZIRCON.

THE DATE OBTAINED IS CONSISTENT WITH OTHER DATES FROM SOUTHERN BAFFIN ISLAND WHICH EARLIER LED TO THE INCLUSION OF THE AREA IN THE CHURCHILL STRUCTURAL PROVINCE.

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GSC 66-68 BIOTITE, K-AR AGE 1555 + OR - 50 M.Y.

K=7.76 PERCENT, AR40/K40=0.1416, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF UN-ALTERED BROWN BIOTITE. ABOUT 5 PERCENT OF THE FLAKES CARRY PLEOCHROIC HALOS. HORNBLENDE CONTAMINATION AMOUNTS TO ABOUT 3-5 PERCENT.

FROM GRANODIORITE
(26 F) DISTRICT OF FRANKLIN, 65-06 N, 68-02 W. MAP-UNIT 13, MAP 17-1966, (CUMBERLAND SOUND). SAMPLE BE-65-52-2, COLLECTED AND INTERPRETED BY R.G. BLACKADAR.

THE SPECIMEN ON WHICH THE DETERMINATION WAS MADE IS AN EQUIGRANULAR, UNALTERED, QUARTZ-FELDSPAR-BIOTITE-PYROXENE SCHIST CONSISTING OF- PLAGIOCLASE AN30-45 32 PERCENT, CLINO-PYROXENE 22 PERCENT, HYPERSTHENE 5 PERCENT, BIOTITE 21 PERCENT, K-FELDSPAR AND QUARTZ 20 PERCENT.

THIS SPECIMEN IS FROM A MAFIC LENS IN GRANITE THAT OUTCROPS EXTENSIVELY BETWEEN AMADJUAKE LAKE AND THE EAST COAST OF BAFFIN ISLAND. THE DATE IS CONSISTENT WITH OTHER DATES FROM SOUTHERN BAFFIN ISLAND WHICH EARLIER LED TO THE INCLUSION OF THE AREA IN THE CHURCHILL STRUCTURAL PROVINCE.

GSC 66-69 BIOTITE, K-AR AGE 1540 + OR - 50 M.Y.

K=7.13 PERCENT, AR40/K40=0.1397, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- A MIXTURE OF TWO CONCENTRATES OF IMPURE BUT UNALTERED DARK BROWN BIOTITE. IMPURITIES CONSIST OF 15-20 PERCENT HORNBLENDE.

FROM GRANITE
(26 C) SOUTHERN BAFFIN ISLAND, DISTRICT OF FRANKLIN, 64-10 N, 68-14 W. MAP-UNIT 13, GSC MAP 17-1966 (CUMBERLAND SOUND). SAMPLE TA65-T73, COLLECTED BY F.C. TAYLOR, INTERPRETED BY R.G. BLACKADAR.

THE SAMPLE WAS PREPARED FROM A MASSIVE GRANITIC ROCK CONSISTING OF 22 PERCENT QUARTZ, 19 PERCENT OLIGOCLASE, 51 PERCENT MICROCLINE, 5 PERCENT BIOTITE, 2 PERCENT HORNBLENDE, AND TRACES OF APATITE AND OPAQUES. THE TEXTURE IS GRANITIC AND K-FELDSPAR FORMS THE LARGEST GRAINS. THERE IS SOME DEVELOP-

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MENT OF MYRMEKITE ALONG GRAIN MARGINS. BIOTITE IS FRESH AND UNALTERED.

THE 1540 M.Y. DATE IS CONSISTENT WITH OTHERS OBTAINED FROM SOUTHERN BAFFIN ISLAND.

GSC 66-70 BIOTITE, K-AR AGE 1500 + OR - 50 M.Y.

K=7.90 PERCENT, AR40/K40=0.1344, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED BROWN BIOTITE WITH LESS THAN 5 PERCENT HORNBLende CONTAMINATION.

FROM GRANITE GNEISS
(25 I) SOUTHEASTERN BAFFIN ISLAND, DISTRICT OF FRANKLIN,
62-39 N, 65-17 W. MAP-UNIT 13, GSC MAP 18-1966
(FROBISHER BAY P.S.). SAMPLE BE 65-101, COLLECTED
AND INTERPRETED BY R.G. BLACKADAR.

THE SAMPLE WAS FROM A LIGHT GREY, BANDED BIOTITE GRANITE GNEISS CONSISTING OF 21 PERCENT OLIGOCLASE, 69 PERCENT QUARTZ-K-FELDSPAR, 3 PERCENT HORNBLende, 7 PERCENT BIOTITE, AND TRACE ACCESSORIES. THE TEXTURE IS GRANOBLASTIC AND GRAINS RANGE IN SIZE FROM 0.5 MM TO 2 MM ACROSS, QUARTZ FORMING THE LARGEST GRAINS WITH MOST OTHER MINERALS INTERSTITIAL. FRESH, UNALTERED BIOTITE IS SEGREGATED IN STREAKS.

THE AGE OBTAINED IS CONSISTENT WITH OTHERS OBTAINED FROM SOUTHERN BAFFIN ISLAND.

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GSC 66-71 WHOLE ROCK, K-AR AGE 767 + OR - 72 M.Y.

K=1.44 PERCENT, AR40/K40=0.0554, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM BASALT
(86 N) ABOUT 7 MILES EAST OF SOUTH TIP OF DISMAL LAKES,
DISTRICT OF MACKENZIE, 67-14 N, 116-24 W. MAP-
UNIT 12, GSC MAP 18-1960 (J.A. FRASER). SAMPLE
BLB-6-48, COLLECTED BY D. BISHOP INTERPRETED BY
W.R.A. BARAGAR.

THE ROCK IS A FINELY PORPHYRITIC BASALT TAKEN FROM NEAR
THE BASE OF THE COPPERMINE RIVER FLOW SEQUENCE. THE PHENO-
CRYSTS ARE RARELY MORE THAN 1 MM LONG AND ARE MAINLY CHLORITE
EVIDENTLY PSEUDOMORPHIC AFTER PYROXENE AND POSSIBLY OLIVINE.
TWO OF THE PHENOCRYSTS ARE AUGITE AND POSSIBLY GIVE AN
INDICTION OF THE ORIGINAL MINERAL PSEUDOMORPHED BY CHLORITE.
MAGNETITE, GENERALLY PARTLY ALTERED TO HYDROUS IRON OXIDES AND
HEMATITE, FORMS MICRO PHENOCRYSTS 0.2-0.4 MM IN DIAMETER. THE
GROUNDMASS IS COMPOSED OF PLAGIOCLASE LATHS AND INTERSTITIAL
FINELY GRANULAR AUGITE. THE PLAGIOCLASE IS APPROXIMATELY 80
PERCENT ALTERED TO FINE WHITE MICACEOUS MATERIAL.

SEE GSC 66-72 FOR INTERPRETATION.

GSC 66-72 WHOLE ROCK, K-AR AGE 890 + OR - 112 M.Y.

K=0.61 PERCENT, AR40/K40=0.0666, RADIOGENIC AR=94 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM BASALT
(86 N) NEAR HEAD OF BURNT CREEK, COPPERMINE RIVER AREA,
DISTRICT OF MACKENZIE, 67-21 N, 116-09 W. MAP-
UNIT 12, GSC MAP 18-1960 (J.A. FRASER). SAMPLE
BLS-1-66, COLLECTED AND INTERPRETED BY W.R.A.
BARAGAR.

THE ROCK IS A FAIRLY FRESH, MASSIVE BASALT TAKEN FROM NEAR
THE TOP OF THE COPPERMINE RIVER FLOW SEQUENCE. IT IS OF
UNIFORM GRAIN SIZE AND SLIGHTLY SUBOPHITIC. BOTH PLAGIOCLASE
AND PYROXENE ARE ESSENTIALLY FRESH ALTHOUGH MINUTE VEINS AND
NETWORKS OF CHLORITE DISSECT SOME OF THE PLAGIOCLASE CRYSTALS.
EQUIDIMENSIONAL GRAINS OF MAGNETITE SCATTERED THROUGH THE

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SECTION ARE EACH SURROUNDED BY A HALO OF HYDROUS IRON OXIDES.

INTERPRETATIONS FOR GSC 66-71 AND 72. SEVEN PREVIOUS AGE DETERMINATIONS DONE ON COPPERMINE RIVER BASALT (FRASER, 1965, P. 60,61, 1966, P. 40,41,42, SMITH, 1965, P. 67) RANGED FROM 740 M.Y. TO 1200 M.Y. THE AGES FALL GENERALLY INTO TWO GROUPS OF RANGES, 1065-1200 M.Y. AND 735-863 M.Y. ONE AGE OF 915-920 M.Y. FROM BATHURST INLET FALLS BETWEEN THE GROUPS. THE AGES OF THE PRESENT SAMPLES TEND TO FALL INTO THE YOUNGER GROUP ALTHOUGH GSC 66-72 IS SLIGHTLY OLDER. THE REASON FOR THE SPREAD OF AGES IS NOT CLEAR, BUT IT IS DEFINITELY NOT RELATED TO STRATIGRAPHIC SUCCESSION AS SHOWN BY THE INVERSE RELATIONSHIP BETWEEN THE AGES OF THE PRESENT SAMPLES AND THEIR POSITION IN THE STRATIGRAPHIC COLUMN. INDIRECT EVIDENCE SUGGESTS THAT THE OLDER AGES MAY BE THE MORE CORRECT ONES, THE MUSKOKX INTRUSION AND THE MACKENZIE DYKES, BOTH OF WHICH ARE BELIEVED TO BE RELATED TO THE COPPERMINE FLOWS, GIVE AGES OF 1095-1155 M.Y. (SMITH, 1961, P. 22, 1965, P. 67) AND 1315 M.Y. (FAHRIG AND WANLESS, 1963) RESPECTIVELY. IF THIS IS SO THEN IT IS REASONABLE TO EXPECT THAT THE YOUNGER GROUP OF AGES MAY BE RELATED TO A LATER TECTONIC EVENT THAT CAUSED SOME LOSS OF ARGON. (NOTE THAT THE MOST ALTERED OF THE TWO SAMPLES DESCRIBED ABOVE, GSC 66-71, GIVES THE YOUNGER AGE). THE COPPERMINE RIVER GROUP IS OVERLAIN UNCONFORMABLY BY A SUCCESSION OF SANDSTONES, SHALES, AND OTHER SEDIMENTS WHICH ARE INTRUDED BY A SWARM OF DIABASE DYKES (BARAGAR, 1967, P. 26). IN ONE PLACE COPPERMINE BEDS DIPPING AS MUCH AS 40 DEGREES ARE TRUNCATED BY NEARLY HORIZONTAL STRATA THUS INDICATING A PERIOD OF SOME DEFORMATION PRIOR TO DEPOSITION OF THE YOUNGER BEDS. THE AGE OF A DIABASE SILL THAT INTRUDES THE YOUNGER SEQUENCE PROVIDES A MINIMUM AGE FOR THE DEFORMATION OF 605 M.Y. (FRASER, 1966, P. 4). IT IS POSSIBLE, THEREFORE, THAT THE MINOR DEFORMATION THAT FOLLOWED COPPERMINE VOLCANISM AND SEDIMENTATION IS RESPONSIBLE FOR UP-DATING MANY OF THE COPPERMINE GROUP SAMPLES INCLUDING THE TWO REPORTED ABOVE.

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GSC 66-73 WHOLE ROCK, K-AR AGE 1835 + OR - 90 M.Y.

K=4.70 PERCENT, AR40/K40=0.1814, RADIOGENIC AR=97
PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM PHYLLITE
(86 G) 8 MILES NORTH OF SCOTSTOWN LAKE, DISTRICT OF
MACKENZIE, 65-44 N, 114-59 W. MAP-UNIT 8, GSC MAP
18-1960, SAMPLE FD-22-59, COLLECTED AND INTERPRETED
BY J.A. FRASER.

THE PHYLLITE IS GREY, FINE GRAINED, AND SCHISTOSE WITH
UNEVEN WRINKLE-LINEATED CLEAVAGE SURFACES WHICH DIVIDE THE
ROCK INTO THIN WEDGES. IT IS COMPOSED OF QUARTZ (60 PERCENT),
FRESH BIOTITE (20 PERCENT) AND MUSCOVITE (10 PERCENT), RAGGED
KNOTS OF ANDALUSITE (LESS THAN 10 PERCENT), AND ACCESSORY
TOURMALINE AND OPAQUE MINERALS.

THE SAMPLE LOCALITY LIES WITHIN THE RECLUSE FORMATION OF
THE EPWORTH GROUP, APPROXIMATELY 2 MILES EAST OF A CONTACT
WITH A LARGE MASS OF GRANITE. SEDIMENTS OF THE FORMATION SHOW
A PROGRESSIVE INCREASE IN METAMORPHISM FROM ARGILLITE, 6 MILES
EAST OF THE GRANITE TO SILLIMANITE SCHIST AT THE CONTACT. THE
AGE OF THE PHYLLITE (1,835 M.Y.) WHICH IS SIMILAR TO AGES
OBTAINED ON BIOTITE FROM THE GRANITE, REFLECTS THE INFLUENCE
OF HUDSONIAN METAMORPHISM IN THIS REGION. THE AGE CONFIRMS
THE RECLUSE SEDIMENTS AS BEING OLDER THAN THE GRANITE AND SETS
A MINIMUM LIMIT TO THEIR DATE OF DEPOSITION.

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GSC 66-74 WHOLE ROCK, K-AR AGE 1255 + OR - 110 M.Y.

K=1.80 PERCENT, AR40/K40=0.1040, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK

FROM DIABASE

(86 H) 20 MILES NORTHWEST OF ITCHEN LAKE, DISTRICT OF MACKENZIE, 65-42 N, 113-39 W. MAP-UNIT 18A, GSC MAP 18-1960. SAMPLE FD 523-65, COLLECTED AND INTERPRETED BY J.A. FRASER.

THE DIABASE IS DARK GREY, FINE TO MEDIUM GRAINED AND MASSIVE. IT IS COMPOSED OF UNALTERED PLAGIOCLASE AND PYROXENE WITH ACCESSORY MAGNETITE AND TRACES OF CHLORITE AND BIOTITE.

THE SAMPLE WAS COLLECTED 6 FEET ABOVE THE BASE OF A FLAT-LYING, UNDEFORMED SILL WHICH CAPS 5000 FEET OR MORE OF SEDIMENTS OF THE EPWORTH GROUP KNOWN TO BE APHEBIAN IN AGE. IMMEDIATELY BELOW THE SILL IS ARGILLACEOUS SILTSTONE. THE ROOF AND TOP OF THE SILL HAVE BEEN REMOVED. THE PRESENT THICKNESS IS ABOUT 80 FEET.

THE SILL IS ONE OF SEVERAL, POSSIBLY REPRESENTING VARIOUS AGES OF INTRUSION, WHICH ARE INTERLAYERED WITH PROTEROZOIC STRATA IN THE COPPERMINE RIVER - BATHURST INLET REGION. THE AGE OF 1255 M.Y. IS CONSIDERED TO BE THAT OF INTRUSION.

GSC 66-75 WHOLE ROCK, K-AR AGE 902 + OR - 106 M.Y.

K=0.67 PERCENT, AR40/K40=0.0676, RADIOGENIC AR=93 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK

FROM GABBRO

(86 H) 19 MILES NORTH OF ENTRANCE TO ITCHEN RIVER FROM MAIN PART OF ITCHEN LAKE, DISTRICT OF MACKENZIE, 65-45 1/2 N, 112-56 W. SEE DIABASE-GABBRO DYKES, GSC PAPER 66-24. SAMPLE BK-66-105B, COLLECTED AND INTERPRETED BY H.H. BOSTOCK.

THE ROCK IS A DARK GREY-GREEN, MEDIUM-GRAINED, EQUIGRANULAR GABBRO CONSISTING MAINLY OF PLAGIOCLASE (60 PERCENT), PYROXENE (28 PERCENT), CHLORITE (5 PERCENT), QUARTZ (2 PERCENT) AND MINOR POTASH FELDSPAR, BIOTITE, HORNBLLENDE AND APATITE.

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THE SAMPLE REPRESENTS A NORTH NORTHWESTERLY STRIKING DIABASE DYKE 80 FEET THICK CONTAINING A SMALL AMOUNT OF QUARTZ AND INTERSTITIAL ALKALI FELDSPAR. THE DYKE IS CUT BY SMALL GRANITIC STRINGERS. IN VIEW OF THE K-AR WHOLE ROCK AGE THE GRANITIC STRINGERS ARE VIEWED EITHER AS COUNTRY ROCK REMOBI-LIZED BY INTRUSION OF THE DYKE, OR MORE PROBABLY, AS GRANITIC SEGREGATIONS WITHIN THE DYKE. THE DYKE MAY BE ASSIGNED TO THE MACKENZIE SWARM.

GSC 66-76 WHOLE ROCK, K-AR AGE 1865 + OR - 235 M.Y.

K=0.41 PERCENT, AR40/K40=0.1866, RADIOGENIC AR= 84 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM METAGABBRO
(86 H) WEST OF SOUTH END OF SMALL LAKE, DISTRICT OF MACKENZIE, 65-43 N, 112-34 1/2 W. MAP-UNIT 18, GSC MAP 18-1960 (J.A. FRASER). SAMPLE BK-64-996 B/2, COLLECTED AND INTERPRETED BY H.H. BOSTOCK.

THE ROCK IS MEDIUM-GRAINED, EQUIGRANULAR, DARK GREEN METAGABBRO CONTAINING 1 PERCENT FRESH PYRRHOTITE IN PATCHES 2-4 MM. IN DIAMETER. IT IS COMPOSED PRIMARILY OF GREEN AMPIBOLE CONTAINING CLUSTERS OF OPAQUE MINERAL GRAINS AND PARTLY SUR-ROUNDED BY CLEAR COLOURLESS AMPIBOLE OF HIGH BIREFRINGENCE AND 2V (CUMMINGTONITE). LOCALLY POIKILITIC ANDESINE-LABRADORITE ANHEDRA FORM A LESSER CONSTITUENT. BIOTITE AND APATITE ARE MINOR.

THE BODY FROM WHICH THE SAMPLE WAS TAKEN VARIES WIDELY IN GRAIN SIZE AND LOCALLY CONTAINS SMALL GRANITIC PATCHES AND VEINS. THESE MAY BE PARTLY REMOBI-LIZED INCLUSIONS OF COUNTRY ROCK OR THEY MAY REPRESENT GRANITIC MATERIAL EMPLACED AFTER INTRUSION OF THE GABBRO.

THE AGE, 1865 + OR - 235 M.Y., CORRESPONDS TO METAMORPHISM DURING THE HUDSONIAN OROGENY. SINCE BIOTITE IN NEIGHBORING GRANODIORITE AND KNOTTED SCHISTS GAVE AGES INTERMEDIATE BETWEEN KENORAN AND HUDSONIAN OROGENIES A PRE-HUDSONIAN K-AR WHOLE ROCK AGE FOR THE GABBRO WAS CONSIDERED POSSIBLE.

THE HUDSONIAN AGE DERIVED FOR THE GABBRO MAY THEREFORE BE INTERPRETED TO INDICATE THAT- (1) THE GABBRO WAS EMPLACED DURING THE HUDSONIAN OROGENY AND WAS SUBJECT TO EXTENSIVE RETROGRADE ALTERATION SOON AFTER EMPLACEMENT (2) OR THE GABBRO WAS EMPLACED PRIOR TO THE HUDSONIAN OROGENY BUT WAS LESS ABLE TO RETAIN ARGON DURING SUBSEQUENT METAMORPHISM THAN WAS BIO-

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TITE IN THE NEIGHBORING ROCKS.

GSC 66-77 MUSCOVITE, K-AR AGE 2275 + OR - 60 M.Y.

K=5.94 PERCENT, AR40/K40=0.2582, RADIOGENIC AR= 95 PERCENT.

CONCENTRATE- SLIGHTLY CONTAMINATED MUSCOVITE WITH 5-10 PERCENT QUARTZ. ABOUT 5 PERCENT OF THE MICA FLAKES ARE STAINED BROWN ON THE EDGES.

(86 H) FROM KNOTTED SCHIST
ISLAND ON EASTERNMOST POINT ON SOUTH SHORE OF
POINT LAKE, WEST OF COPPERMINE RIVER, DISTRICT OF
MACKENZIE, 65-11 N, 112-26 W. MAP-UNIT 2, GSC MAP
18-1960 (J.A. FRASER). SAMPLE BK-64-576C/4,
COLLECTED AND INTERPRETED BY H.H. BOSTOCK.

THE SAMPLE IS A GREY VERY FINE-GRAINED KNOTTED SCHIST WITH DARK GREY ALTERED CORDIERITE PORPHYROBLASTS UP TO ABOUT 1 INCH ACROSS. THE PRINCIPAL MINERAL IS QUARTZ WITH LESSER CORDIERITE, MUSCOVITE AND BIOTITE, MINOR CHLORITE AND OPAQUES AND TRACE TOURMALINE.

THE AGE, 2275 + OR - 60 M.Y. REFLECTS REGIONAL METAMORPHISM AND MAY COMBINE THE EFFECT OF METAMORPHISM DURING THE KENORAN OROGENY WITH PARTIAL ARGON LOSS DURING THE HUDSONIAN OROGENY.

GSC 66-78 BIOTITE, K-AR AGE 1890 + OR - 55 M.Y.

K=6.92 PERCENT, AR40/K40=0.1902, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- CLEAN, SOMEWHAT ALTERED REDDISH BROWN BIOTITE. ABOUT 60 PERCENT OF THE FLAKES SHOW PATCHY CHLORITE ALTERATION AND 15-20 PERCENT CONTAIN WEAK PLEOCHROIC HALOS. IMPURITIES CONSIST OF HORNBLende (2 PERCENT) AND CHLORITE (12 PERCENT).

(75 E) FROM GNEISSIC GRANODIORITE
NORTH SHORE OF SMALL LAKE DIRECTLY NORTH OF THUBUN
LAKES, DISTRICT OF MACKENZIE, 61-41-20 N, 111-46-10
W. MAP-UNIT 9, GSC MAP 525A (TALTSON LAKE).
SAMPLE RM-58-15-65, COLLECTED AND INTERPRETED BY
E.W. REINHARDT.

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SEE GSC 66-79 FOR DESCRIPTION AND INTERPRETATION.

GSC 66-79 MUSCOVITE, K-AR AGE 1735 ± OR - 60 M.Y.

K=8.46 PERCENT, AR40/K40=0.1665, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- CLEAN, COLOURLESS, UNALTERED MUSCOVITE

FROM GNEISSIC GRANODIORITE
(75 E) NORTH SHORE OF SMALL LAKE DIRECTLY NORTH OF THUBUN
LAKES, DISTRICT OF MACKENZIE, 61-41-20 N, 111-46-10
W. MAP-UNIT 9, GSC MAP 525A (TALTSON LAKE).
SAMPLE RM-58-15-65, COLLECTED AND INTERPRETED BY
E.W. REINHARDT.

THIS GRANODIORITE IS REPRESENTATIVE OF AN ELONGATE NORTH-EASTWARD-TRENDING MASS THAT OCCURS BETWEEN THE LA LOCHE RIVER FAULT AND THUBUN LAKES SOUTH OF THE SOUTHWEST EXTENSION OF THE MCDONALD FAULT, WHICH MARKS THE APPROXIMATE BOUNDARY BETWEEN THE SLAVE AND CHURCHILL PROVINCES IN THIS VICINITY. THE MASS OF GNEISSIC GRANODIORITE IS ENVELOPED BY STRATIFORM GRANITIC AND METASEDIMENTARY GNEISSES WHICH HAVE BEEN AFFECTED BY SHEAR ASSOCIATED WITH TRANSCURRENT MOVEMENTS ALONG THE MCDONALD AND ASSOCIATED FAULTS. CONTACT RELATIONS INDICATE THAT THE GRANO-DIORITE WAS AT ONE TIME MORE MOBILE THAN THE ENCLOSING ROCKS.

THE ROCK IS A MEDIUM GRAINED, GNEISSIC, LIGHT GREY GRANO-DIORITE CONTAINING BIOTITE (5 PERCENT), MUSCOVITE (5 PERCENT), PINK GARNET (2 PERCENT), AND TRACES OF HORNBLende. MICROCLINE IS PARTLY INTERSTITIAL TO PLAGIOCLASE, AN25. THE BIOTITE IS PARTLY RAGGED AND ALTERED TO CHLORITE (15 PERCENT) IN VARYING DEGREES, AND CONTAINS INCLUSIONS OF OPAQUE MINERALS, ZIRCON, AND RUTILE. THE MUSCOVITE IS RELATIVELY UNDEFORMED, FRESH, TABULAR, AND CROSSCUTS SOME BIOTITE PLATES BUT APPEARS CONTINUOUS WITH OTHERS. BOTH MICAS IMPART A CRUDE FOLIATION THROUGH PLANAR ORIENTATION OF TABULAR GRAINS.

ALTHOUGH THE DIFFERENCE BETWEEN THE MUSCOVITE AGE (1735 M.Y.) AND THE BIOTITE AGE (1890 M.Y.) IS SMALL WITH RESPECT TO THE PROBABLE ANALYTICAL ERROR GIVEN FOR THE DETERMINATIONS, THESE TWO DATES FROM THE SAME ROCK MAY REPRESENT TWO DISTINCT GEOLOGICAL EVENTS. FOLLOWING THIS INTERPRETATION, FIRST GENERATION BIOTITE IN ASSOCIATION WITH GARNET (AND HORNBLende) WOULD MARK AN EARLY CRYSTALLIZATION. THE BIOTITE AGE (1890 M.Y.) WOULD THEN REFLECT BOTH THIS EARLY CRYSTALLIZATION AS WELL AS A PARTIAL RECRYSTALLIZATION AND/OR DEFORMATION CONTEMPORANEOUS WITH THE FORMATION OF MUSCOVITE (1735 M.Y.). THE MUSCOVITE AGE PROBABLY RECORDS A LOW-GRADE METAMORPHISM

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WHICH IN THE GRANODIORITE WOULD BE CHARACTERIZED BY THE APPEARANCE OF MUSCOVITE, CHLORITE, AND SECOND GENERATION BIOTITE. THIS INCOMPLETE RETROGRADE RECRYSTALLIZATION MAY CORRESPOND WITH EXTENSIVE SHEAR AND MYLONITIZATION DEVELOPED IN THE SURROUNDING METASEDIMENTARY ROCKS. THE INTERPRETATION OF THESE DATES, HOWEVER, MUST REMAIN TENTATIVE PENDING COMPLETION OF FURTHER DATING AND PETROGRAPHIC STUDY IN THIS AREA OF COMPLEX GEOLOGICAL HISTORY. THE TWO VALUES APPROXIMATELY DEFINE THE RANGE OF AVAILABLE MICA AGES FROM THE CHURCHILL PROVINCE BETWEEN THE MCDONALD FAULT AND NONACHO LAKE BUT ARE IN REVERSE ORDER TO THE AGES OBTAINED FROM THE BIOTITE-MUSCOVITE PAIR FROM A MICA SCHIST COLLECTED WEST OF RUTLEDGE LAKE BY C.H. STOCKWELL (GSC 61-79, BIOTITE, 1780 M.Y., GSC 61-80, MUSCOVITE, 1840 M.Y.).

GSC 66-80 MUSCOVITE, K-AR AGE 2315 + OR - 65 M.Y.

K=8.35 PERCENT, AR40/K40=0.2660, RADIOGENIC AR=100 PERCENT.

CONCENTRATE- RELATIVELY CLEAN MUSCOVITE WITH LESS THAN 1 PERCENT OPAQUES AND A TRACE OF QUARTZ.

(75 L) FROM FOLIATED GRANODIORITE
1/4 MILE NORTH OF MCKEE LAKE, 3 MILES SOUTH OF THE MCDONALD FAULT, DISTRICT OF MACKENZIE, 62-21-20 N, 110-04-05 W. MAP-UNIT 3, G.S.C. PRELIMINARY MAPS 51-25A AND 52-5. SAMPLE RM-210-54-65, COLLECTED AND INTERPRETED BY E.W. REINHARDT.

THE SAMPLE IS A GREY, MEDIUM-GRAINED, GNEISSIC GRANODIORITE CONTAINING QUARTZ (30 PERCENT), MICROCLINE (22 PERCENT), ALTERED OLIGOCLASE (38 PERCENT), MUSCOVITE (4 PERCENT), AND BIOTITE (6 PERCENT) MOST OF WHICH IS ALTERED TO CHLORITE AND FINE NEEDLES OF RUTILE. THE MAJORITY OF THE MUSCOVITE APPEARS TO BE PRIMARY AND IS ASSOCIATED WITH THE CHLORITIZED BIOTITE. MINOR AMOUNTS OF SECONDARY MUSCOVITE HAVE DEVELOPED MAINLY FROM THE ALTERATION OF PLAGIOCLASE. EVIDENCE OF SLIGHT DEFORMATION IS DISPLAYED BY BOTH MICAS.

THIS SAMPLE IS CHARACTERISTIC OF GRANODIORITES AND QUARTZ MONZONITES THAT OCCUR IN NARROW FAULT SLICES BOUNDED BY AND SOUTH OF THE MCDONALD FAULT (SEE GSC PAPER 66-1, P. 34). THESE GRANITIC ROCKS HAVE INTRUDED METASEDIMENTARY SCHISTS THAT RESEMBLE SCHISTS OF THE YELLOWKNIFE GROUP, AND THE AGE OF 2315 + OR - 65 M.Y. PROVIDES FURTHER EVIDENCE FOR CORRELATING SOME OF THE ROCKS IMMEDIATELY SOUTH OF THE MCDONALD FAULT WITH ARCHAEOAN ROCKS OF THE SLAVE PROVINCE. THE YOUNGER AGE INDICATED BY THE PRESENT MUSCOVITE AS COMPARED WITH PREVIOUS MICA AGES

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(2555 ± OR - 70 M.Y., BIOTITE, GSC 63-81 AND 2485 M.Y., MUSCOVITE, GSC 60-50) FROM LITHOLOGICALLY SIMILAR GRANITIC ROCKS OCCURRING IN THE VICINITY OF THE McDONALD FAULT CAN BE ATTRIBUTED TO DEFORMATION AND SECONDARY CRYSTALLIZATION ASSOCIATED WITH A FAULT THROUGH THE AXIS OF MCKEE LAKE. THE ROCKS SOUTH OF THIS FAULT HAVE EXPERIENCED POST-ARCHAean DEFORMATION AND METAMORPHISM SUCH AS INDICATED BY THE K-AR AGE OF BIOTITE (1835 ± OR - 60 M.Y., GSC 63-80) FROM A SAMPLE OF CRUSHED GRANITIC GNEISS COLLECTED BY STOCKWELL FROM AN ISLAND IN DION LAKE.

GSC 66-81 WHOLE ROCK, K-AR AGE 1550 ± OR - 170 M.Y.

K=0.65 PERCENT, AR40/K40=0.1406, RADIOGENIC AR=94 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK

FROM DIABASE

(75 E) DISTRICT OF MACKENZIE, 61-07 N, 110-16-02 W.
GSC MAP 607A. SAMPLE MC 62-65, COLLECTED AND
INTERPRETED BY J.C. MCGLYNN.

THIS IS A SAMPLE OF A CHILLED MARGIN OF A DIABASE DYKE THAT STRIKES AT 340 DEGREES AND DIPS 60 DEGREES TO THE EAST AND CUTS SEDIMENTS OF THE NONACHO GROUP AND GRANITIC GNEISSES OF THE BASEMENT OF THESE SEDIMENTS. THE CHILLED PHASE OF THE DIABASE IS COMPOSED OF LATHES OF PLAGIOCLASE AND GRAINS OF PYROXENE AND OLIVINE IN A GROUNDMASS CONSISTING OF TINY LATHES OF PLAGIOCLASE AND PYROXENE EMBEDDED IN BLACK SEMI-OPAQUE MATERIAL. THE DATE IS A REASONABLE ONE AND GIVES A MINIMUM AGE FOR THE NONACHO SEDIMENTS AND FOR FOLDING AND AT LEAST SOME FAULTING OF THESE ROCKS.

GSC 66-82 MUSCOVITE, K-AR AGE 1845 ± OR - 58 M.Y.

K=8.64 PERCENT, AR40/K40=0.1832, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- CLEAN, UNALTERED MUSCOVITE WITH 1 PERCENT HORNBLende CONTAMINATION. LESS THAN 5 PERCENT OF THE FLAKES CONTAIN SMALL INCLUSIONS OF BIOTITE WITH A TRACE OF CHLORITE.

FROM PEGMATITE

DISTRICT OF MACKENZIE

- (75 D) DISTRICT OF MACKENZIE, 60-56-12 N, 110-21-24 W.
MAP-UNIT 3, GSC MAP 607A. SAMPLE MC 36-6J, COLLECTED AND INTERPRETED BY J.C. MCGLYNN.

SEE GSC 66-85 FOR DESCRIPTION AND INTERPRETATION.

GSC 66-83 MUSCOVITE, K-AR AGE 1940 + OR - 60 M.Y.

K=8.94 PERCENT, AR40/K40=0.1982, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- CLEAN MUSCOVITE. 90 PERCENT OF THE FLAKES ARE CLEAR AND COLOURLESS, WHILE ABOUT 10 PERCENT CONTAIN HEMATITE AND IRON STAINS BETWEEN THE PLATES. HORNBLende CONTAMINATION AMOUNTS TO LESS THAN 2 PERCENT.

- FROM GRANODIORITE
(75 E) DISTRICT OF MACKENZIE, 61-03-48 N, 110-03-12 W.
GSC MAP 525A. SAMPLE MC-230A-65, COLLECTED BY P. HOFFMAN, INTERPRETED BY J.C. MCGLYNN.

SEE GSC 66-85 FOR DESCRIPTION AND INTERPRETATION.

GSC 66-84 MUSCOVITE, K-AR AGE 1785 + OR - 55 M.Y.

K=8.42 PERCENT, AR40/K40=0.1743, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, BUT SLIGHTLY CLOUDY MUSCOVITE WITH 2 PERCENT BIOTITE AND ABOUT 4 PERCENT CHLORITE IMPURITIES.

- FROM GRANODIORITE
(75 D) DISTRICT OF MACKENZIE, 60-57-30 N, 110-16-48 W.
MAP-UNIT 1, GSC MAP 607A. SAMPLE MC-65-65, COLLECTED AND INTERPRETED BY J.C. MCGLYNN.

SEE GSC 66-85 FOR DESCRIPTION AND INTERPRETATION.

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GSC 66-85 MUSCOVITE, K-AR AGE 2175 ± OR - 65 M.Y.

K=8.79 PERCENT, AR40/K40=0.2396, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- CLEAN, CLEAR, COLOURLESS MUSCOVITE. ABOUT 25 PERCENT OF THE FLAKES CONTAIN A FEW ORIENTED NEEDLE-LIKE INCLUSIONS. A TRACE OF QUARTZ IS THE ONLY IMPURITY.

FROM GRANITE
(75 E) DISTRICT OF MACKENZIE, 61-03-30 N, 110-01-42 W.
MAP-UNIT 3, GSC MAP 525A. SAMPLE MC-60-65
COLLECTED AND INTERPRETED BY J.C. MCGLYNN.

THESE SAMPLES (GSC 66-82, 83, 84, AND 85) ARE FROM THE THEKULTHILI LAKE AREA ABOUT 150 MILES SOUTHEAST OF YELLOWKNIFE IN THE NORTHWEST TERRITORIES. THE OLDEST ROCKS IN THE AREA CONSIST OF GRANITIC GNEISSES, MIGMATITES AND MASSIVE TO SLIGHTLY FOLIATED GRANITIC ROCKS THAT FORM THE BASEMENT ROCKS OF THE YOUNGER NONACHO SEDIMENTS. ROCKS OF THE NONACHO GROUP COMPRISE A CONFORMABLE SEQUENCE OF POLYMICITIC CONGLOMERATES, CONGLOMERATIC ARKOSES AND LITHIC SANDSTONES AND LOCALLY SHALES. THE SEDIMENTS, IN THE AREA MAPPED BY THE AUTHOR, ARE SEPARATED FROM THE GRANITIC ROCKS BY AN UNCONFORMITY. FAULTING THAT IS LOCALIZED ALONG THE CONTACTS BETWEEN SEDIMENTS AND GRANITIC ROCKS (RESULTING IN MYLONITE ZONES OR ZONES OF INTENSELY SHEARED, CRUSHED OR BRECCIATED ROCK) OBSCURES OR DESTROYS THE EVIDENCE FOR AN UNCONFORMITY IN CERTAIN PARTS OF THE AREA.

SAMPLE MC-230A-65 (GSC 66-83) IS FROM A QUARTZ DIORITE BOULDER FROM A CONGLOMERATE HORIZON IN THE NONACHO SEDIMENTS AND THEREFORE MUST BE FROM THE SOURCE AREA OF THE SEDIMENTS. THE REMAINING SAMPLES ARE FROM BASEMENT ROCKS. MC-36-65 (GSC 66-82) IS A MUSCOVITE FROM A CONFORMABLE PEGMATITE IN THE GRANITIC GNEISSES AND THE OTHER TWO SAMPLES ARE FROM FOLIATED QUARTZ DIORITES IN THE BASEMENT GNEISSES. ALL SAMPLES ARE SIMILAR LITHOLOGICALLY, BEING COMPOSED OF PLAGIOCLASE, QUARTZ AND MINOR AMOUNTS OF MICROCLINE AND MUSCOVITE. CHLORITE, WITH INCLUSIONS OF IRON ORE, OCCURS IN ALL THE ROCKS IN SMALL QUANTITIES AND SOME OF IT AT LEAST APPEARS TO BE DERIVED FROM BIOTITE. IN THIN SECTIONS ALL SAMPLES SHOW EVIDENCE OF CRUSHING. QUARTZ GRAINS EXHIBIT WAVY EXTINCTION AND ARE BROKEN, PLAGIOCLASE GRAINS ARE BROKEN AND HAVE BENT TWIN PLANES, GRAINS OF BOTH MINERALS ARE OFTEN SURROUNDED WITH NARROW ZONES OF CRUSHED MATERIAL. MUSCOVITE FLAKES ARE BENT, HAVE WAVY EXTINCTIONS AND ARE IN PLACES BROKEN. IN THIN SECTION, NARROW ZONES OR LENSES OF CRUSHED MATERIAL COMPOSED OF FINE GRAINS OF QUARTZ AND FELDSPAR AND SHREDS OF MUSCOVITE ARE EVIDENT. IT IS NOT CERTAIN WHETHER THE MUSCOVITE IN SUCH ZONES IS DEVELOPED DURING THE CRUSHING OR IS A RESULT OF BREAKING UP

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OF LARGER GRAINS. THE INTENSITY OF SUCH DEFORMATION VARIES AMONG THE SAMPLES AND IS MOST INTENSE IN SAMPLE MC-65-65 (GSC 66-84). THIS IS NOT SURPRISING BECAUSE THIS SAMPLE WAS SELECTED FROM A BROAD BELT OF CRUSHED ROCK ALONG A MAJOR FAULT ZONE.

GEOLOGICAL EVIDENCE SUGGESTS THAT ALL BASEMENT GNEISSES AND GRANITIC ROCKS WERE FORMED DURING ONE OROGENY AND WERE SHEARED OR FAULTED AT A LATER TIME. THE RANGE OF AGES OF THE MUSCOVITES, THEREFORE, IS NOT THOUGHT TO INDICATE SIGNIFICANTLY DIFFERENT AGES OF GRANITIC ROCKS. THE OLDEST DATES (2175 M.Y. FROM A BASEMENT GNEISS AND 1940 M.Y. FROM A BOULDER IN THE CONGLOMERATE) PROBABLY ARE CLOSEST TO THE TRUE AGES OF THE GNEISS WHICH MAY, IN FACT, BE KENORAN IN AGE (2300-2500 M.Y.). THE YOUNGER AGES MAY BE CLOSER TO THE AGE OF FAULTING THAT AFFECTS THESE ROCKS. THE RANGE OF DATES AND THEIR VALUES PROBABLY ARE CAUSED BY SHEARING OR CRUSHING OF THE ROCKS AND OF MUSCOVITE AT SOMEWHAT ELEVATED TEMPERATURES AND POSSIBLY IN PART BY FORMATION OF NEW MUSCOVITE DURING THIS SHEARING. ARGON, IT IS ASSUMED, WOULD BE DRIVEN OUT OF THE MUSCOVITE AT RATES THAT WOULD VARY WITH INTENSITY OF DEFORMATION.

GSC 66-86 MUSCOVITE, K-AR AGE 1745 + OR - 55 M.Y.

K=7.73 PERCENT, AR40/K40=0.1677, RADIOGENIC AR=100 PERCENT.

CONCENTRATE- IMPURE MUSCOVITE, BEING A MIXTURE OF 80 PERCENT VERY PALE GREEN-STAINED MUSCOVITE, 10 PERCENT QUARTZ AND PLAGIOCLASE, AND 10 PERCENT REDDISH BROWN BIOTITE AND CHLORITE.

(75 E) FROM GRANODIORITE
SOUTHEAST OF GREAT SLAVE LAKE, DISTRICT OF MACKENZIE, 61-12-54 N, 109-56-12 W. MAP-UNIT 1, GSC MAP 526A. SAMPLE MC-104-65, COLLECTED AND INTERPRETED BY J.C. MCGLYNN.

THIS SAMPLE IS FROM THE THEKULTHILI LAKE AREA ABOUT 150 MILES SOUTHEAST OF YELLOWKNIFE IN THE NORTHWEST TERRITORIES. THE OLDEST ROCKS IN THE AREA CONSIST OF GRANITIC GNEISSES, MIGMATITES AND MASSIVE TO SLIGHTLY FOLIATED GRANITIC ROCKS THAT FORM THE BASEMENT ROCKS OF THE YOUNGER NONACHO SEDIMENTS. ROCKS OF THE NONACHO GROUP COMPRISE A CONFORMABLE SEQUENCE OF POLYMYCTIC CONGLOMERATES, CONGLOMERATIC ARKOSES, LITHIC SAND-STONES AND (LOCALLY) SHALES. THESE STRATA, IN THE AREA MAPPED BY THE AUTHOR, ARE SEPARATED FROM GRANITIC ROCKS BY AN UNCONFORMITY. FAULTING THAT IS LOCALIZED ALONG THE CONTACTS BETWEEN SEDIMENTS AND GRANITIC ROCKS RESULTS IN MYLONITE ZONES

DISTRICT OF MACKENZIE

OR ZONES OF INTENSELY SHEARED, CRUSHED OR BRECCIATED ROCK. THE EVIDENCE OF AN UNCONFORMITY IS OFTEN OBSCURED OR DESTROYED BY SUCH FAULTING.

SAMPLE MC-104-65 WAS SELECTED FROM THE BASEMENT FROM WITHIN A FEW FEET OF THE UNCONFORMITY WHERE THE GRANITIC ROCKS ARE INTENSELY SHEARED. IN THIN SECTION THE ROCK IS SEEN TO CONSIST OF QUARTZ, PLAGIOCLASE, MICROCLINE, BIOTITE ALTERED TO CHLORITE, MUSCOVITE AND CARBONATE. THE ROCK IS A GRANODIORITE. THE EFFECTS OF SHEARING ARE EVIDENT IN THIN SECTION - A RUDE BANDING IS PRESENT WITH QUARTZ-RICH BANDS ALTERNATING WITH PLAGIOCLASE AND MICROCLINE-RICH BANDS THAT ALSO CONTAIN SOME QUARTZ AND MUSCOVITE. QUARTZ AND GRAINS OF OTHER MINERALS EXHIBIT WAVY EXTINCTION, PLAGIOCLASE GRAINS ARE BROKEN AND SURROUNDED WITH ZONES OF CRUSHED MATERIAL, LARGE MUSCOVITE GRAINS ARE BENT AND BROKEN. CARBONATE OCCURS AS LENSES OF SMALL GRAINS THAT ARE PARALLEL TO QUARTZ BANDS. MUCH OF THE MUSCOVITE OCCURS AS VERY FINE GRAINS SOME OF WHICH ARE ALIGNED PARALLEL TO THE RUDE BANDING. SUCH MUSCOVITE AND THE CARBONATE MAY HAVE FORMED DURING THE SHEARING OF THE GRANITIC ROCKS. THE AGE YIELDED BY THE MUSCOVITE MAY THEREFORE RECORD THE TIME OF SHEARING RATHER THAN THE AGE OF THE GRANODIORITE.

GSC 66-87 WHOLE ROCK, K-AR AGE 1445 + OR - 155 M.Y.

K=0.62 PERCENT, $AR_{40}/K_{40}=0.1270$, RADIOGENIC AR=88 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM BASALT

(76 C) AYLMEER LAKE AREA, DISTRICT OF MACKENZIE, 64-38 N, 108-01 W. SEE GSC PRELIM. PAPER 10-50. SAMPLE FA-1-66, COLLECTED AND INTERPRETED BY W.F. FAHRIG.

CHILLED DIABASE CONSISTING OF MICROPHENOCRYSTS OF PLAGIOCLASE AND AUGITE IN A SEMI-OPAQUE MATRIX. THE K-AR AGE IS CONSIDERED TO BE THE APPROXIMATE AGE OF INTRUSION.

GSC 66-88 WHOLE ROCK, K-AR AGE 938 + OR - 56 M.Y.

K=2.93 PERCENT, $AR_{40}/K_{40}=0.0711$, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

DISTRICT OF MACKENZIE

FROM DIABASE

- (75 P) NORTHWEST BANK OF CLARKE RIVER, DISTRICT OF MACKENZIE, 63-37-30 N, 104-14 W. MAP-UNIT 18B, GSC MAP 17-1956 (THIS PARTICULAR DYKE IS NOT SHOWN ON MAP). SAMPLE DF-A820-66 COLLECTED AND INTERPRETED BY J.A. DONALDSON.

THE ROCK IS DARK GREENISH BLACK, MASSIVE, FINE-GRAINED, AND OPHITIC. IT IS COMPOSED MAINLY OF SAUSSURITIZED PLAGIOCLASE, CLINOPYROXENE, BIOTITE, QUARTZ, AND OPAQUES.

BECAUSE THE DYKE CUTS THE THELON FORMATION OF THE DUBAWNT GROUP, THE DATE PROVIDES AN ESTIMATE OF THE MINIMUM THELON AGE, IN ADDITION TO AN ESTIMATE OF THE AGE OF DIABASE INTRUSION.

GSC 66-89 WHOLE ROCK, K-AR AGE 1390 + OR - 120 M.Y.

K=2.04 PERCENT, AR40/K40=0.1203, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM BASALT

- (66 D) 6 MILES WEST SOUTHWEST OF LOOKOUT POINT, DISTRICT OF MACKENZIE, 64-08-30 N, 102-45-30 W. MAP UNIT 16, GSC MAP 17-1956. SAMPLE DF-458-65, COLLECTED AND INTERPRETED BY J.A. DONALDSON.

THE ROCK IS A DULL GREENISH TO PURPLISH BROWN, FINE-GRAINED, MASSIVE, ALTERED BASALT COMPOSED OF LABRADORITE, SERPENTINE, CHLORITE, MUSCOVITE, CARBONATE, AND IRON OXIDES. THE PLAGIOCLASE HAS BEEN EXTENSIVELY REPLACED BY MUSCOVITE, AND THE SERPENTINE OCCURS AS PSEUDOMORPHS AFTER PYROXENE, AS WELL AS TOGETHER WITH CHLORITE IN SMALL AMYGDULE-LIKE CLUSTERS. THE ALTERATION PRESUMABLY IS DEUTERIC, AND THE AGE SHOULD DATE EXTRUSION OF THE UNIT REPRESENTED BY THE SAMPLE (MAP UNIT 16, GSC MAP 17-1956). ALTHOUGH CONTACTS ARE NOT EXPOSED, FIELD EVIDENCE INDICATES THAT THE UNIT OVERLIES THE THELON FORMATION, AND THUS A MINIMUM THELON AGE IS PROVIDED. THE BASALT MAY BE THE EXTRUSIVE EQUIVALENT OF DYKES THAT CUT THE THELON FORMATION. A SAMPLE FROM A NEARBY DYKE HAS BEEN DATED AT 1360 M.Y. (GSC 63-44).

GSC 66-90 BIOTITE, K-AR AGE 1645 + OR - 55 M.Y.

DISTRICT OF MACKENZIE

K=7.95 PERCENT, $AR_{40}/K_{40}=0.1537$, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- CLEAN, UNALTERED, REDDISH BROWN BIOTITE WITH LESS THAN 2 PERCENT HORNBLÉNDE IMPURITY.

FROM GRANULITE
(66 M) 40 MILES SOUTH OF CHESTER BAY, DISTRICT OF MACKENZIE, 67-09 N, 102-21 W. MAP-UNIT 4D, GSC MAP 45-1963. SAMPLE FD 103-62, COLLECTED AND INTERPRETED BY J.A. FRASER.

THE SAMPLE IS A FINE-GRAINED GRANULITE COMPOSED OF PALE BROWNISH TO GREENISH ANTIPERTHITE (55 PERCENT), DARK GREY CLINOPYROXENE (33 PERCENT) AND HYPERSTHENE (10 PERCENT), AND ACCESSORY MAGNETITE AND APATITE. BIOTITE, WHICH IS CLEAN AND UNALTERED, CONSTITUTES LESS THAN 1 PERCENT OF THE GRANULITE. MAFIC AND FELSIC MINERALS ARE GROUPED IN NARROW PARALLEL AND SUBPARALLEL TRAINS WHICH DEFINE A STRONG LINEATION.

THE SAMPLE LOCALITY LIÉS EAST OF BATHURST INLET IN A REGION UNDERLAIN PRINCIPALLY BY MIGMATITE, GRANULITE, HYPERSTHENE GRANITE, AND AMPHIBOLITE. THE AGE OF THE BIOTITE (1645 M.Y.) IS THAT OF THE MOST RECENT METAMORPHISM (HUDSONIAN) IN THIS AREA.

DISTRICT OF KEEWATIN

GSC 66-91 MUSCOVITE, K-AR AGE 1480 + OR - 50 M.Y.

K=6.87 PERCENT, AR40/K40=0.1318, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- IMPURE MUSCOVITE SAMPLE CONSISTING OF 40 PERCENT CLEAR MUSCOVITE, 40 PERCENT PALE GREEN MUSCOVITE AND/OR BIOTITE, AND 10 PERCENT QUARTZ WITH A TRACE OF FELDSPAR.

FROM SCHIST

(65 G) DISTRICT OF KEEWATIN, 61-10-30 N, 98-03 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE EA-82-64, COLLECTED AND INTERPRETED BY K.E. EADE.

THE QUARTZ-SERICITE SCHIST IS DERIVED FROM AN IMPURE QUARTZITE FORMATION, THE UPPERMOST UNIT OF THE HURWITZ GROUP IN THIS REGION. THE SERICITE IS DEVELOPED ALONG AXIAL PLANE CLEAVAGE RELATED TO NORTHEAST TRENDING FOLDS. THE FOLDING IS BELIEVED TO RESULT FROM DEFORMATION DURING THE HUDSONIAN OROGENY. THE DATE OBTAINED WOULD APPEAR TO BE SOMEWHAT YOUNG FOR THIS EVENT.

GSC 66-92 WHOLE ROCK, K-AR AGE 694 + OR - 76 M.Y.

K=2.24 PERCENT, AR40/K40=0.0491, RADIOGENIC AR=95 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM DIABASE

(65 P) 4 MILES WEST OF PITZ LAKE, DISTRICT OF KEEWATIN, 63-54-30 N, 96-47-45 W. MAP-UNIT 8, FIG. 2 IN GSC PAPER 64-20. SAMPLE SF-J72-63, COLLECTED BY W.J. CRAWFORD, INTERPRETED BY J.A. DONALDSON.

THE ROCK IS PALE GREENISH GREY, MEDIUM GRAINED, OPHITIC, EQUIGRANULAR, AND CONSISTS OF ABOUT 55 PERCENT SLIGHTLY ALTERED PLAGIOCLASE, 15 PERCENT REDDISH BROWN BIOTITE, 10 PERCENT CLINOPYROXENE, 10 PERCENT AMPHIBOLE, 5 PERCENT OPAQUES, 5 PERCENT QUARTZ, AND MINOR CHLORITE, APATITE, AND CARBONATE. IT IS FROM A PROMINENT NORTHWESTERLY-TRENDING DYKE THAT CAN BE TRACED IN DISCONTINUOUS SEGMENTS FOR SEVERAL HUNDRED MILES.

BECAUSE THE DYKE CUTS THE THELON FORMATION OF THE DUBAWNT GROUP, THE DATE PROVIDES AN ESTIMATE OF THE MINIMUM THELON AGE, IN ADDITION TO AN ESTIMATE OF THE AGE OF DIABASE INTRUSION.

DISTRICT OF KEEWATIN

GSC 66-93 BIOTITE, K-AR AGE 1605 + OR - 50 M.Y.

K=6.63 PERCENT, AR40/K40=0.1483, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, VERY PALE OLIVE-GREEN BIOTITE WITH 8 PERCENT CHLORITE. MOST FLAKES ARE BLEACHED.

FROM SYENITE

(55 M) 16 MILES SOUTHEAST OF MOUTH OF KAZAN RIVER, DISTRICT OF KEEWATIN, 63-53-45 N, 95-03-30 W. MAP-UNIT 5, FIG. 2 IN GSC PAPER 64-20. SAMPLE DF-A221-64, COLLECTED AND INTERPRETED BY J.A. DONALDSON.

THE ROCK IS A DULL PINK, MASSIVE, MEDIUM- TO COARSE-GRAINED BIOTITE-SYENITE. IT CONSISTS OF FRESH EUHEDRAL AND SUBHEDRAL PHENOCRYSTS OF BIOTITE (20 PERCENT) IN A HYPIDIOMORPHIC-GRANULAR MATRIX OF 50 PERCENT K-SPAR, 15 PERCENT CLINOPYROXENE, 10 AMPHIBOLE, 5 PERCENT CHLORITE (MOSTLY PSEUDOMORPHIC AFTER AMPHIBOLE), PLUS MINOR CHLORITE AND OPAQUES.

THE SAMPLE IS FROM A BODY OF MARTELL SYENITE THAT INTRUDES THE KAZAN FORMATION. THE DATE CORROBORATES EARLIER ESTIMATES OF THE AGE OF INTRUSION AND THE MINIMUM AGE OF THE KAZAN FORMATION, AND ALSO SUPPORTS EQUIVALENCE WITH THE CHRISTOPHER ISLAND VOLCANICS (SEE DISCUSSION OF GSC 65-74, GSC PAPER 66-17).

GSC 66-94 BIOTITE, K-AR AGE 1690 + OR - 55 M.Y.

K=8.10 PERCENT, AR40/K40=0.1598, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- CLEAN, PALE OLIVE-GREEN BIOTITE WITH ONLY A TRACE OF HORNBLENDE CONTAMINATION. LESS THAN 1 PERCENT OF THE FLAKES CONTAIN ORIENTED NEEDLE-LIKE INCLUSIONS.

FROM LAMPROPHYRE

(55 L) EAST SHORE OF NORTH ARM OF QUARTZITE LAKE, DISTRICT OF KEEWATIN, 62-10-10 N, 94-33-55 W. SEE GSC PRELIM. MAP 55-17. SAMPLE DM-140-1966, COLLECTED AND INTERPRETED BY A. DAVIDSON.

THE BIOTITE IS PRESENT IN LAMPROPHYRE AS PHENOCRYSTS UP TO ONE HALF INCH IN DIAMETER AND ALSO IN THE GROUNDMASS WITH MICROCLINE AND MINOR ALBITE, QUARTZ, CALCITE, SPHENE, AMPHI-

DISTRICT OF KEEWATIN

BOLE, AND APATITE. THE LAMPROPHYRE OCCURS IN VERTICAL DYKES, RARELY IN EXCESS OF SIX FEET THICK, THAT TREND SOUTHEASTERLY THROUGHOUT THE REGION BETWEEN RANKIN INLET AND CARR LAKE. THIS SAMPLE WAS TAKEN FROM A THREE FOOT THICK DYKE THAT CUTS AN ALTERED GABBRO DYKE WITHIN QUARTZITE CORRELATED WITH THE LOWER PART OF THE HURWITZ GROUP. THE DETERMINED AGE GIVES THE TIME OF CRYSTALLIZATION OF THE LAMPROPHYRE AND ALSO PROVIDES A MINIMUM AGE OF DEFORMATION OF THE HURWITZ GROUP DURING HUDSONIAN OROGENY.

GSC 66-95 WHOLE ROCK, K-AR AGE 1054 + OR - 160 M.Y.

K=0.47 PERCENT, $AR_{40}/K_{40}=0.0826$, RADIOGENIC AR=86 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

(34 M) FROM SPILITIC BASALT
SOUTHWEST CORNER OF ROBERTSON BAY, BELCHER ISLANDS,
DISTRICT OF KEEWATIN, 55-46-45 N, 79-57-47 W.
MAP-UNIT 13, GSC MAP 28-1960 (WITH PAPER 60-20).
SAMPLE JD-207B-59, COLLECTED AND INTERPRETED BY
G.D. JACKSON.

THE SAMPLE IS FROM THE CORE OF A PILLOW FROM THE SAME VICINITY AS GSC 65-83 (RIM). THE ROCK IS GREY, VERY FINE GRAINED, MASSIVE, SLIGHTLY PORPHYRITIC, AND HAS A SUBOPHITIC TEXTURE. THE MAJOR CONSTITUENTS ARE- CLINOPYROXENE, SODIC PLAGIOCLASE, EPIDOTE, CHLORITE, AND SPHENE.

THIS AGE IS BELIEVED TO BE TOO YOUNG TO INDICATE WHEN THESE VOLCANIC ROCKS WERE LAID DOWN OR/AND FOLDED. PROBABLY IT REFLECTS, IN PART, THE EFFECTS OF A LATER GEOLOGICAL EVENT SUCH AS A MILD DISTURBANCE OR/AND EMPLACEMENT OF THE YOUNGER TRAP DYKES.

SASKATCHEWAN

GSC 66-96 BIOTITE, K-AR AGE 1725 + OR - 55 M.Y.

K=7.29 PERCENT, AR40/K40=0.1648, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED OLIVE-GREEN BIOTITE WITH ABOUT 5 PERCENT HORNBLLENDE CONTAMINATION. ABOUT 5 PERCENT OF THE FLAKES CONTAIN ORIENTED NEEDLE-LIKE INCLUSIONS, AND 5 PERCENT CONTAIN DARK PATCHES.

(74 N) FROM MIGMATITE
NO. 2 ZONE, 1/4 MILE NORTH OF ORBIT BAY, NORTH SHORE OF LAKE ATHABASCA, SASKATCHEWAN, 59-32.1 N, 108-53.4 W. MAP-UNIT 3, GSC PAPER 53-15 (W.E. HALE). SAMPLE VK-30C-106, COLLECTED AND INTERPRETED BY V. KOEPPPEL.

THE SAMPLE IS FROM A MIGMATITE CONSISTING OF MEDIUM GRAINED AMPHIBOLITE INTERCALATED AND FOLDED WITH MEDIUM TO COARSE PEGMATITIC ROCK. URANINITE OCCURS IN BOTH ROCK TYPES, AND PYRITE AND CHALCOPYRITE ARE DISSEMINATED IN THE AMPHIBOLITE. THE ROCK OCCURS IN AN AREA WHERE PARTIALLY GRANITIZED ROCKS OF THE TAZIN GROUP DOMINATE.

THE AGE OF 1725 + OR - 55 M.Y. IS COMPATIBLE WITH THE MINIMUM AGE OF URANINITE. THESE AGES ARE LOWER THAN THOSE OBTAINED ON OTHER SYNGENETIC URANIUM DEPOSITS AND ARE ALSO LOWER THAN THE AGE OF THE EPIGENETIC PITCHBLLENDE MINERALIZATION (SEE V. KOEPPPEL, AGE AND HISTORY OF U MINERALIZATION OF THE BEAVERLODGE AREA, SASKATCHEWAN- GSC PAPER 67-31, IN PRESS).

GSC 66-97 BIOTITE, K-AR AGE 1750 + OR - 55 M.Y.

K=7.47 PERCENT, AR40/K4 = 0.1688 = RADIOGENIC AR=99 PERCENT.

CONCENTRATE- CLEAN, MAINLY UNALTERED OLIVE-GREEN TO ALMOST OPAQUE BIOTITE WITH 2 PERCENT HORNBLLENDE, 2 PERCENT QUARTZ AND 1 PERCENT CHLORITE IMPURITY. ABOUT 5-10 PERCENT OF THE FLAKES CONTAIN TINY OPAQUE INCLUSIONS.

(74 N) FROM MIGMATITE
DETAILS AS FOR GSC 66-96. SAMPLE VK-30A 205, COLLECTED AND INTERPRETED BY V. KOEPPPEL.

SEE GSC 66-96 FOR A DESCRIPTION OF THE ROCK. THE

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1750 $\pm$ OR - 55 M.Y. AGE COMPARES WITH THAT OF BIOTITE FROM THE AMPHIBOLITIC PORTION OF THE MIGMATITE (GSC 66-96 AT 1725 $\pm$ OR - 55 M.Y.). IT IS ALSO COMPARABLE WITH THE MINIMUM AGE OF URANINITE. THESE AGES ARE LOWER THAN THOSE OBTAINED ON MINERALS FROM OTHER SYNGENETIC URANIUM DEPOSITS, AND ALSO LOWER THAN THE AGE OF THE EPIGENETIC PITCHBLLENDE MINERALIZATION (SEE V. KOEPEL, AGE AND HISTORY OF U MINERALIZATION OF THE BEAVERLODGE AREA, SASKATCHEWAN, GSC PAPER 67-31, IN PRESS).

GSC 66-98 MUSCOVITE, K-AR AGE 1780 $\pm$ OR - 55 M.Y.

K=8.23 PERCENT, AR40/K40=0.1730, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- HAND-PICKED MUSCOVITE BOOKS.

FROM PEGMATITE
(74 N) MINE DUMP, BETA GAMMA URANIUM MINES LTD., 2.5 MILES NORTH NORTHWEST OF URANIUM CITY, SASKATCHEWAN, 59-36.4 N, 108-38.4 W. MAP-UNIT 5, GSC MEMOIR 269 (A.M. CHRISTIE, 1953). SAMPLE VK-11, COLLECTED AND INTERPRETED BY V. KOEPEL.

THE ROCK IS A PEGMATITE FROM GRANITE GNEISS OF THE CHUM GROUP, NO. 1 SHOWING. IT CONSISTS OF REDDISH K-FELDSPAR, QUARTZ, TOURMALINE AND MUSCOVITE. THE PEGMATITE OCCURS INTERMITTENTLY OVER HUNDREDS OF FEET ALONG THE FOOTWALL OF A SHEAR ZONE. DIABASE OCCURS IN THE HANGING WALL, AND EPIGENETIC PITCHBLLENDE MINERALIZATION OCCURS WHERE THE DIABASE HAS BEEN BRECCIATED.

THE AGE OBTAINED AGREES WITH THOSE FOR OTHER EPIGENETIC URANIUM MINERALIZATIONS OF THE BEAVERLODGE AREA. IT IS LOWER THAN THE AGES OF MINERALS FROM SYNGENETIC (PEGMATITIC) URANIUM DEPOSITS AND THE K-AR AGE MAY REFLECT A LOSS OF RADIOGENIC ARGON AT THE TIME OF THE EPIGENETIC URANIUM MINERALIZATION. FOR FURTHER DISCUSSION SEE S.C. ROBINSON, GSC BULLETIN 31, 1955, PP. 13-14, AND V. KOEPEL, GSC PAPER 67-31 IN PRESS.

GSC 66-99 WHOLE ROCK, K-AR AGE 467 $\pm$ OR - 28 M.Y.
486 $\pm$ OR - 55 M.Y.

K=4.89 PERCENT, AR40/K40=0.0310, RADIOGENIC AR=97 PERCENT.

SASKATCHEWAN

K=2.15 PERCENT, AR40/K40=0.0324, RADIOGENIC AR=96 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

(74 K) FROM FLINTY CRUSH ROCK (ULTRAMYLONITE)
1 MILE EAST OF CLUFF LAKE, SASKATCHEWAN, 58-21 N,
109-30 W. NO PUBLISHED GEOLOGICAL MAP, SAMPLE
FROM APHANITIC UNIT OF THE CLUFF BRECCIAS. SAMPLE
NO. 64080, COLLECTED AND INTERPRETED BY K.L.
CURRIE.

THE ROCK IS A FINELY CRUSHED CATACLASTIC ROCK (ULTRAMYLONITE) WITH STREAKS OF GLASS AMOUNTING TO 10-15 PERCENT OF THE SPECIMEN. A MARKED COLOUR BANDING FROM BUFFISH TO GREY-GREEN WAS NOTICEABLE IN THE SPECIMEN. THE LIGHT COLOURED MATERIAL HAD A K-CONTENT OF 4.89 PERCENT WHILE THAT OF THE GREENISH MATERIAL WAS 2.15 PERCENT. DESPITE THE GREAT DIFFERENCE IN K-CONTENT TWO SPECIMENS FROM THE CONTRASTING COMPOSITIONS GAVE CONCORDANT WHOLE ROCK AGES OF 467 AND 489 M.Y. RESPECTIVELY.

THE INTERPRETATION IS THAT THIS ROCK REPRESENTS A HETEROGENEOUS MIXTURE OF GRANITIC AND SANDSTONE ROCKS ALONG A FAULT ZONE, THE WHOLE HEATED TO HIGH TEMPERATURE BY FRICTION, AND SUBJECTED TO POTASH METASOMATISM. THE HIGH TEMPERATURE EPISODE *SETTING* THE K/AR CLOCK IS BELIEVED TO BE A LATE FEATURE IN THE DEVELOPMENT OF THE CARSWELL CIRCULAR STRUCTURE, WHICH IS THEREBY DATED AS ORDOVICIAN IN AGE. SINCE THE STRUCTURE INVOLVES THE ATHABASCA FORMATION, THIS FORMATION CANNOT BE OF DEVONIAN AGE AS SUGGESTED PREVIOUSLY BY GUSSOW. THE MEAN AGE OF 478 M.Y. IS IN APPROXIMATE AGREEMENT WITH THE AGE OF 432 M.Y. OBTAINED BY FAHRIG (1961) FROM URANINITE IN THE BLACK LAKE AREA, SUGGESTING THAT IGNEOUS ACTIVITY MAY HAVE OCCURRED OVER A CONSIDERABLE AREA IN THE ORDOVICIAN.

REFERENCE-

- FAHRIG, W.F.
1961 THE GEOLOGY OF THE ATHABASCA FORMATION GEOL. SURV.
CAN. BULL. 68.

MANITOBA

GSC 66-100 BIOTITE, K-AR AGE 1515 + OR - 50 M.Y.

K=6.56 PERCENT, AR40/K40=0.1359, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, COARSE, REDDISH BROWN ALTERED BIOTITE IN FLAKES UP TO 1/8 INCHES ACROSS. MOST FLAKES CONTAIN TINY OPAQUE BLEBS. HORNBLLENDE CONTAMINATION AMOUNTS TO LESS THAN 2 PERCENT.

(63 P) FROM MICA-RICH BRECCIA SULPHIDE ORE UNDERGROUND, 16 LEVEL, NO. 2 ORE ZONE, THOMPSON MINE, MANITOBA, 55-43-40 N, 97-50-45 W. MAP-UNIT 5, MANITOBA DEPT. OF MINES AND NATURAL RESOURCES MAP 60-4. SEE ALSO THOMPSON MINE GEOLOGY IN C.I.M.M. TRANS. 66, 1963, PP. 227-236. SAMPLE B-3(Q65-121) COLLECTED AND INTERPRETED BY TERENCE T. QUIRKE, JR., INTERNATIONAL NICKEL CO.

THE SAMPLE IS FROM MICA-RICH ORE THAT IS TYPICAL OF THE ORE ZONE IN THIS PART OF THE MINE. SEE GSC 66-103 FOR INTERPRETATION.

GSC 66-101 BIOTITE, K-AR AGE 1590 + OR - 50 M.Y.

K=8.13 PERCENT, AR40/K40=0.1461, RADIOGENIC AR=97 PERCENT.

CONCENTRATE- CLEAN, VERY COARSE (UP TO 1 CM), UNALTERED DARK BROWN BIOTITE WITH ABOUT 2 PERCENT HORNBLLENDE CONTAMINATION.

(63 P) FROM PEGMATITE FROM PARTLY MINERALIZED BIOTITE-RICH PEGMATITE ADJACENT TO ORE. UNDERGROUND, 16 LEVEL, NO. 2 ORE ZONE, THOMPSON MINE, MANITOBA, 55-43-40 N, 97-50-45 W. MAP-UNIT 5, MANITOBA DEPT. OF MINES AND NATURAL RESOURCES MAP 60-4. SEE ALSO THOMPSON MINE GEOLOGY, C.I.M.M. TRANS. 66, 1963, PP. 227-236. SAMPLE B-1B(BAQ 65-110), COLLECTED AND INTERPRETED BY TERENCE T. QUIRKE, JR., INTERNATIONAL NICKEL CO.

THE SAMPLE IS FROM A BIOTITE-RICH, MINERALIZED PEGMATITE THAT OCCURS ADJACENT TO ORE. SEE GSC 66-103 FOR INTERPRETATION.

MANITOBA

GSC 66-102 MUSCOVITE, K-AR AGE 1630 + OR - 50 M.Y.

K=8.49 PERCENT, AR40/K40=0.1514, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- CLEAN, COLOURLESS MUSCOVITE. ABOUT HALF OF THE FLAKES CONTAIN PATCHES OF TINY OPAQUE BLEBS.

(63 P) FROM MICA SELVAGE AT PEGMATITE-ORE CONTACT UNDERGROUND, 12 LEVEL, NO. 2 ORE ZONE, THOMPSON MINE, MANITOBA, 55-43-40 N, 97-50-45 W. MAP-UNIT 5, MANITOBA DEPT. MINES AND NATURAL RESOURCES MAP 60-4. SEE ALSO THOMPSON MINE GEOLOGY, C.I.M.M. TRANS. 66, 1963, PP. 227-236. SAMPLE B-3(Q64-2), COLLECTED AND INTERPRETED BY TERENCE T. QUIRKE, JR., INTERNATIONAL NICKEL CO.

THE SAMPLE IS FROM A MUSCOVITE-RICH SELVAGE AT THE PEGMATITE-ORE CONTACT. SEE GSC 66-103 FOR INTERPRETATION.

GSC 66-103 BIOTITE, K-AR AGE 1555 + OR - 50 M.Y.

K=7.53 PERCENT, AR40/K40=0.1410, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, SLIGHTLY ALTERED OLIVE-GREEN BIOTITE WITH LESS THAN 5 PERCENT HORNLBENDE CONTAMINATION. ABOUT 10 PERCENT OF THE FLAKES ARE SLIGHTLY BLISTERED. CHLORITE CONTENT IS ABOUT 3 PERCENT.

(63 P) FROM MASSIVE GNEISS OF THE HANGING WALL 800 FT FROM ORE, ABOVE THE NO. 1 ORE ZONE, THOMPSON MINE, MANITOBA, 55-43-40 N, 97-50-45 W. MAP-UNIT 7, MANITOBA DEPT. OF MINES AND NATURAL RESOURCES MAP 60-4. SAMPLE B4A(BA4A) COLLECTED AND INTERPRETED BY TERENCE T. QUIRKE, JR., INTERNATIONAL NICKEL CO.

THE SAMPLE IS FROM FELDSPAR-QUARTZ-BIOTITE PARAGNEISS IN THE HANGING-WALL AT NO. 1 OREBODY. THE SAMPLE IS TAKEN FURTHER THAN 800 FEET FROM ORE AND HAS PROBABLY NOT BEEN AFFECTED BY LATE GRANITIC INJECTION AND ORE DEPOSITION.

THE FOLLOWING FOUR SAMPLES CONSTITUTE A SUITE OF SPECIMENS FROM WITHIN AND NEAR THE THOMPSON MINE- GSC 66-100, 101, 102, AND 103. DATES FROM THESE ROCKS RANGE FROM 1515 + OR -

MANITOBA

50 TO 1630 + OR - 50 M.Y. AND INDICATE THAT THEY ARE SOME OF THE YOUNGEST PRECAMBRIAN ROCKS FROM MANITOBA TO BE DATED BY THE GSC. ALTHOUGH IT MAY BE THAT THE DIFFERENCES IN AGES OF THE ROCKS ARE SIGNIFICANT IT WOULD SEEM SAFER AT THIS POINT ONLY TO ASSUME THAT WHAT HAS BEEN MEASURED IS THE GENERAL DATE OF THE MOST RECENT METAMORPHISM. CERTAINLY, THE AGE OF 1555 + OR 50 M.Y. FROM THE HANGING WALL GNEISSES (GSC 66-103) IS THE DATE OF REGIONAL METAMORPHISM AND THUS IT SHOULD FOLLOW THAT THE OTHER ASSOCIATED ROCKS HAVE BEEN AT LEAST MODIFIED BY WHAT MIGHT HAVE BEEN THE FINAL THROES OF THE HUDSONIAN OROGENY.

DR. C.K. BELL (CRUSTAL GEOLOGY DIVISION OF GSC) ADDS THE FOLLOWING OBSERVATIONS- **WITHIN THE IMMEDIATE MINE AREA, THE COUNTRY ROCK METASEDIMENTS AND PARAGNEISSES ARE INTRUDED BY ACIDIC STOCKS AND ASSOCIATED PEGMATITES. LOCALLY, THE ORE DEPOSITION APPEARS TO BE POST PEGMATITE. THE BIOTITE FROM THIS PEGMATITE (GSC 66-101) DATES AT 1590 + OR - 50 M.Y. BIOTITE ENCLOSED BY ORE (GSC 66-100) DATES AT 1515 + OR - 50 M.Y. MUSCOVITE FROM A MUSCOVITE-RICH SELVAGE AT THE PEGMATITE-ORE CONTACT (GSC 66-102) DATES AT 1630 + OR - 50 M.Y. THE HANGING-WALL COUNTRY ROCK (A FELDSPAR-QUARTZ-BIOTITE PARAGNEISS) (GSC 66-103) DATE OF 1555 + OR - 50 M.Y. INDICATES THE TIME OF REGIONAL METAMORPHISM. THESE FOUR DATES ARE YOUNGER THAN THE MEAN OF 1735 M.Y. FOR THE HUDSONIAN OROGENY (GSC PAPER 66-17, P. 5). WHILE THESE ASSOCIATED *YOUNG* DATES AT THE THOMPSON MINE MAY BE SIGNIFICANT, IT IS MORE PROBABLE THAT THEY INDICATE THE END PULSES OF HUDSONIAN OROGENY METAMORPHISM. COMPARABLE *YOUNG* DATES FROM NEARBY PARTS OF THE CHURCHILL PROVINCE IN MANITOBA ARE (GSC 60-75, 61-120, 63-100, 63-106, 63-107).**

GSC 66-104 BIOTITE, K-AR AGE 1605 + OR - 50 M.Y.

K=6.78 PERCENT, AR40/K40=0.1478, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- CLEAN, BUT SLIGHTLY ALTERED BROWN TO DARK BROWN BIOTITE. MOST FLAKES CONTAIN OPAQUE INCLUSIONS. TOTAL CHLORITE CONTENT IS ABOUT 8 PERCENT.

(63 P) FROM QUARTZ-MONZONITE
ROCK CUT ON RAILWAY GRADE FROM THOMPSON TO MOAK LAKE, ABOUT 1/2 MILE WEST OF MYSTERY LAKE - MYSTERY CREEK INTERSECTION, MANITOBA, 55-49-10 N, 97-46-23 W. MAP-UNIT 10, MANITOBA DEPT. OF MINES AND NATURAL RESOURCES MAP 60-4. SEE ALSO THOMPSON MINE GEOLOGY IN C.I.M.M. TRANS. 66, 1963, PP. 227-236. SAMPLE B-5(Q62-10) COLLECTED BY T.T. QUIRKE, JR., INTERNATIONAL NICKEL CO., INTERPRETED BY T.T.

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QUIRKE, JR. AND C.K. BELL.

SEE GSC 66-105 FOR DESCRIPTION AND INTERPRETATION.

GSC 66-105 MUSCOVITE, K-AR AGE 1615 ± 50 M.Y. $K=6.87$ PERCENT, $AR_{40}/K_{40}=0.1493$, RADIOGENIC $AR=99$ PERCENT.

CONCENTRATE- IMPURE MUSCOVITE WITH ATTACHED FLAKES OF BIOTITE AND OPAQUES. ABOUT 3 PERCENT CHLORITE IS ALSO PRESENT.

FROM QUARTZ-MONZONITE
(63 P) DETAILS AS FOR GSC 67-104.

THE ROCK IS A MASSIVE PORPHYROBLASTIC GRANODIORITE. INEQUIGRANULAR WITH EXCELLENT DIMENSIONAL ORIENTATION OF QUARTZ IN LENSES. ALL FELDSPARS WITH SERICITE ALTERATION. THE PLAGIOCLASE IS BENT, SUBHEDRAL TO RARELY EUHEDRAL, AND SHOWS SUTURED TO MORTAR TEXTURES, WHICH IS DUE, IN PART, TO SECONDARY RECRYSTALLIZATION. PLAGIOCLASE 60 PERCENT, QUARTZ 28 PERCENT, MICROCLINE 7 PERCENT, MUSCOVITE-SERICITE 5 PERCENT, BIOTITE, EPIDOTE-ZOISITE, APATITE, ZIRCON.

THIS SAMPLE IS FROM A LARGE MASS OF PORPHYRITIC GRANITE, FOLIATED IN PART, WHICH HAS BEEN SHOWN TO CROSS-CUT META-SEDIMENTS TYPICAL OF THOSE OF THE MOAK-SETTING BELT AND CLOSE SPACIALLY TO ROCKS OF THE THOMPSON MINE. ITS DATES (BIOTITE- 1605 ± 50 , MUSCOVITE- 1615 ± 50 M.Y.) ARE SIMILAR TO THOSE FROM THE THOMPSON MINE (CF. GSC 66-100, 101, 102 AND 103). FURTHER, THESE DATES SHOULD BE COMPARED TO PREVIOUSLY DETERMINED DATES FOR SIMILARLY OCCURRING AND APPEARING ROCKS IN THE AREA, SPECIFICALLY TO GSC 65-101, A PEGMATITE FROM THE OSPWAGAN GRANITE CUTTING META-SEDIMENTS TYPICAL OF THE MOAK-SETTING BELT. MUSCOVITE FROM THIS PEGMATITE PRODUCED A DATE OF 2035 ± 70 M.Y. FROM AN ISLAND IN SETTING LAKE BIOTITE FROM A STOCK OF QUARTZ MONZONITE (GSC 63-105) PRODUCED A DATE OF 1785 ± 60 M.Y. FURTHER, GSC 64-82, HORNBLende-BIOTITE SYENODIORITE FROM NORTH OF RESTING LAKE MAY BE ADDED TO THIS SERIES, THE HORNBLende FROM WHICH HAS BEEN DATED AT 1690 ± 170 M.Y. ALTHOUGH THIS ROCK IS PROBABLY NOT STRICTLY WITHIN THE MOAK-SETTING BELT OF META-SEDIMENTS IT MAY BE SIGNIFICANT IN THAT IT IS THOUGHT TO HAVE BEEN INTRUDED BY SULFIDE-BEARING PERIDOTITES SIMILAR TO THOSE NEAR WABOWDEN.

THESE ACID BODIES WHICH HAVE BEEN DATED, ALL INTERPRETED AS INTRUSIONS, STRETCH OVER 70 MILES ALONG THE STRIKE OF THE MOAK-SETTING BELT AND MAY BE AN INDICATION OF THE MINIMUM LENGTH OF

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TIME DURING WHICH THIS ZONE WAS UNDERGOING RATHER INTENSE OROGENY, OR AT LEAST, METAMORPHISM- FROM MIDDLE APHEBIAN TIME (EARLY PROTEROZOIC) UNTIL MIDDLE PALEOHELIKIAN (MIDDLE PROTEROZOIC).

GSC 66-106 BIOTITE, K-AR AGE 1640 + OR - 50 M.Y.

K=6.87 PERCENT, AR40/K40=0.1530, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- CLEAN, SLIGHTLY ALTERED OLIVE-GREEN BIOTITE WITH LESS THAN 2 PERCENT HORNBLENDE CONTAMINATION. MOST FLAKES ARE CRACKED AND A FEW ARE BLISTERED. CHLORITE CONTENT IS ABOUT 2 PERCENT.

FROM GNEISS

(54 D) OUTCROP AT SANDY POINT ON NORTH SHORE OF LARGE INLET ON LITTLE CHURCHILL RIVER, MANITOBA, 56-48-00 N, 95-45-00 W. MAP-UNIT 6, GSC MAP 9-1961. SAMPLE BA-U-70, COLLECTED AND INTERPRETED BY C.K. BELL.

THE GNEISS CONSISTS OF 69 PERCENT SODIC ANDESINE, 25 PERCENT STRAINED QUARTZ, 5 PERCENT BIOTITE, 1 PERCENT HORNBLENDE (IN PART REPLACED BY BIOTITE), 1 PERCENT MAGNETITE, AND A TRACE OF APATITE.

THIS SAMPLE IS FROM A MEDIUM-GRAINED, GREY, FOLIATED (SLIGHTLY MYLONITIZED) BIOTITE-QUARTZ DIORITE GNEISS THAT CONTAINS SCATTERED AMPHIBOLITE INCLUSIONS AND IS INTRUDED BY DYKES OF FINE-GRAINED GRANITE. THE ROCK OUTCROPS IN THE CHURCHILL PROVINCE, ASTRIDE THE *OWL RIVER* SHEAR ZONE (GSC PAPER 66-1, P. 135). THE DATE MAY APPROXIMATE THE END (BRITTLE DEFORMATION) PHASES OF HUDSONIAN OROGENY.

GSC 66-107 BIOTITE, K-AR AGE 2300 + OR - 70 M.Y.

K=8.02 PERCENT, AR40/K40=0.2629, RADIOGENIC AR=100 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED, OLIVE-GREEN BIOTITE WITH LESS THAN 3 PERCENT HORNBLENDE IMPURITY. MOST FLAKES HAVE A FEW COLOURLESS INCLUSIONS WITH WEAK PLEOCHROIC HALOS.

FROM QUARTZ MONZONITE

MANITOBA

(52 E) 100 FT. NORTHEAST OF SUNBEAM MINE SHAFT, MANITOBA, 49-45 N, 95-15-20 W. SEE MAP UNIT 8, MANITOBA MINES BRANCH MAP 53-4. SAMPLE MC-MAN, COLLECTED AND INTERPRETED BY W. GIBBINS.

MEDIUM GRAINED (1-3 MM DIAM.) GRANITIC ROCK WHICH CONTAINS SPARSE MICROCLINE PHENOCRYSTS (UP TO 10 MM DIAM.). APPARENTLY MASSIVE ON FRESH AND WEATHERED SURFACES (WEAK TO MODERATE ORIENTATIONS MAY BE SHOWN BY PETROFABRIC ANALYSIS). ROCK HAS A PINKISH GREY COLOUR WHICH BECOMES LIGHT PINK ON WEATHERING. CONTAINS 40 PERCENT PLAGIOCLASE (AB APPROX. 70), 20 PERCENT QUARTZ, 25 PERCENT MICROCLINE, 12-15 PERCENT BIOTITE, 1/2-1 PERCENT AMPHIBOLE, AND 1-2 PERCENT EPIDOTE. SPECIFIC GRAVITY-2.69).

A REMARKABLE NUMBER OF SIMILARITIES BETWEEN THE FLORA LAKE STOCK (R.A. HEINLICH, GSA BULL., 1965, PP. 1-26) AND THE FALCON LAKE STOCK (W.A. GIBBINS, M.SC., NORTHERN U., 1967) SUGGEST THAT THE TWO INTRUSIONS MAY BE RELATED IN METHOD AND TIME OF EMPLACEMENT. THE DIFFERENT K-AR DATES (2660 ± OR - 135 M.Y. FOR THE FLORA LAKE STOCK VS. 2300 ± OR - 70 M.Y. FOR THE FALCON LAKE STOCK) INDICATE THAT THE FALCON LAKE IS CONSIDERABLY YOUNGER.

THE DATE FOR THE FALCON LAKE STOCK CORRESPONDS TO THE END OF THE KENORAN OROGENY (STOCKWELL 1961) AND IS WELL REPRESENTED BY BOTH IGNEOUS AND METAMORPHIC ROCKS OF THE REGION. THIS IS CONSISTENT WITH THE LACK OF REGIONAL AND CONTACT METAMORPHIC EFFECTS CONNECTED WITH THE FALCON LAKE STOCK. THE FLORA LAKE STOCK SHOWS THE SAME LACK OF METAMORPHIC EFFECTS, BUT IS CUT BY A NUMBER OF LARGE FAULTS AND MAY REPRESENT AN EARLIER CYCLE OR STAGE OF INTRUSION.

GSC 66-108 BIOTITE, K-AR AGE 2715 ± OR - 80 M.Y.

K=6.65 PERCENT, AR40/K40=0.3553, RADIOGENIC AR=100 PERCENT.

CONCENTRATE- CLEAN, UNALTERED OLIVE-GREEN BIOTITE. SOME FLAKES ARE BLISTERED AND A FEW CONTAIN FINE, NEEDLE-LIKE ORIENTED INCLUSIONS. A TRACE OF HORN-BLENDE IS THE ONLY IMPURITY.

FROM QUARTZ MONZONITE
(53 M) SOUTHEAST SHORE OF SMALL OVAL LAKE 3/4 MILE SOUTH-WEST OF HIGH HILL RIVER, MANITOBA, 55-45-15 N, 94-57-00 W. MAP-UNIT 7, GSC MAP 55-8. SAMPLE BA-U-57, COLLECTED AND INTERPRETED BY C.K. BELL.

MANITOBA

THIS SAMPLE IS FROM A VERY COARSE-GRAINED, FOLIATED, DARK GREY, HORNBLENDE-PYROXENE-QUARTZ MONZONITE THAT IS CHARACTERIZED BY BLUE QUARTZ EYES AND ONE INCH, COLOURLESS TO GREY, EUBEDRAL, MICROCLINE CRYSTALS (METACRYSTS) THAT ARE LOCALLY DEFORMED TO AUGEN. THE ROCK CONSISTS OF 33 PERCENT QUARTZ, 25 PERCENT MICROCLINE, 17 PERCENT PLAGIOCLASE, 15 PERCENT HORNBLENDE, 5 PERCENT BIOTITE, 3 PERCENT PYROXENE, APATITE, SERICITE, CHLORITE AND MAGNETITE.

THIS MONZONITE LIES WITHIN THE PROPOSED BOUNDARIES OF THE PIKWITONEI SUBPROVINCE (SUPERIOR STRUCTURAL PROVINCE), SEE GSC PAPER 66-1, P. 133. THE DATE TENDS TO CONFIRM THE INTERPRETATION OF THE REGIONAL GEOLOGY THAT WAS PROPOSED IN THE ABOVE PAPER AND EXTENDS THE SUBPROVINCE FIFTY MILES BEYOND THE LOCALITY OF SAMPLE GSC 60-83 TO A POINT JUST EAST OF 95 DEGREES 00 MINUTE W. THE DATE MAY BE COMPARED WITH THE FOLLOWING ROCKS FROM WITHIN THE SAME SUBPROVINCE. SAMPLES NO. AK 206 (GRANODIORITE) AT 2500 M.Y. AND AK 256 (GRANULITE) AT 2410 M.Y. AS REPORTED BY BURWASH ET AL., JOUR. GEOPHY. RESEARCH, VOL. 67, NO. 4, AND GSC AGE DETERMINATIONS 60-83 (HYPERSTHENE CHARNOKITE) AT 2400 M.Y., 64-81 (GRANULITE) AT 2680 M.Y., 64-83 (ANORTHOSITE) AT 2435 M.Y., AND 65-98 (BASIC GRANULITE) AT 2375 M.Y. THIS DATE OF 2715 $\pm$ OR - 80 M.Y. IS THE OLDEST SO FAR REPORTED IN THE NORTHWESTERN PART OF THE SUPERIOR PROVINCE.

GSC 66-109 BIOTITE, K-AR AGE 1675 $\pm$ OR - 55 M.Y.

K=7.28 PERCENT, AR40/K40=0.1578, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN CONCENTRATE OF ALTERED OLIVE-GREEN BIOTITE. MOST FLAKES ARE ALTERED TO CHLORITE ON THEIR EDGES AND THE TOTAL CHLORITE CONTENT OF THE SAMPLE IS ABOUT 20 PERCENT. MOST FLAKES CONTAIN STRONG PLEOCHROIC HALOS WHICH ARE NOT ASSOCIATED WITH INCLUSIONS.

(53 N) FROM GRANODIORITE GNEISS
NORTH SHORE OF RED SUCKER RIVER, 1 MILE BELOW OUTLET OF RED CROSS LAKE, MANITOBA, 55-05 N, 92-45 W. MAP-UNIT 7B, GSC MAP 17-1962. SAMPLE 53N-PK-17-2, COLLECTED BY R. POTTER, INTERPRETED BY C.K. BELL.

THIS SAMPLE IS FROM A GREY, MASSIVE TO FAINTLY FOLIATED, MEDIUM-GRAINED, BIOTITE GRANODIORITE GNEISS CONSISTING OF 54 PERCENT PLAGIOCLASE, 40 PERCENT QUARTZ, 5 PERCENT BIOTITE, MICROCLINE, PYROXENE, SERICITE AND CHLORITE.

THE GNEISS OUTCROPS WITHIN THE CROSS LAKE SUBPROVINCE (GSC

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PAPER 64-17, P. 1). THE DATE IS MUCH YOUNGER THAN THE PRE-VALENT KENORAN DATES OF THE SUPERIOR PROVINCE AND SUGGESTS MODIFICATION OF WHAT IS THOUGHT TO BE TYPICALLY ARCHAEOAN TERRAIN BY THE HUDSONIAN OROGENY. THIS DATE HELPS TO EXTEND THE PARAMETERS OF THE CROSS LAKE SUBPROVINCE.

ONTARIO

GSC 66-110 BIOTITE, K-AR AGE 1920 + OR - 70 M.Y.

K=5.62 PERCENT, AR40/K40=0.1950, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- SLIGHTLY IMPURE OLIVE-GREEN BIOTITE WITH 5-10 PERCENT HORNBLende CONTAMINATION. MOST FLAKES ARE ALTERED TO CHLORITE ON THEIR EDGES, AND TOTAL CHLORITE CONTENT IS 4-5 PERCENT.

FROM GNEISS

(52 D) ONTARIO, 48-45 N, 94-05 W. NO PUBLISHED GEOLOGICAL MAP. SAMPLE FA-11-65, COLLECTED AND INTERPRETED BY W.F. FAHRIG.

THE SAMPLE IS MEDIUM-GRAINED, FAINTLY GNEISSIC METAMORPHIC ROCK (POSSIBLY A METAGABBRO) COMPOSED OF OVOID SAUSSURITIZED PLAGIOCLASE CRYSTALS IN A MATRIX OF HORNBLende, POTASH FELDSPAR AND OLIVE-GREEN BIOTITE. AS THE SAMPLE MATERIAL WAS SITUATED WITHIN 2 INCHES OF THE CONTACT OF A 150 FEET TO 200 FEET WIDE DYKE THE K-AR AGE OF ITS CONTAINED BIOTITE IS THOUGHT TO PROVIDE THE APPROXIMATE AGE OF THE INTRUSION.

GSC 66-111 WHOLE ROCK, K-AR AGE 1480 + OR - 145 M.Y.

K=0.94 PERCENT, AR40/K40=0.1315, RADIOGENIC AR=93 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM DIABASE

(42 L) 1/2 MILE SOUTH OF MELCHETT LAKE, ONTARIO, 50-41 N, 87-02 W. ONTARIO DEPT. MINES MAP 40F (KOWKASH-OGOKI AREA). SAMPLE SP-63-7-55, COLLECTED AND INTERPRETED BY D.F. SANGSTER.

THE SAMPLE IS FROM THE CHILLED BORDER OF A 60-FOOT WIDE, NORTH-STRIKING DIABASE DYKE WHICH CUTS MAGNETITE-QUARTZ IRON-FORMATION AND ASSOCIATED SEDIMENTS.

THE DYKE EXHIBITS A WELL-DEFINED GRAIN GRADATION FROM ITS BORDERS TO THE CENTRE. AT THE CONTACT, THE DYKE ROCK IS BLACK AND LARGELY APHANITIC WITH ONLY A FEW PLAGIOCLASE PHENOCRYSTS VISIBLE. AT THE CENTRE, THE ROCK IS GABBROIC IN TEXTURE AND CONSISTS OF SAUSSURITIZED PLAGIOCLASE, PYROXENE (PARTLY ALTERED TO CHLORITE AND URALITE), MAGNETITE, AND SMALL AMOUNTS OF QUARTZ.

ONTARIO

SAMPLES FROM ASSOCIATED QUARTZ-MUSCOVITE SCHISTS AND PEG-MATITE SILLS GAVE KENORAN DATES (GSC 64-86, 87 AND 88) FOR THE AGE OF METAMORPHISM. DIRECTIONS OF MAGNETIC POLARIZATION IN THE MAGNETITE IRON-FORMATION WERE IMPOSED DURING THIS PERIOD OF METAMORPHISM AND ARE SUB-PARALLEL WITH STRUCTURAL AND PETRO-FABRIC LINEATIONS IN THE SCHIST AND MAGNETITE-QUARTZ LAYERS. INTRUSION OF THE DIABASE DYKE IS THE LAST VISIBLE THERMAL EVENT TO HAVE AFFECTED IRON-FORMATION OF THE KAPIKO IRON RANGE. THERMAL EFFECTS ON THE MAGNETIC POLARIZATION OF MAGNETITE IN IRON-FORMATION ARE LIMITED TO WITHIN A FEW INCHES ADJACENT TO THE CONTACT WITH DIABASE.

GSC 66-112 WHOLE ROCK, K-AR AGE 1335 + OR - 140 M.Y.

K=0.97 PERCENT, AR40/K40=0.1135, RADIOGENIC AR=93 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

(42 L) FROM BASALT
OGOKI RIVER AREA, ONTARIO, 50-45-05 N, 86-50-10 W.
NO PUBLISHED GEOLOGICAL MAP. SAMPLE FA-25-65,
COLLECTED AND INTERPRETED BY W.F. FAHRIG.

THE ROCK IS CHILLED DIABASE CONSISTING OF UNALTERED MICROPHENOCRYSTS OF PLAGIOCLASE IN A SEMI-OPAQUE MATRIX. THE K-AR AGE IS CONSIDERED TO BE THE APPROXIMATE AGE OF INTRUSION OF THE DYKE.

GSC 66-113 WHOLE ROCK, K-AR AGE 785 + OR - 103 M.Y.

K=0.51 PERCENT, AR40/K40=0.0570, RADIOGENIC AR=79 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

(41 N) FROM DIABASE
TRIBAG MINE, ONTARIO, 47-04 N, 84-31 W. NO
GEOLOGICAL MAP REFERENCE. SAMPLE 64-RF-008,
COLLECTED AND INTERPRETED BY S.M. ROSCOE.

THE SAMPLE WAS TAKEN FROM THE CHILLED CONTACT OF A PRE-BRECCIA DIABASE DYKE AGAINST ANOTHER PRE-BRECCIA, PRE-ORE, DIABASE DYKE FROM DRILL CORE IN THE TRIBAG COPPER ORE DEPOSIT. THE ORE DEPOSIT IN BRECCIATED ARCHAEOAN GRANITE IS CUT BY

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DIABASE DYKES THAT ARE PROBABLY OF KEWEENAWAN AGE. FINE GRAINED (GSC 65-106, WHOLE ROCK) AND COARSE-GRAINED MUSCOVITE (GSC 64-84) INTIMATELY ASSOCIATED WITH CHALCOPYRITE HAVE GIVEN K-AR DATES OF 830 ± 84 M.Y. AND 1055 ± 35 M.Y. RESPECTIVELY. KEWEENAWAN LAVA (GSC 65-105) 16 MILES TO THE SOUTH, HAS GIVEN A K-AR WHOLE ROCK AGE OF 915 ± 140 M.Y.

GSC 66-114 BIOTITE, K-AR AGE 1035 ± 35 M.Y.

K=6.69 PERCENT, $AR_{40}/K_{40}=0.0808$, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, REDDISH BROWN BIOTITE. MOST FLAKES HAVE STRONG PLEOCHROIC HALOS. HORNBLÉNDE CONTAMINATION AMOUNTS TO ABOUT 5 PERCENT.

FROM GABBRO
(41 J) ONTARIO, 47-00 N, 83-51 W. NO GEOLOGICAL MAP.
SAMPLE FA-8-65, COLLECTED AND INTERPRETED BY W.F. FAHRIG.

THE ROCK IS A COARSE-GRAINED OPHITIC GABBRO CONSISTING OF PLAGIOCLASE, TITANIFEROUS AUGITE, OLIVINE, IRON-ORES, BIOTITE AND MINOR ALTERATION PRODUCTS. THE K-AR AGE OF THE BIOTITE IS THE APPROXIMATE AGE OF THE INTRUSION.

GSC 66-115 WHOLE ROCK, K-AR AGE 1400 ± 120 M.Y.

K=1.75 PERCENT, $AR_{40}/K_{40}=0.1215$, RADIOGENIC AR=96 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM BASALT
(41 J) ONTARIO, 46-31 N, 83-01 W. NO GEOLOGICAL MAP.
SAMPLE FA-7-65, COLLECTED AND INTERPRETED BY W.F. FAHRIG.

THE ROCK IS A CHILLED DIABASE CONSISTING OF SUB-PARALLEL 1 MM. PHENOCRYSTS OF UNALTERED PLAGIOCLASE AND 1 MM. CLUSTERS OF FINE-GRAINED HORNBLÉNDE PSEUDOMOPHIC AFTER PYROXENE, IN A MICROSCOPICALLY CRYSTALLINE MATRIX THAT IS CHIEFLY HORNBLÉNDE AND IRON-ORES. THE K-AR AGE IS THE APPROXIMATE AGE OF INTRUSION.

ONTARIO

GSC 66-116 WHOLE ROCK, K-AR AGE 1340 + OR - 120 M.Y.

K=1.11 PERCENT, AR40/K40=0.1141, RADIOGENIC AR=90 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM DIABASE
(41 J) SOUTH SIDE OF JIMCHRIST LAKE, ONTARIO, 46-35.3 N, 82-43.8 W. SEE ONTARIO DEPT. MINES MAP 48K (FLACK LAKE). SAMPLE HAA-66-17-D2, COLLECTED BY H.J. HOFMANN, DESCRIBED BY R.D. STEVENS, INTERPRETED BY R.K. WANLESS.

THE ROCK IS A HEAVILY ALTERED DIABASE WITH ABUNDANT GRANULAR MAGNETITE (15 PERCENT). THE RELATIVELY LARGE (2MM) PLAGIOCLASE LATHS ARE COMPLETELY SERICITIZED, AND THE COLOURLESS CLINOPYROXENE IS MODERATELY ALTERED TO FINE UNIDENTIFIED MATERIAL. GREEN AND YELLOW CHLORITES (25 PERCENT) FORM INTERSTITIAL AND PSEUDOMORPHOUS MASSES THROUGHOUT THE ROCK.

FOR INTERPRETATION SEE GSC 66-117.

GSC 66-117 WHOLE ROCK, K-AR AGE 1390 + OR - 120 M.Y.

K=1.24 PERCENT, AR40/K40=0.1202, RADIOGENIC AR=95 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM DIABASE
(41 J) EAST END OF FLACK LAKE, ONTARIO, 46-35.3 N, 82-44.7 W. SEE ONT. DEPT. MINES MAP 48K (FLACK LAKE). SAMPLE HAA-66-17-D1, COLLECTED BY H.J. HOFMANN, DESCRIBED BY R.D. STEVENS, INTERPRETED BY R.K. WANLESS.

THE ROCK IS HEAVILY ALTERED DIABASE WITH ABUNDANT SKELETAL AND GRANULAR MAGNETITE (15 PERCENT) AND SOME GRANULAR PYRITE. THE RELATIVELY LARGE (2 MM) PLAGIOCLASE LATHS ARE ALMOST COMPLETELY SERICITIZED, AND THE COLOURLESS CLINOPYROXENE IS ALSO HEAVILY ALTERED TO UNIDENTIFIED SECONDARY PRODUCTS. INTERSTITIAL AND VEIN-FILLING GREEN AND YELLOW-GREEN CHLORITES ARE VERY ABUNDANT (25 PERCENT).

THE SAMPLES WERE COLLECTED FROM TWO NORTHWEST-TRENDING DYKES WHICH CUT THE BAR RIVER FORMATION **UPPER WHITE QUARTZITE**, OF THE COBALT GROUP OF HURONIAN AGE. THE SPECIMENS

ONTARIO

WERE DATED IN ORDER TO ESTABLISH THE MINIMUM AGE OF PRECAMBRIAN FOSSILS IN THE BAR RIVER FORMATION. THE VALUES OBTAINED INDICATE THAT THE FORMATION MUST BE OLDER THAN 1390 M.Y., BUT RB/SR WHOLE ROCK DETERMINATIONS FOR THE NIPISSING DIABASE, WHICH INTRUDES THE OLDER GORDON LAKE FORMATION 6.4 KM TO THE NORTHWEST, PLACE THE PROBABLE MINIMUM AGE AT 2130 M.Y. THE AGE OF 1390 M.Y. REPRESENTS THE TIME OF INTRUSION OF THE DIABASE DYKES.

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GSC 66-118 WHOLE ROCK, K-AR AGE 431 + OR - 80 M.Y.

K=0.21 PERCENT, AR40/K40=0.0284, RADIOGENIC AR=57 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK

(41 I) FROM BASALT
500 FT. WEST OF WEST SHORE, NORTHEAST BAY OF
JOHNNIE LAKE, ONTARIO, 46-07-10 N, 81-13-40 W.
MAP UNIT 5, GSC MAP 220A. SAMPLE FC-BL-49-65,
COLLECTED AND INTERPRETED BY M.J. FRAREY.

FROM DIABASE INTRUSION CROSSING GRENVILLE FRONT. SEE
REMARKS FOR SAMPLE GSC 66-119.

GSC 66-119 WHOLE ROCK, K-AR AGE 416 + OR - 76 M.Y.

K=0.32 PERCENT, AR40/K40=0.0272, RADIOGENIC AR=58 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

(41 I) FROM DIABASE
SOUTHEAST SHORE OF TURBID LAKE, CARLYLE TP.,

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ONTARIO, 46-06-55 N, 81-11-30 W. MAP UNIT 5, GSC
MAP 220A. SAMPLE FAD-410-65, COLLECTED BY A.
DAVIDSON, INTERPRETED BY M.J. FRAREY.

THE SAMPLE REPRESENTS A DIABASE DYKE THAT CROSSES GRENVILLE TRENDS AND CONTINUES WEST-NORTHWEST INTO HURONIAN ROCKS. THE SAMPLE WAS OBTAINED ABOUT 1.5 MILES WITHIN GRENVILLE PROVINCE. WHILE A **POST-GRENVILLE** AGE (POST 900 M.Y.) WAS ANTICIPATED FROM FIELD RELATIONS, THE DATE APPEARS RATHER TOO LOW, EVEN THOUGH A SUPPORTING FIGURE WAS OBTAINED FROM THE HURONIAN TERRAIN (GSC 66-118). BOTH SAMPLES WERE NOTABLY LOW IN POTASSIUM CONTENT. THE ABSENCE OF DYKES CUTTING THE ORDOVICIAN FORMATIONS OF THIS REGION STRONGLY INDICATES THAT THIS DYKE IS AT LEAST PRE-ORDOVICIAN IN AGE.

SEE GSC 66-118, A RELATED SAMPLE.

GSC 66-120 BIOTITE, K-AR AGE 886 + OR - 33 M.Y.

K=7.10 PERCENT, AR40/K40=0.0662, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN GREENISH BROWN BIOTITE WITH LESS THAN 5 PERCENT HORNBLENDE, 1 PERCENT CHLORITE AND A TRACE OF MUSCOVITE.

FROM GRANITIC GNEISS
(41 I) 5000 FT. EAST OF SOUTHWEST END OF TURBID LAKE, SALE
TP., ONTARIO, 46-06-50 N, 81-10-30 W. MAP-UNIT 4A,
GSC MAP 220A. SAMPLE FAD-412-65, COLLECTED BY A.
DAVIDSON, INTERPRETED BY M.J. FRAREY.

THE SAMPLE IS FROM A FINE TO MEDIUM-GRAINED GRANITE, CONSIDERED FROM FIELD RELATIONS TO BE YOUNGER THAN THE LARGER MASSES OF **KILLARNEY** GRANITE IN THE AREA. THE LOW GRENVILLE DATE APPARENTLY CONFIRMS THIS BUT MAY NOT INDICATE THE ACTUAL TIME OF INTRUSION BECAUSE OF POST-GRANITE DEFORMATION.

GSC 66-121 BIOTITE, K-AR AGE 996 + OR - 36 M.Y.

K=7.47 PERCENT, AR40/K40=0.0768, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, OLIVE-GREEN BIOTITE WITH A TRACE OF HORNBLENDE AND ABOUT 2 PERCENT

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CHLORITE. MOST FLAKES CONTAIN LESS THAN 5 PERCENT COLOURLESS INCLUSIONS WITH ASSOCIATED PLEOCHROIC HALOS.

FROM GRANITE

- (41 I) 4500 FT NORTHEAST CORNER OF MAIN BODY OF BELL LAKE, ONTARIO, 46-09 N, 81-10 W. MAP-UNIT 4B, GSC MAP 220A. SAMPLE FAD-388A-65, COLLECTED BY A. DAVIDSON, INTERPRETED BY M.J. FRAREY.

THE ROCK SAMPLED IS A COARSE-GRAINED PORPHYRITIC RED GRANITE AND CONSTITUTES ONE OF THE BODIES GROUPED UNDER THE TERM **KILLARNEY GRANITE**. AS THE LATTER HAS YIELDED APPRECIABLY OLDER AGES ELSEWHERE (GSC PAPER 63-17), THE DATE IS INTERPRETED AS METAMORPHIC.

GSC 66-122 MUSCOVITE, K-AR AGE 1055 + OR - 40 M.Y.

K=7.43 PERCENT, AR40/K40=0.0826, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, OLIVE-GREEN BIOTITE. ABOUT 70 PERCENT OF THE FLAKES CONTAIN TINY COLOURLESS BLEBS WHICH ARE SURROUNDED BY STRONG PLEOCHROIC HALOS. IMPURITIES CONSIST OF 3 PERCENT HORNBLLENDE AND A TRACE OF QUARTZ.

FROM GRANITE

- (41 I) SOUTH SHORE OF GREY LAKE, SALE TP., ONTARIO, 46-07-50 N, 81-10-10 W. MAP-UNIT 4B, GSC MAP 220A. SAMPLE FC-BL-18-65, COLLECTED AND INTERPRETED BY M.J. FRAREY.

THE SAMPLED ROCK IS A RELATIVELY SMALL, MEDIUM-GRAINED GRANITE BODY CUTTING A MUCH LARGER, DISSIMILAR, COARSER-GRANITIC MASS, LESS THAN A MILE WITHIN GRENVILLE PROVINCE.

INTERPRETATION IS DEFERRED PENDING RESULTS OF AGE INVESTIGATION OF HOST GRANITE AND OTHER WORK.

GSC 66-123 HORNBLLENDE, K-AR AGE 1825 + OR - 55 M.Y.

K=1.15 PERCENT, AR40/K40=0.1799, RADIOGENIC AR=98 PERCENT.

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CONCENTRATE- RELATIVELY CLEAN DARK BROWN HORNBLLENDE WITH ABOUT 1 PERCENT MICA CONTAMINATION.

FROM GABBRO

(42 G) DETAILS AS FOR GSC 66-124. SAMPLE GN65 582-7, COLLECTED BY E. GAUCHER.

SEE GSC 66-124 FOR DESCRIPTION AND INTERPRETATION.

GSC 66-124 BIOTITE, K-AR AGE 1860 + OR - 55 M.Y.

K=7.01 PERCENT, AR40/K40=0.1854, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED, DARK BROWN BIOTITE WITH 3-5 PERCENT HORNBLLENDE IMPURITY. TOTAL CHLORITE CONTENT IS 1 PERCENT.

FROM GABBRO

(42 G) NORTHEAST CORNER OF OWENS TWP., 2.5 MILES SOUTH-WEST OF LEPAGE, ONTARIO, 49-26-37 N, 82-39-02 W. OVAL-SHAPED MAGNETIC ANOMALY ON GSC GEOPHYSICAL MAP 2252G (LOST RIVER). SAMPLE GN65 582-7, COLLECTED BY E. GAUCHER, INTERPRETED BY A.S. MACLAREN AND R.K. WANLESS.

THE ROCK IS A MEDIUM TO COARSE GRAINED, FAINTLY FOLIATED ANORTHOSITIC GABBRO COMPRISED OF PYROXENE, BROWN HORNBLLENDE, PLAGIOCLASE FELDSPAR AND MAGNETITE. THE INTRUSION IS ALSO COMPRISED OF PERIDOTITE AND PYROXENITE.

THE AGE DETERMINED FOR THIS INTRUSIVE PLUG AGREES WITH DETERMINATIONS OF 1790, 1820 AND 1860 M.Y. REPORTED BY GITTINS ET.AL. FOR BIOTITE FROM THE CARGILL CARBONATITE COMPLEX 12 MILES S-SW OF THIS SAMPLE LOCALITY. THE BODIES APPEAR TO HAVE BEEN INTRUDED SIMULTANEOUSLY INTO ARCHAEOAN ROCKS OF THE SUPERIOR PROVINCE AND THE AGES DETERMINED ARE CONSIDERED TO REPRESENT THEIR TRUE AGE OF EMPLACEMENT.

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GSC 66-125 BIOTITE, K-AR AGE 2355 + OR - 65 M.Y.

K=7.32 PERCENT, AR40/K40=0.2743, RADIOGENIC AR=100 PERCENT.

CONCENTRATE- CLEAN, UNALTERED, OLIVE-GREEN BIOTITE WITH LESS THAN 1 PERCENT HORNBLENDE AND A TRACE OF CHLORITE.

FROM GRANITIC GNEISS
(42 I) WAKWAYOWKASTIC RIVER, 13 MILES WEST OF SOUTH END OF KESAGAMI LAKE, MOOSE RIVER AREA, ONTARIO, 50-16 N, 80-39 1/2 W. MAP-UNIT 2, GSC PRELIMINARY MAP P.S. 9-1967. SAMPLE SC 476A-65, COLLECTED AND INTERPRETED BY R. SKINNER.

THE SPECIMEN IS A FINE- TO MEDIUM-GRAINED GREY GNEISS COMPOSED OF A MOSAIC OF QUARTZ (25 PERCENT) AND OLIGOCLEASE (45 PERCENT) CONTAINING SUBPARALLEL FLAKES OF GREEN BIOTITE (10 PERCENT) AND RANDOMLY ORIENTED GRAINS OF GREEN HORNBLENDE (15 PERCENT) PLUS MINOR AMOUNTS OF MUSCOVITE, SPHENE, MAGNETITE AND APATITE.

SEE GSC 66-129 FOR INTERPRETATION.

GSC 66-126 BIOTITE, K-AR AGE 2235 + OR - 65 M.Y.

K=7.90 PERCENT, AR40/K40=0.2502, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED, GREENISH BROWN BIOTITE WITH ABOUT 2 PERCENT HORNBLENDE CONTAMINATION.

FROM GRANULITE
(42 I) ON ONTARIO NORTHLAND RAILWAY RIGHT OF WAY AT R.C.A.F. RELAY STATION 15 MILES SOUTH OF CORAL RAPIDS, ONTARIO, 50-00 N, 81-37 1/2 W. MAP-UNIT 3, GSC PRELIMINARY MAP P.S. 9-1967. SAMPLE SC 436-65, COLLECTED AND INTERPRETED BY R. SKINNER.

THE SPECIMEN IS A BROWN MEDIUM-GRAINED MASSIVE GRANULITE COMPOSED OF A MOSAIC OF ABOUT 85 PERCENT ANDESINE, 15 PERCENT GREEN BIOTITE AND 1 PERCENT QUARTZ.

SEE GSC 66-129 FOR INTERPRETATION.

ONTARIO

GSC 66-127 BIOTITE, K-AR AGE 2180 + OR - 60 M.Y.

K=7.06 PERCENT, AR40/K40=0.2398, RADIOGENIC AR=100 PERCENT.

CONCENTRATE- SLIGHTLY IMPURE, UNALTERED, GREENISH BROWN BIOTITE WITH 5-10 PERCENT HORNBLLENDE CONTAMINATION.

FROM GRANODIORITE GNEISS
(42 I) 8 MILES SOUTHEAST OF MOUTH OF LITTLE ABITIBI RIVER,
MOOSE RIVER AREA, ONTARIO, 50-25 N, 81-22 1/2 W.
MAP-UNIT 2, GSC PRELIMINARY MAP P.S. 9-1967.
SAMPLE SC 453-65, COLLECTED AND INTERPRETED BY R.
SKINNER.

THE SPECIMEN IS A DARK REDDISH-GREY, FINE-TO MEDIUM-GRAINED, FOLIATED GRANODIORITE GNEISS COMPOSED OF A MOSAIC OF 45 PERCENT OLIGOCLEASE, 15 PERCENT QUARTZ, 5 PERCENT MICROCLINE, 25 PERCENT HORNBLLENDE AND 10 PERCENT BIOTITE.

SEE GSC 66-129 FOR INTERPRETATION.

GSC 66-128 BIOTITE, K-AR AGE 1855 + OR - 60 M.Y.

K=7.797 PERCENT, AR40/K40=0.1846, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, VERY SLIGHTLY BLISTERED REDDISH BROWN BIOTITE WITH ABOUT 2 PERCENT HORNBLLENDE CONTAMINATION. A FEW FLAKES CONTAIN OPAQUE INCLUSIONS.

FROM SCHIST
(42 I) NORTH FRENCH RIVER, 17 MILES EAST OF BAREBONE
ISLAND, MOOSE RIVER AREA, ONTARIO, 50-31 1/2 N,
81-05 1/2 W. MAP-UNIT 1, GSC PRELIMINARY MAP PS
9-1967. SAMPLE SC 341A-65, COLLECTED AND INTER-
PRETED BY R. SKINNER.

THE SPECIMEN IS A BROWN, MEDIUM-TO FINE-GRAINED BIOTITE-HORNBLLENDE-FELDSPAR SCHIST CONTAINING 65 PERCENT ANDESINE, 20 PERCENT BIOTITE AND 15 PERCENT HORNBLLENDE.

SEE GSC 66-129 FOR INTERPRETATION.

ONTARIO

GSC 66-129 HORNBLLENDE, K-AR AGE 2515 + OR - 80 M.Y.

K=0.86 PERCENT, AR40/K40=0.3082, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- CLEAN, OLIVE-GREEN HORNBLLENDE WITH ONLY TRACE IMPURITIES OF QUARTZ.

(42 I) FROM GRANULITE GNEISS
1 MILE NORTH OF KIASKO RIVER, 11 MILES EAST OF NORTH FRENCH RIVER, MOOSE RIVER AREA, ONTARIO, 50-41 N, 80-43 W. MAP-UNIT 1, GSC PRELIMINARY MAP P.S. 9-1967. SAMPLE SC 402B-65, COLLECTED AND INTERPRETED BY R. SKINNER.

THE SPECIMEN IS A DARK GREY, FINE- TO MEDIUM-GRAINED, COARSELY BANDED, SLIGHTLY FOLIATED GRANULITE GNEISS COMPOSED OF 40 PERCENT ANDESINE-LABRADORITE, 50 PERCENT HORNBLLENDE AND 10 PERCENT HYPERSTHENE.

THE FIVE DATES LISTED BELOW (GSC 66-125, 126, 127, 128, 129) WERE DETERMINED ON SPECIMENS FROM THE MOOSE RIVER MAP-AREA (42I) MAPPED BY SKINNER IN 1965 (MCLAREN ET AL, 1967). THE OUTSTANDING GEOLOGICAL FEATURE OF THE AREA IS A NORTHEASTERLY TRENDING GRANULITE ZONE WHICH CUTS ACROSS EASTERLY TRENDING GRANITIC GNEISSES, SCHISTS AND VOLCANIC ROCKS. THE GRANULITE ZONE IS DELINEATED BY A STRONG MAGNETIC ANOMALY ASSOCIATED WITH THE KAPUSKASING GRAVITY HIGH.

GSC 66-125, GRANITIC GNEISS SOUTHEAST OF GRANULITE ZONE. K-AR AGE 2355 + OR - 65 M.Y.

GSC 66-126, NARROW GRANULITE BAND INTERCALATED WITH EASTERLY TRENDING QUARTZ-FELDSPAR-BIOTITE (GARNET) SCHISTS 15 MILES SW OF MAIN GRANULITE ZONE. K-AR AGE 2235 + OR - 65 M.Y.

GSC 66-127, GRANITIC GNEISS WEST OF MAIN GRANULITE ZONE. K-AR AGE 2180 + OR - 60 M.Y.

GSC 66-128, CONTORTED BIOTITE-HORNBLLENDE-FELDSPAR SCHIST, CUT BY 8 INCH BASIC DYKE, AND INTERCALATED WITH GRANITIC GNEISS IN A WESTWARD TRENDING BRANCH OF THE MAIN NORTH-EASTERLY TRENDING GRANULITE ZONE. K-AR AGE 1855 + OR - 60 M.Y.

GSC 66-129 GRANULITE GNEISS FROM NORTHEAST PART OF MAIN GRANULITE ZONE. K-AR AGE 2515 + OR - 80 M.Y.

THE K-AR AGES OF ALL THE SAMPLES, EXCEPT GSC 66-128, CONFIRM REASONABLY WELL THE ARCHEAN AGE OF THESE SUPERIOR PROVINCE ROCKS. THEIR CONSISTENT EAST-WEST TRENDS, EXCEPT FOR THAT OF THE GRANULITE BELT, SUGGESTS THAT THEY MAY BELONG TO THE ENGLISH RIVER SUBPROVINCE. THE ANOMALOUS 1855 + OR - 60 M.Y. AGE OF GSC 66-128 MAY REFLECT A MORE RECENT METAMORPHISM INDICATED BY THE HIGHLY CONTORTED AND SHATTERED CONDITION OF THE OUTCROP (DUE TO FAULTING NEARBY) TOGETHER WITH THE

ONTARIO

PRESENCE OF A SMALL BASIC DYKE. THE K-AR AGE GIVEN FOR THE MAIN GRANULITE ZONE INDICATES THAT THESE ROCKS WERE METAMORPHOSSED AT ABOUT THE SAME TIME AS THE SURROUNDING GRANITE GNEISSES AND SCHISTS.

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GSC 66-130 PHLOGOPITE, K-AR AGE 151 ± 8 M.Y.

K=7.42 PERCENT, AR40/K40=0.0092, RADIOGENIC AR=91 PERCENT.

CONCENTRATE- CLEAN, VERY PALE BROWN LOW IRON BIOTITE OR PHLOGOPITE WITH ABOUT 1 PERCENT HORNBLende CONTAMINATION. MOST FLAKES CARRY FINE COLOURLESS AND OPAQUE INCLUSIONS.

(32 D) FROM KIMBERLITE
 UPPER CANADA MINE, KIRKLAND LAKE REGION, GAUTHIER TP., ONTARIO, 48-08 N, 79-50 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE 67-LC-1, COLLECTED BY H.A. LEE AND G. BRAGG, INTERPRETED BY H.A. LEE.

THE SAMPLE IS FROM A NEWLY DISCOVERED KIMBERLITE DYKE THAT IS EXPOSED WITHIN THE UPPER CANADA MINE AT THE 2750 FOOT LEVEL. PYROPE GARNETS WERE FIRST RECOGNIZED IN ESKER SANDS AND TRACED TO THE KIMBERLITE IN THE MINE BY THE GLACIOFOCUS METHOD.

THE ROCK IS BLACK AND PORPHYRITIC. THE PHENOCRYSTS ARE OF OLIVINE, PHLOGOPITE AND PYROPE IN A MATRIX OF CALCITE, OLIVINE, MAGNETITE, CHROMITE, SPINEL, PEROVSKITE, PHLOGOPITE AND MINOR PYRRHOTITE. THE COARSE OLIVINES ARE GENERALLY FRESH BUT HAVE SECONDARY SERPENTINE AND CALCITE ALONG IRREGULAR FRACTURES AND SECONDARY MAGNETITE AND SERPENTINE WITHIN THE RIM ZONES. A STRIKING FLUIDAL TEXTURE IS DUE TO THE MATRIX AND PHLOGOPITE BEING STREAMLINED AND FRACTURED AROUND LARGE OLIVINE GRAINS. XENOLITHS OF FINE-GRAINED ROCK ARE OCCASIONALLY PRESENT.

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THE DATE OF 151 ± 8 MILLION YEARS INDICATES AN UPPER JURASSIC AGE FOR THIS KIMBERLITE IN THE CANADIAN SHIELD AND SHOULD BE COMPARED WITH THE FOLLOWING- (1) THE MONTEREGIAN BODIES OF QUEBEC WITH AN AGE RANGE OF 100 TO 122 M.Y. (ISOTOPIC AGE DATA FROM LOWDON, 1960, 1961, HURLEY ET AL, 1959, FAIRBAIRN ET AL, 1963, ZARTMAN ET AL, 1967), (2) POST MIDDLE DEVONIAN KIMBERLITIC ROCK AND LAMPROPHYRE NEAR CORAL RAPIDS, ONTARIO (BROWN ET AL, 1967, P. 14), AND, (3) KIMBERLITE AT PORTLAND POINT NEAR ITHICA, NEW YORK, WITH AN AGE OF 155 ± 4 M.Y. DETERMINED ON ITS PHLOGOPITE BY GEOCHRON LABORATORIES INC (WATSON, 1967, P. 322).

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ROCKS FROM CENTRAL AND EASTERN UNITED STATES-
AMER. JOUR. SCI. V. 265, P. 848-870.

QUEBEC

GSC 66-131 BIOTITE, K-AR AGE 1092 + OR - 39 M.Y.

K=7.32 PERCENT, AR40/K40=0.0866, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- SLIGHTLY CONTAMINATED REDDISH BROWN BIOTITE WITH 1 PERCENT FREE CHLORITE AND 3 PERCENT HORNBLENDE. LESS THAN 5 PERCENT OF THE MICA FLAKES CONTAIN WEAK PLEOCHROIC HALOS.

FROM DIABASE

(32 E) QUEBEC, 49-46 N, 79-35 W. NO GEOLOGICAL MAP AVAILABLE. SAMPLE FA-650387, COLLECTED AND INTERPRETED BY W.F. FAHRIG.

THE ROCK IS COARSE-GRAINED OPHITIC GABBRO CONSISTING OF PLAGIOCLASE, TITANIFEROUS AUGITE, OLIVINE, IRON-ORES, BIOTITE AND MINOR ALTERATION PRODUCTS. THE K-AR AGE OF THE BIOTITE IS THE APPROXIMATE AGE OF THE INTRUSION.

GSC 66-132 BIOTITE, K-AR AGE 1935 + OR - 58 M.Y.

K=6.37 PERCENT, AR40/K40=0.1978, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- SLIGHTLY CONTAMINATED REDDISH BROWN BIOTITE WITH 2 PERCENT HORNBLENDE. ABOUT 4 PERCENT OF THE FLAKES ARE SLIGHTLY BLEACHED AND ALTERED TO CHLORITE ON THE EDGES, AND A FEW CONTAIN WEAK PLEOCHROIC HALOS. MOST FLAKES CONTAIN FINE, NEEDLE-LIKE, ORIENTED INCLUSIONS, AND ABOUT 10 PERCENT CONTAIN OPAQUE BLEBS. TOTAL CHLORITE CONTENT IS ABOUT 1 PERCENT.

FROM GABBRO

(32 D) QUEBEC, 48-15 N, 78-20 W. NO GEOLOGICAL MAP AVAILABLE. SAMPLE FA-650315, COLLECTED AND INTERPRETED BY W.F. FAHRIG.

THE ROCK IS COARSE-GRAINED OPHITIC GABBRO CONSISTING OF SAUSSURITIZED PLAGIOCLASE, AUGITE LARGELY REPLACED BY BLUE-GREEN HORNBLENDE, BASALTIC HORNBLENDE, APATITE, IRON-ORES AND RED-BROWN BIOTITE. THE K-AR AGE OF THE BIOTITE IS THE APPROXIMATE AGE OF THE INTRUSION.

QUEBEC

GSC 66-133 BIOTITE, K-AR AGE 1850 + OR - 60 M.Y.

K=6.86 PERCENT, AR40/K40=0.1836, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, ALTERED, PALE OLIVE-GREEN BIOTITE WITH LESS THAN 10 PERCENT CHLORITE AND A TRACE OF HORNBLLENDE. THE FLAKES CONTAIN OCCASIONAL COLOURLESS INCLUSIONS WITH ASSOCIATED WEAK PLEOCHROIC HALOS.

(32 D) FROM AMPHIBOLITE
WESTERN QUEBEC, 48-53 N, 78-00 W. NO PUBLISHED GEOLOGICAL MAP. SAMPLE FA-1-65, COLLECTED AND INTERPRETED BY W. F. FAHRIG.

THE BIOTITE OF THE SAMPLE WAS EXTRACTED FROM COUNTRY ROCK WITHIN AN INCH OF A WIDE DIABASE DYKE AND IS THOUGHT TO PROVIDE THE APPROXIMATE AGE OF INTRUSION OF THE DYKE. THE COUNTRY ROCK HERE IS GREENSTONE AND THE BIOTITE OCCURS IN VEINLETS.

GSC 66-134 HORNBLLENDE, K-AR AGE 1085 + OR - 45 M.Y.

K=0.85 PERCENT, AR40/K40=0.0858, RADIOGENIC AR=84 PERCENT.

CONCENTRATE- RELATIVELY CLEAN GREEN HORNBLLENDE WITH LESS THAN 5 PERCENT QUARTZ CONTAMINATION.

(31 F) FROM GRANITE
WESTERN QUEBEC, 45-55 N, 76 40 W. NO GEOLOGICAL MAP. SAMPLE FA-650236 A, COLLECTED AND INTERPRETED BY W.F. FAHRIG.

THE ROCK IS A COARSE-GRAINED AGGREGATE OF DARK GREEN HORNBLLENDE, PLAGIOCLASE AND QUARTZ. THE HORNBLLENDE OF THE SAMPLE WAS EXTRACTED FROM WITHIN ONE INCH OF THE CONTACT OF A DIABASE DYKE THAT IS MORE THAN 150 FEET THICK. IT WAS EXPECTED THAT HEAT FROM THE DYKE WOULD HAVE DRIVEN THE ARGON FROM THE HORNBLLENDE AND THAT THE K-AR AGE OF THE HORNBLLENDE WOULD INDICATE THE AGE OF DYKE INTRUSION. THE K-AR AGE INDICATES HOWEVER THAT UNDER THESE CONDITIONS ARGON IS QUANTITATIVELY RETAINED BY HORNBLLENDE.

QUEBEC

GSC 66-135 WHOLE ROCK, K-AR AGE 1875 + OR - 240 M.Y.

K=0.25 PERCENT, AR40/K40=0.1875, RADIOGENIC AR=77 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK

FROM BASALT

(35 G) QUEBEC, 61-00 N, 75-20 W. NO GEOLOGICAL MAP.
SAMPLE FA-5-65, COLLECTED AND INTERPRETED BY W.F.
FAHRIG.

THE ROCK IS A CHILLED DIABASE CONSISTING OF SUB-PARALLEL PHENOCRYSTS OF PLAGIOCLASE ABOUT 1/2 MM. IN LENGTH ALONG WITH SMALL PATCHES OF FINE-GRAINED ACTINOLITE WHICH IS PSEUDOMORPHIC AFTER PYROXENE PHENOCRYSTS, IN A MICROSCOPICALLY CRYSTALLINE MATRIX. THE K-AR AGE IS THE APPROXIMATE AGE OF INTRUSION.

GSC 66-136 WHOLE ROCK, K-AR AGE 534 + OR - 74 M.Y.

K=0.85 PERCENT, AR40/K40=0.0362, RADIOGENIC AR=83 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM BASALT

(35 G) QUEBEC, 61-10 N, 75-00 W. NO GEOLOGICAL MAP.
SAMPLE FA-4-65, COLLECTED AND INTERPRETED BY W.F.
FAHRIG.

THE ROCK SAMPLE IS CHILLED DIABASE DYKE MATERIAL CONSISTING OF 1 MM. PHENOCRYSTS OF AUGITE AND PARTLY SAUSSURITIZED PLAGIOCLASE IN A MICROCRYSTALLINE OPHITIC MATRIX. THE K-AR AGE IS CONSIDERED TO BE THE APPROXIMATE AGE OF INTRUSION.

GSC 66-137 BIOTITE, K-AR AGE 1080 + OR - 40 M.Y.

K=7.50 PERCENT, AR40/K40=0.0855, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- CLEAN, UNALTERED OLIVE-GREEN BIOTITE WITH ABOUT 1 PERCENT CHLORITE.

FROM QUARTZ MONZONITE

QUEBEC

- (31 J) WEST SHORE OF LAC JAMET, QUEBEC, 46-33-30 N, 74-31-30 W. MAP-UNIT 18, GSC MAP 11-1966 (GSC PAPER 66-32, H.R. WYNNE-EDWARDS). SAMPLE WE-GN-1-64, COLLECTED BY E. GAUCHER, INTERPRETED BY H.R. WYNNE-EDWARDS.

SEE GSC 66-138 FOR DESCRIPTION AND INTERPRETATION.

GSC 66-138 HORNBLLENDE, K-AR AGE 955 + OR 82 M.Y.

K=1.46 PERCENT, AR40/K40=0.0726, RADIOGENIC AR=97 PERCENT.

CONCENTRATE- CLEAN, PLEOCHROIC BROWN TO DARK GREEN HORNBLLENDE.

- (31 J) FROM QUARTZ MONZONITE
DETAILS AS FOR GSC 66-137. SAMPLE WE-GN-1-64, COLLECTED BY E. GAUCHER, INTERPRETED BY H.R. WYNNE-EDWARDS.

THE ROCK IS REPRESENTATIVE OF THE LEAST ALTERED PARTS OF MAP-UNIT 18 OF G.S.C. MAP 11-1966 (PAPER 66-32). THE QUARTZ-MONZONITE IS BUFF IN COLOUR, PORPHYRITIC, HOMOGENEOUS, AND MASSIVE WHERE UNDEFORMED. UP TO 50 PERCENT OF THE ROCK CONSISTS OF LARGE PINKISH TABULAR CRYSTALS OF PERTHITE. CATACLASIS AND PARTIAL RECRYSTALLIZATION HAVE CONVERTED THE QUARTZ MONZONITE TO AUGEN GNEISS IN MANY PLACES, BUT THIS SPECIMEN COMES FROM A RELATIVELY UNDEFORMED PART OF THE UNIT. ON INDEPENDENT STRUCTURAL AND PETROLOGICAL GROUNDS, THE ROCK HAS BEEN ASSIGNED TO A SUITE OF PLUTONIC IGNEOUS ROCKS THAT ARE YOUNGER THAN THE GRENVILLE GROUP OF METASEDIMENTARY GNEISSES, BUT OLDER THAN THE GRENVILLE OROGENY. THIS SUITE ALSO INCLUDES MANGERITE AND THE ANORTHOSITE OF THE MORAN MASS, AND IS BELIEVED TO HAVE BEEN EMPLACED UNDER DEEP-SEATED PLUTONIC CONDITIONS BEFORE THE MAIN METAMORPHISM ACCOMPANYING THE GRENVILLE OROGENY. THIS EVENT HAS BEEN TENTATIVELY CORRELATED WITH THE ELSONIAN OROGENY (1220-1520 MY). A SPECIMEN COLLECTED FOUR MILES TO THE EAST YIELDED A K-AR AGE ON BIOTITE OF 1205 + OR - 43 MY (GSC 65-117, SAMPLE WE-GN-2-64). THIS AGE APPEARED TO BE CONSISTENT WITH THE POSTULATED HISTORY, THE ROCK HAVING INITIALLY CRYSTALLIZED DURING THE ELSONIAN EVENT, BUT LATER HAVING SUFFERED SOME LOSS OF ARGON DURING THE GRENVILLE OROGENY. THESE MORE RECENT DETERMINATIONS ARE AGAIN SOMEWHAT OLDER THAN THE MEAN OF THE GRENVILLE OROGENY AND OF THE K-AR DETERMINATIONS IN THE AREA, BUT APPEAR TO REFLECT ONLY THE LAST MAJOR THERMAL EVENT. THIS MAY IMPLY A SYNTECTONIC AGE OF THE INTRUSION, BUT MAY ALSO INDICATE THAT EARLIER FORMED RADIOGENIC ARGON WAS NOT RETAINED DURING THE GRENVILLE OROGENY IN

QUEBEC

THE SAMPLE SUBMITTED.

GSC 66-139 MUSCOVITE, K-AR AGE 1790 + OR - 120 M.Y.

K=4.77 PERCENT, AR40/K40=0.1744, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- IMPURE SERICITE WITH SLIGHT IRON STAIN. 10 PERCENT QUARTZ IMPURITY IS PRESENT.

FROM **SERICITE ROCK**

(32 G) CHIBOUGAMAU AREA, QUEBEC, 49-53-00 N, 74-16-50 W.
NO GEOLOGICAL MAP REFERENCE. SAMPLE 63-RF-627,
COLLECTED AND INTERPRETED BY S.M. ROSCOE.

THE ROCK IS COMPOSED MAINLY OF FINE-GRAINED MUSCOVITE (SERICITE), QUARTZ **EYES**, ZOISITE AND CARBONATE. IT CONSTITUTES THE SERICITIC WALL ROCK ADJACENT TO COPPER ORE IN THE COPPER RAND MINE AT CHIBOUGAMAU. THE INTENSE ALTERATION IS EVIDENTLY RELATED TO THE ORE MINERALS WHICH WERE INTRODUCED INTO PREVIOUSLY ALTERED ANORTHOSITE-GABBRO OF THE CHIBOUGAMAU COMPLEX. GRANITE, PRESUMEABLY OF KENORAN AGE, HAS BEEN MAPPED AS INTRUDING THE COMPLEX. THE MINE IS ONLY ABOUT 10 MILES FROM THE GRENVILLE FRONT. THERE IS EVIDENCE THAT YOUNG RADIOGENIC LEAD WAS INTRODUCED INTO ORE DEPOSITS. IT IS POSSIBLE THEREFORE THAT THE WALL ROCKS LOST ARGON, OR WERE EVEN ALTERED, DURING THE GRENVILLE OROGENY.

GSC 66-140 BIOTITE, K-AR AGE 1960 + OR - 58 M.Y.

K=5.92 PERCENT, AR40/K40=0.2014, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- SLIGHTLY CONTAMINATED, ALTERED KHAKI BIOTITE. 20 PERCENT OF THE FLAKES ARE ALTERED TO CHLORITE ON THE EDGES AND ALSO CONTAIN FINE, NEEDLE-LIKE, ORIENTED INCLUSIONS. ABOUT 10 PERCENT OF THE FLAKES CONTAIN WEAK PLEOCHROIC HALOS. MAIN IMPURITIES ARE QUARTZ (5 PERCENT) AND HORNBLENDE (3 PERCENT). TOTAL CHLORITE CONTENT IS ABOUT 20 PERCENT.

FROM SCHIST

(32 P) QUEBEC, 51-37 N, 73-30 W. NO GEOLOGICAL MAP.
SAMPLE FA-650567, COLLECTED AND INTERPRETED BY W.F.

QUEBEC

FAHRIG.

THE ROCK IS A FINE-GRAINED GREY BIOTITE SCHIST AND THE ANALYZED MICA WAS EXTRACTED FROM CHIPS OF THIS ROCK LYING WITHIN 2 CM. OF THE MARGIN OF A DIABASE INTRUSION. THE K-AR AGE OF THE BIOTITE IS THOUGHT TO BE THE APPROXIMATE AGE OF THE DIABASE INTRUSION.

GSC 66-141 MUSCOVITE, K-AR AGE 358 + OR - 16 M.Y.

K=6.61 PERCENT, AR40/K40=0.0230, RADIOGENIC AR=95 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, CLEAR MUSCOVITE WITH LESS THAN 10 PERCENT QUARTZ AND ABOUT 5 PERCENT CHLORITE CONTAMINATION.

FROM QUARTZ MONZONITE
(31 H) ON BUSH ROAD, 1/2 MILE NORTHWEST OF NORTH POND OF CHAIN PONDS (LAC LECLERC), SOUTHEAST OF BOWKER LAKE, EASTERN TOWNSHIPS, QUEBEC, 45-25 N, 72-12 W. MAP-UNIT 5, 500 FEET NORTH OF MAP 1363, P.R. NO. 439, QUEBEC DEPARTMENT OF NATURAL RESOURCES. SAMPLE PB 65-6, COLLECTED AND INTERPRETED BY W.H. POOLE.

THE ROCK IS A GREY, MASSIVE, FINE- TO MEDIUM-GRAINED, EQUIGRANULAR, BIOTITE-MUSCOVITE QUARTZ MONZONITE. IN THIN SECTION, IT HAS AN ALLOTRIOMORPHIC-GRANULAR TEXTURE, AND CONSISTS OF ABOUT 40 PERCENT SLIGHTLY STRAINED QUARTZ AND 50 PERCENT CLOUDED FELDSPAR OF WHICH A HALF OR LESS IS POTASH FELDSPAR. PLAGIOCLASE IS WEAKLY TWINNED AND SLIGHTLY ZONED ALBITE. MYRMKITE IS COMMON. ORIGINAL BIOTITE IS NEARLY COMPLETELY ALTERED TO CHLORITE AND EPIDOTE. WHITE MICA RANGES FROM FINE SERICITE IN THE FELDSPARS TO LARGER PLATES.

THE BODY WAS NAMED THE CHAIN PONDS GRANITE AND DESCRIBED BY FORTIER (1946). IT HAS INTRUDED SERPENTINIZED PERIDOTITE BELIEVED TO BE ORDOVICIAN IN AGE. MOST OF THE BODY CONSISTS OF A BRECCIA IN WHICH FRAGMENTS RANGE FROM A FEW MILLIMETERS TO TWO OR THREE FEET IN DIAMETER. THE FRAGMENTS ARE OF UNIFORM COMPOSITION AND THE GENERALLY MINOR MATRIX APPEARS TO BE SIMPLY CRUSHED GRANITE OF THE SAME COMPOSITION.

THE AGE OF THE GRANITE IS UNCERTAIN, IT COULD BE EITHER ORDOVICIAN LIKE THOSE WHICH CUT THE ULTRAMAFIC ROCKS IN THE THETFORD MINES - BLACK LAKE AREA SOME 60 MILES ALONG TREND TO THE NORTHEAST (GSC 62-119, 481 M.Y., GSC 62-120, 477 M.Y.), OR DEVONIAN LIKE SEVERAL STOCKS TO THE SOUTH AND EAST.

QUEBEC

THE DETERMINED DATE OF 358 ± 16 M.Y. COVERS MIDDLE AND LATE DEVONIAN AND IS MUCH LIKE THE MICA DATES RANGING FROM 343 TO 365 M.Y. OBTAINED FROM DEVONIAN GRANITES TO THE EAST. THE CHAINS POND GRANITE IS THEREFORE PROBABLY ALSO DEVONIAN, ALTHOUGH IT IS FAINTLY POSSIBLE THAT THE GRANITE WAS INTRUDED DURING ORDOVICIAN AND THEN DURING DEVONIAN WAS BRECCIATED AND RECRYSTALLIZED, AND MUSCOVITE DEVELOPED.

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ST-JULIEN, PIERRE

1961 PRELIMINARY REPORT ON FRASER LAKE AREA, SHEFFORD AND STANSTEAD COUNTIES. QUEBEC DEPT. MINES, P.R. NO. 439.

GSC 66-142 MUSCOVITE, K-AR AGE 322 ± 14 M.Y.

K=7.22 PERCENT, $AR_{40}/K_{40}=0.0205$, RADIOGENIC AR= 94 PERCENT.

CONCENTRATE- CLEAN SERICITE WITH A TRACE OF QUARTZ CONTAMINATION. SOME FLAKES CONTAIN PATCHES OF CHLORITE AT THEIR EDGES. TOTAL CHLORITE CONTENT IS 8-10 PERCENT.

(21 E) FROM INTENSELY SHEARED GRANITE
ROADCUT, SHERBROOKE-THETFORD MINES ROAD, HIGHWAY 1, NEAR JUNCTION WITH ROAD FROM NORTH, 5 MILES NORTHEAST OF SHERBROOKE, EASTERN TOWNSHIPS, QUEBEC, 45-26-00 N, 71-48-44 W. MAP-UNIT 12, GSC MAP 911A. SAMPLE PB-65-35, COLLECTED AND INTERPRETED BY W.H. POOLE.

FINE MUSCOVITE WAS SEPARATED FROM A WHITE SCHISTOSE GRANITE IN WHICH SMALL WEATHERED CARBONATE AGGREGATES GIVE THE ROCK A LIGHT BROWN COLOUR. THE SCHISTOSE SURFACES CONSIST OF MUSCOVITE AND SERICITE FOLIAE WHICH SEPARATE LENSES OF MEDIUM-GRAINED QUARTZ AND FELDSPAR. IN THIN SECTION, THE LENSES ARE INTENSELY CATACLASTIC AND GRANULATED QUARTZ AND ALBITE.

THE GRANITE BODY HAS BEEN NAMED THE MOULTON HILL GRANITE AND DESCRIBED BY HAWLEY ET AL. (1945) AND BY COOKE (1950). MOST OF THE BODY CONSISTS OF MASSIVE, MEDIUM- TO COARSE-GRAINED GREENISH GREY ALBITE GRANITE LACKING POTASH FELDSPAR. IT HAS

QUEBEC

INTRUDED THE UNFOSSILIFEROUS ASCOT FORMATION OF VOLCANIC AND SEDIMENTARY ROCKS, NOW BELIEVED TO BE CAMBRIAN AND/OR EARLY ORDOVICIAN IN AGE (ST-JULIEN AND LAMARCHE, 1965, ST-JULIEN, 1967). DETRITUS OF ALBITE GRANITE OCCURS IN CONGLOMERATES OF MIDDLE ORDOVICIAN AND YOUNGER FORMATIONS. IT SEEMS PROBABLE THAT THE MOULTON HILL GRANITE IS PRE-MIDDLE ORDOVICIAN. MUSCOVITE WAS DATED TO DETERMINE THE AGE OF SHEARING AND TO PROVIDE A MINIMUM AGE OF THE GRANITE.

THE 322 ± OR - 14 M.Y. SPANS THE INTERVAL FROM LATE MISSISSIPPIAN TO EARLY PENNSYLVANIAN, AND IS OF LITTLE HELP IN DETERMINING THE AGE OF EMPLACEMENT OF THE GRANITE. THE SHEARING CAN CONFIDENTLY BE CONSIDERED YOUNGER THAN ORDOVICIAN, AND BECAUSE THE NEARBY SILURO-DEVONIAN ST. FRANCIS FORMATION IS FOLDED AND FAULTED, THE SHEARING COULD VERY WELL BE LATE DEVONIAN OR YOUNGER. A LATE DEVONIAN INTERPRETATION IS PREFERRED OVER CARBONIFEROUS.

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1945 SHERBROOKE, QUEBEC, GEOL. SURV. CAN., MAP 911A.

1950 GEOLOGY OF A SOUTHWESTERN PART OF THE EASTERN
 TOWNSHIPS OF QUEBEC, GEOL. SURV. CAN., MEM. 257.
- HAWLEY, J.E., FRITZSCHE, K.W., CLARK, A.R., AND HONEYMAN, K.G.
1945 THE ALDERMAC MOULTON HILL DEPOSIT, TRANS. CAN.
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- ST-JULIEN, P.
1967 TECTONICS OF PART OF THE APPALACHIAN REGION OF
 SOUTHEASTERN QUEBEC (SOUTHWEST OF THE CHAUDIERE
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 41-47.
- ST-JULIEN, P., AND LAMARCHE, R-Y.
1965 GEOLOGY OF SHERBROOKE AREA, SHERBROOKE COUNTY,
 QUEBEC DEPT. NAT. RESOURCES, P.R. 530.

GSC 66-143 WHOLE ROCK, K-AR AGE 1790 ± OR - 240 M.Y.

K=0.34 PERCENT, AR40/K40=0.1747, RADIOGENIC AR=90 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM BASALT

QUEBEC

- (25 D) QUEBEC, 60-30 N, 71-20 W. NO GEOLOGICAL MAP.
SAMPLE FA-6-65, COLLECTED AND INTERPRETED BY W.F.
FAHRIG.

THE ROCK IS CHILLED DIABASE-CONSISTING OF TINY PLAGIOCLASE AND AUGITE PHENOCRYSTS, THE LATTER MORE OR LESS REPLACED BY FINE-GRAINED PALE GREEN AMPHIBOLE, IN A SEMI-OPAQUE MICRO-CRYSTALLINE MATRIX. THE K-AR AGE IS THE APPROXIMATE AGE OF INTRUSION.

GSC 66-144 WHOLE ROCK, K-AR AGE 169 + OR - 12 M.Y.

K=3.23 PERCENT, AR40/K40=0.0104, RADIOGENIC AR=96 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

- (22 N) FROM BASALTIC ANDESITE
ON WEST SHORE OF DIAMOND-SHAPED LAKE IN THE LAC
MANICOUAGAN AREA, QUEBEC, 51-24-00 N, 68-57-30 W.
NO GEOLOGICAL MAP REFERENCE. SAMPLE CP 66-C93,
COLLECTED AND INTERPRETED BY K.L. CURRIE.

THE ROCK IS A BASALTIC ANDESITE CONSISTING OF A RAMIFYING NET OF GREY PLAGIOCLASE LATHS IN A FINE, GREYISH BLACK MATRIX WITH FLECKS OF GREEN PYROXENE. THE PLAGIOCLASE PHENOCRYSTS ARE SEVERELY RECRYSTALLIZED.

SAMPLE GSC 66-144 WAS FROM THE SAME UNIT AS GSC 64-127 (UNIT 10 OF GSC MAP 28-1967, IN PRESS). THE AGES ARE SUBSTANTIALLY DIFFERENT (169 AND 225 M.Y. RESPECTIVELY) BUT IT SEEMS VERY UNLIKELY THAT THIS DIFFERENCE IS REAL. GEOLOGICAL AND GEOPHYSICAL EVIDENCE (LAROCHELLE AND CURRIE 1967) INDICATES THAT THE MANICOUAGAN STRUCTURE FORMED WITHIN A SHORT SPACE OF TIME, POSSIBLY AS LITTLE AS 10,000 YEARS. THE MEAN OF THE TWO AGE DETERMINATIONS IS 197 M.Y., WHICH IS WITHIN THE MARGIN OF ERROR OF GSC 64-127, AND AGREES WELL WITH THE PALOMAGNETIC UPPER TRIASSIC POLE DETERMINED FOR THIS UNIT. IT SEEMS PROBABLE THAT THE IGNEOUS ROCKS OF THE MANICOUAGAN STRUCTURE ARE TRIASSIC IN AGE, AND THE EXACT AGE FALLS SOMEWHERE BETWEEN GSC 66-144 AND GSC 64-127.

REFERENCES-

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1967 A PRELIMINARY MAP OF THE MANICOUAGAN STRUCTURE,
QUEBEC, GSC MAP 28-1967 (IN PRESS) IN PAPER 67-70.
LAROCHELLE, A. AND CURRIE, K.L.

QUEBEC

1967 A PALEOMAGNETIC STUDY OF IGNEOUS ROCKS FROM THE MANICOUAGAN STRUCTURE, QUEBEC, J. GEOPHYS. RES. 72 =16.

GSC 66-145 WHOLE ROCK, K-AR AGE 665 ± OR - 74 M.Y.

K=1.00 PERCENT, AR40/K40=0.0466, RADIOGENIC AR= 97 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

(22 N) FROM BASIC DYKE
EAST SIDE OF MANICOUAGAN LAKE, QUEBEC, 51-37-00 N,
68-20-30 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE
B-512, COLLECTED BY J. BERARD, INTERPRETED BY K.L.
CURRIE.

THIS IS A FINE-GRAINED, HOMOGENOUS, BLACK DYKE ROCK WITH OPHITIC TEXTURE. STRONGLY ZONED PLAGIOCLASE (AN35-AN50) LATHS ARE SET IN INTERSTITIAL PYROXENE WHICH HAS BEEN LARGELY REPLACED BY AN INDETERMINATE, FINE MINERAL AGGREGATE. MAGNETITE IS QUITE ABUNDANT IN THE PYROXENE.

SAMPLE GSC 66-145 WAS COLLECTED FROM A TWO FOOT DIKE ON THE EAST SHORE OF MANICOUAGAN LAKE, (UNIT A OF CURRIE AND MURTAUGH). THE GENERAL APPEARANCE OF THIS ROCK IS STRIKINGLY SIMILAR TO THAT OF SOME OF THE IGNEOUS ROCKS OF THE MANICOUAGAN GROUP OF TRIASSIC AGE (SEE ABOVE). THE AGE DETERMINATION SHOWS HOWEVER THAT THIS GROUP OF DIKES IS MUCH OLDER THAN THE MANICOUAGAN GROUP AND REPRESENTS AN UPPER PRECAMBRIAN DIKE SWARM.

REFERENCE-

CURRIE, K.L. AND MURTAUGH, J.G.
(IN PRESS) A PRELIMINARY MAP OF THE MANICOUAGAN
STRUCTURE, QUEBEC, GSC MAP.

GSC 66-146 PHLOGOPITE, K-AR AGE 920 ± OR - 34 M.Y.

K=6.73 PERCENT, AR40/K40=0.0694, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- REASONABLY CLEAN, PALE BUFF PHLOGOPITE
MICA WITH ABOUT 2 PERCENT PARTLY ALTERED AMPHI-

QUEBEC

BOLE FRAGMENTS. ABOUT 3 PERCENT OF THE MICA FLAKES ARE SLIGHTLY ALTERED TO CHLORITE (AND/OR SERPENTINE) ALONG EDGES AND FRACTURES.

FROM MICA PERIDOTITE

- (22 F) IN ROAD CUT, 1 MILE SOUTH OF MANICOUAGAN 2 DAM, NORTH OF BAIE COMEAU, QUEBEC, 49-18 N, 68-21 W. QUEBEC DEPT. OF NATURAL RESOURCES MAP 1424. SAMPLE S-59-63, COLLECTED AND INTERPRETED BY P. SAUVE (LAVAL UNIVERSITY).

THE ROCK IS COMPOSED OF ABOUT ONE THIRD OLIVINE AND SERPENTINE, ONE THIRD MAGNESIAN BIOTITE OR PHLOGOPITE, AND ONE THIRD COLORLESS AMPHIBOLE. THE OLIVINE IS POIKILITICALLY ENCLOSED IN MICA FLAKES UP TO 2 INCHES ACROSS. THE ROCK OCCURS IN A SMALL EXPOSURE AND THE SHAPE AND SIZE OF THE INTRUSIVE BODY ARE UNKNOWN.

THE MICA PERIDOTITE DIFFERS MARKEDLY FROM ALL OTHER IGNEOUS ROCKS OF THE AREA AND IT IS APPARENTLY UNRELATED TO THEM. IT IS BELIEVED TO BE YOUNGER THAN ALL OTHER PRECAMBRIAN ROCKS OF THE AREA.

THE GRENVILLE AGE OF THE MICA PERIDOTITE IS ABOUT THE SAME AS THE K-AR AGES OF THE OLDER GRENVILLE GNEISSES. THIS DATE COULD REPRESENT THE AGE OF INTRUSION OF THE PERIDOTITE BUT IT COULD ALSO BE LOW DUE TO AR LEAKAGE DURING THE GRENVILLE OROGENY IF THE PERIDOTITE WAS OF PRE-GRENVILLE AGE.

GSC 66-147 MUSCOVITE, K-AR AGE 864 + OR - 32 M.Y.

K=8.63 PERCENT, $AR_{40}/K_{40}=0.0641$, RADIOGENIC AR=96 PERCENT.

CONCENTRATE- CLEAN, CLEAR, VERY SLIGHTLY PINK COLOURED MUSCOVITE WITH ONLY TRACE AMOUNTS OF HORN-
BLENDE CONTAMINATION.

FROM MUSCOVITE SCHIST

- (23 B) MT. WRIGHT AREA, QUEBEC, 52-33 N, 67-53 W. SEE GSC MAP 6-1959. SAMPLE DE-65-2, COLLECTED AND INTERPRETED BY S. DUFFELL.

THE SAMPLE IS FROM A MUSCOVITE SCHIST DEVELOPED IN CLEAN, WHITE QUARTZITE OF THE IRON FORMATION SEQUENCE IN THE META-MORPHOSED KANIAPISKAU SUPERGROUP ROCKS. THE AGE DETERMINED CONFIRMS THE GENERAL GRENVILLE AGE RECOGNIZED FOR THESE ROCKS.

QUEBEC

GSC 66-148 MUSCOVITE, K-AR AGE 862 + OR - 32 M.Y.

K=8.83 PERCENT, AR40/K40=0.0640, RADIOGENIC AR=96 PERCENT.

CONCENTRATE- CLEAN SLIGHTLY BLISTERED MUSCOVITE WITH ABOUT 1 PERCENT HORNBLLENDE CONTAMINATION.

FROM GNEISS

(23 B) SEE GSC 66-149 FOR LOCATION, DESCRIPTION, AND INTERPRETATION.

GSC 66-149 BIOTITE, K-AR AGE 835 P OR - 32 M.Y.

K=8.06 PERCENT, AR40/K40=0.0614, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- CLEAN, LIGHT BROWN BIOTITE WITH ABOUT 1 PERCENT HORNBLLENDE CONTAMINATION. SOME FLAKES ARE BLEACHED, AND ABOUT 5 PERCENT OF THEM HAVE PLEOCHROIC HALOS SURROUNDING COLOURLESS INCLUSIONS. CHLORITE NOT DETECTED.

FROM GNEISS

(23 B) MT. WRIGHT AREA, QUEBEC, 52-33 N, 67-53 W. SEE GSC MAP 6-1959. SAMPLE DE-65-1, COLLECTED AND INTERPRETED BY S. DUFFELL.

THE SPECIMEN WAS COLLECTED FROM A MAFIC-RICH BAND IN THE GRENVILLE GNEISS UNDERLYING THE IRON FORMATION SEQUENCE AND WAS TAKEN AS A CHECK ON SAMPLE DE-65-2 (GSC 66-147).

THE AGES DETERMINED FROM BOTH THE MUSCOVITE AND BIOTITE CONCENTRATES (GSC 66-148 AND 149) CONFIRM THE GENERAL GRENVILLE AGE RECOGNIZED FOR THESE GNEISSES.

GSC 66-150 MUSCOVITE, REVISED K-AR AGE 861 + OR - 32 M.Y.
865 + OR - 32 M.Y.
860 + OR - 32 M.Y.

K=8.38 PERCENT, AR40/K40=0.0638, RADIOGENIC AR=98
0.0643 =98
0.0637 =98
PERCENT.

QUEBEC

CONCENTRATE- RELATIVELY CLEAN, CLEAR MUSCOVITE
WITH 5 PERCENT QUARTZ IMPURITY AND SOME FIBROUS
CHLORITE.

FROM MUSCOVITE SCHIST

(23 B) MT. WRIGHT AREA, QUEBEC, 52-33 N, 67-53 W. SEE
GSC MAP 6-1959. SAMPLE DE-58-119, COLLECTED AND
INTERPRETED BY S. DUFFELL.

THIS MUSCOVITE SCHIST IS FROM A SHEARED ZONE IN QUARTZITE
ASSOCIATED WITH THE IRON-FORMATION OF THE MT. WRIGHT AREA. IT
WAS ANTICIPATED THAT THIS MUSCOVITE WOULD DATE THE META-
MORPHISM THAT HAD AFFECTED THE ROCKS OF THE IRON-FORMATION
SEQUENCE, AND PERHAPS THE WHOLE REGION.

IN 1959 AN ANOMALOUSLY YOUNG RESULT OF 440 M.Y. WAS
OBTAINED FOR THIS MUSCOVITE (SAMPLE GSC 59-88, GSC PAPER 60-
17). AT THAT TIME NO SATISFACTORY GEOLOGICAL EXPLANATION FOR
THE LOW AGE WAS APPARENT, AND NONE HAS BEEN FORTHCOMING IN THE
INTERVENING PERIOD. RE-EXAMINATION OF THE ORIGINAL ANALYTICAL
RECORDS PROVED EQUALLY FRUITLESS. IN ORDER TO RESOLVE THE
PROBLEM A PORTION OF THE ORIGINAL CONCENTRATE WAS REANALYZED
AND ADDITIONAL MATERIAL WAS OBTAINED FROM THE SAME SITE (SEE
GSC 66-148, 149, 147).

THE RESULTS PUBLISHED HERE, AND THE TWO PRECEEDING MUS-
COVITE DETERMINATIONS ARE IN EXCELLENT AGREEMENT WITH ONE
ANOTHER AND AVERAGE 862 ± 2 M.Y. THE SINGLE BIOTITE
DETERMINATION IS ABOUT 3 PERCENT LOW, INDICATING THAT IT MAY
HAVE SUFFERED A SLIGHT ARGON LOSS.

GSC 66-151 BIOTITE, K-AR AGE 2160 ± 65 M.Y.

$K=8.06$ PERCENT, $AR_{40}/K_{40}=0.2366$, RADIOGENIC $AR=98$
PERCENT.

CONCENTRATE- CLEAN, UNALTERED, DARK GREEN BIOTITE
WITH LESS THAN 2 PERCENT HORNBLLENDE CONTAMINATION.

FROM GRANITE

(24 H) 10 MILES EAST OF GEORGE RIVER, QUEBEC, 57-19 N,
65-03 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE TA64-
T12, COLLECTED AND INTERPRETED BY F.C. TAYLOR.

THE ROCK IS A BIOTITE-HORNBLLENDE GRANITE OF MEDIUM TO
COARSE GRAINED, MASSIVE TO WEAKLY FOLIATED TEXTURE. IT CON-
SISTS OF ORTHOCLASE, PLAGIOCLASE, HORNBLLENDE, PYROXENE, BIOTITE
AND QUARTZ.

QUEBEC

AN AGE TYPICAL OF EITHER THE CHURCHILL OR NAIN PROVINCE WAS EXPECTED. NO INTERPRETATION OF THE 2160 M.Y. DATE IS AVAILABLE.

GSC 66-152 IMPURE MUSCOVITE, K-AR AGE 563 + OR - 60 M.Y.

K=2.15 PERCENT, AR40/K40=0.0384, RADIOGENIC AR=92 PERCENT.

CONCENTRATE- THE SAMPLE IS A MIXTURE OF MUSCOVITE (55 PERCENT), QUARTZ (20 PERCENT), CHLORITE (20 PERCENT) AND BIOTITE (5 PERCENT). THE MUSCOVITE OCCURS IN TWO VARIETIES, 30 PERCENT IS CLEAN AND COLOURLESS, WHILE 70 PERCENT IS IN VERY FINE FLAKES CONTAINING MANY VERY FINE OPAQUE BLEBS. THESE FLAKES ARE SURROUNDED BY ATTACHED QUARTZ AND CHLORITE. CHLORITE AND BIOTITE FLAKES ALSO OCCUR AS FREE IMPURITIES.

FROM ARGILLACEOUS SANDSTONE
(22 A) RIGHT BANK OF NORTH PORT DANIEL RIVER, 0.4 MILE ABOVE LOWEST BRIDGE, QUEBEC, 48-13-30 N, 64-57-40 W MAP UNIT 6, QUEBEC DEPT. NAT. RESOURCES PRELIMINARY MAP 1382. SAMPLE WBS-64-57-PB, COLLECTED AND INTERPRETED BY W.B. SKIDMORE, GEOLOGIST OF THE QUEBEC DEPT. OF NATURAL RESOURCES.

THE SAMPLE COMES FROM AN OUTCROP OF INTERBEDDED COARSE SANDSTONE AND SHALE OF THE MICTAW GROUP, WHOSE AGE IS ESTABLISHED, ON THE BASIS OF GRAPTOLITES, AS MIDDLE ORDOVICIAN. THE MUSCOVITE IS DETRITAL AND MUST HAVE BEEN DERIVED FROM PRE-EXISTING METAMORPHIC AND/OR IGNEOUS ROCKS, PROBABLY FROM THE MAQUEREAU GROUP WHICH UNCONFORMABLY UNDERLIES THE MICTAW. THE AGE OF THE MAQUEREAU IS NOT KNOWN, BUT HAS USUALLY BEEN GIVEN AS PRECAMBRIAN BECAUSE OF ITS LACK OF FOSSILS, AND HIGH DEGREE OF METAMORPHISM COMPARED WITH MIDDLE CAMBRIAN ROCKS (CORNER OF THE BEACH FORMATION) A SHORT DISTANCE AWAY NEAR PERCE.

THE SANDSTONE IS LIGHT GREY, MEDIUM-GRAINED, POORLY SORTED, AND ARGILLACEOUS, AND CONTAINS VISIBLE QUARTZ GRAINS, LITHIC FRAGMENTS AND MUSCOVITE FLAKES.

THE DATE OF 563 + OR - 60 M.Y. INDICATES THE AGE OF THE MICA TO BE CAMBRIAN OR VERY LATE PRECAMBRIAN, AND SUGGESTS ITS DERIVATION FROM ROCKS INTRUDED OR METAMORPHOSED WITHIN THAT TIME-SPAN. THE INFERENCE IS THAT THE MAQUEREAU GROUP WAS METAMORPHOSED IN CAMBRIAN TO VERY LATE PRECAMBRIAN TIME, AND DEPOSITED SOMEWHAT EARLIER. IT IS INTERESTING TO COMPARE THIS RESULT WITH THE DATE OF 530 + OR - 35 M.Y. OBTAINED FOR THE METAMORPHISM OF THE SHICKSHOCK GROUP (GSC 61-184 IN PAPER 62-

122
QUEBEC

17, PP. 106-107).

REFERENCE-

AYRTON, W.G.

1961 PRELIMINARY REPORT ON CHANDLER - PORT DANIEL AREA,
BONAVENTURE AND GASPE-SOUTH COUNTIES, QUE. DEPT
NATURAL RESOURCES, P.R. 447.

GSC 66-153 HORNBLLENDE, K-AR AGE 945 + OR - 40 M.Y.

K=1.286 PERCENT AR40/K40=0.0718, RADIOGENIC AR=96
PERCENT.

CONCENTRATE- RELATIVELY CLEAN, GREENISH BROWN
HORNBLLENDE WITH 5 PERCENT QUARTZ CONTAMINATION.

FROM GRANITE

(12 E) LOWLANDS GAMACHE CARLETON POINT DRILL HOLE NO. 1,
NORTH SHORE OF ANTICOSTI ISLAND, QUEBEC, 49-45 N,
63-20 W. NO PUBLISHED GEOLOGICAL MAP. SAMPLE
L.G.C.PT. NO. 1, COLLECTED BY M.J. COPELAND, INTER-
PRETED BY M.J. COPELAND AND F.C. TAYLOR.

THIS SAMPLE, KINDLY DONATED BY IMPERIAL OIL LIMITED, IS
FROM THE BASEMENT ROCKS ENCOUNTERED IN DRILLING LOWLANDS
GAMACHE CARLETON POINT NO. 1 ON ANTICOSTI ISLAND. THE CON-
CENTRATE WAS OBTAINED FROM THREE PIECES OF DRILL CORE FROM
BETWEEN 3160 FEET, WHERE THE HOLE ENTERED THE PRECAMBRIAN, AND
3239 FEET WHERE THE HOLE WAS BOTTOMED. THE ROCK IS A GREYISH
PINK, MEDIUM-GRAINED, MASSIVE, EQUIGRANULAR GRANITE CONTAINING
SMALL AMOUNTS OF GREENISH-BROWN HORNBLLENDE AND VERY MINOR
AMOUNTS OF BIOTITE.

THE DETERMINED AGE, 945 + OR - 40 M.Y., GIVES THE AGE OF
THE BASEMENT BENEATH LOWER ORDOVICIAN STRATA THAT LIE UNCONFORM-
ABLY ABOVE. IT ALSO GIVES THE TIME OF THE INTRUSION OF THE
GRANITE AND SHOWS THIS TO HAVE OCCURRED DURING THE GRENVILLE
OROGENY. THE DETERMINATION SHOWS THAT GRENVILLE ROCKS EXTEND
AT LEAST AS FAR SOUTH AS ANTICOSTI ISLAND IN THIS AREA.

NEW BRUNSWICK

GSC 66-154 ACTINOLITE, K-AR AGE 369 + OR - 21 M.Y.

K=0.54 PERCENT, AR40/K40=0.0239, RADIOGENIC AR=92 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, DARK GREEN AMPHIBOLE WITH ABOUT 5 PERCENT MICA AND TRACES OF CHLORITE AND QUARTZ.

FROM METAVOLCANIC

(21 G) SOUTHWEST OF DREWS HEAD, NEW BRUNSWICK, 45-03 N, 66-44-20 W. MAP-UNIT 2 (COLDBROOK GROUP), GSC MAP 1094A (ST. GEORGE). SAMPLE S51-4/30-PB, COLLECTED BY H. HELMSTAEDT, INTERPRETED BY R.L. BROWN AND H. HELMSTAEDT (UNIVERSITY OF NEW BRUNSWICK).

THE ROCK IS A FINE TO MEDIUM GRAINED, GREY-GREEN METAVOLCANIC OF THE COLDBROOK GROUP.

THE COLDBROOK GROUP OF THE BEAVER HARBOUR AREA, CHARLOTTE COUNTY, NEW BRUNSWICK, IS TENTATIVELY CORRELATED WITH THE TYPE SECTION COLDBROOK OF SAINT JOHN WHICH UNDERLIES FOSSILIFEROUS LOWER CAMBRIAN STRATA.

THE K/AR DATE OF 369 + OR - 21 M.Y. HAS BEEN OBTAINED FROM ACTINOLITE IN AMPHIBOLITES WITH AN EQUILIBRIUM ASSEMBLAGE OF ACTINOLITE + ALBITE + EPIDOTE + CHLORITE. THE ACTINOLITE DEFINES A STRONG LINEATION AND IS CONSIDERED TO HAVE CRYSTALLIZED DURING THE LATE STAGE OF THE FIRST PHASE OF REGIONAL DEFORMATION, TEXTURAL STUDIES INDICATE THAT REGIONAL METAMORPHISM FIRST OCCURRED DURING THIS PHASE.

FOLD GEOMETRY AND KINEMATICS IN THE BEAVER HARBOUR AREA INDICATE THAT THE FIRST PHASE OF DEFORMATION IN COLDBROOK ROCKS AND ADJACENT PALEOZOIC ROCKS OF THE MASCARENE GROUP (MAINLY SILURIAN) MAY BE SYNCHRONOUS. THE K/AR DATE GIVES STRONG SUPPORT TO THIS VIEW, AND IT MAY BE CONCLUDED THAT PALEOZOIC PENETRATIVE DEFORMATION AND METAMORPHISM FIRST OCCURRED IN POST LOWER DEVONIAN - PRE UPPER DEVONIAN TIMES.

NOVA SCOTIA

GSC 66-155 WHOLE ROCK, K-AR AGE 194 + OR - 32 M.Y.

K=0.71 PERCENT, AR40/K40=0.0120, RADIOGENIC AR=40 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM BASALT

- (21 A) ON GREAT ISLAND, MEDWAY HARBOUR, NOVA SCOTIA, 44-08 N, 64-32 W. SEE GSC MAP 439A. SAMPLE FA-650581, COLLECTED BY W.F. FAHRIG, DESCRIBED BY R.D. STEVENS, INTERPRETED BY A. LAROCHELLE AND R.K. WANLESS.

THE ROCK IS A PORPHYRITIC BASALT CONSISTING OF 2-3 MM. EUHEDRAL PHENOCRYSTS AND IRREGULAR CRYSTAL AGGREGATES OF PLAGIOCLASE AN80 (20 PERCENT) AND COLOURLESS PYROXENE (15 PERCENT) IN A VERY FINELY CRYPTOCRYSTALLINE TO GLASSY, DARK MATRIX RICH IN MAGNETITE. THE THIN SECTION CONTAINS SMALL XENOLITHS OF SIMILAR BASALTIC ROCK IN WHICH THE PHENOCRYSTS ARE SMALLER AND THE MATRIX DISTINCTLY CRYSTALLINE.

SAMPLES OF THE DYKE ROCK WERE COLLECTED FOR PALAEO-MAGNETIC STUDIES AND POTASSIUM-ARGON AGE DETERMINATION. THE AGE RESULTS CONFIRM THE TRIASSIC AGE ASSIGNMENT OF THE DYKE ROCKS AND THE POLE POSITION WAS FOUND TO BE IN AGREEMENT WITH POLE POSITIONS DETERMINED FOR OTHER NORTH AMERICAN TRIASSIC FORMATIONS.

REFERENCE-

- LAROCHELLE, A. AND WANLESS, R.K.
1966 THE PALAEO-MAGNETISM OF A TRIASSIC DIABASE DYKE IN NOVA SCOTIA, JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 71, PP. 4949-4953.

GSC 66-156 HORNBLLENDE, K-AR AGE 582 + OR - 32 M.Y.

K=0.605 PERCENT, AR40/K40=0.0399, RADIOGENIC AR=86 PERCENT.

CONCENTRATE- CLEAN, DARK GREEN HORNBLLENDE WITH TRACE IMPURITIES OF QUARTZ AND MICA.

FROM GRANITE

- (11 E) 2500 FT EAST OF NORTH END OF EDEN LAKE, NOVA SCOTIA, 45-25-30 N, 62-17-20 W. MAP-UNIT 7C, GSC MAP 58-1963 (D.G. BENSON). SAMPLE BO-3-B-2-65, COLLECTED

NOVA SCOTIA

AND INTERPRETED BY D.G. BENSON.

SAMPLE WAS OBTAINED FROM AN AREA OF ISOLATED OUTCROPS OF LIGHT GREY TO LIGHT PINKISH GREY, MEDIUM-GRAINED HORNBLLENDE SYENODIORITE. THE SYENODIORITE CONSISTS OF ABOUT 70 PERCENT KAOLINIZED PLAGIOCLASE (AN25), 5 TO 10 PERCENT QUARTZ, 15 PERCENT LIGHT BROWN HORNBLLENDE PARTLY ALTERED TO CHLORITE, AND MINOR BIOTITE AND EPIDOTE.

THE SYENODIORITE STOCK, ABOUT ONE MILE IN DIAMETER, IS PROBABLY CONTEMPORANEOUS WITH NEARBY VOLCANIC AND SEDIMENTARY ROCKS OF THE BROWNS MOUNTAIN GROUP (ORDOVICIAN AND EARLIER) (1,2). CONTACT RELATIONSHIPS WERE NOT OBSERVED, AND THOUGH NO CONTACT METAMORPHISM IS APPARENT, IT COULD HAVE BEEN MASKED BY LATER REGIONAL METAMORPHISM.

THE DATE OF 582 ± 32 M.Y. INDICATES AN EARLY CAMBRIAN OR LATE PRECAMBRIAN AGE. IF THIS AGE IS ACCEPTED, IT INDICATES A PERIOD OF VOLCANISM AND RELATED INTRUSIVE ACTIVITY OF THIS AGE, AND SUGGESTS A POSSIBLE PRE-TACONIC DISTURBANCE IN THE AREA. TACONIC AND ACADIAN GRANITES HAVE ALSO BEEN DATED FROM THE ANTIGONISH HIGHLAND (3, AND AGE SAMPLE GSC 66-158).

REFERENCES-

- (1) BENSON, D.G.
1963 LOCHABER MAP-AREA, GEOL. SURV. CANADA MAP 58-1963.
- (2) MAEHL, R.H.
1961 THE OLDER PALAEOZOIC ROCKS OF PICTOU COUNTY, NOVA SCOTIA. N.S. DEPT. OF MINES, MEMOIR NO. 4.
- (3) FAIRBAIRN, H.W., ET AL
1960 AGE OF THE GRANITIC ROCKS OF NOVA SCOTIA. GEOL. SOC. AMER. BULL. VOL. 71, P. 403.

GSC 66-157 HORNBLLENDE, K-AR AGE 411 ± 20 M.Y.

$K=0.55$ PERCENT, $AR_{40}/K_{40}=0.0269$, RADIOGENIC $AR=80$ PERCENT.

CONCENTRATE- CLEAN, DARK GREEN HORNBLLENDE. MOST GRAINS CONTAIN A FEW OPAQUE INCLUSIONS. THE ONLY IMPURITY IS A TRACE OF CHLORITE.

- FROM GRANODIORITE
- (11 E) ON ROAD NEAR HEADWATERS OF WEST BARNEYS RIVER, NOVA SCOTIA, 45-31-05 N, 62-15-20 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE BO-7-B-2-65, COLLECTED

NOVA SCOTIA

AND INTERPRETED BY D.G. BENSON.

THE SAMPLE WAS OBTAINED FROM MEDIUM GREEN, MEDIUM GRAINED MICACEOUS DIORITE THAT GRADES INTO COARSE GRAINED GABBRO IN NEARBY OUTCROPS. THE DIORITE MAY CUT ADJACENT BASIC VOLCANIC ROCKS BUT THE VOLCANICS ARE UNAFFECTED BY THE APPARENT INTRUSION. BOTH THE DIORITE AND THE VOLCANIC ROCKS ARE INTRUDED BY LIGHT RED APLITE DYKES BELIEVED TO BE A PHASE OF A SMALL GRANITE STOCK EXPOSED NEARBY. THIS STOCK, WHICH IS SIMILAR TO DEVONIAN GRANITE ON JAMES RIVER (1) IS ALSO REGARDED AS DEVONIAN, SO THAT THE DIORITE IS EXPECTED TO BE DEVONIAN OR OLDER.

THE 411 ± 20 M.Y. AGE ON THE DIORITE REPRESENTS A MINIMUM AGE FOR THE DIORITE AND THE VOLCANICS DUE TO PROBABLE UPDATING BY METAMORPHIC AFFECTS OF THE NEARBY GRANITE STOCK.

REFERENCE-

- (1) FAIRBAIRN, H.W., ET AL
1960 AGE OF THE GRANITIC ROCKS OF NOVA SCOTIA. GEOL. SOC. AMER. BULL. VOL. 71, P. 403.

GSC 66-158 BIOTITE, K-AR AGE 432 ± 18 M.Y.

$K=6.07$ PERCENT, $AR_{40}/K_{40}=0.0284$, RADIOGENIC $AR=97$ PERCENT.

CONCENTRATE- RELATIVELY CLEAN, SLIGHTLY ALTERED OLIVE-GREEN BIOTITE. 50 PERCENT OF THE FLAKES CONTAIN FINE ACICULAR, ORIENTED INCLUSIONS. ALSO, ABOUT HALF OF THE FLAKE-EDGES SHOW CHLORITE ALTERATION AND BLEACHING. IMPURITIES CONSIST OF HORNBLende (5 PERCENT) AND CHLORITE (5 PERCENT).

- FROM GRANITE
(11 E) BELOW LAKE AT HEADWATERS OF BEAVER RIVER, NOVA SCOTIA, $45^{\circ}31'-50''$ N, $62^{\circ}10'-55''$ W. NO GEOLOGICAL MAP REFERENCE. SAMPLE BO-520-G-3-65, COLLECTED AND INTERPRETED BY D.G. BENSON.

THE SAMPLE WAS OBTAINED FROM AN OUTCROP OF PALE RED MEDIUM-GRAINED BIOTITE GRANITE WITH A FEW HORNBLENDIC INCLUSIONS WHICH MAKES UP A SMALL STOCK ABOUT $1 \frac{1}{2}$ MILES BY 1 MILE IN THE VALLEY OF BEAVER RIVER. THE STOCK CUTS SILTSTONE, VOLCANIC BRECCIA AND PORPHYRITIC ACID VOLCANICS OF THE ORDOVICIAN BROWNS MOUNTAIN GROUP, WHICH ARE OVERLAIN TO THE NORTH AND WEST CONFORMABLY BY FINE-GRAINED SEDIMENTS OF THE SILURIAN ARISAIG GROUP AND TO THE EAST UNCONFORMABLY BY CARBONIFEROUS

NOVA SCOTIA

SEDIMENTS.

THE ROCK IS COMPOSED OF APPROXIMATELY 55 PERCENT FELDSPAR (MICROCLINE AND ALBITE-OLIGOCLASE), 25 PERCENT QUARTZ, 15 PERCENT BIOTITE, 1.5 PERCENT HORNBLende AND 3 PERCENT MINOR CONSTITUENTS. ALTHOUGH THE SAMPLE ROCK IS SLIGHTLY SHEARED, THE ONLY EVIDENCE OF DEFORMATION IN THIN SECTION IS THE SLIGHT BENDING OF SOME BIOTITE CLEAVAGE PLANES. SIMILAR TEXTURE IS OBSERVED IN THIN SECTIONS OF SAMPLES FROM OTHER PARTS OF THE STOCK.

THE DATE OF 432 ± 18 M.Y. SUGGESTS AN UPPERMOST ORDOVICIAN OR LOWER SILURIAN AGE, AS CONTRASTED WITH THE DEVONIAN (370 M.Y.) AGE FOR THE JAMES RIVER GRANITE, ABOUT 5 MILES TO THE NORTHEAST. THE AGE THEREFORE SUPPORTS THE IDEA THAT THERE WAS MORE THAN ONE PERIOD OF INTRUSION IN THE ANTIGONISH HIGHLAND. IT IS BELIEVED THAT SHEARING OF THE GRANITE PROBABLY TOOK PLACE DURING THE ACADIAN OROGENY, BUT AS THE MINERALS ARE UNAFFECTED, THE DATE REPRESENTS A PRE-SHEARING AGE OF MINERAL FORMATION, DURING THE TACONIC OROGENY.

REFERENCE-

FAIRBAIRN, H.W., ET AL
1960 AGE OF THE GRANITIC ROCKS OF NOVA SCOTIA, BULLETIN OF THE GEOLOGICAL SOCIETY OF AMERICA, VOL.71, PP 399-414.

GSC 66-159 BIOTITE, K-AR AGE 493 ± 20 M.Y.

K=5.57 PERCENT, $AR_{40}/K_{40}=0.0330$, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- ALTERED KHAKI BIOTITE, CHLORITE ALTERATION IS MAINLY ON THE FLAKE EDGES, BUT SOME IS FOUND IN CRACKS THROUGH THE MICA. A TRACE OF HORNBLende IS PRESENT AS AN IMPURITY. TOTAL CHLORITE CONTENT IS 25-30 PERCENT.

FROM GRANODIORITE
(11 K) ROAD CUT 1 MILE DUE WEST OF SANDY MCLEOD LAKE, SYDNEY MAP-AREA, CAPE BRETON ISLAND, NOVA SCOTIA, 46-05-38 N, 60-26-35 W. MAP-UNIT 5, GSC MAP 360A. SAMPLE PB 63-68, COLLECTED AND INTERPRETED BY W.H. POOLE.

THE GRANODIORITE IS A PINK, UNDEFORMED, MASSIVE MEDIUM-GRAINED ROCK. IN THIN SECTION, THE SMALLER PLAGIOCLASE SUBHEDRA HAVE INTENSELY CLOUDED CORES WITH WHITE MICA AND EPIDOTE.

NOVA SCOTIA

QUARTZ FORMS ONLY SLIGHTLY STRAINED POLYGONAL ANHEDRA. POTASH FELDSPAR CONSISTS OF VERY LARGE, FAINTLY CLOUDED POIKILITIC ANHEDRA WHICH ENCLOSE PLAGIOCLASE AND QUARTZ. BIOTITE IS PLEOCHROIC LIGHT YELLOW TO DARK BROWN, HAS RAGGED EDGES, AND IS PARTLY ALTERED TO CHLORITE.

THE GRANODIORITE IS ONE PHASE OF AN ELONGATE BODY OF GRANITIC ROCKS WHICH VARY FROM QUARTZ DIORITE TO GRANITE (BELL AND GORANSON, 1938). THIS BODY, IN THE BOISDALE HILLS, AND ITS PROBABLE CORRELATIVES, A MILE TO THE NORTHWEST AND IN THE COXHEATH HILLS A FEW MILES TO THE SOUTHEAST, HAVE INTRUDED PRECAMBRIAN ROCKS AND APPARENTLY ALSO CAMBRO-ORDOVICIAN SEDIMENTARY AND VOLCANIC STRATA (HUTCHINSON, 1952) WHICH THERE LIE UNCONFORMABLY UPON THE OLDEST PRECAMBRIAN ROCKS. THE GRANITE WAS DATED ISOTOPICALLY IN ORDER TO DETERMINE WHETHER THE GRANITES WERE DEVONIAN, AS ARE OTHERS ON CAPE BRETON ISLAND, OR OLDER. SUCH A MIXED GRANITIC ASSEMBLAGE DIFFERS FROM THE USUAL DEVONIAN GRANITES BY VIRTUE OF THEIR VARIABLE COMPOSITION AND THEIR ASSOCIATION WITH PRE-SILURIAN ROCKS. A PRE-SILURIAN, POSSIBLY ORDOVICIAN, AGE WAS SUGGESTED, BUT SOME OF THE GRANITIC ROCKS MAY EVEN BE PRECAMBRIAN. PRELIMINARY ANALYSIS OF A DOZEN SAMPLES OF THE GRANODIORITE REVEALED A RANGE OF RUBIDIUM AND STRONTIUM TOO NARROW TO APPLY THE WHOLE-ROCK ISOCHRON APPROACH.

THE BIOTITE DATE OF 493 ± 20 M.Y. SPANS THE LATE CAMBRIAN - EARLY ORDOVICIAN INTERVAL. SEVERAL YEARS AGO, BIOTITE FROM GRANITE IN THE SIMILAR BODY LYING A MILE TO THE NORTHWEST YIELDED A K-AR DATE OF 518 M.Y. (FAIRBAIRN ET AL., 1960), INDICATING MIDDLE OR LATE CAMBRIAN. RECENTLY, HORNBLLENDE FROM SYENODIORITE IN THE COXHEATH HILLS TO THE EAST YIELDED A K-AR DATE OF 584 ± 30 M.Y. (GSC 66-160) INDICATING LATEST PRECAMBRIAN OR EARLY CAMBRIAN. THE THREE GRANITIC BODIES ARE PROBABLY ALL OF THE SAME GEOLOGICAL AGE.

ALL THREE DATES ARE MUCH OLDER THAN WHAT WOULD BE EXPECTED FROM DEVONIAN OR SILURIAN PLUTONS, AND A PRE-SILURIAN AGE IS CONSISTENT WITH THE GEOLOGICAL SETTING. ON THE OTHER HAND, THE GRANITIC ROCKS HAVE INTRUDED A CONTINUOUS SEQUENCE OF VOLCANIC ROCKS AND FINE CLASTIC MARINE SEDIMENTS RANGING FROM MIDDLE CAMBRIAN TO EARLY ORDOVICIAN AGE. GEOLOGICALLY THE GRANITIC ROCKS SEEM MOST PROBABLY TO BE MIDDLE ORDOVICIAN EVEN THOUGH THE ISOTOPIC DATES SUGGEST OLDER AGES. TWO POSSIBLE EXPLANATIONS FOR THIS APPARENT ANOMALY ARE EVIDENT- 1) THE GRANITIC BODIES MAY BE COMPOSITE WITH AN EARLIER, PARTLY UPDATED PHASE OF LATEST PRECAMBRIAN OR EARLY CAMBRIAN AGE AND A LATER PHASE IN MIDDLE OR LATE ORDOVICIAN, AND 2) THE GRANITIC BODIES WERE INDEED EMPLACED DURING MIDDLE ORDOVICIAN TIME BUT BIOTITE AND HORNBLLENDE DURING LATER (DEVONIAN) ALTERATION AND/OR SLIGHT RECRYSTALLIZATION HAVE ABSORBED FREED RADIOGENIC ARGON. THESE EXPLANATIONS ARE NOT ALTOGETHER SATISFYING.

REFERENCES-

NOVA SCOTIA

BELL, W.A., AND GORANSON, E.A.
1938 SYDNEY SHEET (WEST HALF), NOVA SCOTIA, GEOL. SURV.
CAN., MAP 360 A.

FAIRBAIRN, H.W., HURLEY, P.M., PINSON, W.H., JR., AND CORMIER,
R.F.
1960 AGE OF THE GRANITIC ROCKS OF NOVA SCOTIA, BULL.
GEOL. SOC. AMER., VOL. 71, PP. 399-414.

HUTCHINSON, R.D.
1952 THE STRATIGRAPHY AND TRILOBITE FAUNAS OF THE
CAMBRIAN SEDIMENTARY ROCKS OF CAPE BRETON ISLAND,
NOVA SCOTIA, GEOL. SURV. CAN., MEM. 263.

GSC 66-160 HORNBLLENDE, K-AR AGE 584 + OR - 28 M.Y.

K=0.466 PERCENT, AR40/K40=0.0400, RADIOGENIC AR=92
PERCENT.

CONCENTRATE- RELATIVELY CLEAN, UNALTERED, DARK
GREEN HORNBLLENDE. IMPURITIES CONSIST OF 5 PERCENT
CHLORITE AND TRACES OF QUARTZ AND MICA.

(11K) FROM QUARTZ DIORITE/SYENODIORITE
MINING TRACT 67, CLAIM M, COXHEATH MINE, 9 MILES
SOUTHWEST OF SYDNEY, NOVA SCOTIA, 46-04-18 N, 60-
22-00 W. MAP-UNIT 4, GSC MAP 360A. SAMPLE B01-
B1-65, COLLECTED AND INTERPRETED BY D.G. BENSON.

THE DATED HORNBLLENDE WAS SEPARATED FROM MEDIUM-GRAINED
GREENISH-GREY SYENODIORITE WITH PREDOMINANCE OF PINK COLOURED
FELDSPAR ALONG FRACTURE SURFACES, AND INTERESTING VALUES OF
MOLYBDENUM AND COPPER. THE SYENODIORITE CONSISTS OF ANHEDRAL
GRAINS OF ORTHOCLASE, MINOR QUARTZ AND HORNBLLENDE WITH EARLIER
PLAGIOCLASE. MINOR ACCESSORIES INCLUDE CHLORITE AND BIOTITE.

THE IGNEOUS BODY AS A WHOLE IS COMPOSED OF INTERGRADATIONAL
SYENODIORITE AND DIORITE. IT HAS INTRUDED A FOLDED SEQUENCE
OF VOLCANICS AND SEDIMENTS, PREVIOUSLY DEFINED AS PRE-MIDDLE
CAMBRIAN. THE SYENODIORITE-DIORITE IS IN TURN CUT BY A MON-
ZONITE-GRANITE BODY SIMILAR TO A GRANODIORITE-QUARTZ MONZONITE
BODY EXPOSED IN THE BOISDALE HILLS, AND DATED AS 493 + OR - 20
M.Y. (GSC 66-159).

THE HORNBLLENDE AGE OF THE SYENODIORITE (584 + OR - 28
M.Y.) SUGGESTS THAT THE INTRUDED VOLCANIC SEDIMENTARY SEQUENCE
IS PRECAMBRIAN OR EARLIEST CAMBRIAN.

REFERENCES-

NOVA SCOTIA

BELL, W.A. AND GORANSON, E.A.
 1938 SYDNEY MAP-AREA, (WEST HALF) GEOL. SURV. CANADA
 MAP 360-A

GSC 66-161 BIOTITE, K-AR AGE 354 + OR - 16 M.Y.

K=7.30 PERCENT, $AR_{40}/K_{40}=0.0228$, RADIOGENIC AR=94 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, OLIVE-GREEN BIOTITE. A FEW FLAKES CONTAIN WEAK PLEOCHROIC HALOS NOT ASSOCIATED WITH INCLUSIONS. IMPURITIES ARE FREE CHLORITE (5 PERCENT) AND HORNBLLENDE (2 PERCENT).

FROM GRANITE
 (11 K) E. SIDE OF CABOT TRAIL, ABOUT 4.3 MILES SOUTH OF MOUTH OF MACKENZIE RIVER, CAPE BRETON ISLAND, NOVA SCOTIA, 46-45-30 N, 60-50-00 W. GRANITE WITHIN SCHISTS AND GNEISSES OF MAP-UNIT 1, GSC MAP 1119A (E.R.W. NEALE). SAMPLE JB-65-6A, COLLECTED AND INTERPRETED BY S.E. JENNESS.

SEE GSC 66-162 FOR DESCRIPTION AND INTERPRETATION.

GSC 66-162 MUSCOVITE, K-AR AGE 356 + OR - 16 M.Y.

K=8.54 PERCENT, $AR_{40}/K_{40}=0.0229$, RADIOGENIC AR=93 PERCENT.

CONCENTRATE- CLEAN, CLEAR MUSCOVITE WITH TRACES OF CHLORITE AND QUARTZ AS IMPURITIES.

FROM GRANITE
 (11 K) DETAILS AS FOR GSC 66-161.

THE ROCK IS A LIGHT PINK, MEDIUM-GRAINED EQUIGRANULAR GRANITE, WITH QUARTZ, K-FELDSPAR AND PLAGIOCLASE, BOTH SLIGHTLY ALTERED, FRESH BIOTITE, MUSCOVITE, MYRMEKITE, APATITE, AND MINOR GREEN CHLORITE.

THIS GRANITE CUTS THE MICA SCHIST COUNTRY ROCK IN NORTH-WESTERN CAPE BRETON AND IS IN TURN CUT BY SMALL DYKES OF GRANITE PEGMATITE AND DIABASE. THE DATES 354 AND 356 + OR - 16 M.Y. ON THE TWO MICAS AGREE CLOSELY WITH THE 360 AND 367 M.Y. DATES FOR NEARBY GRANITES ON ST. PAUL ISLAND AND AT BLACK

NOVA SCOTIA

BROOK RESPECTIVELY, REPORTED BY FAIRBAIN ET AL. THEY INDICATE A LATE DEVONIAN CRYSTALLIZATION, PROBABLY MARKING THE END OF MAJOR MAGMATIC ACTIVITY IN THE REGION.

REFERENCES-

FAIRBAIRN, H.W., HURLEY, P.M., PINSON JR., W.H., AND CORMIER,
R.F.
1960 AGE OF THE GRANITIC ROCKS OF NOVA SCOTIA. BULL.
G.S.A., VOL. 71, PP. 399-414.

JENNESS, S.E.
1966 THE ANORTHOSITE OF NORTHERN CAPE BRETON ISLAND,
NOVA SCOTIA, A PETROLOGICAL ENIGMA. GEOL. SURV.
CAN., PAPER 66-21.

NEALE, E.R.W.
1963 PLEASANT BAY, CAPE BRETON ISLAND, NOVA SCOTIA.
GEOL. SURV. CAN., MAP 1119A.

PRINCE EDWARD ISLAND

GSC 66-163 WHOLE ROCK, K-AR AGE 668 ± 81 M.Y.

K=0.93 PERCENT, $AR_{40}/K_{40}=0.0469$, RADIOGENIC AR=91 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

- (11 L) FROM ANORTHOSITE ERRATIC
AT ELEVATION 250 FT., NEAR PARKS CORNER, PRINCE
EDWARD ISLAND, 46-32 N, 63-34 W. MALPEQUE MAP-
AREA. SAMPLE PC 31/64, COLLECTED BY V.K. PREST,
INTERPRETED BY V.K. PREST AND R.K. WANLESS.

THE ROCK IS A TYPICAL GRENVILLE-TYPE HYPERSTHENE ANORTHOSITE CONTAINING MINOR BIOTITE. THE SAMPLE WAS TAKEN FROM A VERY LARGE FROST-SHATTERED BOULDER CLEARED FROM A FARM FIELD IN AN AREA WHERE ERRATIC BOULDERS ARE VERY SCARCE. IN THIS REGION THE LAST MAIN ICE FLOW DIRECTION WAS EAST BY SOUTHEAST.

THE K-AR AGE DETERMINATION, BASED ON THE WHOLE ROCK ANALYSIS, IS PRIMARILY DUE TO THE FELDSPAR CONSTITUENT AND IS THEREFORE CONSIDERED TO BE LOW AS A CONSEQUENCE OF LOSS OF RADIOGENIC ARGON. (A SEPARATE DETERMINATION ON FELDSPAR SEPARATED FROM THE ROCK YIELDED AN AGE OF 642 ± 86 M.Y.). THE TRUE AGE IS MOST PROBABLY GRENVILLE AND SINCE THERE ARE NO KNOWN SOURCE AREAS OF ANORTHOSITIC ROCKS TO THE WEST IN NEW BRUNSWICK, IT IS ASSUMED THAT THE BOULDER WAS DERIVED FROM REGIONS TO THE NORTHWEST, AND MOST PROBABLY NORTH OF THE ST. LAWRENCE RIVER IN THE GRENVILLE PROVINCE.

NEWFOUNDLAND

GSC 66-164 WHOLE ROCK, K-AR AGE 1145 + OR - 104 M.Y.

K=1.16 PERCENT, $AR_{40}/K_{40}=0.0920$, RADIOGENIC AR=90 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM BASALT
(23 J) NEWFOUNDLAND (LABRADOR), 54-40 N, 66-30 W. NO GEOLOGICAL MAP. SAMPLE FA-3-65, COLLECTED AND INTERPRETED BY W.F. FAHRIG.

THE ROCK IS CHILLED DIABASE CONSISTING OF MICROPHENOCRYSTS OF PLAGIOCLASE, OLIVINE, AND CLUSTERS OF VERY FINE-GRAINED RED-BROWN BIOTITE IN A SEMI-OPAQUE MATRIX. THE K-AR AGE IS CONSIDERED TO BE THE APPROXIMATE AGE OF CONSOLIDATION OF THE INTRUSION.

GSC 66-165 BIOTITE, K-AR AGE 1045 + OR - 40 M.Y.

K=8.12 PERCENT, $AR_{40}/K_{40}=0.0815$, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- RELATIVELY CLEAN BROWN BIOTITE.

FROM GRANITE
(23 H) 8 MILES EAST-SOUTHEAST OF CHURCHILL FALLS, NEWFOUNDLAND (LABRADOR), 53-33 1/4 N, 64-09 W. MAP-UNIT 2, GSC MAP 52-9. SAMPLE EC 63-490, COLLECTED AND INTERPRETED BY R.F. EMSLIE.

THE SAMPLE WAS COLLECTED FROM A LARGE FRESH EXPOSURE ON THE SOUTH SHORE OF A SMALL LAKE EIGHT MILES EAST-SOUTHEAST OF CHURCHILL FALLS. THE LOCALITY IS INCLUDED IN A MAP-UNIT DESCRIBED AS BANDED GRANITIC GNEISS AND GNEISSIC GRANITE BY EADE (1952).

THE ROCK IS PINK AND WHITE GRANITE WITH WELL-DEFINED GNEISSOSITY CAUSED BY NARROW CONCENTRATIONS OF MAFIC MINERALS. THE MODAL COMPOSITION ESTIMATED FROM A THIN SECTION IS QUARTZ- 25 PERCENT, MICROCLINE- 50 PERCENT, PLAGIOCLASE- 10 PERCENT, WELL-FORMED BROWN BIOTITE- 6 PERCENT, GREEN HORNBLende- 4 PERCENT, SPHENE- 3 PERCENT, AND SMALL AMOUNTS OF EPIDOTE, APATITE AND MYRMEKITE. BIOTITE IS ORIENTED SUB-PARALLEL TO THE BANDING. THE TEXTURE OF THE ROCK IS XENOMORPHIC EQUI-GRANULAR AND IS NOT NOTICEABLY CRYSTALLOBLASTIC. THE ROCK MAY BE INTERPRETED AS A GNEISSIC IGNEOUS GRANITE.

NEWFOUNDLAND

THE SAMPLE WAS COLLECTED WITH A VIEW TO PLACING CLOSER LIMITS ON THE BOUNDARY BETWEEN THE GRENVILLE AND NAIN PROVINCES IN THIS REGION. THE K-AR BIOTITE AGE OF 1045 M.Y. CLEARLY INDICATES THAT THIS GRANITE SHOULD BE INCLUDED WITHIN THE GRENVILLE PROVINCE.

REFERENCE-

EADE, K.E.
1952 UNKNOWN RIVER (OSSOKMANVAN LAKE) EAST HALF, GEOL. SURV. CAN. MAP 52-9.

GSC 66-166 HORNBLLENDE, K-AR AGE 2360 + OR - 65 M.Y.

K=1.15 PERCENT, AR40/K40=0.2757, RADIOGENIC AR=96 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF GREEN TO OLIVE-GREEN HORNBLLENDE. LESS THAN 5 PERCENT OF THE GRAINS CONTAIN FINE OPAQUE INCLUSIONS. A TRACE OF QUARTZ IS PRESENT.

FROM GNEISS
(14 E) SOUTH SHORE OF FRANK LAKE, NEWFOUNDLAND (LABRADOR), 57-12 N, 62-00 W. NO GEOLOGICAL MAP REFERENCE. SAMPLE TA 64-T5, COLLECTED AND INTERPRETED BY F.C. TAYLOR.

THE SAMPLE IS FROM A MEDIUM TO COARSE GRAINED, MODERATELY WELL LAMINATED, DARK GREENISH GREY HORNBLLENDE GNEISS. SUB-ORDINATE AMOUNTS OF PYROXENE, GARNET, PLAGIOCLASE AND QUARTZ ARE PRESENT.

THE ROCK WAS TAKEN FROM A LOCALITY LYING BETWEEN TWO OTHER DATED SAMPLES, GSC 61-195 AT 2035 M.Y. AND B4016 (BEALL, G.H., ET AL., 1963) AT 1480 + OR - 50 M.Y. THE ARCHEAN AGE ON THIS SAMPLE (2360 + OR - 65 M.Y.) CONFIRMS THE EXTENSION OF ARCHEAN ROCKS THIS FAR SOUTH AS SHOWN ON MAP 4-1965 (STOCKWELL, 1965)

REFERENCES-

STOCKWELL, C.H.
1965 TECTONIC MAP OF THE CANADIAN SHIELD, GEOL. SURV. CANADA, MAP 4-1965.

BEALL, G.H., HURLEY, P.M., FAIRBAIRN, H.W., AND PINSON, W.H. JR
1963 COMPARISON OF K-AR AND WHOLE-ROCK RB-SR DATING IN NEW QUEBEC AND LABRADOR. AM. JOUR. SCI., VOL. 261, NO. 6, P. 580.

NEWFOUNDLAND

GSC 66-167 BIOTITE, K-AR AGE 847 + OR - 30 M.Y.

K=7.80 PERCENT, AR40/K40=0.0625, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- RELATIVELY CLEAN OLIVE-GREEN BIOTITE WITH ABOUT 3 PERCENT HORNBLende AND 1 PERCENT CHLORITE CONTAMINATION.

FROM GRANITE

- (13 C) 20 MILES SOUTHWEST OF LAKE MINIPI, NEWFOUNDLAND (LABRADOR), 52-13 N, 61-08 W. NO PUBLISHED GEOLOGICAL MAP. SAMPLE W-32-65, COLLECTED BY D. WETMORE, INTERPRETED BY I.M. STEVENSON.

THE SAMPLE WAS COLLECTED CLOSE TO THE NORTHERN LIMIT OF AN AREA OF COARSE, FRESH, IN PLACES PORPHYRITIC, GREYISH PINK GRANITE GRADATIONAL INTO GRANITE GNEISS. THE K-AR AGE OF 847 + OR - 30 M.Y. INDICATES THAT THIS EXTENSIVE AREA OF MASSIVE, PREVIOUSLY UNDATED GRANITE WAS EMPLACED PRIOR TO THE CLOSE OF THE GRENVILLE OROGENY, AND LIES WELL WITHIN THE GRENVILLE PROVINCE.

GSC 66-168 BIOTITE, K-AR AGE 445 + OR - 18 M.Y.

K=6.29 PERCENT, AR40/K40=0.0294, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- CLEAN CONCENTRATE OF SLIGHTLY ALTERED KHAKI BIOTITE WITH CHLORITE ALTERATION ON THE FLAKE EDGES. SOME FLAKES CONTAIN FUZZY, WEAK PLEOCHROIC HALOS. TOTAL CHLORITE CONTENT IS 10-15 PERCENT.

FROM GRANITE

- (11 O) 13.5 MILES NORTH NORTHWEST OF THE VILLAGE OF NORTH BAY, NEWFOUNDLAND, 47-59-04 N, 58-26-15 W. NO PUBLISHED GEOLOGICAL MAP. SAMPLE GJ-588-64, COLLECTED AND INTERPRETED BY J.W. GILLIS.

THE DATE OF 445 M.Y. OBTAINED ON THIS SAMPLE IS SOMEWHAT OLDER THAN SOME OTHER AGES OBTAINED FROM WEST-CENTRAL NEW-FOUNDLAND AS INDICATED IN THE FOLLOWING TABLE-

SAMPLE	MINERAL	LOCATION	AGE
GSC 66-168	BIOTITE	NORTH BAY	445 + OR - 18
GSC 65-140	BIOTITE	LA POILE RIVER	346 + OR - 20
GSC 65-141	MUSCOVITE	LA POILE RIVER	344 + OR - 15

NEWFOUNDLAND

GSC 65-138	BIOTITE	SMOKY ISLAND	350 + OR - 16
GSC 65-139	BIOTITE	LITTLE GARIA BAY	350 + OR - 16
GSC 63-162	MUSCOVITE	ROSE BLANCHE	400 + OR - 20
GSC 61-202	MUSCOVITE	PORT AUX BASQUES	415

ACCORDING TO THE TIME SCALE OF THE GEOLOGICAL SOCIETY OF LONDON (1964), THE 346, 344, AND 350 M.Y. DATES INDICATE A LATE DEVONIAN OR EARLY MISSISSIPPIAN AGE, AND SUGGEST THAT THESE ROCKS WERE AFFECTED BY THE ACADIAN OROGENY. THE 400 AND 415 M.Y. DATES INDICATE A MIDDLE SILURIAN TO EARLY DEVONIAN AGE, WHEREAS THE 445 M.Y. DATE INDICATES A LATE ORDOVICIAN OR EARLY SILURIAN AGE. THE 400, 415, AND 445 M.Y. DATES, TOGETHER WITH OTHER ISOTOPIC AGES IN THE 420-484 M.Y. RANGE, SUGGEST PERIODS OF PRE-DEVONIAN, PALAEOZOIC INTRUSIONS IN A BROAD BELT THAT EXTENDS FROM CAPE RAY NORTHEASTWARD TO NOTRE DAME BAY (GSC. 63-167).

REFERENCES-

GEOLOGICAL SOCIETY OF LONDON

- 1964 GEOLOGICAL SOCIETY PHANEROZOIC TIME-SCALE, QUART.
J. GEOL. SOC. LONDON, VOL. 120 S, PP. 260-262.

GILLIS, J.W.

- 1965 PORT AUX BASQUES MAP-AREA- IN JENNESS, S.E.,
COMPILER, REPORT OF ACTIVITIES- FIELD, 1964.
GEOL. SURV. CAN., PAPER 65-1, PP. 133-135.

GSC 66-169 WHOLE ROCK, K-AR AGE 751 + OR - 100 M.Y.

K=0.65 PERCENT, AR40/K40=0.0540, RADIOGENIC AR=67 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM BASALT

- (12 I) NEWFOUNDLAND, 50-30 N, 56-30 W. NO GEOLOGICAL MAP
AVAILABLE. SAMPLE FA-2-65, COLLECTED AND INTER-
PRETED BY W.F. FAHRIG.

THE ROCK IS CHILLED DIABASE CONSISTING OF AUGITE AND PARTLY
SAUSSURITIZED PHENOCRYSTS OF PLAGIOCLASE IN A MICROSCOPICALLY
CRYSTALLINE MATRIX OF AUGITE, PLAGIOCLASE AND IRON-ORES. THE
K-AR AGE IS THE APPROXIMATE AGE OF INTRUSION.

NEWFOUNDLAND

GSC 66-170 BIOTITE, K-AR AGE 393 + OR - 16 M.Y.

K=6.78 PERCENT, AR40/K40=0.0256, RADIOGENIC AR=97 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, BLEACHED KHAKI BIOTITE WITH SOME CHLORITE ALTERATION ON THE FLAKE EDGES. IMPURITIES CONSIST OF LESS THAN 3 PERCENT HORNBLLENDE AND ABOUT 10 PERCENT CHLORITE.

(1 M) FROM AUGEN GNEISS
4 MILES WEST NORTHWEST OF GAULTOIS, NEWFOUNDLAND,
46-37 N, 56-00 W. MAP-UNIT 4, GSC MAP 1043A.
SAMPLE AA9-42-3, COLLECTED AND INTERPRETED BY F.D.
ANDERSON.

THE ROCK IS A COARSE GRAINED BIOTITE AUGEN GNEISS. THE SAMPLE IS FROM A METASEDIMENTARY BELT OF ROCKS ALONG THE SOUTH CENTRAL COAST OF NEWFOUNDLAND. THE ROCKS APPEAR TO BE METAMORPHOSED MID-ORDOVICIAN BAIE D'ESPOIR GROUP. THE ISOTOPIC AGE OF 393 + OR - 16 M.Y. INDICATES A METAMORPHIC AGE OF LATE SILURIAN/EARLY DEVONIAN - HAVING TAKEN PLACE DURING THE OPENING OF THE ACADIAN OROGENY.

GSC 66-171 BIOTITE, K-AR AGE 316 + OR - 14 M.Y.

K=6.20 PERCENT, AR40/K40=0.0201, RADIOGENIC AR=97 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, BUT ALTERED DARK BROWN TO ALMOST OPAQUE BIOTITE. MOST FLAKES ARE ALTERED TO CHLORITE ON THE EDGES, AND A FEW CONTAIN COLOURLESS PRISMATIC INCLUSIONS. HORNBLLENDE CONTAMINATION AMOUNTS TO LESS THAN 2 PERCENT, AND THE TOTAL CHLORITE CONTENT IS ABOUT 15 PERCENT.

(1 M) FROM GRANITE
1 1/2 MILE WEST OF GAULTOIS, NEWFOUNDLAND, 47-37 N,
55-56 W. MAP-UNIT 4, GSC MAP 1043A. SAMPLE AA10-
16-5, COLLECTED AND INTERPRETED BY F.D. ANDERSON.

THE ROCK IS A GREY, MEDIUM TO COARSE GRAINED, MASSIVE, BIOTITE GRANITE. THE GRANITE CUTS BIOTITE AUGEN GNEISS (GSC 66-170 ABOVE) AND GNEISSIC PORPHYRITIC GRANITE. THE AGE OF 316 + OR - 14 M.Y. SUGGESTS THAT IT WAS INTRUDED DURING MIDDLE CARBONIFEROUS TIME.

NEWFOUNDLAND

GSC 66-172 BIOTITE, K-AR AGE 406 + OR - 17 M.Y.

K=7.95 PERCENT, AR40/K40=0.0265, RADIOGENIC AR=97 PERCENT.

CONCENTRATE- RELATIVELY CLEAN, REDDISH BROWN BIOTITE WITH MINOR CHLORITIC ALTERATION ON FLAKE EDGES. ABOUT 10 PERCENT OF THE FLAKES ARE BLEACHED, AND ABOUT 50 PERCENT CONTAIN PLEOCHROIC HALOS. IMPURITIES ARE HORNBLLENDE (3 PERCENT) AND CHLORITE (4 PERCENT).

FROM GRANITE

(2 D) 8 MILES EAST OF ROUND POND, NEWFOUNDLAND, 48-11 N 55-45-20 W. MAP-UNIT 4, GSC MAP 1043A. SAMPLE AA-E-3-1, COLLECTED AND INTERPRETED BY F.D. ANDERSON.

THE ROCK IS A GREY, COARSE GRAINED, FOLIATED BIOTITE GRANITE. THE SAMPLE IS FROM A SMALL STOCK AND LIES WITHIN THE GRANITIC BELT THAT EXTENDS NORTHEASTERLY ACROSS CENTRAL NEWFOUNDLAND. THE AGE OF 406 + OR - 17 M.Y. DOES NOT AGREE WITH A REPORTED AGE OF 342 + OR - 16 M.Y. (65-142) ON A LARGE GRANITE BODY A FEW MILES TO THE WEST. HOWEVER, THE AGE FITS WELL WITH OTHERS OBTAINED FROM THIS BELT, THE GRANITES HAVING BEEN EMPLACED FROM LATE SILURIAN TO EARLY CARBONIFEROUS.

GSC 66-173 BIOTITE, K-AR AGE 408 + OR - 17 M.Y.

K=6.75 PERCENT, AR40/K40=0.0267, RADIOGENIC AR=98 PERCENT.

CONCENTRATE- CLEAN, LIGHT BROWN BIOTITE WITH LESS THAN 2 PERCENT CHLORITE CONTAMINATION.

FROM LAMPROPHYRE

(2 M) ON ROAD 0.8 MILES NORTHEAST OF LOUP MARIN POINT ABOUT 5 MILES SOUTH-SOUTHWEST OF ST. ANTHONY, INSULAR NEWFOUNDLAND, 51-19-01 N, 55-38-02 W. SYENITE LAMPROPHYRE DYKE ON MAP 7, BULLETIN 9, NEWFOUNDLAND DEPARTMENT OF NATURAL RESOURCES. SAMPLE GJ-14-65, COLLECTED BY J.W. GILLIS, INTERPRETED BY W.H. POOLE.

BIOTITE WAS SEPARATED FROM A DARK GREENISH GREY, UNDEFORMED, MASSIVE, FINE-GRAINED MICACEOUS MELANOCRATIC ROCK DESCRIBED AS AN AUGITE-BIOTITE SYENITE LAMPROPHYRE DYKE BY COOPER (1937). IN THIN SECTION, SMALL UNALTERED AUGITE SUB-

NEWFOUNDLAND

HEDRA AND BIOTITE ARE ENCLOSED WITHIN LARGE POIKILITIC PLAGIOCLASE. PLAGIOCLASE IS CLOUDED, WEAKLY ZONED AND POORLY TWINNED. CHLORITE AGGREGATES AND LONG APATITE NEEDLES ARE COMMON, AND QUARTZ OCCURS IN TRACE AMOUNTS. BIOTITE IS PLEOCHROIC LIGHT TAN TO DARK BROWN AND DARK REDDISH BROWN, AND IS PARTLY ALTERED TO CHLORITE.

THE LAMPROPHYRE DYKES, A FEW FEET WIDE, HAVE INTRUDED THE GOOSE COVE SCHIST AND HORNBLENDE GNEISS AFTER THEIR DEFORMATION AND METAMORPHISM. THE SCHIST AND GNEISS DEVELOPED FROM PROBABLE CAMBRO-ORDOVICIAN SEDIMENTARY AND VOLCANIC ROCKS AND WERE INTRUDED BY PERIDOTITE BODIES. THE ENTIRE ASSEMBLAGE WAS THEN TRANSPORTED WESTWARD AS AN ALLOCHTHON, PROBABLY DURING THE MIDDLE ORDOVICIAN, AND WAS THEN INTRUDED BY THE LAMPROPHYRE DYKES. BIOTITE WAS DATED TO DETERMINE THE AGE OF LAMPROPHYRE DYKE INTRUSION AND TO PROVIDE A MINIMUM AGE OF DEFORMATION AND METAMORPHISM OF THE SCHIST AND GNEISS.

THE BIOTITE DATE OF 408 ± 17 M.Y. SPANS SILURIAN TIME. THE LAMPROPHYRE IS CONSIDERABLY OLDER THAN THE UPPER JURASSIC OR LOWER CRETACEOUS LAMPROPHYRE DYKES (GSC 65-144 AND 145) COLLECTED BY H. WILLIAMS FROM THE DEVONIAN FOLDED ZONE OF NORTHERN NEWFOUNDLAND. A SILURIAN AGE FOR THE DYKE IS CONSISTENT WITH THE HYPOTHESIS OF A KLIPPE MOVEMENT IN MIDDLE ORDOVICIAN.

REFERENCE-

COOPER, J.R.

1937 GEOLOGY AND MINERAL DEPOSITS OF THE HARE BAY AREA.
NEWFOUNDLAND DEPT. NAT. RES. BULLETIN 9.

MID ATLANTIC RIDGE

GSC 66-174 BIOTITE, K-AR AGE 1550 + OR - 50 M.Y.

K=7.47 PERCENT, AR40/K40=0.1410, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- CLEAN, UNALTERED OLIVE-GREEN BIOTITE WITH LESS THAN 3 PERCENT HORNBLENDE IMPURITY. ABOUT 1 PERCENT OF THE FLAKES CONTAIN COLOURLESS INCLUSIONS SURROUNDED BY STRONG PLEOCHROIC HALOS. TOTAL CHLORITE CONTENT IS LESS THAN 1 PERCENT.

FROM GNEISS

BALD MOUNTAIN SEA-MOUNT, MID-ATLANTIC RIDGE, 45-13 N, 28-54 W. SAMPLE B10-MAR-19-66-33-1, COLLECTED AND INTERPRETED BY F. AUMENTO.

THE ROCK IS A BANDED QUARTZ-BIOTITE GNEISS. SEE GSC 66-175 FOR FURTHER DESCRIPTION AND INTERPRETATION.

GSC 66-175 BIOTITE, K-AR AGE 1690 + OR - 55 M.Y.

K=6.51 PERCENT, AR40/K40=0.1600, RADIOGENIC AR=99 PERCENT.

CONCENTRATE- CLEAN, UNALTERED REDDISH BROWN BIOTITE WITH LESS THAN 1 PERCENT HORNBLENDE AND ABOUT 1 PERCENT CHLORITE IMPURITY. MOST FLAKES CONTAIN COLOURLESS INCLUSIONS SURROUNDED BY PLEOCHROIC HALOS.

FROM GRANITE GNEISS

BALD MOUNTAIN SEA-MOUNT, MID-ATLANTIC RIDGE, 45-13 N, 28-54 W. SAMPLE B10-MAR-19-66-14-8, COLLECTED AND INTERPRETED BY F. AUMENTO.

THE ROCK IS A DARK, BANDED BIOTITE GRANITE GNEISS. THIS SAMPLE AND GSC 66-174 WERE DREDGED UP BY THE C.S.S. HUDSON FROM **BALD MOUNTAIN**, A SEAMOUNT IN THE **CREST** REGION OF THE MID-ATLANTIC RIDGE. THE SEAMOUNT HAS A DIFFERENT ORIENTATION AND SHAPE TO THAT OF KNOWN VOLCANOES IN THE AREA, AND BOTTOM PHOTOGRAPHS TAKEN IN THE AREA INDICATE JOINTING TYPICAL OF COARSE-GRAINED INTRUSIVES.

K-AR AGES OF 1550 AND 1690 M.Y. EXCLUDE ANY POSSIBILITY OF RECENT GRANITIC INTRUSIONS INTO THE CREST MOUNTAINS OF THE MID-ATLANTIC RIDGE. THERE REMAIN TWO ALTERNATIVES FOR THE PRESENCE OF THESE ROCKS ON BALD MOUNTAIN-

(1) THEY ARE ICE RAFTED FROM THE NORTH. THE HIGH CON-

MID ATLANTIC RIDGE

CENTRATION OF THESE GNEISSIC AND GRANITIC ROCKS ON AN ISOLATED SEAMOUNT WILL REQUIRE CONSIDERABLE EXPLANATION IF ICE RAFTING IS THE SOLE SOURCE.

(2) THERE IS A REMNANT BLOCK OF AN EARLIER CONTINENT REMAINING ON THE MID-ATLANTIC RIDGE. SUCH REMNANTS ARE TO BE EXPECTED IF CONTINENTAL DRIFT HAS TAKEN PLACE. BALD MOUNTAIN IS TOO NEAR THE AXIS OF THE MID-ATLANTIC RIDGE (35 MILES WEST) FOR THIS HYPOTHESIS TO BE READILY ACCEPTABLE- A MECHANISM WOULD HAVE TO BE DEvised TO KEEP THE REMNANT BLOCK NEAR THE AXIS RATHER THAN HAVE IT DRIFT AWAY.

GSC 66-176 WHOLE ROCK, K-AR AGE 785 + OR - 80 M.Y.

K=1.28 PERCENT, AR40/K40=0.0569, RADIOGENIC AR=94 PERCENT.

CONCENTRATE- CRUSHED WHOLE ROCK.

FROM GABBRO

BALD MOUNTAIN SEA-MOUNT, MID-ATLANTIC RIDGE,
45-13 N, 28-51 W. SAMPLE B10-MAR-19-66-14,
COLLECTED AND INTERPRETED BY F. AUMENTO.

THE ROCK IS A COARSE-GRAINED GABBRO CONTAINING CLINO- AND ORTHO-PYROXENE, PLAGIOCLASE, BIOTITE, LAMPROBOLITE, ASSESSORY APATITE AND IRON ORES, AND SECONDARY SERPENTINE AND MAGNETITE. IT WAS COLLECTED FROM **BALD MOUNTAIN**, A SEAMOUNT IN THE **CREST** REGION OF THE MID-ATLANTIC RIDGE AT 45 DEGREES N.

THE SAMPLE WAS ONE OF THE MORE BASIC ROCKS AMONGST AN ASSORTMENT OF ACID/BASIC ROCKS RECOVERED FROM THE SEAMOUNT. IT WAS SUSPECTED THAT MUCH OF THE MATERIAL WAS ICE-RAFTED. THE MORE BASIC MATERIAL, HOWEVER, MAY HAVE BEEN REPRESENTATIVE OF THE SEAMOUNT BEDROCK. A NUMBER OF BASIC ROCKS WERE THEREFORE SUBMITTED FOR AGE DETERMINATION.

A K-AR AGE OF 785 + OR - 80 M.Y. INDICATES THAT THE GABBRO WAS PROBABLY ICE-RAFTED ALONG WITH THE ACID ROCKS. HAD THE GABBRO BEEN IN SITU, AN AGE OF 10 M.Y. OR LESS MIGHT HAVE BEEN EXPECTED.

